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LABOR MARKET FREEDOM AND CORPORATE INVESTMENT. THEORY AND EVIDENCE FROM NORTH AMERICA DATA

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Labor Market Freedom and Corporate Investment. Theory and Evidence from North America data.

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Abstract

We model the channels through which labour market freedom (LMF) affects firm value and shapes its investment decisions in a non competitive market for goods and in presence of financing frictions. We test the theoretical predictions from our model by using a large panel of firms and countries data. Appropriate proxies of labour market freedom and financing constraints are used in the analysis. Consistently with the model, empirical results show that LMF affects investment by affecting the firm's profitability, which in turn depends on the firm's costs and revenues, by relaxing a firm's financing constraints and by reducing the adjustment cost the firm faces in expanding its productive capacity. The effects vary across regions and sectors.

Keywords: Labor market freedom, Firm's value, comporate investments

`Very preliminary draft. Please do not quote`

1 Introduction

This paper studies the impact of Labor Market Freedom (LMF) on corporate investment in presence of capital market imperfections (KMI) and in a non competitive market for goods. In particular, we model the channels through which LMF affects the firm's value and shapes its investment decisions. Our model suggests that LMF affects investment by affecting the firm's profitability, which in turn depends on the firm's costs and revenues, by relaxing a firm's financing constraints and by reducing the adjustment cost the firm faces in expanding its productive capacity.

The model we propose accounts for a number of important issues arising when the relationship between LMF and firms investment is of interest. First, our model takes into account that there exists systematic cross-economies differences in the degree of LMF. Second, we take into consideration the fact that firms face different degree of financing constraints, that can be seen as dependence on the internal cash flow to finance investment because of the higher cost of external finance (Rajan and Zingales, 1998). Third, we investigate the possibility that LMF enhances firm investment. Fourth, we expect the impact of LMF on investment to be dependent on the degree of financing constraints existent across firms and sectors within an economy[1]. Finally, our model lets the market structure playing an important role in defining the effects of LMF on investment.

Our model is a novelty in this literature as it provides a theoretical framework to analyze both the effect of KMI on investment and of LMF on investment via its influence on price of labor, investment adjustment costs and financing constraints.

The first effect, that is the micro-level examination of the link between KMI and investment has seen considerable work since a number of studies after Modigliani and Miller (1958) have extended conventional models of fixed investment to incorporate the role of financing constraints in determining investment (see Hubbard 1998 for a survey). The underlying idea of these studies is that, while in a Modigliani and Miller (1958) setting a firm's capital structure is irrelevant for its investment decisions under the assumption of perfect and complete capital markets, in presence of capital market imperfections, such as asymmetric information and costly agency conflicts, there is a wedge between the cost of internal and external finance. Due to this wedge the firm's

[1] In line with Calcagnini et al.(1999) showing that the impact of EPL on investment is stronger in economies with less efficient capital markets, we expect that when LMF increases, investment of less financially constrained firms increases more than that of more financially constrained firms.

financial structure becomes relevant and firms may have prefer internally generated funds over external sources to finance investment (Myers, 1984; and Myers and Majluf, 1984). This explain why a large number of studies use the magnitude of the sensitivity of investment to cash flow as a measure of the degree of financing constraints faced by firm (Hubbard, 1998). Our model incorporates this effect by specifying a firm stochastic discount factor affecting the current decision to invest and which is in turn affected by the firm availability of cash stock.

The second effect, that is the impact of LMF on investment has not been analyzed yet by the existent literature. There is, however, a number of studies that has analyzed the impact of Employment Protection Legislation (EPL) on investment. EPL refers both to regulations concerning hiring - e.g. rules favouring disadvantaged groups, conditions for using temporary or fixed-term contracts, training requirement - and firing - e.g. redundancy procedures, mandated prenotification periods and severance payments - (OECD 1999). Nevertheless, there is no consensus on the sign of the effect of the EPL on investment. On the one hand, it is argued that higher EPL values increase the adjustment costs to the optimal level of investment as firms find it costlier to adjust the labor input in presence of shocks, by resulting in a lower level of investment (Cingano et al., 2010; Calcagnini et al., 2009). On the other hand, higher EPL values means higher hiring and firing costs and hence higher labor costs. If the labor market is perfect, this may lead firms to replace labor with capital by resulting in a positive effect on investment; on the contrary, in presence of bargaining power between workers and firms higher EPL may lead to higher bairgained wages and lower investment.

In this study, we contribute to the literature on LMF by modelling the impact of LMF on investment via its effect on three factors: price of labor, firm adjustment costs and degree of financing constraints. Our idea is that high values of LMF, that is a less strict minimum wage legislation, a lower government employment and lower union density, will reduce the price of labor (Koeniger 2004, Pishke 2010) and to some extent may distort the production choices toward the more flexibile input, thus replacing capital with labor in an amount which depends on the bargaining power of workers. This will have the effect of reducing the investment in physical capital. However, it is also true that, less regulations may mean lower adjustment costs of investment (Alesina 2005). Therefore, according to this, investment in physical capital might increase. This is in line with Acemoglu (2003) showing that the incentive for firms to invest in new technologies positively depend on the degree of wage compression. Finally, in our model

LMF may affect investment by relaxing firm financing constraints as it reduces total costs and hence increases the firm cash flow. However, the contemporaneous presence of these three effects may leave the researcher with an unclear sign of the final impact of LMF on investment and this is what we want to investigate in this study.

We use data for LMF compiled by the Fraser Institute for US and Canada States over a period ranging from 1981 to 2007. Our results show that LMF affects investment by affecting the firm's costs and revenues, by relaxing a firm's financing constraints and by reducing the adjustment cost the firm faces in expanding its productive capacity.

The paper proceeds as follows. Section 2 presents the basics of our model. Section 3 presents a generalization of the standard q model of investment with imperfections both in the market for goods and capital to show how LMF impacts firm investment via price of labor and hence marginal profitability of capital and labor, adjustment costs of investment and financing constraints. Section 3 describes the empirical methodology and data. Section 4 reports our empirical results and Section 6 gives some concluding remarks.

2 Basics

We model the channels through which LMF (lower minimum wage, lower government employment and lower unionization) affects the firm's value in presence of imperfections in the market for goods and capital and this in turn will influence the level of investment. These channels are the financing constraints the firm faces, the firm's labor costs and the adjusment costs of capital.

As said above, we expect that on the one hand higher values of LMF will reduce wages and then increase the amount of labor used with respect to capital (Koeniger 2004, Pishke 2010). This will have the effect of reducing the investment in physical capital. However, on the other hand, less regulation may mean lower adjustment costs of investment (Alesina 2005). Therefore, according to this, investment in physical capital might increase. Moreover, since in general LMF reduces total costs the firm faces, it increases the cash flow available to the firm by reducing hence the degree of financing constraints, if for financially constrained firm we mean a firm that because of the high cost of external finance or insufficient cash flow has to foregone investments.

Therefore, the final effect of LMF on investment is an empirical issue. In the following, before to present the investment model, we describe how financing constraints and LMF are formalized in our model.

2.0.1 Financing Constraints

In our study financing constraints are introduced in the model via a non-negative constraint on dividends (D) paid to shareholders:

$$D \geq 0, \tag{1}$$

and the multiplier on this constraint (μ) equals the shadow cost of raising external finance - shadow value of equity. This constraint implies that since equity financing is expensive dividends cannot be negative. The firm has to be able to always rely on internal cash. Another way of introducing financing frictions in the model might be limiting the amount of debt the firm can raise. However, a shadow value of debt will have in the investment model the same effect as the shadow value of equity that we use.

2.0.2 Labor Market Freedom

The Index of LMF is extrapolated by the Index of Economic Freedom created by the Heritage Foundation and Wall Street Journal. We measure it as a relaxation in all the three components below. **Minimum Wage Legislation** (High minimum wages restrict the ability of employees and employers to negotiate contracts to their liking. In particular, minimum wage legislation restricts the ability of low-skilled workers and new entrants to the workforce to negotiate for employment they might otherwise accept and, thus, restricts the labor market freedom of these workers and the employers who might have hired them); **Government Employment as a Percentage of Total State Employment (**labor market freedom decreases for several reasons as government employment increases beyond what is necessary for government's productive and protective functions. One of the reasons is that high levels of government employment may mean government is directly undertaking work that could be contracted privately); **Union Density** (Economic freedom decreases where union density - that is, the percentage of unionized workers in a state or province - increases. This because for example unions increases the bargaing power of workers by restricting the ability of employees and employers to negotiate contracts freely)

In our model, we specify:

$$LMF_{it}^{(r)} \equiv \{LMF_{rt} : i \in r\} \tag{3}$$

where $LMF_{it}^{(r)}$ is the level of labor market freedom at time t in the r-th economy ($r = 1, ..., R$ that can be a region or a country) where firm i operates. Notice that $LMF_{it}^{(r)}$is zero when the $i-$th firm does not operate in economy r. Therefore, our defiinition of labor market freedom captures the idea of exposure and proximity, in the sense that only the level of labor market freedom present in the economy where the firm operates matters for its investment decisions.

2.0.3 Labor Market Freedom and Prices

A large strand of economic research argues that minimum wage legislation, unions and EPL affect the wages to be paid and the distribution of wages across countries (Koeniger 2004, Piskye 2010). thereofe, we can assume that LMF impacts both the price of labor input and final goods and ultimately, the profitability of capital and labor. Therefore we define:

$$p_t = p(LMF_{it}^{(r)}, X_t) \tag{4}$$

and

$$p_t^L = p^L(LMF_{it}^{(r)}, L_t) \tag{5}$$

where the price of final, $p(.)$, and labor, $p^L(.)$, depend, other things being equal, upon $LMF_{it}^{(r)}$ and the demand for goods X and L.

We assume that, after observing $LMF_t^{(r)}$, the firm chooses the level of L and X that maximizes profits:

$$\pi(K_t, LMF_t^{(r)}) = \max_{L_t X_t} \left[p(LMF_t^{(r)}, X_t)X_t(K_t, L_t) - p_t^L(LMF_t^{(r)}, L_t)L_t\right] \tag{6}$$

where $\pi(.)$ is a restricted profit function with X_t the firm's output and L_t is the labor input. In each period the frm maximizes profits, taking as given the quantity of the quasi-fixed factor, capital:

The first-order condition with respect to L_t or marginal profitability of labor says that:

$$\frac{\partial \pi(K_t, LMF_t^{(r)})}{\partial L_t} = 0 \quad => \frac{\partial X_t}{\partial L_t}\frac{\partial p_t}{\partial X_t}X_t + p_t\frac{\partial X_t}{\partial L_t} = \frac{\partial p_t^L}{\partial L_t}L_t + p_t^L \tag{7}$$

We factorise each part of the equality:

$$\frac{\partial X_t}{\partial L_t}p_t[1 + \frac{X_t}{p_t}\frac{\partial p_t}{\partial X_t}] = p_t^L[1 + \frac{L_t}{p_t^L}\frac{\partial p_t^L}{\partial L_t}] \tag{8}$$

Also, we can define η_t^{-1} and η_t^{*-1} as the inverse price elasticities of demand for final goods and labor input respectively:

$$\eta_t^{-1} = \frac{X_t}{p_t}\frac{\partial p_t}{\partial X_t} \quad \text{and} \quad \eta_t^{*-1} = \frac{L_t}{p_t^M}\frac{\partial p_t^L}{\partial L_t} \tag{9}$$

By using the notation above, equation 8 can be written as:

$$(1+\eta_t^{-1})p_t\frac{\partial X_t}{\partial L_t} = (1+\eta_t^{*-1})p_t^L \tag{10}$$

This implies that:

$$\frac{\partial X_t}{\partial L_t} = \frac{p_t^L}{p_t}\frac{1+\eta_t^{*-1}}{1+\eta_t^{-1}} \tag{11}$$

This relation is very important because since we are assuming a constant return to scale production function, that term appears in the Euler equation. Indeed, the Euler equation states that:

$$X(K_{t,}L_t) = \frac{\partial X_t}{\partial K_t}K_t + \frac{\partial X_t}{\partial L_t}L_t \tag{12}$$

This implies that the marginal product of capital is negatively related to the marginal product of labor. Similarly, the equation above can be written as:

$$\frac{\partial X_t}{\partial K_t} = \frac{X_t}{K_t} - \frac{\partial X_t}{\partial L_t}\frac{L_t}{K_t} \tag{13}$$

By plugging in the equation 13 the expression of $\frac{\partial X_t}{\partial L_t}$ from equation 11, it yields:

$$\begin{aligned}\frac{\partial X_t}{\partial K_t} &= \frac{X_t}{K_t} - \frac{p_t^L}{p_t}\frac{1+\eta_t^{*-1}}{1+\eta_t^{-1}}\frac{L_t}{K_t} \\ &= \frac{1}{(1+\eta_t^{-1})p_tK_t}((1+\eta_t^{-1})p_tX_t - (1+\eta_t^{*-1})p_t^L L_t)\end{aligned} \tag{14}$$

Similarly, we can use the first order conditions to derive the marginal profitability of capital as:

$$\frac{\partial \pi_t}{\partial K_t} = \frac{\partial X_t}{\partial K_t}\frac{\partial p_t}{\partial X_t}X_t + p_t\frac{\partial X_t}{\partial K_t} \tag{15}$$

By factorising and using the notation of the inverse price elasticities, this equation can be written as:

$$\frac{\partial \pi_t}{\partial K_t} = p_t \frac{\partial X_t}{\partial K_t}[1 + \frac{X_t}{p_t}\frac{\partial p_t}{\partial X_t}] = (1 + \eta_t^{-1})p_t \frac{\partial X_t}{\partial K_t} \tag{16}$$

or as it follows, given $\frac{\partial X_t}{\partial K_t}$ from the Euler equation:

$$\frac{\partial \pi_t}{\partial K_t} = \frac{1}{K_t}\left[(1 + \eta_t^{-1})p_t X_t - (1 + \eta_t^{*-1})p_t^L L_t\right] \tag{17}$$

This result confirms that, in presence of market power - that is when one of the Hayashi's (1982) assumptions is violated - the marginal profitability of capital is no longer simply equal to the average profitability of capital $\frac{\partial \pi_t}{\partial K_t} = \frac{1}{K_t}(p_t X_t - p_t^L L_t)$. It also depends on the inverse price elasticity of demand for labor and final goods (see Hubbard 1998 or Chirinko 1993 for a survey on investment models). Moreover, notice that LMF enters the marginal profitability of capital and labor by affecting directly the price of labor and final good.

2.0.4 Labour market freedom and adjustment cost function

In addition to the transmission channels we have presented above, we assume that labor market freedom reduces the firm's adjustment cost. Our hypothesis is that less regulation can reduce the cost the firm faces to expande its productive capacity, that is it can reduce the firm adjustments costs and hence expand investment. therefore, we asume that:

$$C(I_{it}, LMF_{it}^{(e)}) \tag{18}$$

where $C(.)$ is the adjustment cost function.

We further assume that uncertainty in the model is exclusively due to LMF which, in turn, is perceived as permanent by each firm. Therefore:

$$\forall j \geq 0 \; E(LMF_{t+j+1}^{(r)} - LMF_t^{(r)}) = 0 \tag{19}$$

Following the standard approach in the literature (Hayashi 1982), we assume that the adjustment costs function is convex in the level of investment because there are diseconomies of scale associated with the installation of new capital goods[2]. Therefore:

$$C(I_t, LMF_t^{(r)}) = \frac{\alpha}{2}\left[I_t - \psi I_{t-1} - a - \phi LMF_t^{(r)}\right]^2 \tag{20}$$

[2] We are saying that a big investment project causes a relatively larger disruption in production (time and costs associated with the installation of new machinery, training workers, raising funds etc.) than a small project. This assumption plays a crucial role in the model. In fact, with linear or concave adjustment costs the firm would have an all-or-nothing investment policy. While, convexity of

where α, ψ, ϕ, and a are parameters. As in Love (2003) and Baum et al. (2006), the equation above includes the term ψI_{t-1}, which captures the persistency in the investment behavior of firms. The intuition behind the addition of this term is that it is easier for the firm to continue to invest at some extent ψ of the previous period, since for example it has made arrangements that would be costly to cancel. More importantly, in specifying the equation above, we assume that adjustment costs are determined not only by firm-specific characteristics but also by environmental factors, such as labor market freedom. We assume that the level of LMF influences the firm-specific level of investment at which adjustment costs are minimized. In the equation above this level of investment is represented by the parameter a and LMF enters the adjustment cost function negatively because, thanks to a less strict labor market LMF can reduce the costs the firm face to expand its productive capacity (Alesina, 2005).

3 Theory

4 The investment model

Let's assume

a. A non competitive market for goods where the price of labor and final goods is not taken as given but depends on the level of demand other than on LMF level, as specified in equation 4 and 5.

b. The presence of imperfect capital markets where the external finance is more costly than the internal finance so firm relies on the internal finance for investing

The problem faced by the firm that has to decide its investment in physical capital is straightforward. We consider a generalization of the standard Q model of investment, originally due to Gould (1968), Tobin (1969) and Hayashi (1982), where shareholders choose the level of investment which maximizes the expected discounted value of the stream of current and future net revenues, i.e. the present value of the firm i located in the economy r. The firm value, $V_t(.)$, is given by:

adjustment costs in the level of investment forces the firm to think seriously about the future, as too rapid accumulation of capital will prove costly and too little accumulation results in foregone profits.

$$V_t(K_t, LMF_t^{(r)}) = \max_{\{I_\tau\}_{\tau=0}^{\infty}} E\left\{\sum_{\tau=0}^{\infty}\beta^\tau\left[\pi(K_{t+\tau}, LMF_{t+\tau}^{(r)}) - I_{t+\tau} - C(I_{t+\tau}, LMF_{t+\tau}^{(r)})\right]/\Omega_t^{(r)}\right\}, \tag{22}$$

subject to two constraints:

$$\begin{aligned} K_t &= (1-\delta)K_{t-1} + I_t \\ \forall\tau &\succeq 0 \quad \pi(K_{t+\tau}, LMF_{t+\tau}^{(r)}) - I_{t+\tau} - C(I_{t+\tau}, LMF_{t+\tau}^{(r)}) \succeq 0 \end{aligned} \tag{23}$$

The first constraint describes the evolution of the capital stock. It says that, at the beginning of the period the firm choses the investment rate so that the new capital is installed which becomes operative immediately. The financial frictions are introduced via a non-negativity constraint on dividends (the second constraints) paid to shareholders. In our model, financial frictions are exogenuos to the firm and the multiplier on this constraint equals the shadow cost associated with raising the costly external finance. This condition implicitly assumes that equity financing is expensive due to information and contracting costs, hence the firm has to finance investment only by retained earnings (dividends cannot be negative)[3]. δ which is the depreciation rate of capital. The index i has been omitted for ease of exposition; $E\{.\}$ is the expectation operator conditional on the information available at time t in region r, $\Omega_t^{(r)}$; β^τ is the constant discount factor; $\pi(.)$ is a profit function, the price of the investment good is normalized to 1 as in the estimation it is replaced by fixed and time effects. And finally, we ignore tax considerations due to data constraints.

Under these assumptions, we introduce two Lagrange multipliers μ_t and λ_t, with the first being the shadow cost of internal/external finance and the second being the shadow cost of capital.

$$\begin{aligned} \mathcal{L} = &\sum_{\tau=0}^{\infty}\beta^\tau\left[\left(\pi(K_{t+\tau}, LMF_{t+\tau}^{(r)}) - I_{t+\tau} - C(I_{t+\tau}, LMF_{t+\tau}^{(r)})\right)(1+\mu_{t+\tau}) + \right. \\ &\left.\lambda_{t+\tau}\left(K_{t+\tau} - (1-\delta)K_{t+\tau-1} - I_{t+\tau}\right)\right] \end{aligned} \tag{24}$$

The FOC with respect to investment at $\tau = 0$ is as follows:

[3] As in Love (2003), in this semplified model we can assume that the firm cannot use debt financing, and this assumption does not affect the first order conditions for investment.

$$(i) \quad \frac{\partial \mathcal{L}}{\partial I_t} = 0 \quad => \left(1 + \frac{\partial C(I_t, LMF_t^{(r)})}{\partial I_t}\right)(1+\mu_t) = \lambda_t \tag{25}$$

And the FOC with respect to capital at $\tau = 0$ is:

$$(ii) \qquad \frac{\partial \mathcal{L}}{\partial K_t} = 0 \quad => (1+\mu_t)\frac{\partial \pi_t}{\partial K_t} = \lambda_t - \beta(1-\delta)E_t\lambda_{t+1} \tag{26}$$

Let's define from the equation above:

$$x_t = (1+\mu_t)\frac{\partial \pi_t}{\partial K_t} \tag{27}$$

By plugging this expression of x_t in (ii) and by solving forward:

$$(a) \qquad x_t = \lambda_t - \beta(1-\delta)E_t\lambda_{t+1}$$

$$(b) \quad x_{t+1} = E_t\lambda_{t+1} - \beta(1-\delta)E_t\lambda_{t+2} \tag{28}$$

As we can see, the term $E_t\lambda_{t+1}$ appears in (a) and (b). In order to eliminate this term, we multiply (b) by $\beta(1-\delta)$ and we sum (a) and (b) :

$$x_t + \beta(1-\delta)x_{t+1} = \lambda_t - \beta^2(1-\delta)^2E_t\lambda_{t+2} \tag{29}$$

If we repeat the operation for a finite number of times, say n times, we have:

$$E_t\sum_{\tau=0}^{n}(\beta(1-\delta))^\tau x_{t+\tau} = \lambda_t - (\beta(1-\delta))^{n+1}E_t\lambda_{t+n+1} \tag{30}$$

Using the assumption of no bubbles:

$$\lim_{n\to\infty}(\beta(1-\delta))^n = 0 \tag{31}$$

We can now go to infinity:

$$\sum_{\tau=0}^{\infty}(\beta(1-\delta))^\tau x_{t+\tau} = \lambda_t \tag{32}$$

We replace x_t in this equation and we use the value of λ_t obtained in (i):

$$E_t\sum_{\tau=0}^{\infty}(\beta(1-\delta))^\tau(1+\mu_{t+\tau})\left[\frac{\partial \pi_{t+\tau}}{\partial K_{t+\tau}}\right] = \lambda_t = \left(1+\frac{\partial C_t}{\partial I_t}\right)(1+\mu_t) \tag{33}$$

Equation above states that the firm should invest up to the point where the marginal cost of an additional unit of capital equals its marginal value (λ_t, or Tobin q), i.e., the expected discounted value of the stream of future profits generated by such an additional unit of capital. However, the intuition behind this is that, since we are assuming imperfect capital markets, the marginal adjustment cost of investment is still equal to the shadow value of capital λ_t but the latter is no longer equal just to the marginal profitability of capital. Rather, it is equal to the marginal profitability of capital weighted by the relative shadow cost of external finance in periods t and $t + \tau$.

Indeed, the equation above can be written as:

$$E_t \sum_{\tau=0}^{\infty} (\beta(1-\delta))^{\tau} \frac{(1+\mu_{t+\tau})}{(1+\mu_t)} \left[\frac{\partial \pi_{t+\tau}}{\partial K_{t+\tau}} \right] = \lambda_t = \left(1 + \frac{\partial C_t}{\partial I_t} \right) \tag{34}$$

In the equation above we can denote the relative shadow cost of external finance in periods t and $t + \tau$ as:

$$\theta_t = \frac{(1+\mu_{t+\tau})}{(1+\mu_t)} \tag{35}$$

θ_t can be seen as the discount factor associated with the external finance premium. If the firm is financially constrained, that is unable to issue new equity, the shadow value of these funds rises today relative to tomorrow (i.e, $\mu_t > \mu_{t+\tau}$), thus the discount factor decreases and the firm should postpone the investment to the next period. If capital markets are perfect, $\mu_t = \mu_{t+\tau}$ at all τ and the firm is never constrained. Our result is in line with Love (2003) and Baum et. al. (2006). With capital market imperfections θ_t depends on a number of variables that could be identified in observable firm characteristics proxing for its financial status.

In the next section we will show that by solving the equation 34 for I_t we can get the following expression for the relationship between investment, financing constraints and LMF:

$$\frac{I_t}{K_t} = \phi_{LMF_t^{(r)}} \left\{ \sum_{\tau=0}^{\infty} (\beta(1-\delta))^{\tau} \frac{(1+\mu_{t+\tau})}{(1+\mu_t)} \left[\frac{\partial \pi(K_{t+\tau}, LMF_{t+\tau}^{(r)})}{\partial K_{t+\tau}} \right] \right\} \tag{36}$$

where, for any given level of $LMF_t^{(r)}$, $\phi_{LMF_t^{(r)}}$ is an increasing function because of the hypothesis of convexity of the adjustment cost function.

4.0.5 The link between corporate investment, financing constraints and labor market freedom

We further assume that uncertainty in the model is exclusively due to LMF which, in turn, is perceived as permanent by each firm. Therefore:

$$\forall j \geq 0 \quad E(LMF^{(r)}_{t+j+1} - LMF^{(r)}_t) = 0 \tag{37}$$

Therefore, the expected marginal profitability of capital equals the current marginal profitability of capital:

$$E\sum_{\tau=0}^{\infty}(\beta(1-\delta))^{\tau}\left[\frac{\partial\pi(K_{t+\tau}, LMF^{(r)}_{t+\tau})}{\partial K_{t+\tau}}\right] = A * \frac{\partial\pi_t(K_t, LMF^{(r)}_t)}{\partial K_t} \tag{38}$$

We can compute the value of A as:

$$A = \sum_{\tau=0}^{\infty}(\beta(1-\delta))^{\tau} = \frac{1}{1-\beta(1-\delta)} \tag{39}$$

However, we said that the Tobin's Q is equal to λ_t ,. Let's now call it q_t. We recall from equation 34:

$$q_t = E_t\sum_{\tau=0}^{\infty}(\beta(1-\delta))^{\tau}\frac{(1+\mu_{t+\tau})}{(1+\mu_t)}\left[\frac{\partial\pi_{t+\tau}}{\partial K_{t+\tau}}\right] = \left(1+\frac{\partial C_t}{\partial I_t}\right) \tag{40}$$

$$q_t = \frac{(1+\mu_{t+\tau})}{(1+\mu_t)}A\left[\frac{\partial\pi_t}{\partial K_t}\right] = \left(1+\frac{\partial C_t}{\partial I_t}\right) \tag{41}$$

$$q_t = \theta A\left[\frac{\partial\pi_t}{\partial K_t}\right] = \left(1+\frac{\partial C_t}{\partial I_t}\right) \tag{42}$$

This equation says that the equilibrium level of investment is where the marginal adjustment cost of capital is equal to the marginal profitability of capital weighted by the relative cost of external finance θ.

In this equation we must replace the expression of the marginal adjustment costs recovered from the adjustment cost function as in equation 21:

$$C(I_t, G^{(r)}_t) = \frac{\alpha}{2}\left[I_t - \psi I_{t-1} - a - \phi LMF^{(r)}_t\right]^2$$

We can derive the adjustment cost function with respect to the investment at time t . In this case the investment at time $t-1$ is considered as a constant. We obtain:

$$\frac{\partial C_t}{\partial I_t} = \alpha \left(I_t - \psi I_{t-1} - a - \phi LMF_t^{(r)} \right) \tag{43}$$

We have the expression of the right side of the Tobin's Q equality:

$$\left(1 + \frac{\partial C_t}{\partial I_t}\right) = (\alpha \left(I_t - \psi I_{t-1} - a - \phi LMF_t^{(r)} \right) + 1) \tag{44}$$

Also, for the left side of the Tobin's Q equation:

$$\theta A \left[\frac{\partial \pi_t}{\partial K_t}\right] = (\alpha \left(I_t - \psi I_{t-1} - a - \phi LMF_t^{(r)} \right) + 1) \tag{45}$$

We can simplify to obtain the expression of I_t:

$$I_t = \psi I_{t-1} + \frac{a}{\alpha} - \frac{1}{\alpha} + \frac{1}{\alpha}\phi LMF_t^{(r)} + \frac{A}{\alpha} * \theta_t \left[\frac{\partial \pi_t}{\partial K_t}\right] \tag{46}$$

We call:

$$a' = (\frac{a}{\alpha} - \frac{1}{\alpha})$$

So with the new notation we have:

$$I_t = a' + \psi I_{t-1} + \frac{1}{\alpha}\phi LMF_t^{(r)} + \frac{A}{\alpha} * \theta_t \left[\frac{\partial \pi_t}{\partial K_t}\right] \tag{47}$$

In the last section we have found the expression of the marginal profitability of capital

as:

$$\frac{\partial \pi_t}{\partial K_t} = \frac{1}{K_t}((1 + \eta_t^{-1})p_t X_t - (1 + \eta_t^{*-1})p_t^L L_t)$$

We substitute it in the investment equation:

$$I_t = a' + \psi I_{t-1} + \frac{1}{\alpha}\phi LMF_t^{(r)} + \frac{A}{\alpha} * \theta_t \left[\frac{1}{K_t}((1 + \eta_t^{-1})p_t X_t - (1 + \eta_t^{*-1})p_t^L L_t)\right] \tag{48}$$

We introduce two important notations that we will use until the end, MK_t and MK_t^* :which represent the markup on the price of final goods and labor respectively

$$MK_t = \frac{1}{(1 + \eta_t^{-1})} \qquad \text{and} \qquad MK_t^* = \frac{1}{(1 + \eta_t^{*-1})} \tag{49}$$

We can explicite a little more the expression of MK_t and MK_t^* using the definition of η_t^{-1} and η_t^{*-1} in equation 9:

$$MK_t = \frac{p_t}{(p_t + X_t \frac{\partial p_t}{\partial X_t})} \qquad \text{and} \qquad MK_t^* = \frac{p_t^L}{(p_t^L + L_t \frac{\partial p_t^L}{\partial L_t})} \tag{50}$$

Using these notations:

$$I_t = a' + \psi I_{t-1} + \frac{1}{\alpha}\phi LMF_t^{(r)} + \frac{A}{\alpha} * \theta_t \frac{1}{K_t}\left[MK_t^{-1} p_t X_t - MK_t^{*-1} p_t^L L_t\right] \tag{51}$$

We get the investment equation. You can clearly see that in a non-competitive market for goods and with financial frictions, the firm investment depends on:

- the degree of LMF of the country where the firm is located, which impacts the firm adjustment costs of capital
- the average profitability of capital that in turn depends on the markup in the markets for goods and labor, that is the degree of competition of the marktes, and on the effect of LMF on price of labor and final goods.
- the firm stochastic discount factor which reflects the degree of financial constraints faced by the firm and is summarized by θ.

In our model, financing constraints will affect investment by modifying the firm stochastic discount factor (θ) in the decision of investment and since the this factor is not directly observable, we parameterize it as a function of the firm cash stock and level of labor market freedom as below:

$$\theta_{it} = \left(\alpha_1 + \alpha_2 LMF_t^{(r)}\right) Cash_{it-1} \tag{2}$$

where α_1 is the firm-specific level of financing constraints and LMF is the country level of labor market freedom. The underlying idea is that more the firm is financially constrained larger is the impact of cash stock (internal funds) on the discount factor - α_1 is expected to be positive. However, higher is the degree of LMF the lower will be the impact of cash stock on the discount factor - α_2 is expected to be negative. This is consistent with the view that labor market freedom relaxes financing constraints as it liberates the firm from the need of generating cash to invest.

Then, the final investment equation becomes:

$$I_t = a' + \psi I_{t-1} + \frac{1}{\alpha}\phi LMF_t^{(r)} + \frac{A}{\alpha} * \frac{1}{K_t}\left[MK_t^{-1} p_t X_t - MK_t^{*-1} p_t^L L_t\right]\left(\alpha_1 + \alpha_2 LMF_t^{(r)}\right) Cash_{it-1} \tag{52}$$

5 Data

We use a sample of US and Canadian firms over the time period 1981-2007. Data have been downloaded from Datastream. We collected data for the ratio of investment to total asset for each firm, for market to book, for revenues and costs of production.

The above variables allows us to test the hypotheses, which we characterized in our theoretical model. Nonetheless, in order to check the robustness of our results we include a set of control variables, which refer to firms' size and policies.

A specific analysis deserve the variable, which we use to proxy labor market freedom. We make use of a database compiled by the Fraser Institute, which focuses on the extent and development of economic freedom in all US and Canadian States. This index ranges between 0 and 10 with low/high values indicating low/high degree of economic freedom. This index is an equal average of three components: size of the government, taxation and labor market freedom.

For our purposes we conside only the last component. In turn, it is formed by three sub-components, namely minimum wage legislation, union density and public sector employment to the total. As for the main index, labor market freedom ranges between 0 (low freedom in the labor market) and 10 (high extent of freedom).

The summary statistics of the variables, employed in our analysis, and their correlation matrix are presented in Tables 1 and 2.

[Table 1 and 2 about here]

A quick look at the correlation matrix table reveals that, as expected, a larger felxibility in the labor market is positively and statistically correlated to the percentage of investments operated by firms. Also, a larger amount of revenues increase it, while costs affect it negatively. Those findings, although not conclusive, seems to support our theoretical model. Nonetheless more formal analysis is required.

6 Empirical Analysis

In this section, we present the results from our empirical analysis. In the following Tables, we present estimations of a reduced form of equation (52), which, nevertheless, shed light on the relationship that our model intends to disclose.

In order to check the robustness of our analysis, we employ several estimators, ranging from simple pooled OLS estimation to more sophisticated ones, as the GMM one.

We start by estimating a standard equation for firms' investments, where only lagged investments, revenues and costs are included in the set of regressors. Results are presented in Table 3.

[Table 3 about here]

In Table 3, we report the results coming from the use of 5 different estimators. It can be noted that the results do not differ across all the employed estimators: lagged investments impact positively the amount of investments today, while larger revenues/costs increase/decrease them. As far as the GMM analysis is concerned, the specification tests support our choices and, therefore, we are confident about their validity. It can be also noted that the coefficient estimated by using the Arellano and Bond estimator lies in the interval rapresented by the coefficients estimated by employing the FE and the Kiviet estimator.

In Table 4 we make a further step, since we introduce our measure of labor market flexibility. While previous coefficients are almost unaffected by adding more variables, labor market flexibility measure is always statistically significant and shows the expected sign. This result testifies that, other things being equal, a better quality of labor market enhances the share of investments operated by firms.

[Table 4 about here]

However, as indicated in our theoretical model, labor maket flexibility does not affect only investments' decisions directly. Instead it also reduce the adjustment cost the firm faces in expanding its productive capacity. Therefore, labor market flexibility impact firms' investment decisions through its effect on costs and revenues.

To capture the indirect effect we introduce some interaction terms in our model. As it can be noted from Table 4, the interaction term $(Lmkt \times Costs)_{i,t}$ is positive and significant when we employ GMM estimators. This result is quite important, since it provides further support to our theoretical model, since it points out that, while costs reduces the firms' capacity of investing, other things being equal, a larger degree of market flexibility reduces the negative impact of $Cost$ on investments.

Another important results can be derived by looking at the sign of the coefficient associated to $(Lmkt \times Revenues)_{i,t}$. The negative sign indicates that larger revenues may not necessarely be critical in determining firms' investment decisions when labor market flexibility is high. As mentioned before, those two results are quite critical since offer the necessary support to our theoretical model.

As far as the GMM estimates are concerned, the specification tests support the correctness of the set of instruments.

Labor maket can also unfold its effects through relaxing firms' financial constraints. We account for this third channel of propagation of labor market effect by adding information about firms' financial statements.

[Table 5 about here]

Table 5 shows the results of our analysis when we introduce one by one other three variables, namely $Leverage$, $Cash$ and $Cashflow$, and their interaction with $Lmkt$. All the models have been estimated by employing the Arellano-Bond estimator. First, we may note once again that the specification tests argue in favor of our choice of instruments.

It is easy to note that the our previous results are almost unaffected by the inclusion of the new variables. With the only exception of the coefficients associated to cashflow and its interaction term, noth leverage and cash are statistically significant and show the expected sign along with their interaction terms. A larger amount of leverage reduces firms' investments decisions unless higher labor maket flexibility exits. Moreover larger cash is critical to investment. However, this holds if the extent of labor market flexibility is low.

7 Conclusions

In this paper we provide a theoretical model, which sheds lights on the channel through which labor market flexibility unfolds its effect. The presence of high labor market flexibility relaxes firms' adjustments costs and financial constraints and explains their investments.

Theoretical results have been verified empirically by using data for US and Canadian firms. The empirical analysis has been conducted by using different estimators and specifications and it conferms our theoretical findings.

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Table 1
Sumamry Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Investments	17653	0.066	0.061	0	0.5
Costs	17524	21.794	32.783	0	200
Revenues	17524	2.538	3.158	-3	15
Lmkt	17888	6.964	0.567	5.2	8.1
Cash to Asset	17756	0.089	0.126	0	1
Cashflow	17537	0.104	0.083	-0.030	1
Leverage	17853	0.313	5.461	0	729.510

Table 2
Correlation Matrix

	Investments	Costs	Revenues	Lmkt	Cash to Asset	Cashflow	Leverage
Investments	1						
Costs	-0.3561*	1					
Revenues	0.3733*	0.4236*	1				
Lmkt	0.1322*	-0.0014	-0.0425*	1			
Cash to Asset	0.0903*	0.0579*	0.1366*	-0.0351*	1		
Cashflow	0.2136*	-0.1618*	0.3256*	0.0240*	0.2589*	1	
Leverage	-0.0066	-0.0513*	-0.0689*	0.0057	0.0419*	-0.2877*	1

Table 3

Baseline Models

	OLS	FE	KIV	AB	BB
Constant	0.027***	0.054***			0.039***
	(0.001)	(0.002)			(0.003)
$Invest_{i,t-1}$	0.704***	0.379***	0.450***	0.418***	0.489***
	(0.017)	(0.019)	(0.008)	(0.047)	(0.042)
$Costs_{i,t}$	-0.007***	-0.004***	-0.004***	-0.007***	-0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
$Revenues_{i,t}$	-0.002***	-0.002***	0.002***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
chi^2				706.104	994.893
				[0.000]	[0.000]
AR1				-8.22	-8.45
				[0.000]	[0.000]
AR2				-0.06	0.30
				[0.951]	[0.762]
Sargan test				56.63	72.45
				[0.236]	[0.165]
Log-Likelihood	30,376.94	32,577.05			
Number of observations	16,265	16,265	16,265	14,986	16,265
Adjusted R^2	0.615	0.240			

( ) indicates robust standard errors

[ ] indicates p-values

Table 4
Main Results

	OLS	FE	KIV	AB	BB
Constant	-0.012*	0.110***			-0.248*
	(0.007)	(0.012)			(0.148)
$Invest_{i,t-1}$	0.697***	0.375***	0.450***	0.415***	0.443***
	(0.017)	(0.019)	(0.008)	(0.062)	(0.043)
$Costs_{i,t}$	0.000	-0.005*	-0.004**	-0.008*	-0.004*
	(0.000)	(0.003)	(0.002)	(0.004)	(0.002)
$Revenues_{i,t}$	0.001	0.002	0.003***	0.038*	0.023**
	(0.001)	(0.002)	(0.001)	(0.021)	(0.011)
$Lmkt_{i,t}$	0.006***	0.008***	0.004*	0.171**	0.044**
	(0.001)	(0.002)	(0.002)	(0.070)	(0.022)
$(Lmkt \times Costs)_{i,t}$	0.003	0.008	0.001	0.001*	0.006**
	(0.002)	(0.006)	(0.003)	(0.001)	(0.003)
$(Lmkt \times Revenues)_{i,t}$	-0.004**	-0.002	-0.002	-0.005*	-0.003*
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
chi2				333.101	733.337
				[0.000]	[0.000]
AR1				-7.18	-8.37
				[0.000]	[0.000]
AR2				-0.84	0.02
				[0.401]	[0.984]
Sargan Test				54.41	79.33
				[0.346]	[0.113]
Log-Likelihood	30,411.35	32,599.83			
Number of observations	16,265	16,265	16,265	14,986	16,265
Adjusted R2	0.617	0.242			

( ) indicates robust standard errors
[ ] indicates p-values

Table 5
Robusteness Checks

$Invest_{i,t-1}$	0.371***	0.372***	0.412***	0.397***	0.413***	0.414***
	(0.070)	(0.065)	(0.063)	(0.064)	(0.062)	(0.063)
$Costs_{i,t}$	-0.008**	-0.007*	-0.008**	-0.008**	-0.008*	-0.007
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)
$Revenues_{i,t}$	0.042*	0.039*	0.041*	0.035*	0.040*	0.039
	(0.023)	(0.022)	(0.021)	(0.021)	(0.023)	(0.039)
$Lmkt_{i,t}$	0.143**	0.210***	0.177**	0.187***	0.170**	0.172**
	(0.072)	(0.078)	(0.070)	(0.071)	(0.075)	(0.078)
$(Lmkt \times Costs)_{i,t}$	0.001*	0.001	0.001*	0.001**	0.001*	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$(Lmkt \times Revenues)_{i,t}$	-0.006*	-0.005*	-0.006*	-0.005	-0.006*	-0.006
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.006)
$Leverage_{i,t}$	-0.203*	-0.808**				
	(0.114)	(0.225)				
$(Lmkt \times Leverage)_{i,t}$		-0.280**				
		(0.124)				
$Cash_{i,t}$			0.069**	0.199***		
			(0.024)	(0.081)		
$(Lmkt \times Cash)_{i,t}$				-0.180***		
				(0.047)		
$Cashflow_{i,t}$					0.143	0.212
					(0.146)	(1.626)
$(Lmkt \times Cashflow)_{i,t}$						-0.009
						(0.236)
chi^2	294.553	326.835	329.380	327.738	300.655	294.887
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
AR1	-6.480	-6.830	-7.100	-6.960	-7.050	-7.020
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
AR2	-1.04	-1.27	-0.93	-1.07	-0.65	-0.64
	[0.298]	[0.204]	[0.351]	[0.286]	[0.514]	[0.523]
Sargan test	51.05	46.68	53.94	50.93	52.09	51.39
	[0.432]	[0.568]	[0.326]	[0.398]	[0.393]	[0.380]
Number of observations	14,975	14,975	14,912	14,912	14,860	14,860

( ) indicates robust standard errors
[ ] indicates p-values