Investment, Disinvestment, the User Cost of Capital 
and Asymmetric Measurement Error: Evidence from French Services

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Abstract:
Using a large panel of French services small firms, this paper estimates a structural model of 
investment and disinvestment with a different price of capital for first hand and second hand 
capital, taking into account that data on the second hand price of capital are not available. The 
asymmetric measurement error on the cost of capital may account for \(30\%\) of the attenuation 
factor of the user cost elasticity of aggregate investment. It explains how \textit{low} capital user cost 
elasticity of aggregate investment may be related to a \textit{high} sensitivity of the microeconomic 
decision to invest with respect to the user cost with the net present value criterion. It shows 
that the \textit{decision} to invest or to disinvest depends markedly on the weighted average user cost 
of capital, as predicted by the net present value criterion, with a 95\% confidence interval for 
the user cost elasticity of capital equal to \(-0.6+/\sim-0.1\). The \textit{size} of investment has a short run 
elasticity estimate included in a 95\% confidence interval of \(-0.28+/\sim0.02\). The \textit{size} of 
disinvestment has a short run elasticity estimate close to zero and not significantly different 
from zero, which is not predicted by the neo-classical model.

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I. INTRODUCTION

Estimating the capital user cost elasticity (the opposite of the elasticity of substitution between capital and labour) is helpful for the evaluation of tax policies (Auerbach [1983; 2000], Auerbach and Hassett [2003], Chirinko [2002]), in particular investment tax credit (Bloom et al. [2002]), and for the evaluation of the cost of capital channel of monetary policy. A user cost elasticity close to zero implies a weak monetary transmission channel operating through the rise of the cost of capital leading to a decrease of corporate investment and aggregate demand and supply (for example, the IS curve of the IS-LM model). Summaries by Chirinko [1993, 2002] found that elasticity estimates varied widely, but were generally small and lower than -0.30. Using aggregate data, capital user cost elasticity estimates are in most cases not significantly different from zero, with a large estimated variance. Using firm level panel data and a tax adjusted weighed average cost of capital (WACC), Chirinko, Fazzari and Meyer [1999] found non-zero estimates for the United States (around -0.25), while Chirinko, Fazzari and Meyer [2004] found -0.4 using long panel estimations. On average, the user cost elasticity of aggregate corporate investment is closer to zero than the user cost elasticity of firm level investment.

The large estimated standard errors of the user cost elasticity may be explained by firm level heterogeneity depending on whether the firms invest or disinvest. Dom and Dunne [1998] found that around 30% of firms do not invest each year in the United States. First, the decision to invest or to disinvest should depend strongly on the weighted average cost of capital: in order to accept to finance an investment project, firms and bankers requires strictly positive net prevent value of future cash flows discounted by the weighted average cost of capital (See Bruner et al. [1998] for a survey of best practices in estimating the cost of capital). Second, one may expect that the capital user cost elasticity is higher when the firm invest than when it disinvest. Disinvesting firms may exert an option to wait to invest and may face financial constraints (Lensink and Sterken [2001]). When the firm disinvests, the asymmetric information on the depreciation of second hand capital goods may lead to a capital loss specific to the capital good or may face an illiquid, weak or non-existing second hand market (Akerlof [1970]). In the absence of a second hand market, decreasing the stock of capital is only possible by the depreciation of fixed assets. This capital loss and/or the shadow price related to the limited resale markets (the “Irreversibility Premium” in Chirinko...
and Schaller [2001]) are not taken into account by the sectorial price index on “first hand” capital goods usually taken into account into the measure of the user cost of capital in empirical work. Hence measurement errors for the relevant user cost are likely to be much larger in the case of disinvestment than in the case of investment.

This paper first presents econometric evidence of a strong sensitivity of the investment or disinvestment decision with respect to the user cost. Then, it presents evidence of an asymmetric effect of the user cost on the size of investment or disinvestment. The data used are annual balance sheet from small and medium firms of the French service sector. Services have been chosen, not only because most of investment econometric studies focuses on manufacturing, whereas the share of services greatly expanded in OECD countries, but also because many services firms are small or medium size firms, are very intensive in labour in some sectors and may frequently disinvest.

Section 2 presents a structural model of investment. Section 3 presents estimates of the decision to invest or to disinvest. Section 4 estimates capital user cost elasticities taking into account the investment or disinvestment heterogeneity. Section 5 details the implications of heterogeneity for the aggregate user cost elasticity. Section 6 concludes.

II. A STRUCTURAL MODEL OF THE DECISION TO INVEST OR TO DISINVEST

This model introduces three distortions with respect to the neo-classical model of the choice of capital. First, the price of second hand capital is supposed to be lower than the price of new capital (Abel et Eberly [1996]). Second, the cost of debt includes a default risk premium which increases with leverage, while (third distortion) interest on debt decreases the corporate income tax: hence capital depends on the weighted average cost of capital (Auerbach [1983]). The entrepreneur of firm \( i \) chooses the stock of capital and the stock of debt which maximizes the expected value of discounted dividends:

\[
\max_{[K_0, b_0]_{t=0}} V_{i,t=0} = E_i \left[ \sum_{t=0}^{T} \frac{D_{it}}{\prod_{k=1}^{T} (1 + \rho_k)} \right]
\]

Under the following constraints:
(1) The stock of capital $K_{it}$ increases with net investment (positive $I_{it}$) or decreases with net disinvestment (negative $I_{it}$) and the depreciation of the available stock of capital of the previous period, where $\delta$ denotes the depreciation rate:

$$I_{it} = K_{it} - (1 - \delta)K_{it-1}$$

(2) The accounting flow of funds equation states that dividends are exactly equal to cash flow from operating activities less the variation of cash, new debt, less cash flow from investing (or plus cash flow from disinvesting):

$$D_{it} = (1 - \tau_i) \left[ p_{it} F\left(K_{it}, L_{it}\right) - w L_{it} - r_{it-1} \left( \frac{B_{it-1}}{p_{it-1} K_{it-1}} \right) B_{it-1} \right]$$
$$+ B_{it} - B_{it-1} \left( I_{1,t} > 0 \right) p_{it}^1 \left[ K_{it} - (1 - \delta)K_{it-1} \right] - p_{it}^{1,0} (1 - 1_{I_{1,t} > 0}) (K_{it} - (1 - \delta)K_{it-1})$$

Where the price of second hand capital is lower than the price of new capital: $p_{it}^{1,0} < p_{it}^1$ (the index $s$ refers to sectorial information on the price of capital used in empirical work), where the dummy variable $1_{I_{1,t} > 0}$ is equal to unity when the firm invest and equal to zero when the firm disinvest. $p_{it}$ is the price of the production of firm $i$ on date $t$, $\tau_i$ is the corporate income tax rate of the firm, $L_{it}$ is labour employed by firm $i$ at date $t$, $w_i$ is the nominal wage rate, $B_{it}$ is the stock of debt, $r_{it}$ is the nominal interest rate of the debt. $F(\cdot)$ is the cash flow from operating activities less variation of cash before interest payments and before taxes function. It is assumed to face decreasing returns to scale with respect to capital: $F_K > 0, F_{KK} < 0$.

In practice, disinvesting firms sell *only* second hand capital (or let the assets depreciate, when the second hand market does not work), whereas investing firms buy on average both first hand and second hand capital on average. For this reason, the average price of investing firms remains higher than the price of capital for disinvesting firms. If the price of second hand capital is less precisely measured than the price of first hand capital, the measurement error of the price of capital remains larger for disinvesting firms than for investing firms. The larger the proportion of second hand capital bought by investing firms, the larger the measurement error of their weighted average of the price of capital.

(3) One assumes that the credit supply is an increasing function of leverage: in other words, the default risk premium on debt increases with leverage because of bankruptcy costs:

$$r_{it-1} \left( \frac{B_{it-1}}{p_{it-1} K_{it-1}} \right) \text{ avec } r' > 0.$$
leverage with capital valued at its book value includes losses in the bankruptcy process and the loss of value when lenders sell capital on the second market for capital.

The first order condition on debt is:

\[
\frac{\partial D_t}{\partial B^t} = \frac{1}{1 + \rho_t} \left[ \frac{\partial D_{t+1}}{\partial B^t} \right] = 0
\]

Hence:

\[
1 = \frac{1}{1 + \rho_t} \left[ 1 + E_t (1 - \tau_{t+1}) \left( r_u + \frac{\partial r^u}{\partial B^t} \right) \right]
\]

(1)

\[
\Rightarrow \rho_t - (1 - E_t \tau_{t+1}) r_u = E_t (1 - \tau_{t+1}) \left( \frac{B^t}{p_{st}^t K_{st}} \right) r_u^* > 0
\]

This equation determines an optimal leverage which maximizes the tax deduction of debt knowing that the marginal cost of debt increases with leverage.

The first order condition on the stock of capital \( K_{st} \) for an investing firm is:

\[
(1 - \tau_t) p^t_F (K_{st}, L_{st}) - p^t_{st} + \left( \frac{1}{1 + \rho_t} \right) E_t \left[ (1 - \delta) p^t_{st+1} + (1 - \tau_{t+1}) \left( \frac{B^2}{p_{st}^t K_{st}^2} \right) r_u^* \right] = 0
\]

\[
\Rightarrow F_t (K_{st}^*, L_{st}) = C_{st} = \frac{p^t_{st}}{p^t_u} \frac{1}{(1 - \tau_t)} [1 - c_1 - c_2]
\]

with:

\[
c_1 = \frac{(1 - \delta) E_t p^t_{st+1}}{(1 + \rho_t) p^t_u}, \quad c_2 = \frac{\rho_t - (1 - E_t \tau_{t+1}) r_u}{1 + \rho_t} \frac{1}{p^t_{st} K_{st}^*}
\]

The user cost of capital for a firm who does not use debt is \( 1 - c_1 \) (Hall et Jorgenson [1967]).

The user cost of capital decreases when one expects capital gains because on the price of investment, and it increases with the opportunity cost of equity and with the depreciation rate.

Debt reduces the weighted average cost of capital by \( c_2 \), which measures the tax gain originated by optimal debt. A first order approximation of the cost of capital leads to the textbook weighted average cost of capital formula:
The first order condition on the stock of capital $K_{it}$ for a disinvesting firm is:

$$C_{it} = \frac{p_{it}^I}{p_{it}^l} \frac{1}{1 - \tau_i} [1 - c_1 - c_2] =$$

$$\frac{p_{it}^I}{p_{it}^l} \left[ \left( \frac{B_{it}^*}{p_{it}^l K_{it}^*} \right)^{1 - \frac{\tau_i}{1 - \tau_i}} r_i + \left( 1 - \frac{B_{it}^*}{p_{it}^l K_{it}^*} \right) \frac{\rho_i}{1 - \tau_i} + \delta \left( \frac{E_i p_{it+1}^I - p_{it}^I}{p_{it}^l} \right) \right]$$

The first order condition on the stock of capital $K_{it}$ for a disinvesting firm is:

$$(1 - \tau_i) p_{it}^l F_K(K_{it}, L_{it}) - p_{it}^I$$

$$+ \left( \frac{1}{1 + \rho_i} \right) E_i \left( 1 - \delta \right) p_{it+1}^{I<0} \left( 1 - \tau_{i+1} \right) \left( \frac{B_{it}^2}{p_{it+1}^{I<0} K_{it}^*} \right) r_i = 0$$

$$\Rightarrow F_K(K_{it}^*, L_{it}) = C_{it}^{I<0} = \frac{p_{it}^{I<0}}{p_{it}^l} \frac{1}{(1 - \tau_i)} [1 - c_1 - c_2]$$

With the two components of the user cost of capital $C_{it}:

$$c_1 = \frac{(1 - \delta)}{(1 + \rho_i)} \frac{E_i p_{it+1}^{I<0}}{p_{it}^l}, \quad c_2 = \frac{\left( \frac{\rho_i - (1 - E_i \tau_{i+1}) p_{it}^l}{1 + \rho_i} \right) 1 - B_{it}^2}{p_{it}^l K_{it}^*}$$

For each observation, we define $A_u$ as the ratio of the two user costs such that: $C_{it}^{I<0} = A_u C_{it}^{I>0}$

In the particular case where the inflation of the price of new capital is identical to the inflation of the price of second hand capital, $A_u$ boils down to the ratio of the nominal prices:

$p_{it}^{I<0} = A_u \cdot p_{it}^l$. We assume in what follows that: $A_u < 1$.

Let us consider shocks on the user cost of capital for a firm which invested on the previous date $F_K(K_{it-1}^*, L_{it-1}) = C_{it-1}^l$, and for an unchanged decreasing return to scale profit function:

- If the user cost of capital decreases, the firm invests: $F_K(K_{it}^*) = C_{it}^l < F_K(K_{it-1}^*) = C_{it-1}^l$

- If the user costs increases « only a little » : the firm does not invest or disinvest

$A_u \cdot C_{it} < F_K(K_{it}^*) = F_K(K_{it-1}^*) = C_{it-1} < C_{it} \text{ for } A_u \frac{C_{it}}{C_{it-1}} < 1 < \frac{C_{it}}{C_{it-1}}$

- If the user costs increases widely : the firm disinvest:

$F_K(K_{it-1}^*) = C_{it-1} < A_u \cdot C_{it} = F_K(K_{it}^*) < C_{it} \text{ for } 1 < A_u \frac{C_{it}}{C_{it-1}} < \frac{C_{it}}{C_{it-1}}$
Now let us parameterize the production function with a constant elasticity of substitution where \( S \) are sales:

\[
S = F(K_u, N_u) = E_u \left[ aK_u^{\sigma / \sigma} + bL_t^{\sigma / \sigma} \right]^{(\sigma / \sigma - 1)}
\]

\( E, a, \) and \( b \) are parameters measuring productivity, \( \upsilon \) represents returns to scale and \( \sigma \) is the elasticity of substitution between capital and labour. The marginal product of capital is then:

\[
F_K(K_u, N_u) = \left( \frac{\sigma}{\sigma - 1} \right) \nu E_u S_u \frac{\sigma - 1}{\sigma} K_u^{(\sigma - 1)/\sigma} = (1_{t>0} + 1_{t<0} A_u) C_u
\]

Using logarithms:

\[
\ln(\nu E_u) + \left(1 + \frac{1 - \sigma}{\sigma \nu} \right) s_u - \frac{1}{\sigma} k_u = c_u + 1_{t<0} a_u
\]

Hence, the relation between the demand for capital, sales and the user cost of capital:

\[
k_u = -\sigma (c_u + 1_{t<0} a_u) + \left(1 + \frac{1 - \sigma}{\nu} \right) s_u + \sigma \ln(\nu a E_u)
\]

Writing in first differences:

\[
\Delta k_u \approx \frac{I_u}{K_u} - \delta = \left(1 + \frac{1 - \sigma}{\nu} \right) \Delta s_u - \sigma (\Delta c_u + 1_{t<0} \Delta a_u) + \sigma \Delta \ln(\nu a E_u)
\]

In the econometric model, we assume that the growth of productivity \( \sigma \Delta \ln(\nu a E_u) \) is taken into account by the sectorial fixed or random effects \( \alpha_s \), by the time fixed or random effects \( \alpha_t \), and with firms random or fixed effects \( \alpha_i \) which may be correlated with regressors, and with perturbations \( \varepsilon_{it} \).

The measurement error on the user cost in case of disinvestment is \( -1_{t<0} \Delta a_u \). It may include a firm level component: \( \Delta a_u = [\Delta a_u] + [\Delta a_u] \). One includes a dummy variable equal to unity for disinvesting firms net of depreciation \( 1_{t<0} = 1 \) ( \( \Delta k_u \leq 0 \) ) else equal to zero in case of net investing firms net of depreciation ( \( \Delta k_u > 0 \) ).
\[ \Delta k_{it} \approx \frac{I_{it}}{K_{it}} - \delta = -\sigma \Delta c_{it} - \sigma (d_{UC} 1_{(i(t) < 0)}) \Delta c_{it} \]

\[ + \bigg( \sigma + \frac{1 - \sigma}{\nu} \bigg) \Delta s_{it} + \bigg( \sigma + \frac{1 - \sigma}{\nu} \bigg) (d_{s} 1_{(i(t) < 0)}) \Delta s_{it} + \alpha_i + \alpha_s + \alpha_i \]

\[ + \alpha_i + \big( 1_{(i(t) < 0)} \big) \big( -\sigma [\Delta a_{it}] \big) + \varepsilon_{it} + \big( 1_{(i(t) < 0)} \big) \big( -\sigma [\Delta a_{it}] \big) \]

Estimated parameters are the user cost elasticity (or the elasticity of substitution between capital and labour) \( \sigma \), returns to scale \( \nu \), and the attenuation parameters \( 0 \leq d_{UC} < 1 \) and \( 0 \leq d_{s} < 1 \). The measurement error on the user cost in case of disinvestment is at the origin of an attenuation bias on the user cost elasticity in case of disinvestment. This is the reason to estimate separately the elasticities for investing and disinvesting firms.

In the model of the decision to invest, the growth of capital \( \Delta k_{it} \) is a latent variable determined by the model of the demand for capital (equation (3)):

\[ \text{prob}(\Delta k_{it} > 0) = \text{prob} \left( -\sigma \Delta c_{it} + \left( \sigma + \frac{1 - \sigma}{\nu} \right) \Delta s_{it} + \alpha_i + \alpha_s + \alpha_i + \varepsilon_{it} > 0 \right) \]

\[ = F \left( -\sigma \Delta c_{it} + \left( \sigma + \frac{1 - \sigma}{\nu} \right) \Delta s_{it} + \alpha_i + \alpha_i + \alpha_i \right) \]

Assuming the normality of perturbations, \( F \) is the cumulative distribution function of the normal law. The estimation of the decision to invest also estimates the user cost elasticity.

The measurement error on the user cost of capital is an usual explanation for an attenuation bias on the estimated effect on the user cost of capital, in particular at the macroeconomic level. When the measurement error is asymmetric, the attenuation bias interacts with a composition effect when aggregating firms which invest and firms which disinvest. The expected user cost elasticity of aggregate investment is the sum of elasticities for investing and disinvesting firms weighted by the endogenous probability of investing or disinvesting (assuming that the random disturbances entering into the model of the decision to invest are independent between firms in order to use the law of large numbers). When the attenuation factor \( 0 \leq d_{UC} < 1 \) is equal to zero, one has

\[ \hat{\sigma}^M_i = d_{i>0} \sigma \int F \left( -\sigma \Delta c_{it} + \left( \sigma + \frac{1 - \sigma}{\nu} \right) \Delta s_{it} + \alpha_i + \alpha_i + \alpha_i \right) d \]

\[ + 0.5 \sigma \left[ 1 - \int F \left( -\sigma \Delta c_{it} + \left( \sigma + \frac{1 - \sigma}{\nu} \right) \Delta s_{it} + \alpha_i + \alpha_i + \alpha_i \right) d \right] \]
The usual explanation of the low estimate of the aggregate user cost elasticity, denoted $\sigma^M$, is the attenuation bias due to measurement error on the cost of first hand capital, measured by the attenuation factor denoted $d_{I>0}$, while the attenuation factor for disinvesting firms leads to a zero estimated elasticity.

Besides this well known effect, the (multiplicative) attenuation bias of the estimated aggregate elasticity due to the asymmetry of measurement error for disinvesting firms is equal to the proportion of disinvesting firms. A large proportion of firms do not invest on a given year, around an average of 30% of plants in Doms and Dunne [1998] and of firms in our sample. This gives an order of magnitude of the average bias due to asymmetric measurement errors.

A second property is that this attenuation bias varies over time. The estimated user cost elasticity of aggregate investment denoted $\sigma^M$ is a non linear function of the firm level user cost elasticity $\sigma$, with a trade-off between a positive and a negative effect of $\sigma$. The negative effect of $\sigma$ on $\sigma^M$ is larger for a large positive growth rate of the user cost on a given date. The larger the increase of the cost of capital and the larger the firm level user cost elasticity, the larger the increase of the proportion of firm who disinvest (because of the net present value criteria), and the lower the estimated user cost elasticity of aggregate investment.

A low estimated aggregate capital user cost elasticity may not necessarily be a signal of a weak cost of capital channel of monetary policy. On the contrary, it may be a signal of a highly powerful cost of capital channel of monetary policy on the decision to invest, leading to a large number of projects rejected using the net present value criterion.

### III. DATA AND DESCRIPTIVE STATISTICS

This section presents data, the estimation method of the decision to invest or to disinvest and econometric estimates. The data used are from the Diane database: it comprises 6143 French services firms (excluding holdings) over a six year period 1995-2000, with balance sheet data available for at least five consecutive years of the six year sample period and after excluding outliers (see data appendix). It includes mostly very small firms: 57% have less than 10 employees and 93% have less than 50 employees. The capital stock is computed with the
perpetual inventory method and the tax adjusted weighted average user cost of capital is computed as done by Chirinko, Fazzari et Meyer [1999] (see appendix).

Table 1 presents descriptive statistics which reveals the heterogeneity between the group of firms who disinvest (31% of the sample) and the group of firms who invest. The variation of the book value of net fixed assets between two years for each firm \( i \) at each date \( t \) measures \( \Delta k_{it} \). The median investing firm benefits from a decline of its user cost of capital of -1.9% and from a sales growth of 5.9%, so that its capital growth is 2.3%. By contrast, the median disinvesting firm faces a user cost growth of +0.6% whereas its sales growth is limited at 2.4%, so that its capital decreases by -14.7%. These observations comforts Chirinko and Schaller [2001] finding that firms with very low investment have discount rates much higher than other firms.

Insert table 1 here.

IV. USER COST ELASTICITY ESTIMATES USING THE DECISION TO INVEST

This section presents estimations results of the decision to invest or to disinvest, related to a latent variable \( \Delta k_{it} \) for each firm \( i \) at each year \( t \), measured by the variation of the logarithm of the of net fixed assets. This latent variable is determined by the structural model of section 2.

The decision to invest is measured by a dummy variable equal to unity \( z_{it}=1 \) in case of net investment (\( \Delta k_{it} > 0 \)) and equal to zero \( z_{it}=0 \) in case of stagnation or in case of net disinvestment (\( \Delta k_{it} \leq 0 \)). It is estimated by a Probit model with individual random effects, temporal fixed effects \( \alpha_t \), sectorial fixed effects \( \alpha_s \) and dummies for 5 classes of size of firms according to their number of employees \( \alpha_r \), (less than 10, between 10 and 19, between 20 and 49, between 50 and 99 and at least 100 employees). The size variables intends to capture the aggregation of multiple investment project inside the firm which may decreases the volatility over time of investment and disinvestment decisions for larger firms. Following Mundlak [1978], the model also includes the average over time of regressors, in order to correct from the potential correlation between the regressors and the individual random effects:
(6) \[ \text{prob}(\Delta k_i > 0) = F\left( \left( \sigma + \frac{1 - \sigma}{\nu} \right) \Delta s_i - \sigma \Delta c_i + \beta_1 \Delta s_{i-1} + \beta_2 \Delta c_i + \alpha_i + \alpha_T + \alpha_s + \alpha_T + \varepsilon_i \right) \]

Where \( F \) is the distribution function of the normal law.

For robustness checks, one considered also non structural extensions of the model (6) taking into account an autoregressive effect of the decision to invest and lags for the growth rate of the user cost and the growth rate of sales.

(7) \[ \text{prob}(\Delta k_i > 0) = F\left( \left( \sigma + \frac{1 - \sigma}{\nu} \right) \Delta s_i - \sigma \Delta c_i + \beta_1 (\Delta k_{i,1} > 0) + \beta_4 \Delta s_{i-1} - \beta_5 \Delta c_{i-1} \right) \]

The results of the random effect probit from 1996 à 2000 are presented on table 2. Column 1 to 6 presents probit regression in cross section for each year and the probit regression without random effects, including all lagged variables (regression 1 and 2), excluding the lagged dependent variable (regression 3 and 4) and finally excluding all lagged dependent variables.

The results leads rather high user cost elasticity of capital stock \(-\sigma = -0.5 +/- 0.1\). It is not the elasticity of the of the decision to invest with respect to the user cost growth, which is non linear. The average over time of the user cost growth is not statistically different from zero. User cost growth is not correlated with the firm specific random effect.

The sales elasticity of the capital stock has the same order of magnitude in absolute value \((0.6 +/- 0.1\). By contrast, there is an important effect of the average over time of the sales growth with a large coefficient (1.5). Sales growth is correlated with the firm specific random effect, which is correct with the partial equilibrium model where sales are endogenously determined. When one removes the average over time of sales growth for each firm, the sales elasticity increases a lot.

Taking into account firm specific random effects decreases the effect of the auto-regressive term with respect to a pooled regression which omits random effects. The coefficient Rho which allows to test the existence of firm specific random effects (with non zero standard error) is statistically different from zero. This suggests that the random effect model should be prefered with respect to the pooled probit without random effects. When one omits the auto-regressive term, the coefficient Rho, which measures the share of the variance of the individual effect in the total variance of the random disturbances, increases (it reaches the
value 0.42). Omitting the auto-regressive term increases the parameters of the lagged dependent variables (user cost growth and sales growth).

With respect to control variables, the probability to invest increases with the size of the firms. For large firms, the aggregation of investment of different plants or departments leads to a higher proportion of investing firms.

Firms from the sectors of transports and communications, of real estate for firms and of financial services have a lower probability to invest than firms from educational services, social and personal services, health services and hotels and restaurants, which represents 32% of observations in the sample.

Results available from the authors adds financial variables such as cash flow and leverage. These variables are significantly different from zero but have a less sizeable effect on the probability to invest. They change only marginally the estimates of the user cost elasticity.

Insert Table 2 here

A measure of the quality of the forecast of the model is provided by the pair of discordant forecasts, which remain around 33% to 35% in all the models. This result is not so bad, taking into account the wide heterogeneity of firms in the sample. Having transformed a continuous variable (the growth of net fixed assets) into a binary variable may sometimes provide better forecasts than when one keeps the continuous variable as dependent variable, which is the focus of the next section.

V. USER COST ELASTICITY ESTIMATES USING THE DEMAND FOR CAPITAL

As presented in section 2, the econometric model of the capital demand is:

\[
\Delta k_{it} \approx \frac{I_{it}}{K_{it}} - \delta = -\sigma \Delta c_{it} - \sigma (d_{it} \cdot 1_{(i,t) \leq 0}) \Delta c_{it} \\
+ \left( \sigma + \frac{1-\sigma}{\psi} \right) \Delta s_{it} + \left( \sigma + \frac{1-\sigma}{\psi} \right) (d_s \cdot 1_{(i,t) > 0}) \Delta s_{it} + \alpha_i + \alpha_s \\
+ \alpha_s + (1_{i,t) \leq 0}) (-\sigma[\Delta a_{it}]) + \varepsilon_{it} + (1_{i,t) > 0}) (-\sigma[\Delta a_{it}])
\]

where \( \alpha_i \) are firm specific random effects in case of investment to which are added firm specific measurement error \(-\sigma[\Delta a_{it}]\) in case of disinvestment. The random disturbances \( \varepsilon_{it} \)
are inflated by time and firm varying measurement error in case of disinvestment: $-\sigma[\Delta a_{it}]$. The return to scale parameter $\nu$ and the elasticity of substitution between capital and labour $\sigma$ are parameters to be estimated. Because of the asymmetric measurement error on the cost of capital in the case of disinvestment, the estimated elasticities of regressors are likely to face an attenuation bias written $d_{uc}$ for the growth of the user cost and $d_s$ for sales growth for disinvesting firms.

Table 3 presents estimations of fixed assets growth. The overall variance of the fixed assets growth is decomposed into the between firm variance which account for 28% of the overall variance and the within firm variance which account for the remaining 72% of the overall variance. The neoclassical model explains 13.5% of the between variance while it explains only 2% of the within variance (table 3, column 1 and 2). The estimate of the user cost elasticity is nearly the same using the between or the within estimates (-0.20). However, the estimate of the sales elasticity is markedly higher in the between estimate (0.76) than in the within estimate (0.17). As a consequence, the Hausman test, which is related to a statistic measuring a wedge between the within and the between estimated parameters leads to reject the random effects model and to choose the within or fixed effect model (column 3). This endogeneity related to a correlation between sales and firms individual random effect was also found in the probit estimation.

As suggested by the standardized coefficients, in the between model, the growth of sales contributes more to the R2 than the user cost growth. By contrast, in the within model, the user cost growth has a larger contribution to the R2 than the sales growth. This larger contribution of the user cost is also found in the random effect probit regressions including Mundlak’s components. A first interpretation of these differences would be that sales growth has a relatively larger effect in the long term effect than the user cost growth whereas the user cost growth has a relatively larger effect in the short run. A second interpretation is that the average over time of sales growth may be more correlated with time invariant firm specific random effects than the user cost (which includes exogenously decided components for the interest rates): hence it may be more biased in the between regression. A third interpretation is that the attenuation bias for disinvesting firms may have a larger effect on the user cost estimate using the average over time of the user cost growth, in the between regression.

Insert table 3 here.
In column 4, we add interaction terms of the dummy variable for strictly positive fixed assets growth with the user cost growth and sales growth. The user cost elasticity is close to zero for disinvesting firms while it is equal to -0.28 for investing firms. The sales elasticity is negative (!) for disinvesting firms and equal to 0.38. Distinguishing between disinvesting firms and investing firms helped increases the estimated elasticities of investing firms. By contrast, for disinvesting firms, the neo-classical model is rejected, with the potential explanation of large measurement error on the second hand of capital.

In column 5, the introduction of lagged variables (without the lagged dependent variable) in the within regression had very little to the regression, and other elasticities are only marginally altered.

Finally, we estimate the model using the generalized method of moments, which is supposed to correct the endogeneity of the lagged dependent variable and of the other regressors. A consistent estimation procedure based on the generalized method of moments (GMM) (Hansen [1982]) and adapted to dynamic panel data is the GMM-system estimator by Arrelano et Bover [1995], programmed on DPD98 by Arellano et Bond. This GMM-system estimator is obtained by a simultaneous estimation of model (2) in levels (the explained variable is the logarithm of the capital stock) using lagged explanatory variables written in first differences as instrumental variables and an estimation of model (2) in first differences using lagged explanatory variables in levels as instrumental variables. This estimation combines both levels and first differences of the explained variable.

Due to the dynamic model (which includes two lags) and the estimation method (requiring lagged variables as instruments), the estimation period shrinks to the shortest time dimension for panel data (two years: 1999 and 2000). Nonetheless, the use of panel data doubles the number of observations (12286 observations) with respect to cross section estimation. What is more, the two years were markedly different with respect to aggregate sales and interest rates changes, so that this approach is close to Cummins, Hassett and Hubbard [1994 and 1996] estimates of capital’s responsiveness by focusing on periods with major tax reforms.

The results of the estimation of the capital demand excluding or including the endogenous investment decision dummy variable are reported on table 3. First, the Sargan test of over-identifying restrictions id not rejected at the 5% threshold for both equations, and the p-values of those tests increase a lot when the endogenous investment decision is taken into account.
The instrumented estimates change marginally with respect to the within estimate excluding the lagged dependent variables. When the decision to invest is taken into account, for firms who disinvest, the estimated short run user cost elasticity is positive and close to zero (0.018) but not significantly different from zero (T-statistics is equal to 0.2). For firms who invest, the estimated short run user cost elasticity is -0.33, whereas it is still not significantly different from zero for disinvesting firms.

Insert table 4 here.

VI. CONCLUSION

The analysis in this paper lead to several conclusions. First, the user cost has an important effect on the decision to invest. Second, the amount disinvested by a firm does not depend on the usual measure of the user cost of capital (which takes into account capital gains on the first hand market of capital and omits variables related to the second hand market for capital). Third, the amount invested by a firm does depend on a measure of the user cost, with a short run elasticity of -0.3.

These micro-level results suggests a additional factor explaining the low (often zero) estimated user cost elasticity with high estimated standard error usually found at the aggregate level. Those results may be partly explained by taking into account the investment/disinvestment decision in the aggregation. A high sensitivity of the proportion of investing firms to the user cost is likely to increase the standard error of the estimates of the aggregate user cost elasticity and is also likely to lead to a decrease of this estimated user cost elasticity.

These results are appealing, since they reconcile firm level common practice of net present value criteria for investment decisions with empirical econometric evidence and comfort the belief of a strong effect of the user cost channel of monetary policy on the investment decision. Second, they integrate the irreversibility premium measurement error as part of a story explaining why the capital user cost elasticity is elusive at the aggregate level or for pooled sample of firm level panel data. Third, they explain why such an effect may decrease the estimate of the user cost elasticity and may increase its estimated variance when using aggregate data.
REFERENCES


Appendix 1 : Sample selection and variables

The sample consists of balance sheets of French services firms included in the database Diane from 1994 to 2000. These firms correspond, in NES classification, to hotel and restaurants
(HH), transports and telecommunications (II), financial services (JJ) housing and renting services (KK), education (MM), health and social action (NN), collective, social and personal services (OO), and to domestic services (PP). Balance sheets with negative sales or value added or debt or assets were excluded. We eliminated firms for which the value of one of the variables of interest are over five times the inter-quartile interval below the first quartile or over the third quartile, each year for the investment ratio \( I_{it} / K_{i,t-1} \), the profit rate \( EBE_{it} / K_{i,t-1} \), cash-flows/capital \( CF_{it} / K_{i,t-1} \), leverage \( B_{it} / K_{it} \), the user cost of capital \( C_{it} \), the “apparent” interest rate \( iB_{it} / B_{it} \), the sales growth rate \( \Delta \ln Q_{it} \) the capital growth rate \( \Delta \ln K_{it} \), and the user cost growth rate \( \Delta \ln C_{it} \). We ended with 103,264 observations over the period 1996-2000. The variables are described:

**Sectoral variables : the measurement of the prices of capital goods and of value added.**

The sectoral value added price (denoted \( P_{st} \)) are found in national accounts (series 2.203, INSEE website, base year 2000, NES36 level) which relates to 15 different indices for the sectors of services used in our firm level data.

The sectoral capital goods price (denoted \( p_{st} \)) are only available at NES16 level, which includes only 4 different sectorial indices for services: real estate, services to firms, services to households, overall market services (base year 2000, series 2.403). Prices are not available for transports (sector L ; 21.6% of the sample), and administrative services (sector Q : 7.3% of the sample, including 5% in the health sector). For these sectors, we used the overall sectoral price of market services (sector DJ). The measurement error of the expected inflation of new capital goods with respect to firm level decisions is potentially already large for new capital and certainly much larger for second hand capital.

**Firms level variables**

The source is the compulsory accounting forms required under the French General Tax Code. These forms are completed by the firms and numbered by the tax administration (D.G.I.) from 2050 to 2058. The code of each form omitting the first two numbers are provided below: for example, we denote item FN of tax form 2050 as “[50].FN”.

- Value added at market price \( Q_{it} \) is given by total net sales \([52].FL\), plus the change in inventories of own production of goods and services \([52].FM\), plus own production of goods
and services capitalised [52].FN less intermediate consumption ([52].FS+FU+FT+FV+FW+FX).

- The weighted average cost of capital \( C_u \) is computed as follows:

\[
C_u = \frac{p_u^I}{p_u} \frac{1}{(1 - \tau_t)} \left[ 1 - c_1 - c_2 \right] \approx \\
\frac{p_u^I}{p_u} \left[ \rho_i + \delta - \frac{E_t p_{t+1}^I - p_u^I}{p_u} - \left( \frac{B_u}{B_u + E_u} \right) \left( \frac{\rho_i}{1 - \tau_t} - r_{iu} \right) \right]
\]

The nominal interest rate is the minimum of the legal usury rate for firms credit on a given year, available on the Banque de France website, and the firm level ratio \( r_{iu} B_u / B_u \), where interest and similar charges \( r_{iu} \) are given by item GR and where financial Debt \( B_u \) includes banking debt (DU) and other debt (DV):

\[
i_u = \min \left( \text{usury}, \frac{i_u B_u}{B_u} = \frac{GR}{DS + DT + DU + DV} \right).
\]

When equity \( E_u \), given by item LP, is strictly negative, the leverage ratio is set to unity: \( \frac{B_u}{p_u^I K_u} = \min \left( 1, \frac{B_u}{B_u + E_u} \right) \). The opportunity cost of equity \( \rho_i \) is taken as the 10 years French government bonds rate. A similar assumptions are made in other papers, for example, Chirinko, Fazzari, Meyer [1999]. For large firms traded on the stock market, the opportunity cost of equity is the average return on the world stock markets, corrected by the market beta of the firm. Market Beta for determining the risk premium for non quoted small firms is not available. The depreciation rate is 11%.

The capital stock is the value in replacement terms of the capital stock book value of property, plant and equipment. To convert the book value of the gross capital stock into its replacement value, we used the following iterative perpetual inventory formula:

\[
K_u = \frac{p_u^I}{p_u} I_u - (1 - \delta) K_{i,t-1}
\]

where the investment goods deflator is denoted \( p_u^I \) and the depreciation rate is taken to be 8%. The initial capital stock is given by:

\[
K_{t0}^K = \frac{K_{t0}^{BV}}{p_{t0}^K}, \text{ with } p_{t0}^K = p_{t0-\text{mean}}.
\]
The book value of the gross capital stock of property, plant and equipment $K_{t_0}^{BV}$ on the first available year for each firm is obtained by the sum of land $[50].AN$, buildings $[50].AP$, industrial and technical plant $[50].AR$, other plant and equipment $[50].AT$, plant, property and equipment under construction $[50].AV$ and payments in advance/on account for plant, property and equipment $[50].AX$. It is deflated by assuming that the sectoral price of capital is equal to the sectoral price of investment $T_{\text{mean}}$ years before the date when the first book value was available, where $T_{\text{mean}}$ represents the corrected average age of capital (this method of evaluation of capital is sometimes called the “stock method”). The average age of capital $T_{\text{mean}}$ is computed by using the sectoral useful life of capital goods $\max T_{K}$ and the share of goods which has been already depreciated in the first available year in the firm’s accounts $\frac{\text{DEPR}_{t_0}^{BV}}{(p_{K_{t_0}}^{K})}$ ($\text{DEPR}_{t_0}^{BV}$ is the total book value of depreciation allowances in year $t_0$ according to the following rule of thumb proposed by Mairesse):

$$T_{\text{mean}} = T_{\max}\left[\frac{\text{DEPR}_{t_0}^{BV}}{p_{K_{t_0}}^{K}}\right] - 4 \quad \text{if} \quad T_{\max}\left[\frac{\text{DEPR}_{t_0}^{BV}}{p_{K_{t_0}}^{K}}\right] > 8,$$

$$T_{\text{mean}} = \frac{1}{2} T_{\max}\left[\frac{\text{DEPR}_{t_0}^{BV}}{p_{K_{t_0}}^{K}}\right] \quad \text{if} \quad T_{\max}\left[\frac{\text{DEPR}_{t_0}^{BV}}{p_{K_{t_0}}^{K}}\right] < 8.$$

The book value of depreciation allowances $\text{DEPR}_{t_0}^{BV}$ is obtained by the sum of depreciation, amortisation and provisions on land $[50].AO$, on buildings $[50].AQ$, on industrial and technical plant $[50].AS$, on other plant and equipment $[50].AU$, on plant, property and equipment under construction $[50].AW$ and on payment in advance/on account for plant, property and equipment $[50].AY$. The sectoral useful life of capital goods is $T_{\max} = 15$ years.

- **Investment** $(I_t)$ is the difference of the book value of the gross capital stock between this year $t$ and the previous year $t-1$.

- **Earnings before interest, taxes and depreciation allowances** $(\text{EBITDA}_t)$ corresponds to the sum of value added and of working subsidies (FO), less taxes (FX), wages (FY), and social security payments (FZ).

- **Cash-flows** $(\text{CF}_t)$ corresponds to EBITDA plus other exploitation charges (GE), common operations (GH+GI), financial income (GJ+GK+GL+GM+GN+GO+GP), exceptional income (HA-HE), less financial transfers (GM), financial payments (GQ+GR+GS+GT), workers participation (HJ) and corporate income tax (HK).
### Table 1: Descriptive Statistics, sample period 1996-2000

<table>
<thead>
<tr>
<th></th>
<th>Investment (17185 observations: 70%)</th>
<th>Disinvestment (7555 observations: 30%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>Median</td>
</tr>
<tr>
<td>( \Delta c_i ): User Cost Growth</td>
<td>-3.5%</td>
<td>-1.9%</td>
</tr>
<tr>
<td>( \Delta s_i ): Sales Growth</td>
<td>8.0%</td>
<td>5.9%</td>
</tr>
<tr>
<td>( \Delta k_i ): Capital Growth</td>
<td>10.8%</td>
<td>2.3%</td>
</tr>
</tbody>
</table>

### Table 2: Probit Estimations of the decision to invest

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Delta c_{it} )</td>
<td>-0.56 [-0.65, -0.46]</td>
<td>-0.61 [-0.70, -0.52]</td>
<td>-0.56 [-0.65, -0.46]</td>
<td>-0.61 [-0.70, -0.52]</td>
<td>-0.41 [-0.5, -0.32]</td>
<td>-0.52 [-0.61, -0.43]</td>
</tr>
<tr>
<td>( \Delta s_{it} )</td>
<td>0.61 [0.48, 0.73]</td>
<td>0.62 [0.49, 0.75]</td>
<td>0.61 [0.48, 0.73]</td>
<td>0.65 [0.52, 0.77]</td>
<td>0.48 [0.35, 0.61]</td>
<td>0.57 [0.44, 0.70]</td>
</tr>
<tr>
<td>( \Delta c_{it-1} )</td>
<td>-0.02 NS [-0.28; 0.24]</td>
<td>0.01 NS [-0.26; 0.24]</td>
<td>-0.02 NS [-0.28; 0.24]</td>
<td>-0.01 NS [-0.28; 0.24]</td>
<td>-0.14 NS [-0.40; 0.12]</td>
<td>-0.09 NS [-0.35; 0.17]</td>
</tr>
<tr>
<td>( \Delta s_{it-1} )</td>
<td>1.44 [1.16; 1.72]</td>
<td>1.55 [1.27; 1.83]</td>
<td>1.53 [1.25; 1.81]</td>
<td>1.68 [1.4; 1.96]</td>
<td>1.58 [1.3; 1.86]</td>
<td>1.80 [1.52; 2.08]</td>
</tr>
<tr>
<td>((\Delta k_{it-1} &gt; 0))</td>
<td>0.23 [0.19; 0.28]</td>
<td>0.15 [0.11; 0.19]</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>( \Delta c_{it-1} )</td>
<td>-0.21 [-0.30; -0.12]</td>
<td>-0.23 [-0.32; -0.14]</td>
<td>-0.24 [-0.33; -0.15]</td>
<td>-0.26 [-0.35; -0.17]</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>( \Delta s_{it-1} )</td>
<td>0.20 [0.12; 0.28]</td>
<td>0.22 [0.14; 0.30]</td>
<td>0.25 [0.17; 0.33]</td>
<td>0.26 [0.18; 0.34]</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Rho</td>
<td>0.30 [0.15; 0.45]</td>
<td>0.42 [0.30; 0.54]</td>
<td>0.41 [0.30; 0.54]</td>
<td>0.42 [0.30; 0.54]</td>
<td>0.41 [0.30; 0.54]</td>
<td>0.42 [0.30; 0.54]</td>
</tr>
<tr>
<td>Controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>N</td>
<td>18597</td>
<td>18597</td>
<td>18597</td>
<td>18597</td>
<td>24740</td>
<td>24740</td>
</tr>
</tbody>
</table>

Controls: years, size classes, sectors and intercept. Numbers between brackets provides the 95% confidence interval. NS= not statistically significantly different from zero at the 5% level.
Table 3: Estimations of the fixed assets growth

<table>
<thead>
<tr>
<th></th>
<th>Between</th>
<th>Fixed Effects</th>
<th>Random Effects</th>
<th>Fixed Effects</th>
<th>Fixed Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Delta c_{it} )</td>
<td>-0.22</td>
<td>-0.20</td>
<td>-0.220</td>
<td>0.02</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>[-0.28, -0.16]</td>
<td>(0.01)</td>
<td>(0.028)</td>
<td>(0.02)</td>
<td>(0.02)</td>
</tr>
<tr>
<td></td>
<td>-0.09 STB</td>
<td>-0.13 STB</td>
<td>-0.01 STB</td>
<td>-0.03 STB</td>
<td></td>
</tr>
<tr>
<td>((\Delta k_{i,t} &gt; 0)\Delta c_{it})</td>
<td>-0.30</td>
<td>-0.28</td>
<td>-0.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.02)</td>
<td>(0.02)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.14 STB</td>
<td>-0.15 STB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \Delta s_{it} )</td>
<td>0.76</td>
<td>0.17</td>
<td>0.31</td>
<td>0.69</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.71, 0.81]</td>
<td>(0.013)</td>
<td>(0.02)</td>
<td>(0.02)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.36 STB</td>
<td>0.08 STB</td>
<td>0.15 STB</td>
<td>0.28 STB</td>
<td></td>
</tr>
<tr>
<td>((\Delta k_{i,t} &gt; 0)\Delta s_{it})</td>
<td>-0.05</td>
<td>-0.03</td>
<td>-0.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.02)</td>
<td>(0.02)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.03 STB</td>
<td>-0.01 STB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \Delta c_{i,t-1} )</td>
<td></td>
<td></td>
<td></td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>((\Delta k_{i,t-1} &gt; 0)\Delta c_{i,t-1})</td>
<td>-0.02</td>
<td>-0.01</td>
<td>-0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.02)</td>
<td>(0.02)</td>
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<td></td>
</tr>
<tr>
<td>( \Delta s_{i,t-1} )</td>
<td></td>
<td></td>
<td></td>
<td>-0.03</td>
<td></td>
</tr>
<tr>
<td>((\Delta k_{i,t-1} &gt; 0)\Delta s_{i,t-1})</td>
<td>-0.03</td>
<td>-0.01</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>(0.02)</td>
<td>(0.02)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \Delta c_{i,t-1} )</td>
<td></td>
<td></td>
<td></td>
<td>-0.01</td>
<td></td>
</tr>
<tr>
<td>((\Delta k_{i,t-1} &gt; 0)\Delta c_{i,t-1})</td>
<td>-0.01</td>
<td>-0.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
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</tr>
<tr>
<td>N</td>
<td>6143</td>
<td>24739</td>
<td>18596</td>
<td>24739</td>
<td></td>
</tr>
<tr>
<td>R2</td>
<td>13.5%</td>
<td>2% (within variance)</td>
<td>5% (within variance)</td>
<td>6% (within variance)</td>
<td></td>
</tr>
<tr>
<td>% total variance</td>
<td>28%</td>
<td>72%</td>
<td>72%</td>
<td>72%</td>
<td></td>
</tr>
<tr>
<td>dependent variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

STB: standardized betas or coefficients. Standard errors in parenthesis.
Tableau 4 : Growth of fixed assets: GMM estimations.

<table>
<thead>
<tr>
<th></th>
<th>Omitting the decision to invest dummy variable</th>
<th>Including the decision to invest dummy variable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>t-statistics</td>
</tr>
<tr>
<td>$\Delta c_{it}$</td>
<td>-0,305</td>
<td>-2,3</td>
</tr>
<tr>
<td>Estimated standard error</td>
<td>(0.146)</td>
<td>p=2.1%</td>
</tr>
<tr>
<td>95% confidence interval</td>
<td>[-0.59;-0.02]</td>
<td></td>
</tr>
<tr>
<td>$(\Delta k_{it} &gt; 0)\Delta c_{it}$</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(Differential coefficient)</td>
<td>p=2.1%</td>
<td>p=84.1%</td>
</tr>
<tr>
<td>Estimated standard error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>95% confidence interval</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\Delta s_{it}$</td>
<td>0,328</td>
<td>2,8</td>
</tr>
<tr>
<td>$(\Delta k_{it} &gt; 0)\Delta s_{it}$</td>
<td>0,488</td>
<td>-1,0</td>
</tr>
<tr>
<td>$\Delta k_{i,t-1}$</td>
<td>0,421</td>
<td>1,8</td>
</tr>
<tr>
<td>$(\Delta k_{i,t-1} &gt; 0)\Delta k_{i,t-1}$</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>$\Delta c_{i,t-1}$</td>
<td>-0,020</td>
<td>1,5</td>
</tr>
<tr>
<td>$(\Delta k_{i,t-1} &gt; 0)\Delta c_{i,t-1}$</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>$\Delta s_{i,t-1}$</td>
<td>0,050</td>
<td>-2,2</td>
</tr>
<tr>
<td>$(\Delta k_{i,t-1} &gt; 0)\Delta s_{i,t-1}$</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>AR2 Test and P-Values</td>
<td>-1,19</td>
<td>p=0,23</td>
</tr>
<tr>
<td>Sargan Statistics and P-Values</td>
<td>9,35</td>
<td>p=0,58</td>
</tr>
<tr>
<td>Number of observations</td>
<td>12286</td>
<td>12286</td>
</tr>
</tbody>
</table>

Columns 2 and 3: The first differences equation uses the following instrumental variables: all the regressors in levels lagged three times. The «level» equation uses the following instruments variables in first differences: all the regressors in levels lagged three times.

Columns 4 and 5: The first differences equation uses the following instrumental variables: all the regressors in levels lagged three times. The «level» equation uses the following instruments variables in first differences: all the regressors in levels lagged three times.