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MONETARY TRANSMISSION :

EMPIRICAL EVIDENCE FROM LUXEMBOURG FIRM-LEVEL DATA

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Abstract

This paper investigates the transmission of monetary policy in Luxembourg. It is the first empirical analysis conducted for Luxembourg firm-level data. The results indicate that the sales accelerator may be at work. A very robust result is the negative effect of the user cost of capital on firms' investment ratio. Changes in user cost are significantly affected by changes in the monetary policy indicator. In addition, firm specific balance sheet characteristics, such as the lagged cash stock to capital ratio influence the investment behaviour according to the broad credit channel theory. It is shown that young firms, in particular, are more sensitive to user cost changes, sales growth and the lagged cash to capital ratio.

JEL Codes: D21, D92, E22, E52
Keywords: Investment, User Cost of Capital, Credit Channel, Panel Data

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Non-technical Summary

Firms' investment behaviour may be affected by at least two channels of monetary transmission - the interest rate channel and the credit channel - both of which are of key interest to this paper. The interest rate channel refers to the direct impact of interest rate changes through the user cost of capital on firms' investment activity. The credit channel refers to information asymmetries and other market frictions affecting the investment behaviour of individual firms. Information asymmetries between firms and potential lenders with regard to the true financial situation, investment opportunities, and thus the appropriate market value of the firm, may result in an adverse selection problem driving a wedge between the cost of externally raised funds and the opportunity cost of internal funds. As a result, firms may have to pay an external finance premium, which is related to the financial situation of the firm. In general, it is expected that the more creditworthy firms are, the lower their external finance premium will be. The existence of a credit channel would imply that monetary policy affects not only current interest rates, but also the size of the external finance premium via reduced current and expected future profits, lowering equity prices and hence collateral, which in turn amplifies the monetary policy effect on firms' investments.

This paper fits into a growing empirical literature that aims to analyse the existence of the credit channel. The aim of this paper is to present first empirical results on the monetary transmission process using Luxembourg firm-level data. More specifically, we investigate whether Luxembourg firms' investment is sensitive to the user cost of capital, to which extent the user costs are affected by monetary policy, as well as to analyse the existence of the broad credit channel. In doing so we make use of the sales accelerator model of investment. The influence of the strength of firms' balance sheets is proxied by the inclusion of the cash level to capital ratio. In order to analyse the presence of differential effects between firms we examine the role of firm age and firm size as well as that of other firm-specific characteristics, as the distinction between firms in the services sector and firms operating within the industrial sector, as well as firms' legal status.

The results suggest that the sales accelerator mechanism may be at work in the case of Luxembourg firms. The estimated magnitude of the accelerator is, however, very small. This may be related to the short sample period of seven years, not capturing a full business cycle. In line with a priori expectations, the coefficient of the user cost of capital is negatively significant. This result is also remarkably robust to changes in the specification and the definition of the user cost of capital. With regard to the cash to capital ratio, the obtained results support the idea that the strength of the balance sheet significantly influences the investment of firms, which is consistent with the arguments forwarded by the broad credit channel theory.

Furthermore, the obtained results strongly suggest that young firms, in particular, seem to be financially more constrained than older firms. Firms younger than seven years have significantly higher sales growth and lagged cash to capital coefficients, as well as a significantly higher user cost elasticity. The results also suggest that the tightness of the constraint declines with increasing age, as the magnitude of the coefficients and their significance generally decrease. In general then, younger firms are more dependent on internal liquidity to finance their investments and are more sensitive to changes in the user cost of capital and hence to monetary policy.

The results with regard to the differences between large and small, private liability and public or industrial and service firms are less obvious. There is some weak evidence to suggest that smaller firms rely more on internal liquidity to finance their capital expenditures than larger firms, as they appear to be more sensitive to the lagged cash to capital ratio. This is in line with prior expectations, as these firms are thought to have worse access to capital markets. Service firms seem to be more dependent on sales growth than industrial firms. Lastly, no significant effects with regard to the governance structure of firms emerge.

A brief analysis of the relationship between the user cost of capital and the monetary policy indicator reveals that monetary policy signals have the expected positive impact, meaning that a positive change in the Belgian 3-month money market rate implies a positive change in the user cost. Taking into consideration the results with regard to the user cost, this indicates that monetary policy, indeed, affects firms' investment behaviour.

In summary, this paper presents first results on the monetary transmission process for Luxembourg firm-level data. The results suggest that the sales accelerator mechanism may be at work. The strength of the balance sheet and, even more so, the user cost of capital, are significant and robust determinants of the investment behaviour of Luxembourg firms. Furthermore, young firms in particular show signs of being financially more constrained, as their investment behaviour is more sensitive to changes in the user cost of capital changes and/or internally generated liquidity. These results are consistent with the broad credit channel theory.

1. Introduction

From a theoretical point of view, the monetary policy transmission process works through numerous channels. Firms' investment behaviour may be affected by (at least) two of these channels - the interest rate channel and the credit channel. The interest rate channel refers to the direct impact of interest rate changes through the user cost of capital on firms' investment activity.[1] The credit channel refers to information asymmetries and other market frictions affecting the investment behaviour of individual firms. These two channels are of key interest in this paper.

Information asymmetries between firms and potential lenders with regard to the true financial situation, investment opportunities, and thus the appropriate market value of the firm, may result in an adverse selection problem driving a wedge between the cost of externally raised funds and the opportunity cost of internal funds. As a result, firms may have to pay an external finance premium reflecting all types of costs associated with overcoming the asymmetry between lender and borrower. The existence of the credit channel would imply that monetary policy affects not only the level of the current interest rates, but also the size of the external finance premium.[2]

Firms' external finance premium is related to banks' loan supply and the firms' own financial situation. Firstly, according to the '*bank lending channel*' theory, banks may reduce loan supply following monetary tightening, as deposits decline. This may entail considerable implications on firms' credit and investment decisions. Banks raise the interest rates on bank loans, which in turn is likely to increase the external finance premium. Alternatively, banks may start to ration credit, which affects bank dependent loan applicants, i.e. small and medium size firms in particular. Secondly, according to the '*balance sheet channel*' theory, the magnitude of the external finance premium is related to the financial situation of the firm. More specifically, the more creditworthy firms are, e.g., due to a large share of collateralised assets, deep pockets, or high net worth, the lower their external finance premium will be. For given information asymmetries, the strength of the balance sheet simply determines the risk the lender has to face and, via the external finance premium, ultimately the amount of investment undertaken by the firm. Adverse monetary shocks tend to increase the cost of debt, in particular that of short-term debt, resulting in the reduction of firms' profits. Rising interest rates also tend to worsen firms' expected future profitability and hence equity prices. This reduces firms' creditworthiness and therefore tends to increase the external finance premium. As the strength of the balance sheet typically moves in a pro-cyclical fashion, the balance sheet channel is said to amplify the effects of a shift in monetary policy or any other real shock. This phenomenon has become known as the '*financial accelerator*' mechanism.

[1] For a brief review of these channels see Mishkin (1995).
[2] See e.g. Bernanke and Gertler (1995) or Hubbard (1998).

A growing empirical literature analyses the effects of financial constraints on investment behaviour of firms. Numerous contributions investigated whether the strength of the balance sheet and other factors affect the external finance premium. Indicators most commonly employed are the cash flow to capital ratio (e.g. Fazzari et *al.*, 1988; Harhoff & Ramb, 2000) and the (inverse) coverage ratio (e.g. Vermeulen, 2000; Mörttinen, 2000). Furthermore, it has become custom to split samples according to some ex ante specified size, age or liquidity criterion.[3]

Other factors influencing the investment behaviour of firms have also been studied. The effect of differences in dividend pay out have been analysed by Van Ees et *al.*, (1998). The empirical results indicate that debt constraints are particularly important for low dividend pay-out firms, suggesting that the latter may suffer from asymmetric information problems, which render external finance relatively more expensive than internal funds. Haan & Sterken (2000) show that the external finance premium may also be influenced by the governance structure of firms. Their empirical results indicate that quoted firms are significantly less affected by monetary policy changes than non-quoted firms. Differences between industries were analysed by Dedola & Lippi (2000) using industry level data for France, Germany, Italy, the UK and the USA. Their results support the view that monetary policy effects are strongest for the durable goods industry and for industries characterised by small firm size and low leverage ratios. In general, the empirical results seem to be consistent with the existence of a broad credit channel.

The principal aim of this paper is to present first empirical results of the monetary policy transmission process for Luxembourg based on firm-level data. More specifically, we empirically investigate whether Luxembourg firms' investment is sensitive to the user cost of capital, to which extent the user cost is affected by changes in the monetary policy indicator, and we analyse the existence of the broad credit channel. In order to analyse the effects of the user cost and monetary policy on firms' investment decisions, we make use of the sales accelerator model of investment. In addition, we investigate whether firms' investment behaviour is significantly affected by the strength of their balance sheets, as indicated by the cash level to capital ratio. In order to analyse the presence of differential effects between firms, we examine the role of firm age, firm size and other firm-specific characteristics such as the distinction between firms in the services sector and firms operating within the industrial sector, as well as firms' legal status.

The remainder of this paper is organised as follows: Section II illustrates selected aspects of the Luxembourg firm environment and presents structural data. Section III concerns the sales accelerator model. Section IV presents the micro data and variable definitions. Section V presents the empirical results. Section VI concludes.

[3] For an extensive list of contributions, see Bernanke et al., (1996).

2. A Brief Account of some Luxembourg Peculiarities

Luxembourg is one of the original Member States of the European Community and, with an estimated population of approximately 440 000 people and a share of around 0.3% in euro area GDP, the smallest economy in today's European Union.

The growth record of Luxembourg throughout the last decade has been impressive. Average annual growth of real GDP was around 5.4% between 1990 and 2000. The rapid expansion of the Luxembourg economy owes much to the developments in the financial sector, which started in the early 1980s and still continues today. On 31 December 2001, the Luxembourg financial centre counted 189 banks and 618 monetary and financial intermediaries (MFIs) (BCL, 2002a). They accounted for about 6.5% of the total number of MFI's in the euro area. This is a high share when compared to Luxembourg's economic weight in the euro area. The sectoral composition of GDP also reflects the importance of the financial service sector in Luxembourg. In 2000, the industrial sector, including energy, accounted for about 12.1% of Luxembourg gross value added, while the Financial Services sector accounted for roughly 43.8%. The rest is made up of Agriculture (0.7%), Construction (5.7%), Retail Trade, Tourism, etc. (22.2%), and Other Services (15.5%). In spite of the dynamic economic growth pattern, the institutional, social and political settings are exceptionally robust.

In 1997, the market share of large banks (i.e. banks with total assets larger than EUR 6 billion) was 61.7%. This seems to be relatively high considering the presence of about 200 banks at the Luxembourg financial centre. According to the Herfindahl index, the Luxembourg banking sector does, however, not appear to be particularly concentrated. In 1997, the market concentration in the Luxembourg banking sector was *as if* the total market was divided equally between 34.5 banks. This is among the least concentrated market outcomes in the euro area (e.g. Ehrmann et *al.*, 2001, table 2). Also, the Luxembourg banking sector is characterised by a relatively low degree of state influence. State influence in 1995, measured as the percentage of assets of the top ten banks owned or controlled by the government, was 5.1% and among the lowest in the euro area.

The corporate finance structure in Luxembourg is characterised by strong bank-lending relationships. In the second half of the 1990s, outstanding loans to the non-financial corporate sector exceeded total gross fixed capital formation and its share in GDP navigated around 25%. On the contrary, financing investment via stock markets is only of secondary importance, as is reflected by the low number of publicly traded companies. Only 60 out of the approximately 20 000 Luxembourg firms were listed at the Luxembourg stock exchange in 2000. Equally, corporate bonds exhibit only a minor role for Luxembourg firms' investment. This underpins the high relevance of bank lending in Luxembourg corporate finance.[4]

[4] More background information on financial structures in Luxembourg can be found in BCL (2002b).

Another peculiarity of Luxembourg is the long absence of an independent national central bank. In June 1998, the Banque centrale du Luxembourg (BCL) had been established. Only half a year later its decision powers were transferred to the European Central Bank (ECB). The main reason for which Luxembourg did not have an independent central bank prior to June 1998 is connected to the Belgo-Luxembourg Economic Union (BLEU) and the monetary association between Belgium and Luxembourg, which were set up in July 1921.[5] This can be seen as the very first step in modern European integration per se. In practice, this meant that a Belgo-Luxembourg customs union was established with free trade within the customs area. The right to change the tariffs and enter trading agreements with other countries lay in the hands of Belgium. Any third-party agreement was subject to prior consultation of Luxembourg authorities. The Belgian Franc became legal tender in Luxembourg while the reverse was de iure not the case.[6] The Institut Monétaire Luxembourgeois (IML), the predecessor of the BCL, had only limited rights to issue new Luxembourg Francs. Currency issuance had to take into account the Belgian Franc in circulation in Luxembourg and the relationship between the populations of Belgium and Luxembourg. The main task of the IML was banking sector supervision. The Banque Nationale de Belgique was responsible for monetary policy operations and the liquidity of banks, as well as foreign exchange operations. This also constitutes the reason for using the Belgian 3-month money market rate as primary monetary policy indicator.

[5] For an account of the legal history of the Luxembourg Franc see Link (1995).

[6] Note that, initially, the official exchange rate between Belgium and Luxembourg was not explicitly specified. Both currencies, however, were defined according to the gold standard and according to almost the same legislative text. With the exception of the period 1935-1944, both currencies circulated in practice with an exchange rate of 1:1.

3. Theoretical Aspects

The most frequently applied approaches to estimate firms' investment demand rely on the Euler equation, Tobin's q and the sales accelerator specification. Due to considerable data limitations, and given that no information is available on firm-specific market capitalisation, we are restricted to focusing on the '*sales accelerator model*'.[7]

Sales Accelerator Specification

We essentially rely on the sales accelerator specification proposed by Bond et *al*. (1997), where for a given firm the desired capital stock is defined as a log linear function of its output and the user cost of capital.

$$\log K_{i,t} = a \log S_{i,t} - b \log UC_{i,t} \qquad (1)$$

where $K_{i,t}$, $S_{i,t}$ and $UC_{i,t}$ reflect the desired capital stock, sales and the real user cost of capital, respectively. The subscripts *i* and *t* denote the cross-section and the period identifier.
This function is consistent with profit maximisation subject to returns to scale and a CES production function, thereby allowing for a fixed capital-output ratio. Taking first differences and applying the approximation $\Delta \log K_{i,t} \approx I_{i,t} / K_{i,t-1} - \delta$, where $I_{i,t}$, $K_{i,t}$ and δ denote investment, the capital stock and the depreciation rate, respectively, one obtains the following sales accelerator specification

$$\frac{I_{i,t}}{K_{i,t-1}} = \delta + a \Delta \log S_{i,t} - b \Delta \log UC_{i,t} . \qquad (2)$$

The depreciation rate δ will be subsumed into the unobserved latent variable. This equation may be changed into an auto-regressive distributed lag specification in order to allow for a smooth inter-temporal adaptation of the actual capital stock to the desired capital stock. Additional variables capturing balance sheet effects may also be included. They are referred to as BS. Allowing for firm specific fixed effects we get

$$\frac{I_{i,t}}{K_{i,t-1}} = \sum_{k=1}^{K} \alpha_k \frac{I_{i,t-k}}{K_{i,t-k-1}} + \sum_{l=0}^{L} \beta_l \Delta \log S_{i,t-l} + \sum_{m=0}^{M} \chi_m \Delta \log UC_{i,t-m} + \sum_{n=0}^{N} \phi_n BS_{i,t-n} + \eta_i + \varepsilon_{i,t} . \qquad (3)$$

[7] As the sales accelerator specification does not provide convergence of the current stock of capital to a long run value, we also estimated an error correction specification. The results are, however, poor. Furthermore, it remains unclear as to whether one may sensibly derive information about the long term from a panel as compact as the one considered here. Therefore, the error correction specification will not be pursued any further in this paper.

4. Data, Variables and Estimation Methodogy

Data

The data are taken from Luxembourg firms' annual, consolidated where available, balance sheets as published by *Bureau Van Dijk* (Belgium) and refer to the period from 1992 to 1998. In order to prolong the panel, data from the *BELFIRST* and the *AMADEUS* data set were merged.[8] For the purpose of the analysis, data from both databases were made compatible. The database initially covers 266 firms.

We decided to identify outliers along the time series dimension at the individual firm level and not as a function of a multiple of the inter-quartile range around the median. The reason is that the panel contains a relatively small number of firms from very different industries revealing large discrepancies with respect to size, age or legal form, which may justify significant differences in investment structures. For example, young and dynamic firms may display much higher investment or sales growth rates. Also, the investment ratio of a manufacturing firm may be very different form that of an estate agent.

Unless applied to well-defined intra-homogeneous sub-samples, the removal of outliers based on multiples of the inter-quartile range does not discriminate between different industries and their characteristics, and may therefore eliminate firms from the sample for the wrong reason. Furthermore, such a method may not identify implausible jumps in the firms' individual investment behaviour through time, as no connection is made between individual firms and time. As our panel is compact, splitting into sub-samples as required by any sensible removal of outliers based on percentiles is infeasible.

Instead, we perform a plausibility check in identifying changes along the time dimension for each firm separately. In doing so, we tried, as far as possible, to take into account the merging activities of firms. A firm-year observation is therefore identified as an outlier if, for each cross-section, the year-on-year change is either below or above a certain threshold. However, to ensure that true underlying changes, as opposed to data errors, do not lead to the exclusion of an otherwise impeccable observation, implausibility additionally requires the subsequent year-on-year change to exceed the threshold values. The threshold level is initially set to ± 40%. This is to say that we eliminate one-period spike formations or trough formations for which the initial and succeeding boom and bust rate both exceed a threshold of ± 40%.[9] Also worthwhile noting is that the plausibility check was run on the raw data and not on the variables included in the estimation.

[8] The *BELFIRST* database is a subset of the *AMADEUS* database that includes Belgian and Luxembourg firms' balance sheets only.
[9] The sensitivity of the estimations has also been explored using an alternative threshold value of ± 20% (see appendix table A1).

Table 1:

Sector Statistics, in 1996 and percent

	Value Added	Wage Compens.	Employment	Share of Total No. of Firms	Share of Firms with >20 Empl.
Agriculture, Hunting, Fishery	0.9	0.4	1.9	n.a.	n.a.
Extraction, Industry, Energy & Water	13.4	17.3	15.5	5.1	14.7
Construction	5.7	8.3	11.1	8.2	23.2
Retail Trade, Repairs, Domestic Articles	9.8	10.0	15.5	35.1	22.5
Hotels and Restaurants	2.4	2.6	5.2	12.9	4.4
Transport and Communication	8.6	8.3	7.3	5.4	7.6
Financial Intermediation and Insurance	42.8	27.7	21.1	4.5	12.2
Other Marketable Services	16.4	25.4	22.3	28.9	15.4

Note: Columns 1-3 refer to ESA 95, while columns 4-5 refer to NACE 1. Columns may not add up exactly due to rounding differences.
Source: STATEC

At the beginning of 1996, a total of around 18 000 firms were registered in Luxembourg. As illustrated in table 1, roughly 60% of these registered firms had salaried employees. Only around one sixth of all registered firms belong to the industry sector. In contrast, approximately 60% of the firms used in this paper's empirical analysis belong to the manufacturing sector. Therefore, the empirical analysis cannot be taken as an accurate description of the monetary transmission process in Luxembourg as such but rather of the Luxembourg manufacturing sector.

Variable Definitions

Estimates of the firm specific capital stock have been obtained in using the perpetual inventory method. As a benchmark, the depreciation rate is assumed to be six percent.[10]

Sales are simply approximated by firms' turnover, as genuine sales data were not available. Factors feeding into the user cost are the monetary policy indicator, which is of particular interest to this study and economic and legal variables, such as the depreciation rate and expectations on the future price level. The user cost of capital definition used in this paper is given in equation (4) as[11]

$$UC_{i,t} = \frac{p_t^I}{p_t} \cdot \left(wr_{i,t} + d_i - (1-d_i) \cdot \frac{\Delta p_{i,t+1}^I}{\Delta p_{i,t}^I} \right). \qquad (4)$$

UC, p^I , *p, d* and *wr* respectively represent the user cost of capital, the price level of investment, the economy-wide price level, depreciation in percentage terms and the weighted average cost of capital (WACC). As above, the subscripts *i* and *t* denote the cross-section and time period identifier. This user cost of capital measure is dynamic in the sense that it includes expectations regarding prices of investment goods. The static equivalent is obtained in abstracting from $\Delta d_{i,t+1}^I$. The presented estimations will use the dynamic specification. This is because estimated results are stronger and more plausible and also reflects that, as expected, the forward-looking element seems to matter.

The firm-specific weighted cost of capital, wr, involves weighting of the gross debt share by the debt interest rate and the own funds share by the equity interest rate $er_{i,t}$. The weighted cost of capital definition given in specification (5) relies on the apparent interest rate $ar_{i,t}$.[12] The apparent interest rate is a proxy for interest paid on debt. It is a firm-specific variable and it is defined in equation (6) as the ratio of debt charges over gross debt.

$$wr_{i,t} = \frac{gross\ debt_{i,t}}{(gross\ debt_{i,t} + funds_{i,t})} . ar_{i,t} + \frac{funds_{i,t}}{(gross\ debt_{i,t} + funds_{i,t})} . er_{i,t} \qquad (5)$$

$$\text{with } ar_{i,t} = \frac{debt\ payments_{i,t}}{(current\ liab._{i,t} + non-current\ liab._{i,t})} . \qquad (6)$$

The equity interest rate *er* is defined as $er_{i,t} = dr_{i,t}^{long} + ep$, where $dr_{i,t}^{long}$ denotes the long-term debt rate, which we take to be the 10-year Government bond in Luxembourg. *ep* denotes the equity premium in percentage points, which is assumed to be 6%.[13]

[10] The sensitivity of the estimates was assessed in using an alternative depreciation rate of 8% (see appendix table A1).
[11] The user cost does not include any taxation term due to data unavailability. We also experimented with other user cost of capital definistions in order to assess the sensitivity of the obtained results. These are shown in table A2 in the appendix.
[12] Please refer to table A2 in the appendix for results using the monetary policy indicators, such as the 3-month money market rate in Belgium instead of the apparent interest rate, ar.
[13] The sensitivity with regard to the equity premium was also explored. See table A1 in the appendix.

Table 2 provides some basic descriptive statistics of the benchmark sample used in the regressions. Investment had to be calculated as the difference in tangible fixed assets between two years from the asset and liability statement. This is somewhat dissatisfactory, but inevitable, given that data on genuine investment were not available from the income statement. The benchmark depreciation rate is set to be 6%. As noted above, this yardstick also enters the capital stock equation. Its underlying assumption may be meaningful from a macroeconomic perspective, but may not correspond to the accounting practice of firms, which, at least in part, may explain the low investment ratios obtained. If this was the case, one may argue that the bias is constant over firms and time and hence subsumed into the constant.

Table 2:

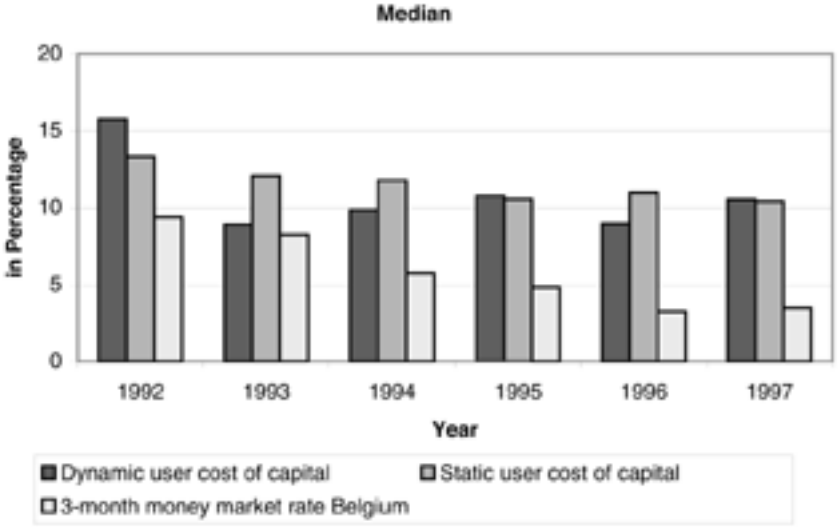
Summary Statistics of Variables used in Estimation

	$Tangible\ Assets_t^a$	I_t / K_{t-1}	$Sales_t^a$	$\Delta \log Sales_t$	UC_t	$\Delta \log UC_t$	$Cash_{t-1} / K_{t-1}$
Mean	24 822	0.052	57 384	0.003	0.106	-0.052	0.822
Maximum	1 309 611	2.331	513 958	0.646	0.196	1.408	36.643
Minimum	34	-0.654	3 883	-1.221	0.022	-1.597	0.000
Std. dev.	116 401	0.227	75 101	0.180	0.031	0.347	3.313
Observations	517	436	429	349	445	365	285
Cross-sections	80	80	80	80	80	80	80

[a] In EUR 1000.

Figure 1:

User Cost of Capital and the Monetary Policy Indicator



In particular, the user cost of capital measure deserves some attention. The values are within a plausible range, and correspond closely to those provided by other MTN contributions. The medians of the user cost of capital indicators appear to follow the monetary policy indicator. As

explained above, the differences between dynamic and static specification of the user cost of capital measure can be explained by the inclusion of the forward-looking component in the former measure.

Most of the other explanatory variables are self-explanatory. A more detailed description of the individual variables is given in table 3.

Table 3:

Summary of Variable Definitions

Investment, (I)	$\frac{Tang.Assets_{i,t} - Tang.Assets_{i,t-1} + Depr.}{Capital_{i,t-1}}$
Capital, (K)	According to Perpetual Inventory Method, taking first balance sheet value as initial value.
Depreciation, (d)	Depreciation rates assumed to be 6% in the benchmark case. The sensitivity with regard to 8% is explored.
Investment Price Deflator, (p^I)	Derived from national accounts.
Price Deflator, (p)	Harmonised Index of Consumer Prices.
Sales, (S)	Sales are approximated by turnover.
User Cost of Capital, (UC)	According to equations (4) and (5). Apparent interest rates are calculated from firms' balance sheets according to equation (6). Long-term interest rate refers to the 10-year government bond in Luxembourg. The equity premium is assumed to be 6% in the benchmark case. Short-term interest rate refers to 3-month money market rate for Belgium or Germany.
Cash Stock (CS)	Cash and Cash Equivalent.
Age Dummy (Age)	Dummy variable: We used the 30%, 50% and 70% values of the Gompertz function as threshold values.
Legal Form Dummy, (LF)	Dummy variable: 0 if private liability company, 1 if public company.
Industry Services Dummy (IS)	Dummy variable: 0 if services, 1 if industry.
Size Dummy (SIZE)	Dummy variable: Discrimination of small and large firms according to total assets. The cut-off threshold value is the 30% value of the cumulative distribution function.

Note : Sales are not deflated, as deflation by the Harmonised Index of Consumer Prices was found not to affect the estimated results in any significant way.

As illustrated in the introduction, the empirical results of other studies are generally in line with the ideas forwarded by the broad credit channel theory as the investment of smaller and younger firms is found to be more sensitive to the user cost and cash flow to capital ratio. However, it is not always clear whether the statistical significance of the individual coefficients can be taken at face value, i.e. can be taken to reflect the presence of financial constraints and asymmetric information. A possible explanation for the cash flow effect on investment may be due to a correlation between internal finance with sales. Hence, it is not entirely clear whether cash flow signals the profitability of investments, not being captured in basic sales specifications, or whether cash flow represents a source of cheap internal funds for firms relative to external finance. Furthermore, if cash flow is correlated with firms' future profitability, then a significant relationship between cash flow and investment could simply reflect the relationship between expected profitability and investment emphasised in the neo-classical investment theory.[14] Similar to other studies in this area, this unresolved issue will have to be borne in mind when interpreting the estimates obtained within this study.

Trying to be less subjected to the above criticism, we use the level of cash rather than cash flow as our primary balance sheet indicator. Cash levels say little about the quality of future investment projects and hence have little to do with the profitability of investments. According to the advocates of the credit channel theory, financially constrained firms are more likely to have to resort to internal financing, i.e. one would expect a positive correlation between being constrained and the level of cash. Consequently, we use lagged rather than current cash divided by the lagged capital stock as our primary balance sheet indicator. This is because it is the cash reported in the closing balance of the preceding period, which represents the level of cash available to the firm at the beginning of the reporting, i.e. investing, period.

Differential Effects

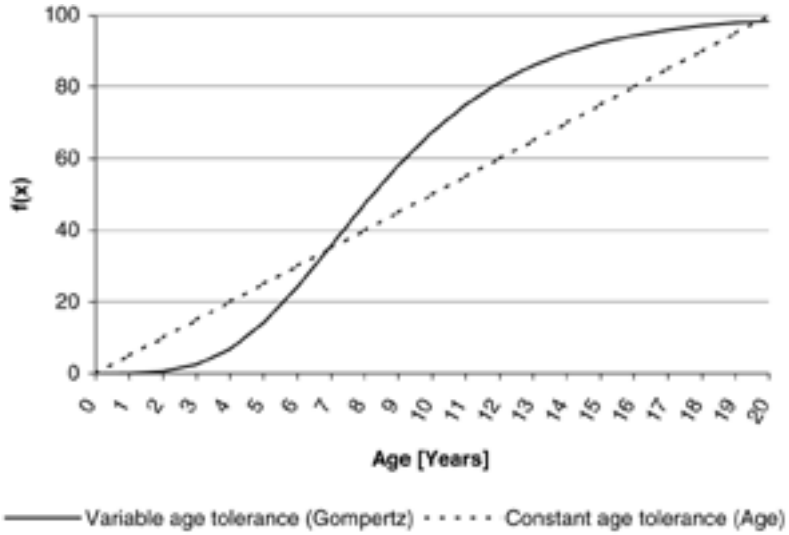
The working hypothesis is that young, small, private liability and unquoted firms, as well as service sector firms have different sales growth, user cost and cash stock sensitivities. We analyse the presence of differential effects by using interaction variables. All exogenous variables are interacted with a dummy variable, indicating whether or not firms meet some kind of ex ante specified criterion, such as age, or firm size (see table 3).

Unfortunately, the linear age variable probably cannot be taken to reflect the tightness of financial constraints in a sensible manner given that time, ceteris paribus, will not reduce the tightness of the constraint at a constant degree (i.e. regardless of the age of any given firm). For the purpose of illustration, we transform age using a Gompertz function. The transformation basically draws on the idea that, initially, the access of young firms to credit is rather restricted and time may not improve bank-firm relationships and banks' credit risk aversion in a proportional way until a sufficient level of reliability, confidence and continuity is

[14] The current debate owes much to Kaplan and Zingales (1997, 2000) who refute, both on theoretical grounds and on the basis of their empirical results, the idea that higher cash flow sensitivities can be interpreted as evidence for more severe financial constraints. Fazzari et *al*. (1988) and Hubbard (1998) acknowledge this ambiguity but defend this interpretation in a comment on Kaplan & Zingales (2000).

attained. At some intermediate age level, the marginal impact of age on access to financial resources may be increasing. Once a certain "maturity stage" has been achieved, the role of age with respect to access to financial resources will become negligible in that bank-firm relationships are fully established and additional age will not per se lead to higher credit worthiness.

Figure 2:
The Transformed Age Function



According to these assumptions, the relationship between age and credit worthiness/access to financial resources may be described by a s-shaped pattern, as illustrated in figure 2. Modelling is done by means of the following Gompertz-type function,

$$A^{tr} = L e^{-\alpha e^{-\beta f(A)}} \qquad (7)$$

where L, A and A^{tr} denote the maturity level, age and transformed age, and α and β denote calibration parameters.

For simplification and interpretation purposes, the transformed function was normalised so as to yield results between 0 (maximum age-related financial constraints) and 100 (minimum age-related financial constraints). Furthermore, α and β were defined in order to obtain no significant reduction in the tightness of the constraint below the age of five, as well as no considerable further improvement beyond the age of 15 years.

Estimation Methodology

The inclusion of a lagged dependent variable in dynamic panel data estimation results in OLS estimates being biased and inconsistent, as not only the dependent, but also the lagged dependent variable is a function of the firm-specific error term η_i. Hence, the lagged investment ratio is correlated with the error term (e.g. Baltagi, 1995). Estimation by means of Generalised Methods of Moments (GMM) provides consistent and unbiased estimates (e.g. Arellano & Bond, 1991). However, due to the rather short and wide nature of the panel, the loss of observations in using lagged variables as instruments, either in levels or in first differences, would be extremely high. Also, GMM estimates may be unreliable in cases where no appropriate instruments are available (e.g. Mojon et *al.*, 2001).

Trognon & Sevestre (1985) show that in theory the consistent estimator lies in between the OLS and WITHIN estimates. The OLS estimator overestimates the true coefficient, while the WITHIN estimator underestimates the true coefficient. The magnitude of the bias depends, among other things, on the size of the coefficient of the lagged dependent variable and on the so-called intra-class correlation coefficient. In reporting both estimations, an upper and a lower bound for the value of the consistent estimator may be provided. In light of the severe sample size restrictions in our case, providing OLS and WITHIN estimates may prove a valid alternative. This is particularly the case if the estimated coefficients are close to each other.

As the coefficients of the lagged sales growth, user cost, and the balance sheet variables are not significantly different from zero, the subsequently presented estimations rely on the restricted specification of equation (3).[15] The basic sales accelerator specification to be estimated can be summarised as follows:

$$\frac{I_{i,t}}{K_{i,t-1}} = \alpha \frac{I_{i,t-1}}{K_{i,t-2}} + \beta \Delta \log S_{i,t} + \chi \Delta \log UC_{i,t} + \phi BS_{i,t} + \eta_i + \varepsilon_{i,t}. \qquad (8)$$

[15] Estimation results of the unrestricted specification, including lagged sales and user cost growth, are available upon request.

4. Empirical Results

This section presents the empirical results. For each regression, both OLS and WITHIN estimates are reported. Firstly, regression (I) presents the empirical estimates of the basic sales accelerator specification augmented by the lagged cash stock to capital ratio. Regression (II) explores differences between various sub samples. Regression (III) presents selected results with regard to monetary policy changes and its impact on the user cost of capital. The notation (i) and (ii) refers to OLS and WITHIN estimates respectively.

Regression (I): The Benchmark Regression

The results of regression (I) in table 4 provide partial evidence in favour of the sales accelerator mechanism in the case of Luxembourg firms. The sales growth coefficient is positively significant in the OLS estimations while it is not significant in the WITHIN estimations.[16] The low magnitude of the sales growth coefficient in the OLS estimation, ranging around 0.08, as well as its insignificance in the WITHIN estimation, may be related to the short sample period, not capturing a full business cycle.

The results with regard to the user cost of capital are as expected. The coefficients range between -0.084 and -0.152 and are significant at the 5% level or better, regardless of whether referring to the OLS or WITHIN estimation. The size of the estimated coefficients seems to be on the low side compared to other studies in the literature (e.g. Harhoff & Ramb, 2000). Also worthwhile noting is that the differences between the estimated coefficients in the respective OLS and WITHIN estimations are relatively small.[17]

With regard to the lagged cash to capital ratio, the WITHIN estimations seem to provide stronger results. The estimated coefficient is 0.025 and significant in regression (Ib-ii). This result supports the idea that the strength of the balance sheet influences the investment of firms, which is consistent with the arguments forwarded by the broad credit channel theory. Bearing in mind that the coefficients should not be taken at face value, the inclusion of the balance sheet indicator does not affect the sales growth or user cost coefficients in a significant way, as is shown by a simple Wald-test. This can, however, not be said for the lagged investment ratio coefficient.

[16] We refrain from providing the long-term elasticities of the individual coefficients. This is because our lagged dependent variable is often insignificant, the specifications do not contain any lags and the period under investigation does not cover a full business cycle. This calls into question the entire concept. The interested reader may easily compute the long-term coefficients by dividing the individual coefficients by 1 minus the coefficient of the lagged dependent variable.

[17] However, the theoretically derived property that the OLS overestimates the true coefficient while the WITHIN estimator underestimates it, does not seem to hold for the estimated user cost and cash to capital ratio coefficients, as the coefficients are smaller in the OLS specification than in the WITHIN specification.

Table 4:

Estimates for the Investment Ratio

Regression	(Ia-i)	(Ia-ii)	(Ib-i)	(Ib-ii)
Method	OLS	WITHIN	OLS	WITHIN
Dependent variable	I_t / K_{t-1}		I_t / K_{t-1}	
Cross-sections	80		80	
Observations	257		195	
I_{t-1} / K_{t-2}	0.082	-0.061	0.245 ***	-0.126 *
	0.052	0.040	0.074	0.073
$\Delta \log SALES_t$	0.079 **	-0.042	0.081 **	0.002
	0.035	0.039	0.038	0.050
$\Delta \log UC_t$	-0.099 **	-0.084 ***	-0.152 ***	-0.125 ***
	0.039	0.027	0.049	0.032
$CASH_{t-1} / K_{t-1}$			0.002	0.025 ***
			0.003	0.008
R-Squared	0.054	0.482	0.163	0.626
Adjusted R-Squared	0.043	0.237	0.145	0.346
F-Statistic	4.788 ***	8.080 ***	9.258 ***	61.948 ***

Standard errors below coefficient in lower font. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. Estimates are heteroskedasticity consistent and obtained using the plausibility threshold of ± 40%, the dynamic user cost, the apparent interest rate in the WACC definition, and a depreciation rate of 6% in the capital stock calculation.

Regression (II): Differential Effects

Regression (II), presented in tables 5 and 6, analyses the existence of differential effects between different types of firms. Due to the short and narrow data set, an interaction variable approach was selected and it was decided not to use separate estimation for various sub-samples. We analyse whether small, young, service sector or private liability firms are different in terms of investment behaviour. According to advocates of the credit channel theory, these results are consistent with the idea of those firms being financially more constrained.

The results obtained strongly suggest that young firms, in particular, seem to be financially more constrained than older firms. Firms below a threshold of 30% according to the Gompertz function[18] (regression (IIa-i)) have a significantly higher sales growth and lagged cash to capital coefficients, as well as a significantly higher user cost elasticity. The magnitude of the respective coefficients is quite revealing, though this fact should not be emphasised too much, as we know that the estimates are not entirely consistent. With the exception of the user cost, this effect also appears in regression (IIa-ii). The estimated results also suggest that the tightness of the constraint declines with increasing (transformed) age, as the magnitude of the coefficients and their significance generally seem to decrease as higher age thresholds are selected.[19]

[18] Within the given environment, this corresponds to firms of an age of less than seven years.
[19] Using the Gompertz function itself as an interaction variable does not provide any significant results.

Table 5:

Differential Effects for Young Firms

Regression Method	(IIa-i) OLS	(IIa-ii) WITHIN	(IIb-i) OLS	(IIb-ii) WITHIN	(IIc-i) OLS	(IIc-ii) WITHIN
Dep. variable	I_t / K_{t-1}		I_t / K_{t-1}		I_t / K_{t-1}	
Cross-sections	78		78		78	
Observations	191		191		191	
I_{t-1} / K_{t-2}	0.256 ***	-0.107	0.271 ***	-0.114	0.250 ***	-0.099
	0.078	0.075	0.081	0.079	0.082	0.081
$\Delta \log SALES_t$	0.068 *	-0.015	0.061 *	-0.014	0.065 *	-0.029
	0.036	0.050	0.037	0.050	0.038	0.051
$\Delta \log UC_t$	-0.156 ***	-0.123 ***	-0.148 ***	-0.119 ***	-0.162 ***	-0.123 ***
	0.050	0.032	0.051	0.034	0.055	0.033
$CASH_{t-1} / K_{t-1}$	0.001	0.018 **	0.002	0.019 ***	0.002	0.023 ***
	0.003	0.007	0.003	0.007	0.003	0.008
Interaction var.	Gompertz		Gompertz		Gompertz	
Threshold value	**<30%**		**<50%**		**<70%**	
Corresponds to	<7 years		<8 years		<11 years	
I_{t-1} / K_{t-2}	-1.098 ***	0.638 ***	-0.602 ***	0.126	0.041	-0.060
	0.358	0.220	0.161	0.138	0.238	0.233
$\Delta \log SALES_t$	0.595 ***	0.290 ***	0.321	0.355 **	0.100	0.231
	0.158	0.080	0.319	0.147	0.167	0.142
$\Delta \log UC_t$	-0.588 ***	-0.078	-0.303 ***	0.049	0.022	-0.029
	0.136	0.140	0.086	0.080	0.134	0.068
$CASH_{t-1} / K_{t-1}$	0.057 ***	0.055 ***	0.052 ***	0.054 ***	0.034	0.068 ***
	0.007	0.007	0.012	0.009	0.026	0.022
R-Squared	0.198	0.645	0.204	0.644	0.181	0.646
Adj. R-Squared	0.163	0.357	0.169	0.356	0.145	0.360
F-Statistic	5.617 ***	27.237 ***	5.830 ***	27.146 ***	5.035 ***	27.409 ***

Standard errors below coefficient in lower font. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. Estimates are heteroskedasticity consistent and obtained using the plausibility threshold of ± 40%, the dynamic user cost, the apparent interest rate in the WACC definition, and a depreciation rate of 6% in the capital stock calculation.

In general then, younger firms are more dependent on internal liquidity to finance their investment decisions and are more sensitive to changes in the user cost of capital. However, as is often the case with dummy variable interaction approaches, this result is sensitive to the choice of the cut-off threshold value. It is also worthwhile noting that the user cost and sales growth, as well as the cash stock ratio retain their significance (see upper half of table 5). This is reassuring as the inclusion of interaction variables in small samples often leads to insignificance of both coefficients, i.e. the coefficient of the base variable and its interaction term.

Table 6:

Differential Effects for Small and Service Sector and Private Firms

Regression Method	(IId-i) OLS	(IId-ii) WITHIN	(IIe-i) OLS	(IIe-ii) WITHIN	(IIf-i) OLS	(IIf-ii) WITHIN
Dep. variable	I_t / K_{t-1}		I_t / K_{t-1}		I_t / K_{t-1}	
Cross-sections	80		80		80	
Observations	194		195		195	
I_{t-1} / K_{t-2}	0.257 ***	-0.113	0.179 **	-0.146 *	0.322 ***	-0.164
	0.093	0.077	0.084	0.083	0.101	0.106
$\Delta \log SALES_t$	0.067	-0.027	0.044	-0.028	0.065	-0.011
	0.062	0.066	0.036	0.056	0.053	0.071
$\Delta \log UC_t$	-0.166 ***	-0.107 ***	-0.202 ***	-0.153 ***	-0.175 **	-0.144 ***
	0.059	0.033	0.068	0.046	0.072	0.047
$CASH_{t-1} / K_{t-1}$	0.002	0.022 ***	-0.008	0.032	0.003	0.025 ***
	0.003	0.008	0.008	0.023	0.003	0.009
Interaction variable	**Size**		**Service**		**Private**	
Threshold value	30%					
I_{t-1} / K_{t-2}	-0.031	-0.022	0.190	0.161	-0.162	0.101
	0.141	0.194	0.134	0.153	0.139	0.137
$\Delta \log SALES_t$	0.042	0.132	0.177 **	0.248 ***	0.031	0.062
	0.074	0.079	0.088	0.094	0.066	0.087
$\Delta \log UC_t$	0.078	0.059	0.148	0.074	0.076	0.057
	0.103	0.074	0.092	0.060	0.086	0.059
$CASH_{t-1} / K_{t-1}$	0.013	0.097 **	0.010	-0.013	-0.008	0.001
	0.029	0.041	0.009	0.024	0.009	0.018
R-Squared	0.168	0.680	0.210	0.642	0.179	0.631
Adj. R-Squared	0.132	0.417	0.176	0.351	0.144	0.330
F-Statistic	4.664 ***	32.156 ***	6.196 ***	27.412 ***	5.084 ***	26.091 ***

Standard errors below coefficient in lower font. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. Estimates are heteroskedasticity consistent and obtained using the plausibility threshold of ± 40%, the dynamic user cost, the apparent interest rate in the WACC definition, and a depreciation rate of 6% in the capital stock calculation.

The results with regard to the differences between large and small, private liability and public or industrial and service firms are less obvious. They are shown in table 6. The coefficient of the cash level ratio term in regression (IId-ii) has the expected sign and is significant. Hence, there is some weak evidence to suggest that smaller firms rely more on internal liquidity to finance their capital expenditures than larger firms, as they appear to be more sensitive to the lagged cash to capital ratio. This is in line with prior expectations, as these firms are thought to have worse access to capital markets. Service firms seem to be more dependent on sales growth than industrial firms (see regressions (IIe-i) & (IIe-ii)). Lastly, there seem to be no significant effects with regard to the governance structure of firms.

Regression (III): The Effect of Monetary Policy on the User Cost

Regression (III) briefly explores the relationship between the user cost of capital and the monetary policy indicator. It can clearly be seen that monetary policy signals have the expected positive impact, i.e. a positive change in the Belgian 3-month money market interest rate implies a positive change in the user cost. Also the coefficient of the lagged value of the monetary policy indicator is positively significant. This result complements the results obtained in previous regressions, where it was shown that the user cost of capital is the most robust determinant of firms' investment behaviour.

Table 7:

Monetary Policy Indicator and User Cost of Capital

Regression	(IIIa-i)	(IIIa-ii)
Method	OLS	WITHIN
Dep. var.	$\Delta \log UC_t$	
Cross-sections	80	
Observations	303	
$\Delta \log MPI_t$	0.951 ***	0.952 ***
	0.142	0.132
$\Delta \log MPI_{t-1}$	0.696 ***	0.689 ***
	0.266	0.241
R-Squared	0.230	0.308
Adjusted R-Squared	0.225	0.055
F-Statistic	44.84 ***	98.58 ***

Standard errors below coefficient in lower font. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. Estimates are heteroskedasticity consistent and obtained using the plausibility threshold of ± 40%, the dynamic user cost, the apparent interest rate in the WACC definition, and a depreciation rate of 6%.

Some Sensitivity Tests

Table A1 in the appendix provides some sensitivity tests. Several alterations were made. Regression (A1a) includes only firms within the 20 per cent threshold range. Regression (A1b) changes the equity premium to 3%, while regression (A1c) uses a depreciation rate of 8% for the calculation of the capital stock and the investment ratio.

The results indicate strong robustness, in particular with respect to the user cost. Despite the modifications undertaken, the coefficients of the user cost and sales growth, as well as of the lagged cash to capital ratio keep their sign and remain significant. The exception is regression (A1c-i), where the sales growth coefficient fails to be significantly positive. Again, the user cost of capital coefficient is negatively significant across regressions. Furthermore, the magnitude of the individual coefficients is very similar to those in regression (I). In regression (A1c), where a depreciation rate of 8% instead of 6% is assumed, the user cost and cash to capital coefficients seem to be somewhat higher than in regression (I).

Table A2 provides some results using different user cost of capital proxies. The results also suggest that using the dynamic user cost of capital proxy seems to yield stronger results than using static proxies. The results obtained in regression (A2c), which makes use of the dynamic user cost of capital proxy with the Belgian 3-month money market rate instead of the apparent interest rate, are almost as good as those obtained in regression (Ib). Nevertheless, we chose to focus on the proxy using the apparent interest rate, as this comes closest to the way practitioners calculate firms' specific interest rate. Hence, our focus on the dynamic user cost definition using the apparent interest rate.

5. Concluding Remarks

The main aim of this paper was to present first results on the monetary transmission process for Luxembourg based on firm-level data. Despite the severe sample size restriction, we obtain indicative results. The results suggest that the sales accelerator mechanism may be at work. Its magnitude is, however, very low. This may be due to the short nature of the data set, and the fact that the period under investigation does not capture a full business cycle. The strength of the balance sheet and, even more so, the user cost of capital are significant and robust determinants of the investment behaviour of Luxembourg firms. Furthermore, young firms in particular show signs of being financially more constrained, as their investment behaviour is more sensitive to changes in the user cost of capital changes and/or internally generated liquidity. These results are consistent with the broad credit channel theory.

Future research will have to address a number of issues. Firstly, the sample width and length will need to be widened considerably. This will allow several issues to be addressed. It will be possible to introduce more lags in the empirical estimation, thereby allowing meaningful long-run coefficients to be obtained. Also, the analysis of differences between firms would be improved upon. An extended data set may also allow for the use of more sophisticated estimation methods. Here, we refer to more sophisticated dynamic panel data techniques, such as the dynamic GMM estimator.

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7. Appendix

Table A1:

Sensitivity Analysis of Estimates for the Investment Ratio

Regression	(A1a-i)	(A1a-ii)	(A1b-i)	(A1b-ii)	(A1c-i)	(A1c-ii)
Method	OLS	WITHIN	OLS	WITHIN	OLS	WITHIN
PL thresholds	**± 20%**		± 40%		± 40%	
Equity premium	6%		**3%**		6%	
Depr. cap. stock	6%		6%		**8%**	
Dep. variable	I_t / K_{t-1}		I_t / K_{t-1}		I_t / K_{t-1}	
Cross-sections	71		80		80	
Observations	171		195		195	
I_{t-1} / K_{t-2}	0.264 ***	-0.111	0.243 ***	-0.133 *	0.404 ***	-0.113
	0.087	0.076	0.075	0.074	0.067	0.068
$\Delta \log SALES_t$	0.084 *	-0.047	0.076 *	-0.004	0.061	0.036
	0.047	0.067	0.039	0.051	0.046	0.054
$\Delta \log UC_t$	-0.159 ***	-0.127 ***	-0.123 ***	-0.104 ***	-0.206 ***	-0.218 ***
	0.054	0.034	0.045	0.029	0.071	0.046
$CASH_{t-1} / K_{t-1}$	0.003	0.032 ***	0.002	0.025 ***	0.003	0.043 ***
	0.002	0.008	0.003	0.008	0.003	0.009
R-Squared	0.177	0.659	0.150	0.620	0.292	0.717
Adj. R-Squared	0.157	0.397	0.132	0.336	0.278	0.505
F-Statistic	8.900 ***	61.950 ***	8.380 ***	60.450 ***	19.632 ***	93.557 ***

Standard errors below coefficient in lower font. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. Estimates are heteroskedasticity consistent and obtained using the dynamic user cost, and the apparent interest rate in the WACC definition.

Table A2:

Estimates for the Investment Ratio with Different User Cost Definitions

Regression	(A2a-i)	(A2a-ii)	(A2b-i)	(A2b-ii)	(A2c-i)	(A2c-ii)
Method	OLS	WITHIN	OLS	WITHIN	OLS	WITHIN
PL thresholds	± 40%		± 40%		± 40%	
User cost def.	**Static**		**Static**		Dynamic	
WACC def.	**3-M MMR**		AR		**3-M MMR**	
Depr. cap. stock	6%		6%		6%	
Dep. variable	I_t / K_{t-1}		I_t / K_{t-1}		I_t / K_{t-1}	
Cross-sections	80		80		80	
Observations	258		258		195	
I_{t-1} / K_{t-2}	0.230 ***	-0.130 *	0.224 ***	-0.144 *	0.254 ***	-0.114
	0.065	0.075	0.067	0.075	0.075	0.073
$\Delta \log SALES_t$	0.082 **	-0.035	0.055	-0.060	0.081 **	0.003
	0.038	0.064	0.043	0.065	0.038	0.053
$\Delta \log UC_t$	-0.349 ***	-0.188	-0.070	-0.027	-0.123 ***	-0.097 ***
	0.132	0.119	0.044	0.034	0.037	0.027
$CASH_{t-1} / K_{t-1}$	0.001	-0.012	0.001	-0.013	0.002	0.026 ***
	0.003	0.026	0.003	0.025	0.003	0.008
R-Squared	0.084	0.445	0.061	0.440	0.155	0.620
Adj. R-Squared	0.069	0.180	0.046	0.172	0.137	0.336
F-Statistic	5.795 ***	46.488 ***	4.111 ***	45.493 ***	8.683 ***	60.334 ***

Standard errors below coefficient in lower font. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. Estimates are heteroskedasticity consistent. 3-M MMR refers to the Belgian 3-month money market rate.