

**Capital Market Imperfections Before and After Financial Liberalization:
An Euler Equation Approach to Panel Data
for Ecuadorian Firms**

**Fabio Schiantarelli
and
Andrew Weiss (Boston University)
and
Fidel Jaramillo (Facultad Latinoamericana de
Ciencias Sociales-Ecuador)**

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By

Fidel Jaramillo
(Facultad Latinoamericana de Ciencias Sociales-Ecuador)

Fabio Schiantarelli
(Boston College and Boston University)

Andrew Weiss
(Boston University)

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ABSTRACT

Using a large panel of Ecuadorian firms, this paper analyzes the role of capital market imperfections for investment decisions, and investigates whether the financial reforms introduced in the 80's have succeeded in relaxing financial constraints. The model allows both for an increasing cost of borrowing, as the degree of leverage increases, and for a ceiling on the latter. The econometric results suggest both types of capital market imperfections are important for small and young firms, but not for large and old ones. Moreover, the estimated equations do not provide evidence that financial reform in Ecuador has helped to relax these financial constraints.

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I.- INTRODUCTION

During the 80's Ecuador introduced financial reforms to facilitate capital accumulation and growth. These reforms consisted mainly of the removal of administrative controls on the interest rate, and the elimination or scaling down of directed credit programs. Whereas there has been a growing literature and research effort in assessing the effect of liberalization on the financial markets, less is known about the effects of these reforms on firms. The studies that exist are often descriptive in nature and have concentrated on the larger macro picture. The purpose of this paper is to provide some evidence on the effects of liberalization by focusing on individual firms as the unit of analysis. The question we address here is whether financial reform has relaxed the constraints faced by firms in obtaining external funds for investment. Our empirical investigation is based on a rich panel data set for Ecuador, containing balance sheets and profit and losses statements for 420 manufacturing companies over the period 1983-1988.

In order to evaluate the effects of financial reform on firms' capital accumulation decision, we must improve our understanding of the relationship between firms' financial and real choices, in the presence of imperfections in the capital markets. Such imperfections are due to the existence of administrative controls and regulations, and, at a deeper level, to asymmetric information problems. A growing body of literature has examined how informational asymmetries and the risk of bankruptcy may restrict access to outside funding and the implications thereof for a firm's investment decisions, even in the absence of administrative credit rationing.¹

The empirical work in this field has mainly tried to assess whether there is a significant departure from investment models derived in the absence of information asymmetries and incentives problems, and whether the importance of such departure varies across firms with different characteristics. Most of the empirical work has used data from developed countries, for which panel data on firms were available, and it provides evidence against the perfect capital paradigm.² Frequently the econometric

¹ At a theoretical level see the contributions by Stiglitz and Weiss (1981, 1987), Wette (1984), Myers and Majluf (1984), Bernanke and Gertler (1989), Gertler and Hubbard (1988), Greenwald and Stiglitz (1988).

² Examples are Fazzari, Hubbard and Petersen (1988), Gertler and Hubbard (1988), Hoshi et al. (1988),

strategy consists of adding financial variables, in particular cash flow and debt, to a standard investment model, usually based on a neoclassical technology with adjustment costs, yielding a relationship between investment and the market value of the firm relative to the replacement cost of capital (Tobin's Q). Under the assumption of perfect capital markets, financial variables should not matter, given Q . Its significance is taken as a sign of imperfections in the capital markets.

Another set of contributions starts from a model with adjustment costs, like the first group of papers, and directly estimates the Euler equation for investment, without making use of Q . The idea here is that the standard Euler equation will be misspecified for those firms that either have reached the (exogenous) maximum amount of debt allowed, or are at the point of paying no dividends. A correctly specified Euler equation would contain multipliers associated with the constraints, and their omission would lead to misspecification.³

The Euler equation approach is particularly appealing for developing countries (where stock markets are not well developed) because it does not require information on stock market values. In this section we extend the Euler equation in two directions. First we assume that agency problems can be thought of as giving rise to an increasing cost of borrowing above the safe rate, as the degree of leverage increases (see also Galeotti et al. (1989)). Second we introduce ceilings on the maximum degree of leverage that various firms are allowed, and discuss whether this form of imperfection can be distinguished from the rising cost of funds schedule. We then ask empirically whether these two forms of imperfection affect firms differently, and whether they become less severe after financial liberalization.

The lack of appropriate firms' panel data for LDC's has hindered the econometric investigation of the relationship between investment and financial conditions. With a few exceptions, the work on investment has been conducted using aggregate data that are inappropriate for determining the role of financial factors in capital accumulation decisions and how their relevance varies across different groups of firms and over time, particularly with regard to the effects of financial liberalization.⁴

Blundell, Bond, Devereux, and Schiantarelli (1992), and Devereux and Schiantarelli (1990).

³ See Gilchrist (1989), Whited (1992), Hubbard and Kashyap (1992), Galeotti, Schiantarelli and Jaramillo (1990), Gertler, Hubbard, and Kashyap (1990).

⁴ Tybout (1983) uses three digits manufacturing industry data for Colombia. He partitions his observations into small and large firms, and investigates whether the significance of profits in a standard accelerator model varies according to firms' size. Another example is Nabi (1989) for Pakistan. Most studies for developing countries include various measures of the aggregate credit as independent variables in (quasi) reduced form investment equations. Aggregate data for various LDC's is used for estimation. See Fry (1988) for a review.

The availability of panel data for Ecuador allows us to investigate whether financial liberalization has relaxed financial constraints and whether it has helped financing investment.⁵

The structure of the paper is as follows. In Section II, we develop a theoretical model for investment that allows for a rising premium for external finance and for a ceiling in the debt to capital ratio, and we derive the appropriate Euler equation for the capital stock. In Section III, we present econometric evidence on the importance of capital market imperfections for different categories of firms (small versus large, young versus old). In Section IV, we test whether financial reform has relaxed financial constraints. In addition of the evidence based on Euler equations, we also present results for a more ad hoc investment model. Section V concludes the paper.

II.- THE MODEL

Denote by R_t the required rate of return, the following standard arbitrage condition must hold for a firm's shareholder:

$$(1) \quad R_t = \frac{(1-m_t) D_t + (1-z_t) E_t (W_{t+1} - W_t - S_t^n)}{W_t}$$

where D_t denotes dividends, W_t the value of the firm, S_t^n the nominal value of new shares, m_t the personal tax rate, z_t the tax rate on capital gains, and E_t the conditional expectations operator.⁶ Solving (1) recursively gives us the present discounted value of the company. We assume that firms maximize the value of the firm for existing shareholders, W_t :

$$(2) \quad W_t = E_t \sum_{j=0}^{\infty} \beta_t^j \left[\gamma_{t+j} D_{t+j} - S_{t+j}^n \right]$$

⁵ See Jaramillo, Schiantarelli, and Weiss (1992) for an empirical analysis on a different but related topic, namely whether financial liberalization has succeeded in allocating credit and investment to more efficient firms.

⁶ For developing countries, in which often equity markets are absent, equation (1) should be interpreted broadly. Dividends should be understood also as profits distributed to the owners, which may take various forms, including direct salaries or other perks provided to manager-owners. New share issues should be seen as fresh money from the owner or other investors that is remunerated by dividend payments or capital gains.

subject to the following constraints:

$$(3) \quad D_t = (1 - \tau_t) [p_t F(K_t, N_t, I_t) - w_t N_t - i_t B_{t-1} - A(B_{t-1}, p_{t-1}^k K_{t-1})] \\ + (B_t - B_{t-1}) - p_t^k I_t + S_t^n + C_t$$

$$(4) \quad K_t = (1 - \delta) K_{t-1} + I_t \\ D_t \geq 0 \\ B_t \geq 0 \\ S_t^n \geq 0$$

where:

$$\beta_t^j = \prod_{i=0}^j (1 + R_{t+i}^*)^{-1}$$

$$R_t^* = \frac{R_t}{(1 - z_t)}$$

$$\gamma_t = \frac{(1 - m_t)}{(1 - z_t)}$$

τ_t = corporate tax rate

p_t = output price

$F(\cdot)$ = net production function

K_t = capital stock

N_t = labor

I_t = investment

w_t = wage rate

i_t = riskless interest rate

B_t = stock of debt

p_t^k = price of investment goods

C_t = tax savings associated with depreciation allowances on existing capital goods

We are allowing for internal costs for adjusting the capital stock, so that the production function $F(K_t, N_t, I_t)$ can depend negatively upon investment ($F_I < 0$). The adjustment costs are convex ($F_{II} < 0$) and the firm faces a downward sloping demand function for its product. Finally we explicitly include in the maximand an agency/financial distress cost function $A(\cdot)$ which captures the premium paid by firms above the safe rate, i . The premium on external borrowing reflects the asymmetry of information between the borrower and the lender and the difficulty of enforcing contracts. In those circumstances there is a potential conflict between the interest of the two parties which results in the lender imposing on the borrower a cost over and above the safe rate. This cost may take the form of an explicitly higher rate of interest, or of a

set of restrictions limiting borrowers' discretionary actions. Since the greater the amount of debt in firm's financial structure, the more severe the incentive problem becomes, we assume that agency costs increase with the stock of debt ($A_B > 0$)⁷. We also assume that agency costs are a decreasing function of the amount of collateralizable assets, represented here by the capital stock ($A_K < 0$).

Besides this premium on debt, we allow for another type of capital market imperfection, namely that there is an upper limit to the debt to capital ratio that lenders consider acceptable. One additional constraint will therefore appear in the maximization problem:

$$(5) \quad M - \frac{B_t}{p_t^k K_t} \geq 0$$

where M is some exogenous ceiling on the maximum debt to capital ratio that is specific to the firm.

Another type of capital market imperfection that can be easily incorporated in the maximization problem is the existence of a premium on new equity. The premium can be generated by an adverse selection argument, whereby only firms which are overvalued have an incentive to issue new shares (Myers and Majluf (1984)). Fazzari, Hubbard and Petersen (1988) suggest to replace S_{t+j}^n by $(1+\omega_t) S_{t+j}^n$ where ω_t captures the existence of a lemon premium. ω_t could also be interpreted as the transaction costs that firms must bear when issuing new shares. In this paper, we will focus on the agency cost of debt. The first order conditions for K_t , I_t , N_t , B_t , and S_t^n are respectively:

⁷ We will also assume that agency costs are convex in debt, so that $A_{BB} > 0$.

$$(6) \quad (\gamma_t + \lambda_t^d) (1-\tau_t) \left[p_t (1 - \varepsilon_t^{-1}) F_{k_t} \right] - E_t (\gamma_{t+1} + \lambda_{t+1}^d) (1-\tau_{t+1}) \beta_{t+1}^0 A_{k_t}$$

$$- \lambda_t^k + \lambda_t^m \frac{B_t}{p_t K_t} + E_t \lambda_{t+1}^k \beta_{t+1}^0 (1-\delta) = 0$$

$$(7) \quad (\gamma_t + \lambda_t^d) \left[(1-\tau_t) p_t (1 - \varepsilon_t^{-1}) F_{i_t} - (1-\mu_t) p_t \right] + \lambda_t^k = 0$$

$$(8) \quad (\gamma_t + \lambda_t^d) (1-\tau_t) \left[p_t (1 - \varepsilon_t^{-1}) F_{n_t} - w_t \right] = 0$$

$$(9) \quad (\gamma_t + \lambda_t^d) - E_t \beta_{t+1}^0 (\gamma_{t+1} + \lambda_{t+1}^d) (1 + (1-\tau_{t+1}) i_{t+1})$$

$$- E_t \beta_{t+1}^0 (\gamma_{t+1} + \lambda_{t+1}^d) (1-\tau_{t+1}) c \frac{B_t}{p_t K_t} - \frac{\lambda_t^m}{p_t K_t} + \lambda_t^b = 0$$

$$(10) \quad (\gamma_t + \lambda_t^d) - 1 + \lambda_t^s = 0$$

where μ_t is the present value of tax savings associated with depreciation allowances on investment, and λ_t^k , λ_t^d , λ_t^b , λ_t^s , and λ_t^m are the Lagrange multipliers associated with the capital accumulation equation, with the non-negativity constraints on dividends, debt, new share issues, and with the ceiling on the debt to capital ratio. Subscripts k and i indicate first derivatives respect to capital and investment. ε is the demand elasticity and recognizes explicitly the possibility of imperfect competition. Equations (6) through (10), in addition to the complementary slackness condition (not reported here for brevity sake) defines the firm's optimal plan.

It is well known that in this model a firm will not issue new shares and pay dividends simultaneously.⁸ When the firm issues debt but no new shares, and dividends

⁸ This can be seen from equation (10) and the complementary slackness conditions. When new shares are issued, $\lambda_t^s=0$. (10) then implies that $\lambda_t^d > 0$, and hence $D_t=0$ (provided that $1 > \gamma_t$). When dividends are paid, $\lambda_t^d=0$. Then (10) implies that $\lambda_t^s > 0$. It is also possible to consider a regime in which a firm is not paying dividends or issuing shares. See section II.2 for further discussion.

are strictly positive in period t and $t+1$, then $\lambda_t^d = \lambda_{t+1}^d = 0$. Then solving for λ_t^k into (7), substituting in (6) and assuming a constant demand elasticity, we obtain:

$$(11) \quad \frac{\varepsilon - 1}{\varepsilon} \left\{ F_{k_t} + F_{i_t} - E_t \psi_{t+1} \beta_{t+1}^0 (1-\delta) F_{i_{t+1}} \right\} =$$

$$\left\{ \frac{(1-\mu_t) p_t^k}{(1-\tau_t) p_t} - E_t \psi_{t+1} \beta_{t+1}^0 (1-\delta) \frac{(1-\mu_{t+1}) p_{t+1}^k}{(1-\tau_{t+1}) p_{t+1}} \right\} + E_t \frac{\beta_{t+1}^0 \gamma_{t+1} (1-\tau_{t+1}) A_{k_t}}{p_t \gamma_t (1-\tau_t)}$$

$$- \frac{\lambda_t^m B_t}{\gamma_t (1-\tau_t) p_t p_t^k K_t^2}$$

where:

$$\psi_{t+1} = \frac{\gamma_{t+1} (1-\tau_{t+1}) p_{t+1}}{\gamma_t (1-\tau_t) p_t}$$

This is the appropriate Euler equation when the firm finances its investment at the margin through retentions and new debt. Note that equation (11) contains on the right-hand side the unobservable multiplier λ_t^m associated with the ceiling in the debt to capital ratio. The left hand side of equation (11) is the marginal product of capital net of adjustment costs. The first term on the right hand side is the standard user cost of capital, the second term the marginal reduction in agency cost generated by an increase in the capital stock, and the last term captures the value of an additional unit of capital, insofar as it relaxes the ceiling on the degree of leverage. Along the optimal path, the net marginal product of capital must equal marginal net financial costs.

We could obtain an Euler equation for capital that does not contain the unobservable non negativity multiplier for dividends also when the firm's marginal source of finance is new equity, while dividend payments are equal to zero, since in this case (10) implies that $\lambda_t^d = 1 - \gamma_t$. However, it is possible to think of a situation in which a firm with good investment opportunities has used up all its retentions by cutting dividends to zero, yet it is not profitable to issue new shares. At the margin, investment

will be financed only through debt.⁹ If this is the case at time t or at $t+1$, λ_t^d and λ_{t+1}^d will be different from zero in (6) through (10). Since λ_t^s and λ_{t+1}^s will also be non-zero, the unobservable non-negativity multiplier for dividends cannot be eliminated from the Euler equation. As a result (14) and (16) will be misspecified because they have been obtained by assuming positive dividends payments, so that $\lambda_t^d = \lambda_{t+1}^d = 0$. The emphasis on the dividend floor characterizes the contributions of Fazzari et.al. (1988) in the context of Q models, and by Whited (1988) and Gilchrist (1989) in the context of the Euler equation approach. Although the dividend floor constraint may be empirically important, in this paper we assume that dividend payments are positive, and we concentrate on the imperfection related to the cost and availability of debt, which are of great importance in the context of a developing country. This choice is also motivated by the fact that our data set on Ecuadorian firms does not contain direct information on dividend payments. Hubbard and Kashyap (1992) also focus on debt, and consider the effect of allowing for an exogenous upper limit on the amount of loans available to a firm. Our model differs from theirs because we allow for a rising premium on external finance, as a function of the debt to capital ratio, and for a ceiling in the degree of leverage.

II.1.- EULER EQUATION WITH NON-BINDING CONSTRAINTS

Consider the case in which the firm pays dividends, issues debt, but the ceiling on the degree of leverage is not binding. In this situation, since $\lambda_t^m = 0$, no unobservable multiplier will appear in equation (11). If we assume that the agency cost function is homogeneous of degree one in debt and the capital stock, equation (9) with $\lambda_t^d = \lambda_t^m = \lambda_t^b = 0$, will determine the optimal debt to capital ratio for each level of the discount factor, β_{t+1}^0 . For the purpose of econometric estimation of equation (11) it is necessary to parametrize the agency cost function. Assume that:

$$(12) \quad A(B_{t-1}, p_{t-1}^k K_{t-1}) = \frac{c B_{t-1}^2}{2 p_{t-1}^k K_{t-1}}$$

⁹ The floor on dividend payments may be above zero for signaling reasons. Nothing of substance changes in our analysis if dividend floor is strictly positive.

This specification implies that we can think of the interest rate on debt issued at the end of period $t-1$ to be equal to the safe rate i_t , plus a premium that is linear in the degree of leverage, $\frac{c B_{t-1}}{2 p_{t-1}^k K_{t-1}}$. In order to obtain an equation that can be estimated, we assume an additively separable production function such that $F(K_t, N_t, I_t) = F(K_t, N_t) - G(K_t, I_t)$, where $F(\cdot)$ is a gross value added production function and $G(\cdot)$ is a convex adjustment cost function. We assume that both functions are homogeneous of degree one in their arguments, and that the adjustment cost function can be written as:

$$(13) \quad G(K_t, I_t) = \frac{b}{2} \frac{I_t^2}{K_t}$$

We would expect (although we will not impose) a positive value for b . Using (12) and (13), and replacing expected by actual values we obtain the following equation:

$$(14) \quad \left[\psi_{t+1} \beta_{t+1}^0 (1-\delta) \frac{I_{t+1}}{K_{t+1}} + \frac{1}{2} \frac{I_t^2}{K_t^2} - \frac{I_t}{K_t} \right] =$$

$$\alpha 1 \left\{ \frac{(1-\mu_t) p_t^k}{(1-\tau_t) p_t} - \psi_{t+1} \beta_{t+1}^0 (1-\delta) \frac{(1-\mu_{t+1}) p_{t+1}^k}{(1-\tau_{t+1}) p_{t+1}} - \frac{\pi_t p_t^k}{p_t^k K_t p_t} \right\} + \alpha 2 \left[\frac{Y_t}{K_t} \right]$$

$$+ \alpha 3 \left\{ \frac{\gamma_{t+1}(1-\tau_{t+1}) \beta_{t+1}^0 B_t^2 p_t^k}{\gamma_t(1-\tau_t) (p_t^k K_t)^2 p_t} \right\} + \nu_{t+1}$$

where:

$$\alpha 1 = \frac{\varepsilon}{b(\varepsilon-1)}, \quad \alpha 2 = \frac{1}{b(\varepsilon-1)}, \quad \alpha 3 = \frac{-c\varepsilon}{2b(\varepsilon-1)}$$

π_t represents nominal operating profits (value added minus wage bill), Y_t output, and ν_{t+1} is a serially uncorrelated forecast error.¹⁰ Note that equation (14) is

¹⁰ Note that $F(K, N) = F_k K + F_n N$. Using the first order condition for labor, equation (8), we can obtain $F_k = \frac{\varepsilon}{\varepsilon-1} \pi_t - \frac{1}{\varepsilon-1} \frac{Y_t}{K_t}$. Together with (12) and (13), this yields equation (14).

exactly identified so we can recover the structural parameters of the model. We are particularly interested in the slope of the agency cost function, c . Note also that if there is perfect competition, i.e. $\varepsilon \rightarrow \infty$, then $\alpha_1 = 1/b$, $\alpha_2 = 0$, and $\alpha_3 = -c/2b$.

II.2.- EULER EQUATION WITH BINDING CONSTRAINTS

Equation (14) is correctly specified only if the firm does not face credit constraints. When the ceiling for the debt to capital ratio is reached, an additional variable containing the unobservable multiplier λ_t^m should appear in the Euler equation (see equation (11)). However, even if the ceiling is binding, we can eliminate λ_t^m using the first order condition for debt. If we continue to assume that the firm is using a positive amount of debt, so that $\lambda_t^b = 0$, from (9) we can obtain:

$$(15) \quad \frac{\lambda_t^m}{p_t^k K_t} = \gamma_t - E_t \beta_{t+1}^0 \gamma_{t+1} (1 + (1-\tau_{t+1}) i_{t+1}) - E_t \beta_{t+1}^0 \gamma_{t+1} (1-\tau_{t+1}) c \frac{B_t}{p_t^k K_t}$$

Substituting (15) into (11) and replacing expected by actual values yields:

$$(16) \quad \left[\psi_{t+1} \beta_{t+1}^0 (1-\delta) \frac{I_{t+1}}{K_{t+1}} + \frac{1}{2} \frac{I_t^2}{K_t^2} - \frac{I_t}{K_t} \right] =$$

$$\frac{\varepsilon}{b(\varepsilon-1)} \left\{ \frac{(1-\mu_t) p_t^k}{(1-\tau_t) p_t} - \psi_{t+1} \beta_{t+1}^0 (1-\delta) \frac{(1-\mu_{t+1}) p_{t+1}^k}{(1-\tau_{t+1}) p_{t+1}} - \frac{\pi_t p_t^k}{p_t^k K_t p_t} \right\} + \frac{1}{b(\varepsilon-1)} \left\{ \frac{Y_t}{K_t} \right\}$$

$$- \frac{c\varepsilon}{2b(\varepsilon-1)} \left\{ \frac{\gamma_{t+1}(1-\tau_{t+1}) \beta_{t+1}^0 B_t^2 p_t^k}{\gamma_t(1-\tau_t) (p_t^k K_t)^2 p_t} \right\} + \frac{c\varepsilon}{b(\varepsilon-1)} \left\{ \frac{\gamma_{t+1}(1-\tau_{t+1}) \beta_{t+1}^0 B_t^2 p_t^k}{\gamma_t(1-\tau_t) (p_t^k K_t)^2 p_t} \right\}$$

$$- \frac{\varepsilon}{b(\varepsilon-1)} \left\{ \frac{[\gamma_t - \beta_{t+1}^0 \gamma_{t+1} (1 + (1-\tau_{t+1}) i_{t+1})] B_t p_t^k}{\gamma_t (1-\tau_t) p_t^k K_t p_t} \right\} + \nu_{t+1}$$

Comparing (14) with (16), we see that two additional regressors (the last two

in (16)) now appear in the Euler equation. They are a quadratic and a linear term in the debt to capital ratio. Adding together the coefficients of the two quadratic terms in the debt to capital ratio reverses the sign that we have obtained in the case in which credit constraints were not binding. This is a convenient feature of the model because it allows us to test whether the ceiling on debt is binding or not. Therefore, the equation to be estimated can be written as:

$$(17) \quad \left[\psi_{t+1} \beta_{t+1}^0 (1-\delta) \frac{I_{t+1}}{K_{t+1}} + \frac{1}{2} \frac{I_t^2}{K_t^2} - \frac{I_t}{K_t} \right] =$$

$$\alpha 1 \left\{ \frac{(1-\mu_t) p_t^k}{(1-\tau_t) p_t} - \psi_{t+1} \beta_{t+1}^0 (1-\delta) \frac{(1-\mu_{t+1}) p_{t+1}^k}{(1-\tau_{t+1}) p_{t+1}} - \frac{\pi_t p_t^k}{p_t^k K_t p_t} \right\} + \alpha 2 \left\{ \frac{Y_t}{K_t} \right\} +$$

$$\alpha 3 \left\{ \frac{\gamma_{t+1} (1-\tau_{t+1}) \beta_{t+1}^0 B_t^2 p_t^k}{\gamma_t (1-\tau_t) (p_t^k K_t)^2 p_t} \right\} +$$

$$\alpha 4 \left\{ \frac{[\gamma_t - \beta_{t+1}^0 \gamma_{t+1} (1 + (1-\tau_{t+1}) i_{t+1})] B_t p_t^k}{\gamma_t (1-\tau_t) p_t^k K_t p_t} \right\} + \nu_{t+1}$$

where:

$$\alpha 1 = \frac{\varepsilon}{b(\varepsilon-1)}, \quad \alpha 2 = \frac{1}{b(\varepsilon-1)}, \quad \alpha 3 = \frac{c\varepsilon}{2b(\varepsilon-1)}, \quad \alpha 4 = -\frac{\varepsilon}{b(\varepsilon-1)}$$

The importance and the type of capital market imperfections is reflected in the significance and signs of the coefficients in front of the leverage terms in equation (17). If $\alpha 3 > 0$ and $\alpha 4 < 0$, then this can be taken as evidence that the firm faces an increasing premium for external finance, and that it has also hit the ceiling constraint for leverage. Note also that the model implies that $-\alpha 4 = \alpha 1 = \varepsilon/[b(\varepsilon-1)]$. If we impose this restriction, the model becomes just identified and we can recover the structural parameters. If $\alpha 3 < 0$ and $\alpha 4$ is not different than zero, then we return to the model of equation (14), in which the interest rate increases with the debt to capital ratio, but the ceiling is not binding. Finally, if $\alpha 3 = 0$ and $\alpha 4 = 0$, then we are back to a model in which

both types of financial constraints are absent.

III- CAPITAL MARKET IMPERFECTIONS AND FIRMS' HETEROGENEITY: ECONOMETRIC RESULTS

In the specification and estimation of the various models, the error term is modeled as the sum of a firm specific effect, a time effect common to all firms, and an idiosyncratic shock. To eliminate the firm specific effect all the equations are estimated in first differences. To allow for the potential endogeneity of the regressors, we use the Generalized Method of Moments (See Hansen (1982), and Arellano and Bond (1991)). As a test of specification we also provide the Sargan-Hansen test of over-identifying restrictions.¹¹

The model summarized in equation (17) has been estimated on a balanced panel of 420 firms in the manufacturing sector, covering the period 1983-1988. The panel is based on data collected by the Superintendencia de Compañías, and consist of balance sheets and profit and loss statements.¹² In order to estimate (17), we must choose a proxy for the discount factor β_{t+1}^0 .¹³ We have experimented with proxies based upon the interest rate on deposits, adjusted and unadjusted for a risk premium, and upon the lending rate. Results are not sensitive to the different measures of β_{t+1}^0 . As we mentioned before, the significance of α_3 and/or α_4 represents deviations from the investment model under perfect capital markets. If $\alpha_3 < 0$ and $\alpha_4 = 0$, then the model would be consistent with imperfections related to agency/financial distress costs that make the borrowing rate depend upon the degree of leverage. If instead, $\alpha_3 > 0$ and $\alpha_4 < 0$, then in addition we expect to have binding credit constraints.

In Table 1 column (A) we present estimates of the unrestricted version of (17) (the restriction $-\alpha_4 = \alpha_1$ has not been imposed) over the entire period. Column (A)

¹¹ We have used the DPD program for estimation. See Arellano and Bond (1988).

¹² See the Data Appendix for a more detailed description.

¹³ When the ceiling on the degree of leverage is not binding, we can obtain from the first order conditions for debt, (12), a relationship between the firm's discount factor, on the one hand, and the safe rate of interest and the debt to capital ratio, on the other. Assuming that the safe rate of interest and the tax parameters for the next period are known at time t , we could solve for β_{t+1}^0 and use the result in the Euler equation (17). However, when the ceiling constraint is binding, we cannot replace β_{t+1}^0 in (20) in terms of observable variables (λ_t^m will appear in the definition of β_{t+1}^0).

contains the results for the full sample of firms.¹⁴ The coefficients α_1 and α_2 , that are functions of the adjustment cost parameter, b , and the elasticity of demand, ε , have the expected sign and are fairly significant. However, the estimates of α_3 and α_4 , that capture capital market imperfections, suggest that we cannot reject the perfect capital market model. α_3 and α_4 , in fact, are not individual or jointly significant (see $W_2=4.86$, distributed as $\chi^2(2)$). The Sargan/Hansen test does not suggest gross misspecification, either.

It would be wrong, however, to conclude that the paradigm of a perfect capital market is appropriate to describe the conditions faced by all Ecuadorian firms. It is likely, for instance, that firms' access to external funding depends upon firms' characteristics like size and age. Informational problems are likely to be more severe for small and/or young firms. Size consideration may also affect the access to the directed credit programs at subsidized rates available in Ecuador, although it is difficult to say a priori which firms will benefit more. On the one hand, certain programs like the ones promoting exports, are likely to be more advantageous for large firms. The latter probably also enjoyed better political connections, which may be instrumental in obtaining access to directed credit. On the other hand, in Ecuador there were lines of credit that provided cheap access to long term finance for small firms.¹⁵ Finally, the resources devoted to the provision of directed credit have actually decreased with the introduction of financial reform. We will discuss at length the effect of financial liberalization in the next section.

In column (B) of Table 1, we allow the coefficients on the financial variables, α_3 and α_4 , to differ between small and large companies. We define large companies as those that have a value of capital stock (in machinery, plant and equipment) greater than 600,000 US dollars at 1975 prices. They represent in average 22% of the total sample over the period. Note that we allow firms to transit over different categories by introducing an endogenous size dummy variable for the two categories and interacting them with the last two financial terms in equation (19). The GMM estimation method we have adopted, that uses appropriate lagged variables as instruments, accounts for the endogeneity of the size dummies and the other regressors. In this case, the Wald test of joint significance of the coefficients on the leverage terms ($W_2 = 10.25$ with four degrees of freedom), points to a rejection of the model of perfect capital markets at the 5%

¹⁴ The results in columns (A) through (C) are obtained using the interest rate on deposits to obtain a proxy for β_{t+1}^0 .

¹⁵ See Jaramillo (1992), Chapter II for more details on financial reforms in Ecuador.

significance level. A closer look at the results shows an interesting difference between

Table 1
UNRESTRICTED ESTIMATES OF EQUATION (20):
ROLE OF SIZE AND AGE

Coefficient	(A) Whole sample	(B) With size interaction dummies	(C) With age interaction dummies	(D) Including risk premium
α_1	0.107 (1.73)	0.205 (2.81)	0.218 (2.40)	0.203 (2.84)
α_2	0.030 (3.60)	0.038 (3.94)	0.039 (3.81)	0.038 (3.93)
α_3	0.009 (1.20)			
α_4	0.096 (0.22)			
α_{31}		-0.038 (-0.79)	0.012 (1.20)	-0.038 (-0.80)
α_{30}		0.022 (2.25)	0.022 (1.77)	0.022 (2.28)
α_{41}		-0.835 (-0.38)	0.183 (0.41)	-0.755 (-0.34)
α_{40}		-0.884 (-1.25)	-1.680 (-1.46)	-0.864 (-1.25)
W1	17.83 4	24.97 6	20.84 6	25.09 6
W2	4.86 2	10.255 4	5.876 4	10.38 4
M1	-8.29	-7.530	-8.660	-7.51
Sargan/Hansen	23.68 21	24.549 22	24.549 23	24.76 22

Instruments: $gmm(I/K)$, $gmm(I/K)^2$, $gmm(Y/K)$, L/K , $(L/K)^2$, $D1(B/K)$, $D1(B/K)^2$, $D0(B/K)$, $D0(B/K)^2$, $I/(1+i)$, $D1$, all dated $t-2$ in levels. L represents liquid assets; $D1$ is the dummy for large (old) firms, $D0$ for small (young) firms. Asymptotic "t" statistics are shown in parenthesis. W1: Wald test for joint significance of all the regressors. W2: Wald test for joint significance of financial variables. M1: test for first order serial correlation, distributed as $N(0,1)$. The Sargan/Hansen test is distributed as a χ^2 . Degrees of freedom are presented below the respective tests.

large firms, on the one hand, and smaller firms, on the other. Note that the first number following the α 's refers to the coefficient number, as defined in (20), and the second number refers to size (1 for large firms, 0 for small firms). For large firms there is no strong indication that variables capturing firms' financial structure matter. It is interesting to note that despite its low significance, the coefficient on the quadratic term on the

leverage ratio (α_{31}) is negative, as one would have expected in the case where firms face increasing costs of borrowing but no binding credit constraints. The coefficient on the linear term (α_{41}) should then not be different from zero.

For small firms, the situation is very different. Here we find a significant positive coefficient on the quadratic term (α_{30}) which is consistent with a model where firms face both credit constraints and rising costs of borrowing. The coefficient on the linear term (α_{40}) is negative as expected in this case, although not very precisely determined. This suggests that smaller firms are more likely to be affected by informational problems and not only have to pay an increasing premium for debt, but are also rationed in the credit markets.

A similar picture results if we divide firms by age. In column (C) of Table 1 we present results allowing for different slope coefficients for young firms, and old firms. Young firms are defined as those born after 1970, and represent 47% of the sample.¹⁶ Young firms appear to be more constrained and facing higher costs of debt, as we can see from the coefficients α_{30} and α_{40} , compared to old firms (see α_{31} and α_{41}). Note also that letting financial factors have a different effect according to size or age increases the overall significance, as well as the individual significance of the first two coefficients α_1 and α_2 (on profits and output). This is a further indication that the specification allowing for capital market imperfections is more satisfactory.

Up to this point we have allowed firms to differ only with respect to the degree and type of capital market imperfections they face. However, demand elasticities and adjustment costs parameters may also differ across firms' categories. This can be easily handled by interacting, for instance the profit and output terms in (20) with size dummies. When this is done, we cannot reject the hypothesis that α_1 and α_2 do not differ across size categories. For the model in column (B), for example, the Wald test is 2.32 with two degrees of freedom.

Finally, in column (D) we report the results obtained when a risk premium of 5% for small firms is added to the deposit rate in constructing a proxy for β_{t+1}^0 . As one can see, results are nearly identical to the ones of column (A). The same is true if the premium is added also for large firms.

Let us explore further the results obtained when size interaction dummies are included. Since the coefficients in front of the financial variables for large firms (α_{31} and α_{41}) are not significant, we can set them both to zero. In this case we obtain the

¹⁶ In this case, in α_{ij} , j refers to age ($j=1$ for old firms, and $j=0$ for young firms).

model in column (A) of Table 2.

Table 2
RESTRICTED ESTIMATES OF EQUATION (20)

Coefficient	(A)	(B)
α_1	0.211	0.165
	(2.84)	(2.53)
α_2	0.037	0.035
	(3.55)	(4.05)
α_{31}		
α_{30}	0.028	0.013
	(2.62)	(2.30)
α_{40}	-1.046	
	-(1.50)	
W1	25.99	21.15
	4	3
W2	10.66	6.29
	2	1
M1	-8.06	-8.19
	420	
Sargan/Hansen	26.66	22.29
	20	22

See footnotes to Table 1

The corresponding coefficients for smaller firms (α_{30} and α_{40}) become more significant, and indicate that smaller firms suffer from both sources of capital market imperfections. From equation (17) the coefficient in front of the profit term and the one in front of the (linear) leverage term should be equal in absolute value and opposite in sign ($-\alpha_{40} = \alpha_1$). When we impose this restriction, we obtain the model in column (B). We can then recover the structural parameters b , ϵ , and c . All the coefficients have the expected sign and are significant. Sargan/Hansen test does not provide evidence against the specification and the choice of instruments. The structural parameters of the model are presented in Table 3. All of them are significant and have reasonable magnitudes.

The size of the elasticity of demand, ϵ , indicates that firms in the manufacturing sector have some monopolistic power. More precisely, an ϵ of approximately 4.5 implies a mark-up over marginal cost of 28.6%. We are not aware of any other study that estimates the elasticity of demand for manufacturers in Ecuador. However, the magnitude of this parameter is similar to the one obtained by estimating the

Euler equation for capital for other countries (see for instance Galeotti and Schiantarelli (1991)).

Table 3
STRUCTURAL PARAMETERS

Parameter	Value
c	0.158
	(7.46)
e	4.753
	(8.99)
b	7.659
	(6.70)

Asymptotic "t" statistics in parenthesis.

Investment models estimated under the assumption of quadratic adjustment costs have often yielded very high values of the adjustment cost parameters that imply huge costs of changing the capital stock. The value of b obtained here is, instead, reasonable and it implies that adjustment costs are approximately 6.2% of total sales in manufacturing during the 1984-1988 period, still substantial but not unrealistically so.¹⁷

Finally, the slope coefficient of the marginal agency cost for small firms, c, implies that the average premium over the safe rate (calculated at the average debt to capital ratio) is 7.7%.¹⁸ To get an idea of the importance of the premium, note that in 1986, for example, the average nominal borrowing rate was 30.75% and the real one approximate 9%.

IV.- THE EFFECT OF FINANCIAL LIBERALIZATION

The importance of capital market imperfections for different types of firms has been highlighted and empirically tested in last section. It is likely that the results we have obtained reflect both the presence of asymmetric information problems and the importance of administrative controls on interest rates and on the allocation of credit which were widely used until the first half of the 80's. In this section we discuss whether financial liberalization has relaxed financial constraints for Ecuadorian firms. This was the presumption of the early literature on financial liberalization, which suggested that

¹⁷ Note that adjustment costs = $\frac{b}{2} \frac{I^2}{K}$. If we divide by Y, we get $\frac{b}{2} \frac{I^2}{K^2} \frac{K}{Y}$. This formula is used to calculate the size of adjustment costs reported in the text, using sample averages for the investment rate (0.19), and the capital-output ratio (0.37).

¹⁸ The premium is equal to $\frac{c}{2} \frac{B}{p^k K}$. In the calculation we have used the average leverage ratio for small firms over the entire period (0.96).

freeing the interest rates from controls that kept them artificially low, would increase the supply of loanable funds, and alleviate problems of credit constraints.¹⁹ Whatever the macro effect may be, it is not clear that liberalization will necessarily relax financial constraints for all classes of firms. Even after the elimination of administrative constraints, information problems remain and it is possible that certain firms may face a rise in the premium they have to pay for external finance. Moreover, one must pay attention to the impact for different classes of firms of the reduced importance of subsidized credit programs that accompanies financial reform. In the context of our model, one way to assess the impact of liberalization is to analyze whether there is a structural change in the coefficients of the variable that capture the rising cost of funds schedule, or the ceiling on the degree of leverage.

Financial reform in Ecuador has not been implemented with a single act, but has been a multi-stage process. This implies that there is some degree of arbitrariness in the choice of the breaking point of the sample to conduct tests of structural stability. We have chosen 1986 because in that year all interest rates were completely freed and the real rate reached positive levels (of approximately 10 per cent in 1986 and 1987) for the first time in many years. Moreover, most subsidized credit programs were eliminated or substantially reduced. These included export credits under FOPEX (Fund for Export Promotion) and subsidized lines of credit for small firms like FOPINAR (Fund for Small Industry and Handicraft).

In testing for structural change in the context of equation (17), if liberalization relaxes the ceiling constraint, then the linear term in the leverage ratio should not enter the equation ($\alpha_4a=0$).²⁰ Moreover, the coefficient on the quadratic term on the leverage ratio (α_3a) should switch sign and become negative. If liberalization helps in mitigating informational problems that cause an increase in the premium for external finance, then we would expect α_3a to be smaller in absolute values than α_3b , its value before liberalization. If both α_3a and α_4a are not significant this would mean that the perfect market paradigm cannot be rejected after liberalization.

A different way of assessing the impact of financial reform would be to see whether the marginal significance level of the Sargan/Hansen test of over-identifying restrictions changes when the equation is estimated allowing the coefficients to differ before and after liberalization. The Sargan/Hansen test statistics in Tables 2 and 4 do not suggest that there is evidence of misspecification against either set of equations, and the

¹⁹ See McKinnon (1973) and Shaw (1973).

²⁰ a refers to the value of the coefficients after liberalization, and b before liberalization.

marginal significance levels do not change in any informative way.

In the previous section we have argued that capital markets imperfections affect mainly small firms. The relevant question is then whether financial liberalization has improved their access to external finance. Results are presented in column (A) of Table 4 for the model that corresponds to column (A) in Table 2, but allows the coefficients on the financial variables to differ pre and post liberalization. The evidence suggests that small firms suffered from a ceiling constraint and an increasing cost of borrowing both before and after liberalization. Moreover we cannot reject the hypothesis that the coefficients capturing capital market imperfections are identical in the two sub periods.

Finally, if we impose the restriction that $-\alpha_4 b = -\alpha_4 a = \alpha_1$, as the theory suggests, we can recover the structural parameters. The results for the restricted version of (17) are presented in column (B). The estimates in column (B) suggest that the slope of the marginal agency costs function for small firms, c , decreases slightly after liberalization (from .175 to .155), and it is less significant. However, the difference is not statistically significant.

Table 4
EULER EQUATION AND THE EFFECT OF FINANCIAL REFORM

Coefficient	(A)	(B)
α_1	0.190 (2.42)	0.164 (2.09)
α_2	0.041 (3.78)	0.032 (3.52)
α_{30a}	0.051 (2.41)	0.013 (1.51)
α_{30b}	0.036 (2.49)	0.014 (2.54)
α_{40a}	-1.884 (-1.49)	
α_{40b}	-1.862 (-1.70)	
W1	25.02 6	18.741 4
W2	12.87 4	6.547 2
M1	-8.59	-9.035
Sargan/Hansen	15.98 17	21.995 19

See footnotes to Table 1. In the definition of instruments we allow for the pre and post liberalization split for the debt to capital ratio.

Although we do not present the econometric estimates for reasons of space, we have obtained very similar results when firms are divided according to their age. Also in this case, the financial constraints facing young firms were not affected significantly by financial reform.

One of the drawbacks of the Euler Equation approach is that it imposes a tight structure on the data and is sensitive to extraneous model misspecification. For this reason, it is useful to supplement the results obtained from Euler equations with those derived from estimating a more loosely specified investment equation of a generalized accelerator type, with the addition of variables that measure the availability of internal funds, like cash flow. The idea is that, once we control for variables that capture investment opportunities (the change and the lagged level of output in the equation below) cash flow should matter more if a firm is financially constrained.²¹ The problem

²¹ See Harris, Schiantarelli and Siregar (1992) for evidence from unrestricted investment equations estimated on a panel of Indonesian firms that financial reform has been beneficial for smaller firms in

with this approach is that cash flow itself may be an indicator of future profitability.

The equation we have estimated is:

$$(20) \quad \frac{I_t}{K_t} = \gamma_0 + \gamma_1 \frac{I_{t-1}}{K_{t-1}} + \gamma_2 \frac{\Delta Y_t}{K_t} + \gamma_3 \frac{Y_{t-1}}{K_{t-1}} + \gamma_4 \frac{CF_{t-1}}{p_{t-1} K_{t-1}} + \nu_t$$

where: $\frac{CF_{t-1}}{p_{t-1} K_{t-1}}$ is the lagged cash flow to capital ratio

The model was estimated in first differences and using GMM, to control for firm specific effects and to account for endogeneity problems. We have also interacted cash flow with two dummy variables which equal one respectively for large firms and for the post liberalization period, and are zero otherwise. The coefficients on these three additional regressors capture the difference due to size being large and to liberalization, with respect to the reference case of small firms in the pre liberalization period.²² The results, reported in Table 5, suggest that cash flow has a different effect on large and small firms. While the availability of internal finance is of some importance for the latter (shown by a positive and significant γ_4 coefficient equal to 0.082), it is not for large firms (the sum of γ_4 and γ_41 is practically zero). This situation did not change for either small or large firms after financial liberalization, since we cannot reject the hypothesis that α_4a and α_41a are individually or jointly zero. The conclusions that can be derived from the estimation of the unrestricted investment equation are similar to those obtained from the Euler equation approach. Results presented here suggest that financial reform did not help in improving the access to credit markets or in reducing significantly the premium for external finance for small firms.

Indonesia.

²² In the coefficients definition, 1 denotes large firms, and a the period after liberalization.

Table 5
AD HOC INVESTMENT EQUATION AND
THE EFFECT OF FINANCIAL REFORM
(1984-1988)

Coefficient	
γ_1	0.056
	(2.03)
γ_2	0.0004
	(6.40)
γ_3	0.008
	(3.34)
γ_4	0.082
	(1.82)
γ_{4a}	0.012
	(0.14)
γ_{41}	-0.082
	-(1.88)
γ_{41a}	0.034
	(0.38)
W1	411.358
	7
W2	10.340
	4
M1	-9.570
M2	-0.049
Sargan/Hansen	49.339
	37

Instruments: $gmm(I/K)$, $gmm(Y/K)$, $gmm(CF/K)$, $gmm(B/K)$, π/K , GDP by industry, $1+i$, all dated $t-2$. W1: Wald test for joint significance of all the regressors. W2: Wald test for joint significance of financial variables. M1: first order serial correlation test; M2: second order serial correlation test, both distributed as $N(0,1)$.

V.- CONCLUSIONS

The estimation of Euler equations for the capital stock suggests that capital market imperfections have a differential effect across firms, both pre and post liberalization. In particular there is empirical support for a rising supply of funds schedule and rationing in the case of small (young) firms, but not in the case of large (old) firms. Our econometric results are not supportive of a substantial regime change after liberalization. Financial reform does not seem to have had much effect on the financial constraints faced by firms when making investment decisions. One should treat this conclusion with caution, since the Euler equation approach imposes a rather stringent

structure on the data. However, the econometric results do not contain obvious signs of misspecification, and the estimation of a more loosely specified investment model leads to the same conclusions.

The main limitation of our exercise is the fact that we have available a small number of years before and after the implementation of financial reform to allow us to assess fully its effects in the longer term. Moreover, the evolution of the macroeconomic situation in Ecuador may be part of the explanation. In fact, the increase in the real interest rate in Ecuador was interrupted by a severe inflationary episode in 1988, following a major earthquake and fiscal mismanagement. Finally, the second part of the 80's saw a reduction in the funds provided by the Central Bank to the commercial banks (to support directed credit programs) that was not fully compensated by the increase in financial savings during the years of positive interest rate. As a result, the real supply of credit to the private sector decreased in real terms between 1986 and 1988, and it is likely that this has influenced the effect of financial reform on different categories of firms. All this suggests that further work is needed on different countries and using longer panels. This paper should only be considered as a first step in evaluating the impact of financial reform on financial constraints.

DATA APPENDIX

The econometric estimation was based on a balanced panel of 420 firms in the manufacturing sector for which there was continuous information for sales, capital stock, value added, profits, and other key variables for the study. Firms selected had to satisfy standard consistency checks, and additional criteria, including non-negative capital stock or value added. The panel is based on information collected by the "Superintendencia de Compañías" (SC) of Ecuador. SC is an official agency that controls corporate activities. Among other duties, every quarter SC collects and inspects information presented by companies. By law, firms have to submit accurate information in order to do business in Ecuador and carry out a wide range of activities such as obtaining credit (official loans, as well as regular credit), tax identification numbers, etc.

The data includes yearly balance sheet and profit and losses information for the period 1984-1988. The balance sheets also include information of the revaluation of assets allowed by the Government to account for inflation and exchange rate depreciation. The definition of investment includes plant and machinery, buildings, and others (excluding land), and has been obtained by taking the difference between the gross capital stock at historical cost. The capital stock measure used in the equations is instead the revalued measures of the net capital stock. Our measure of debt includes both long term and short term debt, mainly obtained from banks and other financial institutions. Trade debt is not included. As a proxy for the output price we have used the two-digit wholesale price index. As a proxy for the price of investment goods, we have used the aggregate investment deflator. Both series are regularly published by the Banco Central del Ecuador. The statutory tax rates and depreciation allowances were used in calculating τ_t and the present value of tax savings associated with a unit of new investment, μ_t . The personal tax rate, m_t , has been set equal to 20% and the effective rate on capital gains, z_t , equal to zero.

In estimating our model we classify as large those firms with a capital stock larger than 600,000 dollars at 1975 prices. The panel includes 91 large and 329 small firms. We define as young those firms that are born after 1970. The panel has 197 young firms and 223 old firms. For additional details on the data sources see Jaramillo (1992).

BIBLIOGRAPHY

Arellano, M. and S. Bond (1991), "Some tests of specification for panel data: Monte Carlo Evidence and an application to employment situations", Review of Economic Studies, Vol. 58, pp. 277-297.

Arellano, M. and S. Bond (1988), "Dynamic Panel Data Estimation Using DPD: A Guide For Users", Institute For Fiscal Studies Working Paper No. 88/15

Bernanke, B. and M. Gertler (1989), "Agency Costs, Net worth and Business Fluctuations", American Economic Review, Vol. 79, No. 1, March, pp. 31-41.

Blundell, M., S. Bond, M. Devereux, and F. Schiantarelli (1992), "Investment and Tobin's Q: Evidence from Company Panel Data", Journal of Econometrics, Vol. 51, pp. 233-257.

Calomiris C. and Hubbard R. (1990), "Firm Heterogeneity, Internal Finance and Credit Rationing", The Economic Journal, Vol. 100, pp. 90-104.

Devereux, M.P., and F. Schiantarelli (1990), "Investment, Financial Factors & Cash Flow from UK Panel Data", in Information, Capital Market and Investment, edited by G. Hubbard, Univ. Of Chicago Press.

Fazzari, F.M., Hubbard, R.G., and Petersen, B.C., (1988), "Financing Constraints and Corporate Investment", Brookings Papers on Economic Activity, Vol. 1, pp. 141-195.

Fry, M.W., (1988), Money, Interest, and Banking in Economic Development, The Johns Hopkins University Press, Baltimore.

Galeotti, M., and F. Schiantarelli, (1991), "Generalized Q Models for Investment", The Review of Economics and Statistics, Vol. LXXIII, No. 3, August, pp. 383-392.

Galeotti, M., F. Schiantarelli, and F. Jaramillo (1990), "Investment Decisions and The Role of Debt, Liquid Assets, and Cash Flow: Evidence from Italian Panel Data", Mimeo, March.

Gertler, M., and R. G. Hubbard (1988), "Financial Factors in Business Fluctuations," in Financial Market Volatility, Federal Reserve Bank of Kansas City, Sept.

Gertler, M., R. G. Hubbard, and A. Kashyap, (1990), "Interest Rate Spreads, Credit Constraints, and Investment Fluctuations: an Empirical Investigation", NBER Working Paper No. 3495.

Gilchrist, S., (1989) "An Empirical Analysis of Corporate Investment and Financing Hierarchies using Firm Level Panel Data", Mimeo, Univ. of Wisconsin - Madison, Nov.

Greenwald, B., and J. Stiglitz (1988), "Financial Market Imperfections and Business Cycle", NBER, Working Paper # 2494.

Hansen, L.P., (1982), "Large Sample Properties of General Methods of Moments Estimations", Econometrica, Vol. 50, July, pp.1029-1054.

Harris, J., F. Schiantarelli, and M. Siregar (1992), "The Effect of Financial Liberalization on Firms' Capital Structure and Investment Decisions: Evidence from a Panel of Indonesian Manufacturing Establishments, 1981-1988", mimeo.

Hoshi, T., Kashyap, A., and D. Scharfstein, (1990), " Corporate Structure and Investment: Evidence from Japanese Panel Data", Quarterly Journal of Economics,

Hubbard, G.R., and Kashyap, A. (1992), "Internal Net Worth and the Investment Process: An Application to U.S. Agriculture, 1910-1987," Journal of Political Economy, Vol. 100, No.3, June, pp. 506-534

Jaramillo, F., (1992), Investment and Export Decisions in Ecuador, unpublished Ph.D. Dissertation, Boston University.

Jaramillo, F., F. Schiantarelli, and A. Weiss (1992), " The Effect of Financial Liberalization on the Allocation of Credit: Panel Data Evidence for Ecuador" , mimeo.

Leyland, H., and Pyle, D.(1977), "Information Asymmetries, Financial Structure and Financial Intermediaries", Journal of Finance, Vol 32, pp. 371-387.

McKinnon, Ronald I.,(1973), Money and Capital in Economic Development, The Brookings Institution, Washington D.C.

Myers, S.C., and Majluf, N.S., (1984), " Corporate Financing and Investment Decisions when firms have information that investors do not have", Journal of Financial Economics, Vol. 13, June, pp.1417-1426.

Nabi, I.,(1989), "Investment in Segmented Capital Markets", Quarterly Journal of Economics, Vol 54, August, pp. 453-462.

Shaw, E. S. (1973), Financial Deepening in Economic Development, Oxford University Press, New York.

Stiglitz, J.E., and A. Weiss (1981), "Credit Rationing in Markets with Imperfect Information", American Economic Review, Vol 71, June, pp.393-410.

Tybout, J.R. (1983), "Credit Rationing and Investment Behavior in a Developing country", Review of Economics and Statistics, Vol 65, pp. 598-607.

Wette, H.C. (1984), "Collateral in Credit Rationing in Markets with Imperfect Information: Note," American Economic Review, Vol. 73, pp.442-445.

Whited, T.M. (1992), "Debt, Liquidity Constraints, and Corporate Investment: Evidence from Panel Data," Journal of Finance, in press.