Private Firms, Corporate Investment and the WACC: Evidence from France

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June 2, 2021

Abstract

How is corporate investment affected by the weighted average cost of capital (WACC)? Since existing studies focus on listed firms, little is known of the case of private firms, in spite of their relevance in both developed and developing economies. In this paper, we attempt to fill this gap. We develop an empirical study on the impact of the WACC on private firms' investment rates. We exploit accounting information on a panel of around 1,700 French private corporate groups in the non-farm, non-financial sectors, covering the period 2005-2015. We overcome the challenge posed by the lack of observable information about the cost of equity for private firms by developing a methodology that relies on estimates for comparable public firms. We find that a one-standard deviation increase in the WACC (2 percentage points) leads to a 0.7 percentage point decrease in the investment rate the following year. Increases in both components of the WACC, namely the cost of debt and the cost of equity, are associated with lower investment rates. A back-of-the-envelope calculation suggests that the heightened WACC following the euro area crises reduced the aggregate corporate investment rate of French private firms by a cumulative 1.6 percentage points over 2009-2015.

Keywords: Corporate Investment, WACC, Cost of Equity, Debt, Privately-held Firms.
JEL Classification: G31; G32.

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I. Introduction

Standard q-theory predicts a negative relationship between corporate investment and the weighted average cost of capital (WACC). Most available empirical tests of this important prediction focus on public firms, for which the cost of equity (CoE) can be computed with widely available stock market data (Frank and Shen, 2016; Drobetz et al., 2018; Kim, 2020).

The attention given to public firms by the literature, mostly the consequence of the lack of suitable data for privately-held firms, leaves open an important gap. Understanding the microeconomic determinants of capital expenditure decisions by private firms is paramount for explaining the dynamics of aggregate investment. Privately-held firms are predominant in European economies. In France, for instance, of a total of 145,000 firms in the non-farm, non-financial sector in 2017, less than 1% are listed. Private firms are smaller than public ones on average, but their contribution to aggregate investment and the economy is substantial: over half of capital expenditure by non-financial corporations (NFC) in France is accounted for by private firms, while outstanding shares of non-listed non-financial corporations outweigh listed shares by a factor of three.[1]

In this paper, we attempt to fill this gap. We develop an empirical study of the impact of the WACC on investment rates of privately-held firms. We exploit firm-level accounting information available for around 1,700 French private non-financial corporate groups from 2005 to 2015 collected by the Banque de France. From these data, we obtain measures of leverage, income tax payments and the implied cost of debt. We call each firm in our dataset a "corporate group" because the balance sheet data are consolidated at the level of economic groups, which are potentially composed of several firms (*unités légales* in French). This feature is advantageous for our purposes because it allows a better comparison with the data on public firms used in our study and in the literature (e.g. COMPUSTAT), which is based on consolidated accounting statements.

One important contribution of our paper is to propose a methodology to overcome the challenge raised by the lack of information on the CoE for private firms. Our strategy

[1] Although there are no official statistics we compute a rough lower-bound. Total capital expenditure of publicly held French companies amounted to some EUR 127 billion in 2016 (Datastream), whereas total investment of resident non-financial corporations (from national accounts) was around EUR 267 billion the same year. The outstanding volume of non-listed shares issued by non-financial corporations amounted to EUR 4,771 billion in 2016 and that of listed shares was EUR 1,578 billion.

exploits the available information for comparable public firms. We collect stock market information on the entire population of French publicly-listed non-financial corporations (around 1,100 for the period 2005-2015) and merge it with industry-level profit forecasts from I/B/E/S. For each 2-digit industry, we compute a time-varying measure of the average CoE that we estimate with a standard dividend-discount model. We then compute measures of firm-specific WACCs for the privately-held corporate groups in the sample by combining the industry-specific estimate of the CoE with firm-level measures of the tax-adjusted cost of debt and leverage, that we construct using the balance sheet data.[2] The essence of this method lies in emulating common practice by private equity investors, who use stock market forecasts to make decisions on whether and how much capital to supply to private firms.[3] This methodology delivers a WACC measure that averages 5.4% across industries and years, resulting from the combination of average tax-adjusted cost of debt of 3.0% and average CoE of 7.4%. These figures are in line with orders of magnitude reported in related studies (e.g., Melolinna et al., 2018, for the UK). The CoE is higher than the cost of debt, and displays a larger volatility and higher dispersion across industries than the cost of debt, which is expected given that the CoE is strongly affected by fluctuations in the stock market.

The analysis is based on an empirical investment equation derived from a standard Q-model of investment, where Tobin's q is decomposed (as in Abel and Blanchard, 1986), into a linear function of cash flow and the WACC. Our results show that the WACC is negatively and significantly associated with investment by private firms. Our preferred specification includes corporate-group fixed effects, which control for time-invariant characteristics and provide identification from observed changes in the WACC and investment rate over time and within corporate groups. It also include time fixed effects to control for macroeconomic fluctuations and a standard set of corporate-group level, time-varying variables (including leverage and size). Quantitatively, the regressions show that a one standard deviation increase in the WACC (2 percentage points) leads to a decrease in the investment rate of the average private firm by 0.7 percentage points the following year (corresponding to 6% of the sample

[2] A comparable empirical strategy is deployed by Chirinko et al. (1999), who estimate the elasticity of investment to the user cost of capital on panel data, and approximate capital costs with industry-level asset prices.

[3] As pointed out in the influential survey by Berger and Udell (1998): *"The pricing of angel finance and venture capital at the origination stage are based in great part on forecasts of valuation at the time of exit. One of the principal valuation techniques involves taking current public market price/earnings multiples and applying them to forecasted earnings at exit"*, p. 651. Furthermore, survey evidence suggests that firms commonly discount future cash flows associated with investment with firm-level weighted average costs of capital (Graham and Harvey, 2001; Kruger et al., 2015).

mean value). We then include each component of the WACC separately in the regression, thereby allowing for potentially different effects for the costs of debt and equity. We find that both components are associated with lower investment rates: a one standard deviation increase in the tax-adjusted implicit cost of debt decreases investment by 0.9 percentage points, whereas a similar increase in the CoE is associated with a 0.6 percentage point reduction on investment.

We test for the robustness of our main findings along two main dimensions. One is the method to estimate the CoE for the public firms that constitute the reference group. We show that our results do not depend on minor parametric adjustments of the H-model used to compute our baseline measure of the CoE within each industry. We also resort to the approach developed by Easton (2004), which is based on projected earnings and earnings growth (i.e., the PEG ratio). Another dimension concerns the method to assign the CoE for public firms to the private firms in the sample. We use propensity score and matching techniques to calculate a private firm' CoE based on the CoE of public firms which are similar in terms of observable characteristics, using economic and financial determinants of both the choice of going public and the CoE as proposed in the literature (e.g. Altman, 2013; Hasan et al., 2015; Saunders and Steffen, 2011).[4] We use nearest neighbour matching techniques which provide us, for each private group in a given year, the 25 public firms closest in terms of the propensity score, as in Saunders and Steffen (2011). We then compute the CoE as the average of the closest neighbours of each private firm and each year. These alternative measures provide results that are qualitatively and quantitatively similar to those of the baseline case.

The overall effect masks heterogeneity across sectors and firms, particularly in terms of size and financial constraints. The estimations show that the impact of the WACC is more precisely estimated for large and medium-sized firms than for SMEs, and that it is strongest for manufacturing industries. In the former, a one standard deviation increase in the WACC is associated with a decline in the investment rate of close to 1 percentage point. We test for a potential role of financial constraints by running separate regressions on subsamples of firms more likely to face such constraints. We find stronger and more significant effects for highly-leveraged firms, with an associated coefficient that is about three times larger than that of less leveraged ones. The same conclusion is obtained when we split the sample across firms in sectors with high- and low- dependence on external finance, according to the industry-level Rajan-Zingales (RZ) index of financial dependence.

[4]We are grateful to two anonymous referees for suggesting this extension.

We use our estimates to provide a simple back-of-the-envelope estimation of the contribution of the WACC to the evolution of macroeconomic investment in France since the Great Financial Crisis of 2008, following concerns by policy-makers, which have blamed "excessive" levels of corporates' CoE for the persistent sluggishness of productive investment in Europe economies (Villeroy et al. (2015) for France and McKinsey (2016) for the United States and Western Europe). Our estimates imply that the aggregate investment rate of French private firms would have been higher by a cumulative 1.6 percentage points over 2009-2015 if the WACC faced by these firms had remained at its pre-crisis level.

Our paper contributes to different streams of work in the corporate finance literature. One strand, which is mostly related to our approach, studies the role of the WACC in affecting corporate investment using firm-level data. Perhaps surprisingly, evidence on the specific role of the WACC is scarce. An important paper by Frank and Shen (2016) uses COMPUSTAT data for a long-time horizon and shows that the WACC has a strong negative impact on investment rates of listed US firms, although they highlight that the results depends on the way in which the WACC is measured. Melolinna et al. (2018) estimate WACC and hurdle premia for a sample of listed UK firms. In addition to confirming and extending these analyses to private firms, we show that the relationship between investment and the WACC varies according to the degree of financial constraints. A related contribution of our work is to construct a new and publicly available dataset of industry-level, time-varying measures of CoE for 49 industries in France over 2004-2015, and to provide a method for using these data to approximate the CoE for private firms that can be easily replicated using increasingly available data on private and public firms. The sector-level CoE and WACC dataset is readily available for researchers upon request and will be updated regularly.

More generally, the results in our paper speak to a wider body of empirical work that tackles the question by looking at debt financing, and finds a negative impact of the cost of debt on investment rates. Such literature can be divided into two main approaches. One approach, closer to ours, studies the role of market finance. Prominent contributions along these lines include Gilchrist and Zakrajsek (2007), who construct a firm-level measure of the user cost of capital using long-term corporate debt yields combined with accounting data and Philippon (2009) who develops a bond-based q-theory. Another approach relies on matched bank-firm data and seeks to identify how idiosyncratic shocks to banks affect investment via changes in credit supply. Influential methodological papers in this line are Gan (2007) and Amiti and Weinstein (2018).

Representative contributions of this wide literature include Berrospide and Meisenzahl (2015) and Ivashina and Scharfstein (2010).[5] We complement these results by showing that corporate investment of private firms is affected not only credit market conditions but also by the cost of equity.

Finally, by highlighting the unexplored role of the cost of equity, our study adds to the literature on the impact of financial pressures on private firms in Europe, that has focused on the role of debt to finance investment (e.g. Vermeulen, 2002; Gebauer et al., 2018; Kalemli-Ozcan et al., 2019), firm growth (e.g. Coluzzi et al., 2015) and cash management (e.g. Pal and Ferrando, 2010).

The rest of the paper is organised as follows. Section II motivates the empirical model. Section III presents our data and explains the construction of our firm and industry-level variables. Section IV details our results. Section V examines the policy implications and conducts a simple counterfactual analysis. The last Section concludes.

II. Empirical model

We estimate an investment equation derived from a standard Tobin's q model of optimal capital-budgeting at the firm level, closely following the version by Frank and Shen (2016) of the Abel and Blanchard (1986) model, and using the notation of Frank and Shen (2016) to facilitate comparison.

Consider a representative profit-maximizing firm assumed to live infinitely. Every period t the firm makes decisions about optimal expenditures on investment, given by net asset purchases and denoted by I_t. The optimal I_t maximizes the expected net present value of the firm, given by the discounted stream of revenues π net of capital adjustment costs, labeled c, which are assumed to take a quadratic form:

$$c(I_t, K_t) = I_t + \frac{\Phi}{2}\left(\frac{I_t}{K_t}\right)^2 K_t$$

Importantly, future cash-flows are discounted with the weighted average cost of capital, r_t. Each period, decisions are taken conditionally on Γ_t, the set of information available at time t, and after observing the current realization of a random profitability shock a_t. The stock of fixed assets depends on investment and depreciation according

[5] At an even more general level, our paper inscribes itself on a large literature studying how financing conditions of firms affect firm-level investment, with notable contributions Fazzari et al. (1988) and Kaplan and Zingales (1997)

to the following standard capital accumulation equation:

$$K_{t+1} = K_t(1-\delta) + I_t$$

The optimal value for I_t is derived from the first order condition of the firm's maximization program, obtained by deriving the firm's NPV with respect to K_t:

$$\frac{I_t}{K_t} = \frac{1}{\Phi}(\underbrace{\mathbb{E}\left\{\sum_{j=1}^{\infty}(1-\delta)^{j-1}\frac{\pi_K(a_{t+j},K_{t+j}) - c_K(I_{t+j},K_{t+j})}{\Pi_{s=1}^{j}(1+r_{t+s})}\Big|\Gamma_t\right\}}_{=q_t} - 1) \tag{1}$$

where q_t is marginal Tobin's q: the expected marginal discounted profit associated with an additional unit of capital. At the optimum, marginal benefits and costs are equalized.

We derive an empirical version of equation (1) by expressing Tobin's q as a linear function of expected profits and the cost of capital (obtained by applying a Taylor expansion on q_t).[6] Our main estimating equation, which is the empirical counterpart of equation (1), is given by:

$$\frac{I_{i,t}}{K_{i,t-1}} = \beta_0 + \beta_1\, WACC_{i,t-1} + \beta_2\, \frac{\text{Cash flow}_{i,t-1}}{K_{i,t-1}} + \beta_3\mathbf{Z}_{s,t_1} + \delta_i + \gamma_t + \epsilon_{it} \tag{2}$$

where we have replaced the discount rate r_t with an empirical measure of the weighted average cost of capital, $WACC$. $\frac{\text{Cash flow}_{i,t-1}}{K_{i,t-1}}$ is the empirical measure of average profits normalized by total assets, which proxy for the future marginal profit rate (see footnote 6), and $\mathbf{Z}_{s,t_1}$ a vector of controls at the firm- and sector-levels (specified below).

At any time t, the $WACC_{i,t}$ for firm i is defined as:

$$WACC_{i,t} = L_{i,t}t(1-\tau)CoD_{i,t} + (1-L_t)CoE_{i,t} \tag{3}$$

$CoE_{i,t}$ and $CoD_{i,t}$ are respectively the cost of equity and the cost of debt, and τ is the corporate tax rate. These variables are weighted by leverage L_t, defined as the ratio of gross debt to the sum of gross debt and equity capital: $L_{i,t} = \frac{\text{Gross Debt}_{i,t}}{\text{Gross Debt}_{i,t}+\text{Equity}_{i,t}}$.

[6]As explained by Frank and Shen (2016), this requires two assumptions: i) the dynamics of the one-period discount factor and the one-period marginal product of capital can be described as AR(1) processes and ii) the marginal future profit rate can be approximated by the observable average profit rate. This is in line with studies on public firms. See Hayashi (1982) for the conditions allowing this equivalence from a theory perspective and Gutierrez and Philippon (2016) for an empirical application.

The main coefficient of interest is β_1. The model predicts a negative sign: a higher cost of capital reduces the net present value of the firm, lowering the marginal value of investing one additional unit and therefore negatively affecting capital expenditures. The coefficient associated with average profits, β_2, is expected to have a significant and positive sign, as average profits are a proxy for the future marginal profits.[7] To control for potentially confounding factors, we will run specifications with firm-level controls derived from the literature and summarized in the vector of co-variates $Z_{i,t-1}$. It includes leverage, sales growth, firm size (log of total assets), the depreciation rate of capital and a (contemporaneous) dummy for mergers and acquisitions. The M&A dummy is equal to 1 when a firm in our sample undertakes an M&A transaction, by acquiring other firms. We include this variable to control for the extra investment and the change in total assets that result from the M&A transaction. Control variables are lagged one period to mitigate potential endogeneity concerns.

III. Data

A. Data sources and sample selection

The empirical analysis relies on two main data sources: 1) *Balance Sheet data for Corporate Groups in France*, which provide us with empirical measures of firm-level investment, the cost of debt, leverage, and the control variables, and 2) *Stock Market Information for Publicly-listed firms in France*, from which we calculate the cost of equity, both at the individual firm level and at the sector level. We now present both datasets in detail.

1) Balance Sheet data for Corporate Groups in France: We obtain consolidated balance sheet and income statement data for non-financial privately held French corporate groups from the *FIBEN Groupes* database, which also provides information about the industrial sector to which the firm belongs. Firms are classified into the 4-digit industries of the revision 2 of the statistical classification of economic activities in the European Community, NACE. Revision 2 has been active since 2008, and contains 35 2-digit codes labeled "Divisions". The data are collected at a yearly frequency by regional offices of the Banque de France with the purpose of gathering information about firms' credit worthiness. The Banque de France uses the FIBEN data to calculate credit ratings for corporate groups. These ratings are then used to measure

[7]It should be noted, though, that models featuring financial constraints also predict a positive relationship between cash flows and investment, albeit for different reasons - see, for example, the seminal paper by Fazzari et al. (1988).

potential risks contained in banks' loan portfolios. Previous papers using data from FIBEN in a corporate finance context include Aghion et al. (2019), Cahn et al. (2020), and Mesonnier et al. (forthcoming).

Having access to consolidated accounts is a clear advantage of our study. Consolidated financial ratios are relevant in the likely scenario where investment and financing decisions of subsidiaries are planned or supervised by the group's parent firm. Reporting consolidated accounts is mandatory for privately held corporate groups that exceed thresholds in terms of the value of total assets, turnover, and number of employees. Consolidated reporting is mandatory if the group has exceeded at least two of these three thresholds. However, small corporate groups (i.e. those with metrics below the thresholds) that seek to obtain a rating from the Banque de France publish consolidated accounts on a voluntary basis. For this reason, our sample also includes SMEs. It should be noted that the value of the minimum thresholds for consolidated reporting changed in 2016. Before 2016, consolidated reporting was required for groups with total assets higher than EUR 15 million, net income higher than EUR 30 million and employing more than 250 workers. In 2016, the first two thresholds were increased to EUR 48 million, thereby reducing the number of corporate groups present in the dataset.

In its raw format, the *FIBEN Groupes* database covers the period 1988-2019 and contains 98,204 group-year observations belonging to 13,387 distinct corporate groups. It is strongly unbalanced as the scope of the database increased progressively with time due to increased efforts to enlarge coverage by the Banque de France. To work with a dataset featuring a stable number of observations, we start our analysis in 2005, the year when coverage began to be wide and stable, and we chose 2015 as the final year of the sample in order to avoid changes in sample size due to the aforementioned change in reporting thresholds.

We implement a few cleaning steps. We consider only the ultimate level of consolidation when several layers and definitions of the group coexist in the data. We delete corporate groups which belong to the farming, public administration, financial, real estate and public health-care sectors. We keep observations with non-missing data for total assets, fixed assets, book equity, investment in fixed assets, financial debt, and EBITDA. We delete group-year observations with zero or negative values of book equity, debt, and total assets. We delete group-year observations in which the ratios of gross debt over total assets, depreciation over total assets, and interests paid on debt over financial debt (the sum of bank-debt and bonds) lie outside the close interval

[0;1]. We keep only groups with always strictly positive gross investment rates and delete groups with quasi-zero gross investment rates. For this purpose, and considering the unbalanced nature of the panel, we first regress gross investment rates on year dummies and define firms with quasi-zero gross investment rates as firms with average residual values below the tenth percentile. Finally, we drop observations with outlier investment rates, profitability or costs of equity and debt (i.e., values outside of the 1-99 percentiles interval).[8] After these cleaning steps, our estimating sample comprises 7,202 group-year observations corresponding to 1,667 corporate groups.

2) Stock Market Information for Publicly-listed firms in France: We obtain, from Datastream, data on balance sheets, income statements, and dividend yields for around 1,100 publicly held corporations traded on the Euronext Paris stock exchange, which contains the firms listed in the main French stock exchange indexes: the CAC 40, which tracks the 40 largest French stocks based on Euronext Paris market capitalization, and SBF 120, which is based on the 120 most actively traded stocks listed in Paris. This source provides us with an average of 700 group-year observations, starting in 2004. Datastream also provides data on the industry classification of each corporation.[9]

We complement these data with sector-specific profit growth forecasts at the 3-5 year horizon from I/B/E/S and long-run (> five years) nominal GDP growth forecasts from the Euro-system Survey of Professional Forecasters,[10] approximating long-run nominal GDP growth with the sum of long-run real GDP growth and French consumer price inflation (measured with the Harmonized Index of Consumer Prices - HICP- compiled and published by the Europaan Statistical Agency Eurostat).

B. Estimating the cost of equity and the WACC of private firms

One obvious difficulty that we face when computing the cost of equity for privately-held firms is the lack of market values for the equity of those firms. Proposing a methodology to overcome this empirical challenge is one of the key contributions of our work. We proceed in two steps. First, we calculate the cost of equity for each

[8]The alternative to such trimming would be winsorizing. The most extreme values in the data are likely to be the result of measurement error, as confirmed by the Banque de France's unit in terms of data collection. Thus we believe that removing such extreme observations is a better strategy.

[9]69 industries using the Global Industry Classification Standard (GICS) developed by MSCI and Standard & Poor's. More information can be found on the MSCI website: https://www.msci.com/gics; last accessed on 16/02/2021. The GICS uses a methodology similar to the FTSE's Group Industry Classification Benchmark (ICB).

[10]For information on I/B/E/S please visit this website: https://www.refinitiv.com/en/financial-data/company-data/institutional-brokers-estimate-system-ibes. For the Survey of Professional Forecasters please visit: https://www.ecb.europa.eu/stats/ecb_surveys/survey_of_professional_forecasters both sites accessed on 15/03/2021.

public firm for which we observe all the relevant information in the above-described sample. Second, we use these estimations to proxy for the cost of equity of each private firm in the FIBEN sample. We use different methods to match private groups to public groups for each year in the sample.
Our baseline procedure uses industry affiliation as the main matching characteristic. More precisely, we assume that the cost of equity for a private firm in a given 2-digit industry and year is close to the average cost of equity for publicly listed firms in the same industry and year. As discussed above, privately held corporate groups tend to be large and therefore more likely to compare with listed peers in the same industry than individual private firms. As an alternative, we develop a more sophisticated matching procedure by estimating propensity scores and using matching techniques to calculate each private firm's CoE based on the CoE of public firms which are similar in terms of observable characteristics. As we will show in robustness tests, this procedure leads to very similar results in terms of the impact of the WACC on investment.

The industry-specific cost of equity is estimated using an H-model version of the standard dividend discount (DDM) model (Fuller and Hsia, 1984). In the calculation, expected cash flows accruing to shareholders include dividends from French publicly listed companies of the given industry. Estimating the cost of equity with this approach requires short- and long-run forecasts of the future dividend growth of firms in each sector. We assume constant dividend payout rates and proxy these forecasts with sector-specific forecasts of profit growth at 3-5 years $\left(g^{ST}\right)$ and long-run nominal GDP growth forecasts $\left(g^{LT}\right)$. We then assume that the growth rate of expected future dividends converges from its short-run towards its long-run value over a period of H=16 years. Note that the cost of equity is inherently a forward-looking measure. Since our market data are measured at the end of each year, we define the contemporary cost of equity (i.e., at year t) as the cost of equity that could be computed at the beginning of the same period (i.e., using information at the end of year $t-1$). For each industry, we then compute the average cost of equity as:

$$CoE_{s,t} = \frac{Div}{MV}_{s,t-1}\left[\left(1+g^{LT}_{s,t-1}\right)+\frac{H}{2}\left(g^{ST}_{s,t-1}-g^{LT}_{s,t-1}\right)\right]+g^{LT}_{s,t-1} \tag{4}$$

where $(\frac{Div}{MV})_{s,t-1}$ is the weighted average dividend yield of sector s at the beginning of period t (time $t-1$). For robustness we construct alternative versions of the sector-specific CoE using different values for the parameter H of the ibid.'s model for robustness checks. We also use an alternative method for computing the CoE, namely the PEG ratio method proposed by Easton (2004).

With this estimation of the CoE in hand, we construct a measure of the WACC for each corporate group in the estimating sample. In practice, we plug the sector-specific measure of the CoE into the WACC formula (3), together with firm-level measures of book leverage and the cost of debt. We use a standard measure of the firm-level leverage ratio, namely the financial debt to capital ratio (capital equals the sum of financial debt and book equity). The (implied) cost of debt is defined as interest payments normalized by gross financial debt. Thus, $WACC_t$ is defined at the level of the corporate group/year. Regarding the tax rate that applies to each firm, we consider the average apparent tax rate on corporations of the same size bin in the same industry. Note that we use a real version of the cost variables (real WACC) when estimating equation (2), obtained by deflating nominal variables with French annual consumer price inflation as a proxy for expected inflation.

C. Descriptive statistics

Figure 1 checks the external validity of our sample in terms of investment rates. For this purpose, we first calculate the aggregated gross investment rate over the period 2005-2015 for the firms in our sample as the sum of individual investment rates weighted by each group's share in total assets of the sample. We then plot this measure together with the macroeconomic investment rate for French non-financial corporations obtained from the National Statistical Institute, INSEE. The aggregate investment rate is analogous to the micro one, and defined as the change in fixed assets between years t and t-1 divided by the stock in year t, therefore analogous to the investment rate calculated for each individual group. Our measure of corporate groups' investment rate displays slightly larger values across time, from around 8% in 2005 to more than 13% in 2008, but follows a similar path to its macroeconomic counterpart.

Table 1 presents the distribution of firm size in the final sample of privately-held firms. The classification follows the definition set by the French Economic Modernization Act of 2008 (in French, *Loi de Modernisation Economique*, henceforth LME Act) with respect to total assets and turnover thresholds. We construct the table by using the thresholds in terms of sales and assets values that are defined by law. According to the 2008 LME Act, SMEs are defined as firms with less than 250 employee and annual sales below 50 EUR million, or total assets whose value does not exceed 43 EUR million. All the firms above these thresholds are categorized as mid-size *Entreprises de taille intermédiaire* or large corporations *Grandes entreprises* depending on whether

total employment is below or above 5,000. A total of 42 (2%) groups are classified as being “Large" (*Grandes entreprises*), 1046 (56%) are classified as “Mid-size" (*Entreprises de taille intermédiaire*) and 746 (42%) are classified as “SMEs".
Table 2 provides descriptive statistics of the variables used in the empirical analysis. The average investment rate is 12.4%, which is close to the national accounts investment rate (of around 12%). The estimating sample features strong variation in investment across firms. Firms in the first decile of the distribution invested less than 2.5% of their fixed assets on average per year, while firms in the last decile reported investment exceeding 26% of their fixed assets on average. Leverage is 42% on average, in line with estimates of the macroeconomic leverage of non-financial firms in France, which are around 50%.[11]

On average, the calculated nominal CoE stands at 7.8%, while the (pre-tax) apparent cost of corporate debt is around 4.3%. Our estimate of the average income tax rate, at 30%, is close to the official corporate income tax rate in France over the period (33.3% for the most general case, 15% for small firms). Overall, the average WACC stands at 5.4%, slightly above the median WACC (5.1%). Figures 2 and 3 show boxplots across industries of the average nominal COE, cost of debt, and WACC within each industry. The cost of equity is more heterogeneous than costs of debt across industries. The year-on-year average increase in the WACC is 0.03 pp during the sample period (with a maximum of +2.5 pp and a minimum of -2.1 pp). The cost of equity displays larger variation over time than the cost of debt. The reason is that, naturally, the change in the CoE is tightly linked to movements in stock markets, which can be seen in the large fluctuations that the variable displays during times of stock market stress, notably in the years after the Great Financial Crisis and the euro area debt crisis of 2011/2012. The cumulative change in the WACC during 2005-2015 is +0.3 percentage points.

IV. Results

This section presents the results. We first consider the baseline specification of the empirical equation (2), experimenting with alternative combinations of firm, time and industry fixed-effects. We then investigate how the main components of the WACC, that is, the cost of equity and the cost of debt, are separately associated with investment rates at the corporate-group level.

[11]Data on aggregated leverage come from INSEE. Macroeconomic leverage is defined as the ratio of total financial debt to total assets.

We test for robustness along different dimensions. We consider other methods for estimating the CoE for public firms, alternative procedures for matching public and private firms, and for calculating standard errors. Once the main results of the paper are established, we go on to consider potential heterogeneous effects of the WACC on investment according to sector of activity (distinguishing manufacturing and retail), firm size, firm leverage, and the industry of affiliation's dependance on external finance. We conclude this section with a computation of the aggregate implications of the estimations and a discussion of the policy implications of our findings.

A. Baseline specification

The results of estimating equation (2) are presented in columns (1) to (3) of Table 3. Column (2) includes, other than the lagged WACC, corporate group-level controls and year- and industry-fixed effects. All variables are lagged one period to mitigate potential endogeneity concerns, as noted above, and indicated by the (-1) prefix in the table.

The econometric results show that the WACC is negatively and significantly associated with investment. Column (3) is our preferred specification because it adds corporate group-level fixed effects that control for time-invariant group characteristics that might affect investment (for example, geographical situation), thus providing identification from observed changes in the WACC and investment rate over time and within corporate groups, and also time effects that control for macroeconomic fluctuations which can affect investment decisions. As the comparison with column (3) shows, including corporate group fixed effects increases the magnitude of the coefficient associated with the WACC. In economic terms, $\beta_1 = -0.361$ implies that an increase in the real WACC by one standard deviation (2 percentage points) is associated with a decrease in the investment rate of 0.7 percentage points, which is equivalent to about 6% of the sample average investment rate. The magnitude is close to the effect found by Frank and Shen (2016) for public US firms, in the specifications where they estimate the cost of equity using methods akin to ours (between -0.22 and -0.57, see Table 9 in their paper).

The remaining co-variates have the expected signs. Investment positively co-moves with expected profitability, which we proxy using cash flows. The magnitude of the associated coefficient, β_2, is remarkably stable across all specifications, ≈ 0.58. As discussed in Section II, the positive sign for β_2 is predicted by the model in Abel and Blanchard (1986). In economic terms, the coefficient implies that a one standard deviation increase in expected profits (+35.3 percentage points) is associated with an increase in the investment rate of around 2 percentage points.

Sales growth is positively correlated with investment: a one standard deviation increase in sales growth (+13 pp) is associated here with an increase of only 0.3 pp in investment. Leverage is strongly negatively associated with investment: a one standard deviation (21 pp) increase in leverage decreases the investment rate by around 4 percentage points. Highly-leveraged firms are more likely to hit a bound where the level of debt is high enough to increase the likelihood of default, resulting in a reduced capacity to access debt finance ("debt overhang"). The negative impact of leverage on investment is a well-established theoretical result in the literature, starting with Myers (1977), that has received support from a large number of subsequent empirical contributions (e.g., Lang et al., 1996; Fazzari et al., 1988; Aivazian et al., 2005). This result points to an active role for financial frictions in deterring investment, a point that we will further investigate below. Firm size, measured by total assets, is negatively associated with investment, in line with the results in Gala and Brandon (2016) who rely on COMPUSTAT data and find that, controlling for Tobin's q as we do, smaller firms invest significantly more than larger ones. These results suggest that small size might correlate with better investment opportunities, instead of poorer financial conditions (which then would imply a positive relationship between size and investment).

Table A2 in the Appendix provides the results obtained when estimating the baseline specification of column (3) but correcting the standard errors using the Erickson-Whited method for generating measurement error-consistent disturbances in investment equations. The correction reduces the significance of the WACC variable to the 5% level.

In columns (4) to (6) of Table 3 we separately include both components of the WACC, namely the (tax-adjusted) cost of debt and the cost of equity. The results show that both variables are negatively associated with investment, with the cost of debt estimated more precisely. A one standard deviation increase in the tax-adjusted real interest rate (2.9 percentage points) is found to decrease investment by 0.9 percentage points. The cost of equity also negatively affects investment, with a slightly smaller effect: investment falls by around -0.6 percentage points with a one-standard deviation increase in the CoE. Column (6) introduces both variables, obtaining coefficients which are almost equal to those in columns (4) and (5).

B. Robustness: alternative CoE measures and matching procedure

We now perform two types of robustness tests, based on the construction of alternative CoE measures and a matching procedure founded on observable characteristics of private and public corporate groups in the sample.

Alternative measures of the cost of equity

First, we test whether our results are robust to the use of alternative methodologies to estimate the cost of equity for public firms. We construct alternative versions of the dividend discount model (H-Model) using different values for the coefficient that drives the expected speed of convergence of short-run expected profit growth towards its long-run value, the "*H* parameter". Results are provided in Table 4. Column (1) shows the results obtained with the baseline measure for comparison, where the CoE is constructed with H = 16. Columns (2) and (3) show the results obtained by imposing H = 8 and H = 10 respectively. The results are similar to the baseline.

Matching public and private firms based on propensity-scores

Second, we implement an alternative method to infer private firms' CoE from the one computed for public firms. Instead of proxying the CoE for private corporate groups with the average of the observed CoE for public firms in the same sector, we construct a proxy for the cost of equity for each private firm that is based on the observed cost of equity of only a subset of public firms that are closest in terms of economic and financial variables. For this purpose, we use propensity scores and matching techniques to match each private firm in our sample to a group of public firms which are comparable in terms of observable characteristics. This procedure is standard in the literature studying the impact of being public on firm performance, where propensity score matching is used together with a difference-in-difference approach to control for the potential selection bias associated with the fact that the decision to go public is endogenous (e.g. Saunders and Steffen, 2011). Our purpose is related but slightly different, as we use propensity scores to identify public firms which are close to private firms in terms of observable determinants of the CoE.[12]

Specifically, we follow a three-step procedure. In a first step, we pool private and public firms and estimate a Probit model where the endogenous variable is a dummy that equals one for private firms. We run a separate estimation for every year in order to avoid matching across years. We use the following explanatory variables: net working

[12]We are grateful to two anonymous referees for this suggestion.

capital, retained earnings, log cash, profitability, leverage, and sales. We normalize all regressors by total assets given the differences in size across public and private firms in the sample (see Table A1). The set of explanatory variables is inspired by the literature looking at the determinants of the cost of equity (e.g. Hasan et al., 2015, Ng and Rezaee, 2015). Note however that the bulk of the literature uses variables only available for public firms, such as stock liquidity, book-to-market value, forecasted earnings and forecast dispersion, see e.g. Gebhardt et al (2001). Table A4 in the Appendix shows the result of this Probit model estimation for three years of our sample (Results for the remaining years can be made available upon request).

From this estimation we obtain a propensity score for each firm in the sample, that is, the probability that a firm in the sample is private, conditional on the co-variates. In a second step, we use the obtained propensity scores in a matching procedure to identify, for each private firm in a given year, the closest public firms. We use the nearest neighbor matching method with replacement, and keep observations lying in the common support of the propensity scores. In a third step, we use the cost of equity of firms identified as closest neighbours to proxy for the cost of equity of each private firm in each year. We produce two alternative versions, using averages that are calculated using two populations of firms: (i) the 25 closest neighbors for each year and (ii) the 50 closest neighbours in a given year which are in the same 2-digit sector as the private firm in question.
Finally, we estimate the cost of equity using the method proposed in Easton (2004), which is based on the PEG ratio (details are presented in Section B of the Appendix). We assign this alternative measure to each private corporate group using the matching procedure described above.

Detailed results are presented in columns (4) to (7) of Table 4. "N=25" indicates that the cost of equity is measured as the average of the 25 closest neighbors of each private firm and each year, while "w/n Sector" is the average across all closest neighbors within the firm's sector. Results are qualitatively and quantitatively similar to the baseline case. Finally, in columns (6) and (7), we use the cost of equity estimated following the PEG ratio method proposed by Easton (ibid.) (instead of our baseline DDM H-Model) and we apply the two matching procedures. The coefficient of interest is no longer significant, but still negative.

C. Additional results: heterogeneity across broad sectors and firm sizes

We now study whether the relationship between investment and the WACC is heterogeneous across sectors and within sectors, according to firm size and financial constraints.

We first look at two broadly defined sectors, manufacturing and retail, which account for 662 and 639 groups out of a total of 1,672.[13] The results are presented in Table 5, where the first column replicates column (3) of Table 3 for comparison purposes. As can be seen by comparing columns (2) and (3), we find a larger coefficient of the WACC for retail firms than in the baseline, as a one standard deviation (2 percentage points) increase in the WACC yields a decrease in the investment rate by almost 1 percentage point for these firms. Interestingly, the coefficient associated with cash flow provides the inverse picture, affecting manufacturing firms strongly.

The next two columns, (4) and (5), look at potential heterogeneous effects depending on firm size. We split the sample into two non-overlapping groups of firms. "Small" firms are those classified as SMEs according to the legal definition provided in Section C, and "Large" firms, are the remaining ones.[14] The results of running separate regressions on both subsamples show stronger and more precisely estimated effects for large firms. Interestingly, the coefficient associated with leverage is much stronger for SMEs, indicating potential mechanisms related to financial constraints, that we study next.

Finally, we test whether the impact of the WACC on capital expenditure depends on the degree of financial constraints faced by the firm. Contradicting the irrelevance theorem of Modigliani and Miller (1958), and starting with the seminal contribution of Myers (1977), a number of past contributions have documented a role for financial frictions in affecting investment (Denis and Denis, 1993; Lang et al., 1996; Peyer and Shivdasani, 2001; Aivazian et al., 2005; Ahn et al., 2006). One of the main mechanisms put forward is that highly-leveraged firms are less able to profit from growth opportunities because of difficulties in accessing the required funds. Such mechanism of "debt overhang" might be driving the higher coefficient associated with leverage for the sample of small firms that is reported in the last column of Table 5.

[13]Sectors are defined following the one-digit NACE rev2 introduced above, where Manufacturing is included in Section C, and Retail is included in Section G. Remaining firms represent less than 15% of the observations and belong to services sectors.

[14]Notice that these definitions are time-specific, firms can in principle move from one category to the other, although, in our data, such changes of status are rare. Over our estimating period, we observe only 167 firms moving from a category from another.

We now ask whether the elasticity of investment with respect to the WACC is different for highly-leveraged firms. In particular, a larger elasticity would be consistent with the debt overhang argument. We consider two simple measures of financial constraints. We construct a dummy for high leverage by sorting each year all firms according to their leverage the year before. We define firms with lagged leverage above the median as highly-leveraged. We also use an updated version of the Rajan-Zingales (RZ) index of financial dependence at the industry level. Rajan and Zingales (1998) define financial dependence at the firm-level as the share of capital expenditures which is not funded by the firm's cash flows (hence funded externally). The industry-level equivalent is computed as the median index across firms in each industry. The original index was computed using Compustat data on US publicly-held corporations over the 1980s. In order to account for structural changes that occurring within non-financial industries and in the financial sector since then, we use the version computed by Guevara and Maudos (2011) for UK publicly-listed firms over 1993-2003. We then sort industries according to their degree of dependence on external finance and define as *ex ante* more financially dependent firms that belong to industries in the upper half of this distribution.

Table 6 shows the results. We find that the negative effect of a higher WACC on investment is much stronger and more significant for highly-leveraged firms: a 2 percentage point increase in the WACC now leads to a reduction in capital expenditures of 1.7 percentage points for such firms, i.e. about three times more than for less leveraged ones. Similarly, the specifications run in columns (4) and (5), which split the sample across firms in sectors with high- and low- dependence on external finance, point to a stronger effect of the WACC on investment for firms that are more dependent on external finance. A 2 percentage point increase in the WACC is associated with a 1.4 percentage point reduction in the investment rate of that sub-sample. Overall, our findings support the intuition that changes in the cost of capital are more likely to affect investment when the firm is financially constrained, in line with previous studies documenting that financial frictions lead to less growth in European firms (e.g. Coluzzi et al. (2015)). It is interesting to notice that the coefficient associated with cash flow is larger for the set of firms less likely to face credit constraints, which is consistent with the idea that leverage prevents firms from profiting from growth opportunities. As already mentioned, a large literature suggests a different interpretation of the cash flow coefficient than the one favored by our result - starting with the influential paper by Fazzari et al. (1988). The argument is that the cash-flow sensitivity of investment is an indication of credit constraints. The results we find are more in line with the interpretation that cash flow represents future opportunities.

Recent papers have argued that weaker competition and increased uncertainty have reduced investment in US firms (Gutierrez and Philippon (2016) and Gulen and Ion (2016)). In Section D of the Appendix we follow those papers and study the role of the competitive environment and earnings uncertainty in affecting investment rates of our sample of firms. Unlike the available evidence for the US, both variables turn out to be non-significant (see Table A5 in Appendix).

D. A simple conterfactual analysis of the impact of the WACC on aggregate investment

Aggregate investment expenditure collapsed in Europe in the aftermath of the global financial crisis. Many factors have been put forward, such as low demand, high uncertainty, and overall financing conditions. Some influential observers, including central bank governors, have also pointed to increases in the costs of raising equity (e.g. Villeroy et al., 2015). To get a grasp of the benefits that the development of private equity financing might have for aggregate investment, we use our estimates to provide a simple counterfactual quantification of the aggregate investment rate in France should the cost of equity had stayed constant since 2008.

We calculate a "counterfactual" level of investment for each firm. It is defined as the investment rate that would have prevailed if the WACC had remained at its 2008 level. For each year t, the counterfactual level is defined as:

$$\left(\frac{I_{i,t}}{K_{i,t-1}}\right)^{C} = \frac{I_{i,t}}{K_{i,t-1}} - 0.361 \times (WACC_{i,t-1} - WACC_{i,2008}) \tag{5}$$

where 0.361 is the coefficient estimated in column (3) of Table 3. It provides the impact of a one-standard deviation increase in the WACC on the investment rate of private firms. Next, using equation (5) we derive the WACC-induced investment gap as the difference between actual and counterfactual investment at t:

$$IG_t : \left[\left(\frac{I_{i,t}}{K_{i,t-1}}\right) - \left(\frac{I_{i,t}}{K_{i,t-1}}\right)^{C}\right] \tag{6}$$

Finally, we compute aggregate investment as size-weighted averages of firm level investment. This simple exercise ignores general equilibrium effects and should be interpreted with caution. It is useful to provide an economic sense of the magnitude of our estimates once translated into a metric that better compares to macro variables.

Figure 4 shows the yearly change in the resulting aggregate investment gap (left-side scale), plotted against the aggregate WACC (right-side scale). Between 2008 and 2010, the WACC increased from about 3% to above 4%, generating a cumulative negative investment gap of around 1 percentage point. In the following two years, 2011 and 2012, the WACC decreased, contributing positively to investment and reducing the cumulative investment gap. Finally, over 2013-2015, the relatively high levels of the WACC weighed on corporate investment, generating an additional cumulative negative aggregate investment gap of slightly more than 1 percentage point. Overall, we evaluate that the aggregate investment rate of French private firms would have been higher by a cumulative 1.6 pp over 2009-2015 if the WACC for firms had remained at its pre-crisis level.

V. What do the results suggests for the design of macro-policies?

Our results lend support to policies aimed at lowering the cost of capital for private firms as a tool to raise investment. The standard policy tool used to incentivize business investment is monetary policy. By lowering interest rates and increasing liquidity, the central bank alters inter-temporal capital allocation decisions (the "interest rate channel") and provides incentives for banks to increase their credit supply (the "bank lending channel"), thus boosting aggregate demand via increases in investment. Nevertheless, our evidence suggests that monetary policy's strong focus on debt might be insufficient.[15]

Simple metrics are appallingly telling of the underdevelopment of European public and private equity markets in comparison with the United States. In 2019, capitalization of public equity markets average 156% of GDP in the US, against 70% of GDP in the EU27 (Lannoo and Thomadakis, 2020). Moreover, although integration has been on the rise is the past decade, european capital markets remain highly fragmented across countries (Allen and Pastor, 2018). At the same time, US venture capital investments, measured as a share of GDP, were larger than those in Europe by a factor of six: 0.05% versus 0.3% in 2018 (European Investment Bank, 2020). Overall, currently european capital markets fail to channel enough savings towards equity financing. Capital market participation in Europe concerns 20% of euro area households hold stocks, compared with 50% in the US (Bhatia et al., 2016). American startups receive on average 8.3 times more capital than European ones (Ekeland et al., 2016).

[15]Evidence on the effect of monetary policy on firm-level investment can be found in Durante et al. (2020).

It is important to highlight that the restricted opportunities for equity financing in France need to be taken into account when interpreting our results: the elasticities we report are conditional on the actual supply of both types of capital. The equity supply shortage (both public and private) with respect to debt conditions the relationships we estimate from the data. The resulting high cost of equity capital has consequences for employment decisions. A lower cost of capital leads, everything else equal, to higher investment and thus employment of labor types that are complementary to capital. As such labor is typically skilled, encouraging capital formation is likely to lead to skill upgrading (Parro, 2013). Notice also that a larger cost of raising capital might crowd out employment in firms with low markups, which are typically small and young firms. Thus, as equity financing is key especially at the early stages of firm development (Berger and Udell, 1998; Hall and Lerner, 2010), higher costs of equity might condition firm post-entry growth (Aghion et al., 2007).

This issue has been long recognized by European policy-makers (e.g., Villeroy et al., 2015). The current initiatives for the creation of a european Capital Market Union aim strongly at overcoming such "structural bias" towards debt financing Market (Allen and Pastor, 2018; European Commission, 2020; Orlowski, 2020). Such actions attempt to reducing the cost of equity. One important direction aims at encouraging the supply of savings into equity markets, both by households and financial institutions such as banks and insurers. Another direction concerns the particularities of unlisted equity financing, through facilitating the flow of information between entrepreneurs and investors and to encouraging the development of private equity funds, as done in the European Long-Term Investment Fund (ELTIF) regulation.[16]

VI. Conclusion

In this paper, we evaluate the effects of the cost of capital on investment for a large sample of non-listed French corporate groups, including a large proportion of SMEs, over the 2005-2015 decade. Our results add to the large body of empirical work using either macro series or micro-data on large, listed firms.

We propose a methodology to overcome the challenge raised by the lack of observable information on the cost of equity for private firms. Using data on the universe of French public firms, we compute a time-varying measure of the average CoE using a standard dividend-discount model. We then compute measures of firm-specific

[16] ELTIFS website: https://ec.europa.eu/info/law/european-long-term-investment-funds-eltifs-regulation-eu-2015-760_en

WACC for the privately-held corporate groups in our sample, by combining this industry-specific estimate of the CoE and firm-level measures of the tax-adjusted cost of debt and leverage. In robustness checks we use propensity scores and matching techniques to estimate a private firm's CoE based on the CoE of public firms which are similar in terms of observable characteristics, obtaining similar results.

We find new evidence that fluctuations in the estimated WACC of privately held firms matter when explaining their capital expenditures. Furthermore, we show that financially more fragile firms or firms that rely more on external finance appear to cut investment more when facing an increase in their cost of capital. Considering the importance of privately held firms in France as in many developed economies, our results shed light on the debate about the reasons for the sluggish rate of corporate investment observed in the aftermath of the 2008 crisis.

The analysis in this paper suggests several avenues for future research. Our results show that the cost of debt carries significant explanatory power to explain investment rates of privately-held firms. An extension of the empirical model that takes advantage of the availability of matched firm-bank data, thereby suitable for establishing causality, constitutes a very interesting direction. Furthermore, a systematic approach to the comparison of financing conditions of private and public firms, especially in terms of access and cost of equity capital is promising and needed research.

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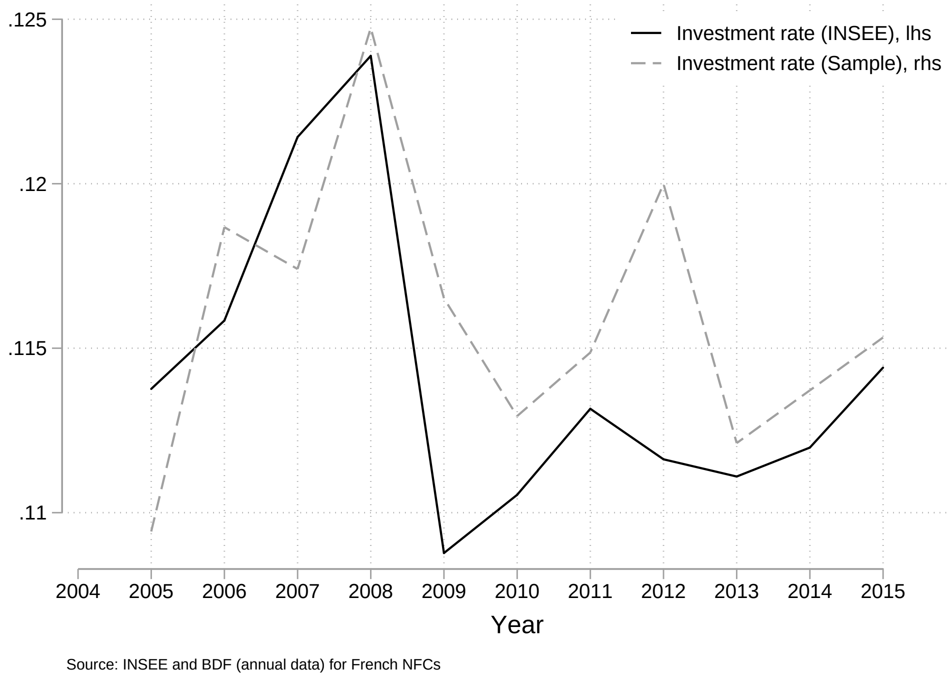
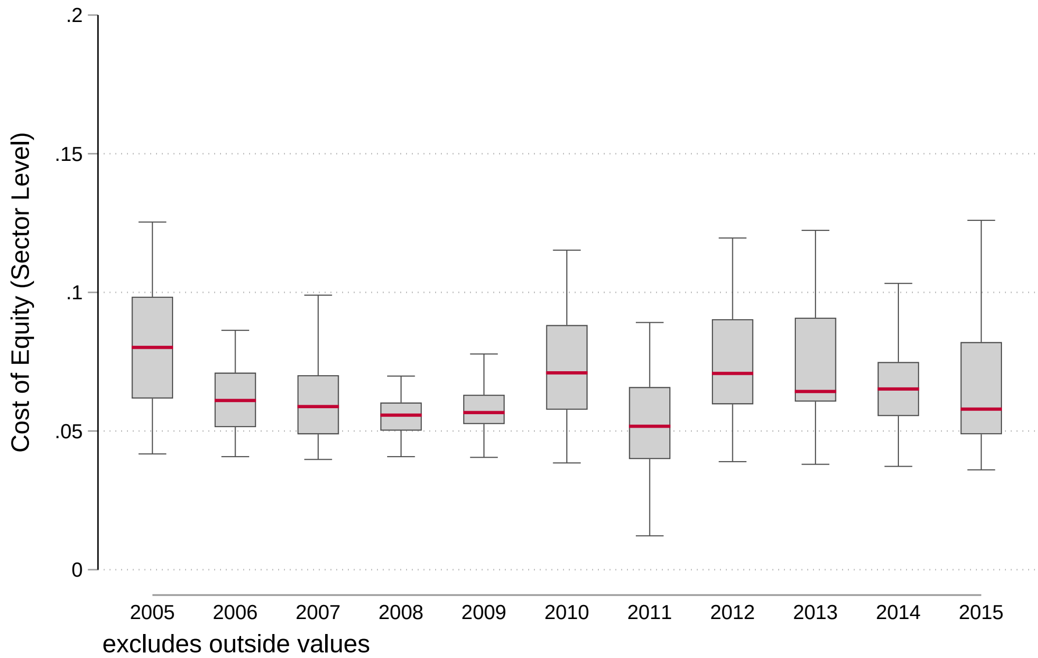
Figure 1: Corporate investment rate of non-financial corporations: macro series vs sample aggregate



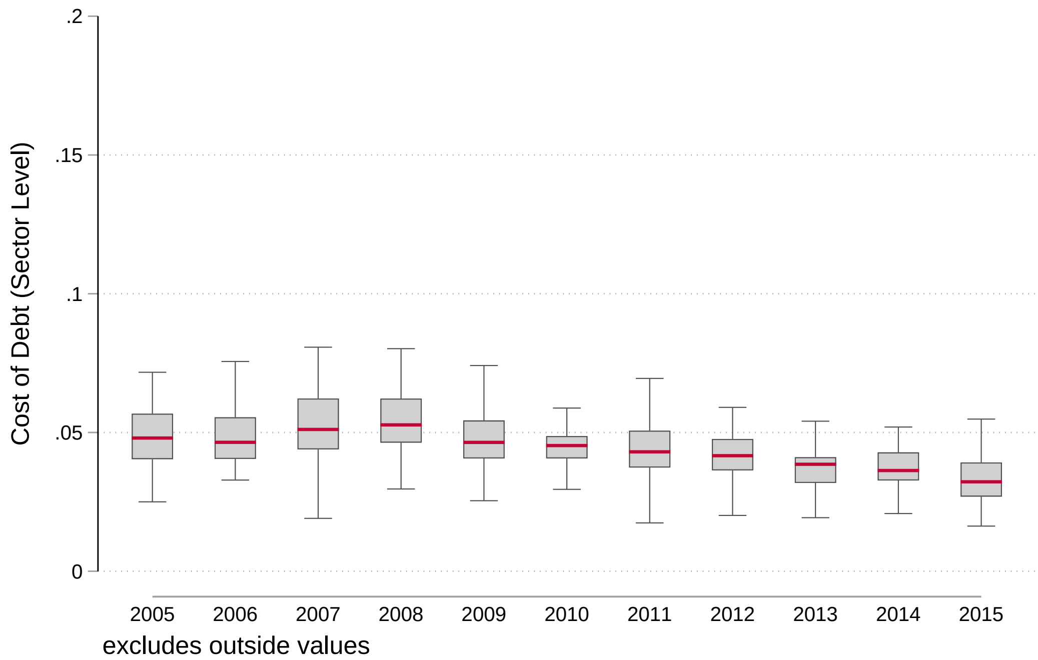
Note. This figure compares the aggregated gross investment rate over the period 2005-2015 for the firms in our sample (gray dashed line) and the macroeconomic investment rate for all French non-financial corporations (solid black line). The aggregated gross investment rate over the period 2005-2015 for the firms in our sample is the sum of individual investment rates weighted by each group's share in total assets of the sample. The macroeconomic investment rate for French non-financial corporations is obtained from the National Statistical Institute, INSEE. The aggregate investment rate is analogous to the micro one, and defined as the change in fixed assets between years t and t-1 divided by the stock in year t, therefore analogous to the investment rate calculated for each individual group.

Figure 2: Industry-level COE and cost of debt

A. COE

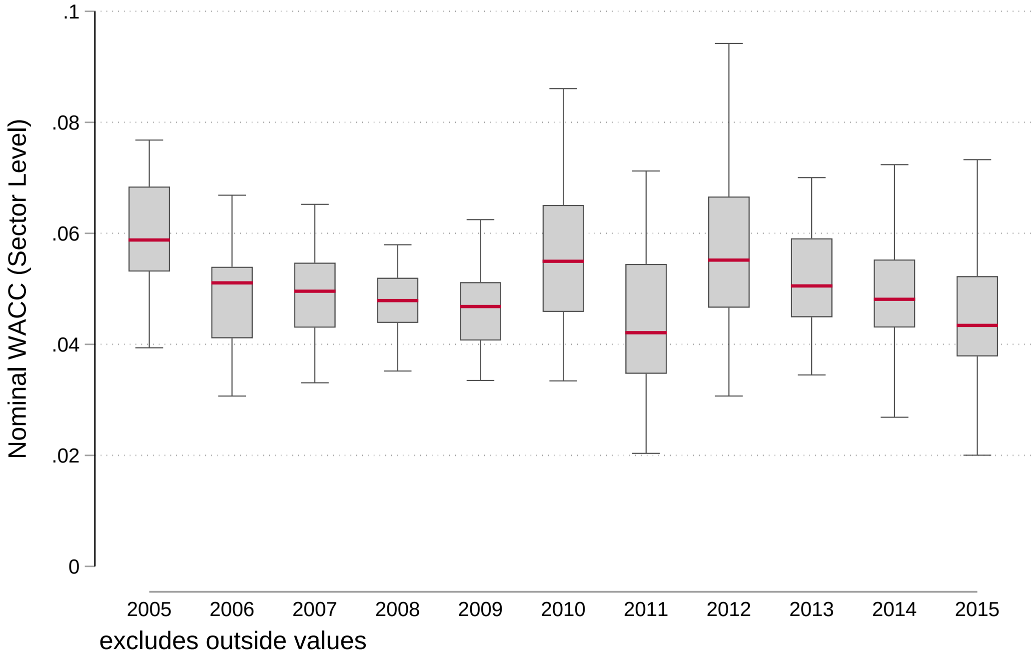


B. Cost of debt



Note. The top panel (A) shows the distribution through time of the sector-level cost of equity (our baseline estimation), from 2005 to 2015, while the bottom panel (B) represents the sector-level cost of debt. The red lines indicate the median values.

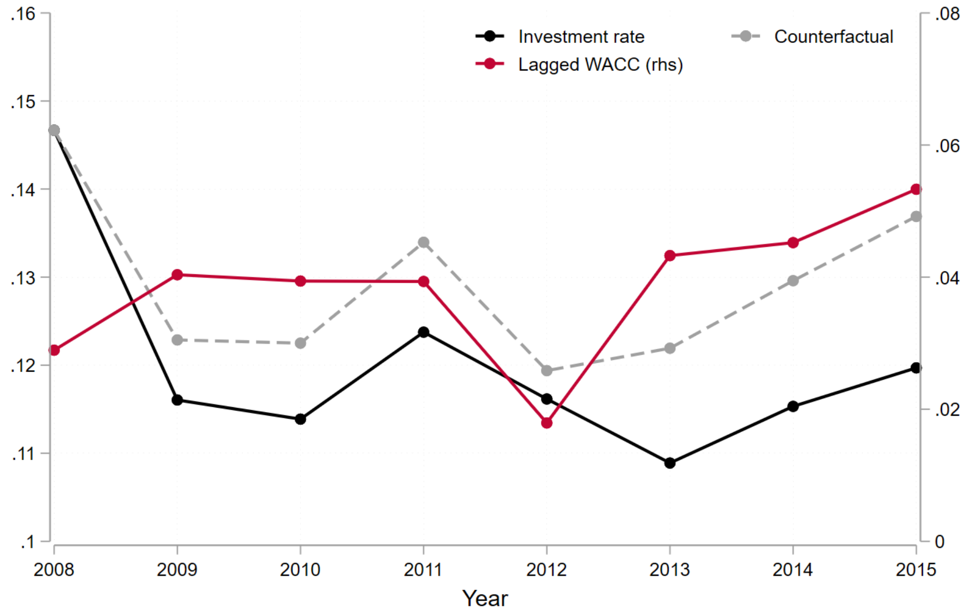
Figure 3: Industry-level WACC



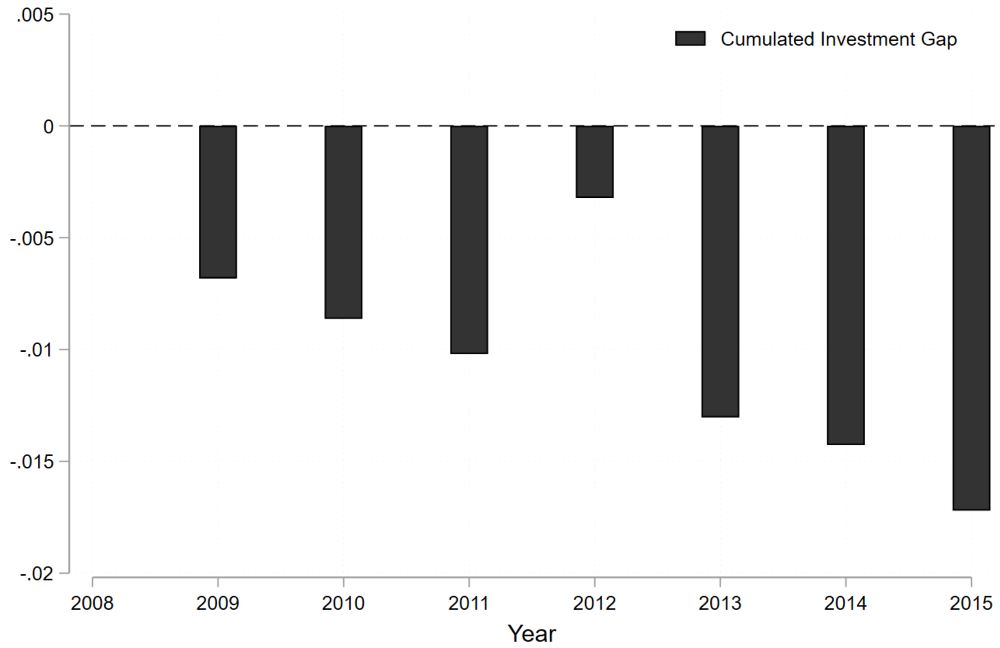
Note. This figure shows the distribution through time of the sector-level WACC (defined in equation 3) from 2005 to 2015. The red lines indicate the median values.

Figure 4: Aggregate implications of the WACC's fluctuations since 2008:

A. Counterfactual investment rate



B. Cumulated investment gap



Note. The figure A. represents the counterfactual investment rate (top panel) and the figure B. represents the corresponding investment gap (in pp) (bottom panel), defined in equation 6. Realized and counterfactual investment rates, investment gap and the WACC are averages of firm-level estimates weighted by total fixed assets. The real WACC is lagged by one period to be consistent with the empirical specification of firm-level regressions.

Table 1: Distribution of firm size in the estimating sample (by year)

	Small		**Medium**		**Large**	
	#.	%	#.	%	#.	%
2005	130	34.8	229	61.2	15	4.0
2006	159	34.8	283	61.9	15	3.3
2007	147	31.9	302	65.5	12	2.6
2008	144	31.4	298	65.1	16	3.5
2009	186	35.1	327	61.7	17	3.2
2010	235	35.9	402	61.5	17	2.6
2011	291	38.6	444	59.0	18	2.4
2012	315	37.7	502	60.1	18	2.2
2013	340	38.2	532	59.8	17	1.9
2014	351	36.8	579	60.7	24	2.5
2015	271	32.4	543	64.9	23	2.7

Note. Sample of 1,667 corporate groups (firms) present at least 3 consecutive years over 2005-2015. The size classification follows the definition set by the French Economic Modernization Act of 2008 (in French, *Loi de Modernisation Economique*, henceforth LME Act) with respect to total assets and turnover thresholds. Small: consolidated sales $<$ 50 M euros or consolidated assets $<$ 43 M euros. Medium-sized firms: larger than small firms but with sales $<$ 1.5 bn euros or assets $<$ 2 bn euros. Larger firms: above these thresholds.

Table 2: Descriptive statistics

	Nb.Obs.	Mean	Std.Dev.	p10	p25	Median	p75	p90
Investment rate (I/FA_{t-1})	7202	0.124	0.121	0.025	0.049	0.090	0.158	0.260
Net Investment rate (NI/FA_{t-1})	7202	0.047	0.151	-0.061	-0.023	0.016	0.079	0.182
Depreciation rate δ (DEP/FA_{t-1})	7202	0.097	0.082	0.032	0.055	0.082	0.120	0.176
Cash-flows to Fixed Assets ($OIBDP/FA_{t-1}$)	7202	0.284	0.354	0.070	0.126	0.198	0.325	0.528
Sales growth	7202	0.041	0.130	-0.087	-0.018	0.036	0.098	0.175
Firm size (TA, in M euros)	7202	809.315	10253.899	21.052	33.938	62.718	146.975	362.132
Leverage (Debt / Equity + Debt)	7202	0.423	0.210	0.134	0.265	0.429	0.579	0.700
Tax rate τ (Apparent, sector level)	7202	0.307	0.100	0.232	0.274	0.304	0.340	0.365
Nominal Cost of Debt (CoD)	7202	0.043	0.041	0.017	0.026	0.037	0.050	0.068
Nominal CoD * (1 - τ)	7202	0.030	0.029	0.012	0.018	0.026	0.035	0.048
Nominal Cost of Equity	7202	0.074	0.022	0.050	0.059	0.070	0.088	0.107
Nominal WACC	7202	0.054	0.018	0.035	0.042	0.051	0.063	0.076
Real Cost of Debt	7202	0.029	0.041	0.002	0.012	0.023	0.036	0.054
Real Cost of Equity (CoE)	7202	0.060	0.026	0.030	0.045	0.057	0.073	0.104
Real CoD * (1 - τ)	7202	0.020	0.029	0.002	0.008	0.016	0.025	0.038
Real WACC	7202	0.042	0.019	0.020	0.030	0.040	0.051	0.066

Note. Sample of 1,667 corporate groups (firms) present at least 3 consecutive years over 2005-2015. Gross investment: acquisitions minus disposals of fixed assets, net investment: gross investment minus depreciation and amortization, Cash-flows: Operating Income Before Depreciation (EBITDA), CoD is the (firm-specific) implied cost of debt: interest payments normalized by gross long-term debt and leverage: D/(D+E). CoE: computed at the sector level for 49 sectors with a DDM H-Model. Nominal returns are deflated using the French (core HICP) yoy inflation.

Table 3: Corporate investment and the WACC

	I/FA					
	(1)	(2)	(3)	(4)	(5)	(6)
Cash Flow (-1)	0.061***	0.058***	0.057***	0.056***	0.057***	0.057***
	[0.018]	[0.010]	[0.019]	[0.019]	[0.019]	[0.019]
Real WACC (-1)	-0.229**	-0.305**	-0.361**			
	[0.102]	[0.134]	[0.144]			
CoD $\times$ (1 - τ) (-1)				-0.327***		-0.328***
				[0.056]		[0.056]
CoE (-1)					-0.164*	-0.166*
					[0.091]	[0.091]
Leverage (-1)	-0.225***	-0.048***	-0.234***	-0.236***	-0.215***	-0.236***
	[0.025]	[0.010]	[0.028]	[0.028]	[0.027]	[0.028]
Sales growth (-1)	0.032***	0.045***	0.026**	0.028**	0.025**	0.027**
	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]
Size (-1)	-0.067***	-0.004***	-0.060***	-0.060***	-0.060***	-0.060***
	[0.011]	[0.001]	[0.014]	[0.014]	[0.014]	[0.014]
Depreciation rate δ (-1)	0.001	0.333***	0.003	0.002	0.002	0.003
	[0.065]	[0.050]	[0.065]	[0.065]	[0.065]	[0.065]
M&A dummy	0.008	0.019*	0.007	0.008	0.008	0.008
	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]
Firm FE	Yes	No	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes	Yes
Industry FE	No	Yes	No	No	No	No
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,202	7,202	7,202	7,202	7,202	7,202
Adj. R2	0.41	0.20	0.41	0.42	0.41	0.42

Note. OLS estimations of Equation 2. Sample period: 2005-2015. Unbalanced panel of all firms in our sample. Dependent variable: gross fixed capital investment rate (I/FA_{-1}). Regressors are defined in Section III and described in Table 2. We alternatively include firm fixed-effects, year fixed-effects and industry fixed-effects. Standard errors in parentheses are clustered at the firm level.

Table 4: Corporate investment and the WACC: alternative computations of the CoE

	I/FA						
	Sector-Level Cost of Equity			**Firm-level Matched Cost of Equity**			
	(1) Baseline (H=16)	(2) H=10	(3) H=8	(4) N=25 (H-Model)	(5) w/n Sector (H-Model)	(6) N=25 (Easton)	(7) w/n Sector (Easton)
Cash Flow (-1)	0.057***	0.057***	0.057***	0.065***	0.058**	0.065***	0.058**
	[0.019]	[0.019]	[0.019]	[0.021]	[0.027]	[0.021]	[0.027]
Real WACC (-1)	-0.361**	-0.415**	-0.429**	-0.327**	-0.169***	-0.101	0.028
	[0.144]	[0.167]	[0.174]	[0.150]	[0.057]	[0.071]	[0.043]
Leverage (-1)	-0.234***	-0.236***	-0.236***	-0.232***	-0.207***	-0.227***	-0.193***
	[0.028]	[0.028]	[0.028]	[0.029]	[0.032]	[0.029]	[0.032]
Sales growth (-1)	0.026**	0.027**	0.027**	0.022*	0.012	0.022*	0.013
	[0.012]	[0.012]	[0.012]	[0.012]	[0.016]	[0.012]	[0.016]
Size (-1)	-0.060***	-0.060***	-0.060***	-0.061***	-0.062***	-0.060***	-0.061***
	[0.014]	[0.014]	[0.014]	[0.014]	[0.017]	[0.014]	[0.017]
Depreciation rate δ (-1)	0.003	0.003	0.003	0.007	0.035	0.006	0.032
	[0.065]	[0.065]	[0.065]	[0.067]	[0.097]	[0.067]	[0.097]
M&A dummy	0.007	0.007	0.007	0.007	0.001	0.007	0.000
	[0.011]	[0.011]	[0.011]	[0.012]	[0.014]	[0.012]	[0.014]
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,202	7,202	7,202	7,025	4,745	7,025	4,745
Adj. R2	0.41	0.41	0.41	0.42	0.38	0.42	0.37

Note. OLS estimations of Equation 2. Sample period: 2005-2015. Unbalanced panel of all firms in our sample. Dependent variable: gross fixed capital investment rate (I/FA_{-1}). First column corresponds to our baseline version of the WACC with the cost of equity measured at sector-level and with H = 16. In columns 2 and 3, the cost of equity is identical except H respectively equals 10 and 8. In columns 4 and 5, we compute a firm-level cost of equity as the average cost of equity of publicly-traded matched firms: we take the 25 nearest *neighbors* in column 4 and all the *neighbors* within the same industry in column 5. In columns 6 and 7, the matching is similar but the cost of equity is estimated using a method proposed by Easton (2004). See Section B for more details. Other regressors are similar to Table 3. We include firm and year fixed-effects. Standard errors in parentheses are clustered at the firm level

Table 5: Corporate investment and the WACC: heterogeneity by size and industry

	I/FA				
		Sector		**Firm size**	
	(1)	(2)	(3)	(4)	(5)
	All	Manuf	Retail	Large	SME
Cash Flow (-1)	0.057***	0.108***	0.040	0.090***	0.015
	[0.019]	[0.028]	[0.037]	[0.025]	[0.026]
Real WACC (-1)	-0.361**	-0.591***	-0.899***	-0.406**	-0.180
	[0.143]	[0.196]	[0.292]	[0.161]	[0.294]
Leverage (-1)	-0.234***	-0.204***	-0.291***	-0.181***	-0.362***
	[0.028]	[0.036]	[0.051]	[0.026]	[0.057]
Sales growth (-1)	0.026**	0.003	0.036**	0.028**	0.015
	[0.012]	[0.018]	[0.018]	[0.014]	[0.019]
Size (-1)	-0.060***	-0.060***	-0.034	-0.077***	-0.044
	[0.014]	[0.016]	[0.024]	[0.016]	[0.028]
Depreciation rate δ (-1)	0.003	0.042	-0.149*	0.064	-0.076
	[0.065]	[0.057]	[0.089]	[0.090]	[0.085]
M&A dummy	0.007	0.013	0.005	0.003	0.005
	[0.011]	[0.014]	[0.018]	[0.012]	[0.038]
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes
Observations	7,202	2,918	2,992	4,574	2,514
Adj. R2	0.41	0.37	0.29	0.48	0.33

Note. OLS estimations of Equation 2. Sample period: 2005-2015. Unbalanced panel of all firms in our sample. Dependent variable: gross fixed capital investment rate (I/FA_{-1}). SMEs: sales $<$ 50 M euros or assets $<$ 43 M euros. Larger firms: above these thresholds. Other regressors are similar to Table 3. We include firm and year fixed-effects. Standard errors in parentheses are clustered at the firm level.

Table 6: Corporate investment and the WACC: leverage and external-finance dependence

	I/FA				
		Leverage		**Financial Dependance**	
	(1)	(2)	(3)	(4)	(5)
	All	High	Low	High	Low
Cash Flow (-1)	0.057***	0.041**	0.081***	0.024	0.106***
	[0.019]	[0.019]	[0.023]	[0.019]	[0.040]
Real WACC (-1)	-0.361**	-0.869***	-0.144	-0.604***	-0.088
	[0.143]	[0.287]	[0.159]	[0.217]	[0.241]
Leverage (-1)	-0.234***	-0.432***	-0.218***	-0.227***	-0.251***
	[0.028]	[0.051]	[0.035]	[0.038]	[0.047]
Sales growth (-1)	0.026**	0.035**	0.006	0.026*	0.044*
	[0.012]	[0.016]	[0.018]	[0.014]	[0.024]
Size (-1)	-0.060***	-0.083***	-0.050**	-0.073***	-0.041*
	[0.014]	[0.021]	[0.020]	[0.019]	[0.023]
Depreciation rate δ (-1)	0.003	0.133	-0.013	-0.072	0.059
	[0.065]	[0.090]	[0.091]	[0.061]	[0.136]
M&A dummy	0.007	-0.001	-0.018	-0.007	0.041**
	[0.011]	[0.017]	[0.018]	[0.013]	[0.021]
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes
Observations	7,202	3,254	3,685	3,882	2,594
Adj. R2	0.41	0.45	0.44	0.41	0.41

Note. OLS estimations of Equation 2. Sample period: 2005-2015. Unbalanced panel of all firms in our sample. Dependent variable: gross fixed capital investment rate (I/FA_{-1}). High leverage (in year t) is a dummy for firms in the upper half of the leverage distribution of year t. High Financial Dependence is a dummy for firms in the upper half of industrial sectors according to a Rajan-Zingales index of financial dependence computed using UK firm-level data over 1993-2003. Other regressors are similar to Table 3. We include firm and year fixed-effects. Standard errors in parentheses are clustered at the firm level.

Appendix

A. Definition of variables

Firm-level balance sheet items and financial ratios and variables are defined as follows:

- **Net fixed assets**: net tangible assets (including leasing) + net intangible assets.
- **Gross investment rate**: net capital expenditure in fixed assets (acquisition minus sales) / lagged net fixed assets.
- **Depreciation rate**: net depreciation and provisions.
- **Net investment rate**: Gross investment rate - (depreciation /lagged net fixed assets).
- **Cash flow to fixed assets** : EBITDA / lagged net fixed assets.
- **Leverage** : financial debt / (financial debt + book equity).
- **Cost of debt** : interest paid / total financial debt.
- **Income tax**: Income tax expense / Taxable profit (average ratio by sector and firm size).
- **M&A dummy**: equals 1 if a merger or acquisition takes place in the year and exceeds in value 10% of lagged fixed assets of the buyer.

A. *Descriptive statistics for public firms*

Table A1: Public vs. private firms: descriptive statistics

	Panel A: Private Firms							
	Nb.Obs.	Mean	Std.Dev.	p10	p25	Median	p75	p90
Firm size (TA, in M euros)	7202	809.315	10253.899	21.052	33.938	62.718	146.975	362.132
Leverage (Debt / Equity + Debt)	7202	0.423	0.210	0.134	0.265	0.429	0.579	0.700
Profitability (OIBDP / Total Assets (t-1))	7202	0.109	0.072	0.038	0.066	0.100	0.141	0.189
Liquidity (Cash / Total Assets (t-1))	7202	0.079	0.075	0.012	0.028	0.059	0.108	0.171
	Panel B: Public Firms							
	Nb.Obs.	Mean	Std.Dev.	p10	p25	Median	p75	p90
Firm size (TA, in M euros)	9456	4760.350	15331.507	16.016	49.397	213.737	1330.773	9883.896
Leverage (Debt / Equity + Debt)	9456	0.328	0.273	0.010	0.110	0.298	0.490	0.660
Profitability (OIBDP / Total Assets (t-1))	9456	0.075	0.130	-0.037	0.033	0.077	0.126	0.197
Liquidity (Cash / Total Assets (t-1))	9456	0.077	0.099	0.006	0.019	0.045	0.093	0.180

Note. Panel A: our baseline sample of private corporate groups over 2005-2015. Panel B: sample of French public firms from Datasteam over 2005-2015. Profitability: Operating Income Before Depreciation (EBITDA) over lagged total assets. Liquidiy: cash reserve over lagged total assets. Leverage: debt/(debt+equity).

Table A2: Corporate investment and the WACC: measurement errors

	I/FA	
	(1) Baseline	(2) Erickson-Whited Model
Cash Flow (-1)	0.057***	0.082***
	[0.019]	[0.017]
Real WACC (-1)	-0.361**	-0.354**
	[0.143]	[0.157]
Firm FE	Yes	Yes
Year FE	Yes	Yes
Other controls	Yes	Yes
Observations	7202	7202
Adj. R2	0.41	

Note. OLS estimations of Equation 2. Sample period: 2005-2015. Unbalanced panel of all firms in our sample. Dependent variable: gross fixed capital investment rate (I/FA_{-1}). First column corresponds to our baseline estimation. In columns 2, we implement the Erickson-Whited correction for measurement errors using the Stata module `xtewreg`. Other regressors are similar to Table 3. We include firm and year fixed-effects. Standard errors in parentheses are clustered at the firm level.

B. Alternative measure of the cost of equity

To test the robustness of our main results, we compute an alternative version of the cost of equity that relies on the seminal work by Easton (2004), using the simplifying assumption that the variation of the expected abnormal growth in earnings equals zero (see equation (11) of Easton (ibid.)). We estimate the cost of equity using the following formula for a firm i at time t:

$$EPS_{i,t+2} + r_{i,t} \times DPS_{i,t+1}/P_t = r_{i,t} \times (r_{i,t} - \Delta AGR_{i,t,t+1}) + (1 + \Delta AGR_{i,t,t+1}) \times EPS_{i,t+1}/P_t \tag{7}$$

Where $r_{i,t}$ is the expected rate of return used to proxy the equity cost of capital, P_t, is the stock price at t, EPS_{t+1} stands for the I/B/E/S forecast of expected earnings per share at period t+1, DPS_{t+1} stands for I/B/E/S forecast of the expected dividends per share at period t+1 and $\Delta AGR_{i,t,t+1}$ captures the future long-run change in abnormal growth in accounting earnings here set to zero. Easton (ibid.) shows that under the condition ($EPS_{t+2} \geq EPS_{t+1} \geq 0$) equation 7 has two solutions and at least one positive solution.

Table A3: Alternative measures of the cost of equity

	Nb.Obs.	Mean	Std.Dev.	p10	p25	Median	p75	p90
CoE: H-Model (Baseline)	7202	0.060	0.026	0.030	0.045	0.057	0.073	0.104
CoE: H-Model, matched (N=25)	7077	0.059	0.023	0.032	0.045	0.055	0.075	0.089
CoE: H-Model, matched w/n sector	4899	0.064	0.053	0.026	0.037	0.051	0.073	0.117
CoE: Easton Model, matched (N=25)	7077	0.117	0.031	0.078	0.095	0.111	0.145	0.155
CoE: Easton Model, matched w/n sector	5185	0.113	0.073	0.044	0.073	0.097	0.119	0.196

Note. In this table we compare four alternative measures of the real cost of equity to our baseline, sector-level estimate. In order to compute the alternative measures, we use a firm-level matching procedure where we use the cost of equity for closest neighbors to proxy for the cost of equity of each private firm in each year. We use averages (i) across the 25 closest neighbors for each year and (ii) across all the closest neighbors in the same 2-digit industry, for both firm-level cost of equity computed using the DDM H-Model and the method proposed by Easton (ibid.)

C. Matching procedure: Probit model

Table A4: Likelihood of being private

	P(Private firm)		
	(1)	(2)	(3)
	2005	2010	2015
Leverage	0.010	0.444***	0.001
	[0.013]	[0.081]	[0.001]
Profitability	2.509***	2.851***	2.716***
	[0.514]	[0.575]	[0.342]
Liquidity	-3.551***	-1.167**	-3.423***
	[0.639]	[0.595]	[0.399]
NWC / TA	2.140***	3.038***	1.697***
	[0.243]	[0.257]	[0.188]
RE / TA	-0.251	0.652***	-0.010***
	[0.155]	[0.196]	[0.001]
Sales / TA	1.165***	1.427***	0.696***
	[0.078]	[0.090]	[0.053]
Observations	1,335	1,790	1,892
Pseudo R2	0.26	0.36	0.21

Note. Estimations of a Probit model for three years: 2005, 2010 and 2015. Dependent variable: dummy equal to 1 if the firm is private. Profitability: Operating Income Before Depreciation (EBITDA) over Total Assets. Liquidity: Cash Reserves over Total Assets. Leverage: debt/(debt+equity). NWC / TA is Net Working Capital over Total Assets. RE / TA is Retaied Earnings over Total Assets. Sales / TA is sales over Total Assets. See section B for more details.

D. The role of Competition and Sector-level Uncertainty

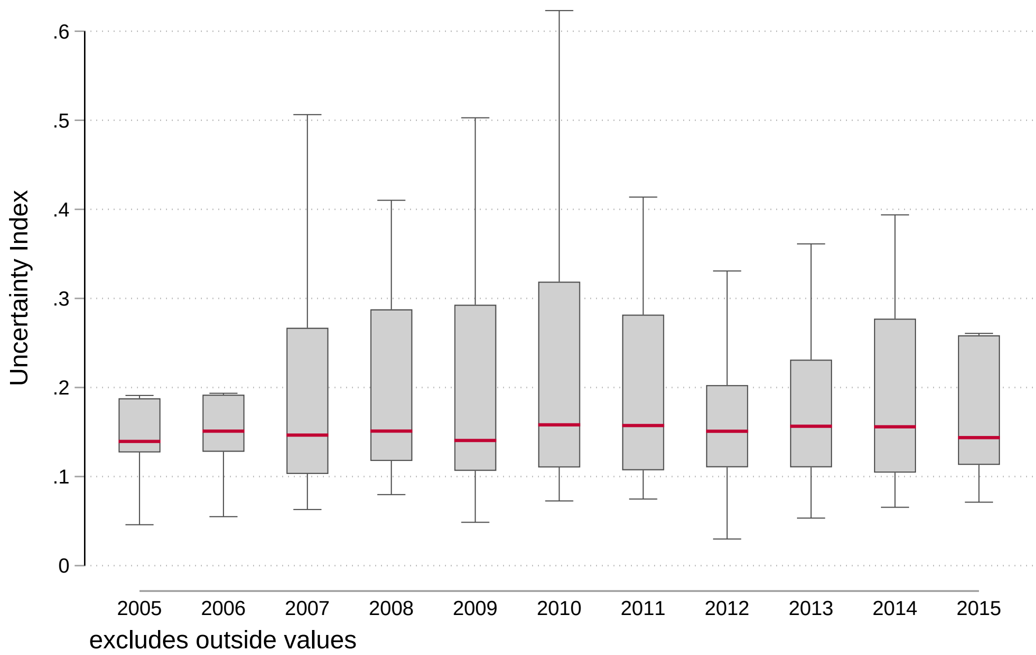
Recent papers have documented a role for competition and uncertainty in driving investment rates (Gutierrez and Philippon (2016) and Gulen and Ion (2016)). We use our data to test whether these hypothesis find support in the French case. We construct two sector-level measures: 1) we measure within-industry competition with the sector-level Herfindhal index of firm sales, computed using income statement data from the FIBEN database on individual French firms, that is, individual firms and not consolidated groups as in the main dataset, to take advantage of the largest number of firms, and 2) we measure within-industry profit uncertainty using the dispersion of firms' ROA (net income over lagged total assets) within a given year and sector (based on the private firms in our baseline sample).

Figures A4 show the distribution through time of these variables. No clear trend emerges regarding concentration over the 2005-2015 decade. Median concentration dropped during the 2008 crisis, before returning gradually to its pre-crisis level. Median profit uncertainty also remained quite flat over the decade. However, the dispersion of uncertainty across industries increased sharply with the subprime crisis and became very skewed to the right. Interestingly, the dispersion of our sector-level measure of uncertainty broadly follows the pattern of commonly used macroeconomic measures of uncertainty, such as the stochastic volatility of options on stock market indexes (such as the VSTOXX for Europe).

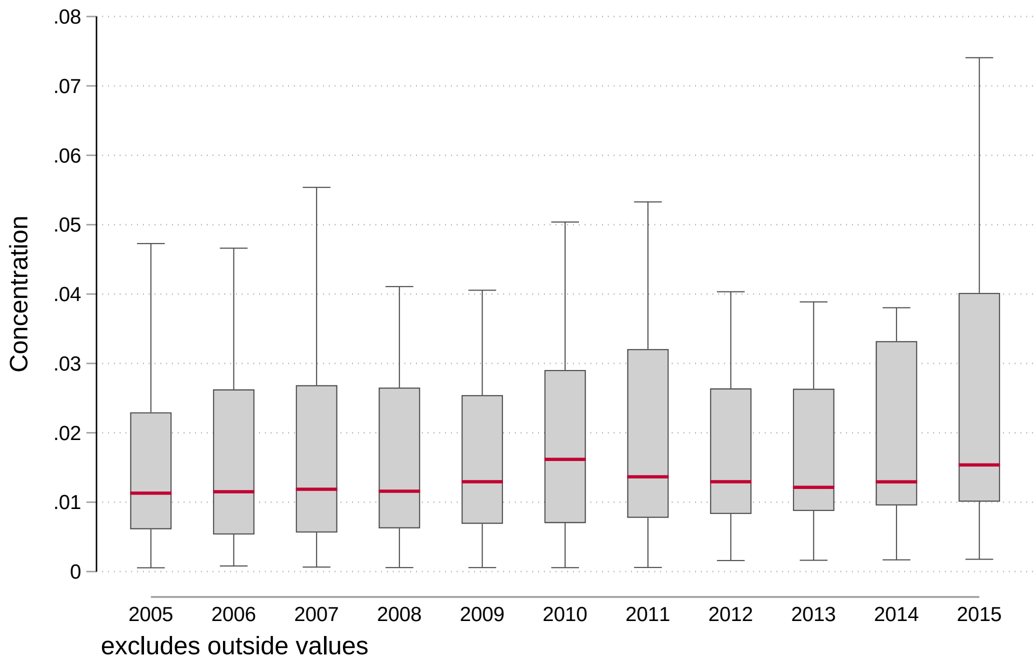
In Table A5, we include our measures of sector-specific concentration and uncertainty in our baseline regressions. Our analysis does not point to a role for concentration, which might have to do with the fact that concentration did not substantially increase in France and Europe, contrary to the US (see Gutierrez and Philippon (2018)). We find no effect for our measure of uncertainty, but notice that the inclusion of time-fixed effects might absorb part of the variance explained by sector-level uncertainty.

Figure A4: The role of competition and uncertainty at the sector-level

A. HHI of sales



B. Profit uncertainty



Note. The top panel shows the distribution through time of the sector-level Herfindhal index of firm sales, a proxy for within-industry competition. The bottom panel represents the dispersion of firms' ROA (net income over lagged total assets) within a given year and sector (based on the private firms in our baseline sample), from 2005 to 2015, a proxy for profit uncertainty at sector-level. The red lines indicate the median values.

Table A5: Corporate investment and the WACC: Uncertainty and competition

	I/FA					
	(1)	(2)	(3)	(4)	(5)	(6)
Cash Flow (-1)	0.061***	0.058***	0.057***	0.056***	0.057***	0.057***
	[0.018]	[0.010]	[0.019]	[0.019]	[0.019]	[0.019]
Real WACC (-1)	-0.229**	-0.306**	-0.361**			
	[0.102]	[0.133]	[0.143]			
CoD $\times$ (1 - τ) (-1)				-0.327***		-0.328***
				[0.056]		[0.056]
CoE (-1)					-0.165*	-0.167*
					[0.091]	[0.091]
Leverage (-1)	-0.225***	-0.048***	-0.234***	-0.236***	-0.215***	-0.236***
	[0.025]	[0.010]	[0.028]	[0.028]	[0.027]	[0.028]
Sales growth (-1)	0.032***	0.045***	0.026**	0.028**	0.025**	0.027**
	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]
Size (-1)	-0.067***	-0.004***	-0.060***	-0.059***	-0.059***	-0.060***
	[0.010]	[0.001]	[0.014]	[0.014]	[0.014]	[0.014]
Depreciation rate δ (-1)	0.001	0.333***	0.003	0.003	0.002	0.003
	[0.065]	[0.050]	[0.065]	[0.065]	[0.065]	[0.065]
M&A dummy	0.008	0.019*	0.007	0.008	0.008	0.008
	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]
Concentration (-1)	0.047	0.006	0.041	0.030	0.047	0.040
	[0.168]	[0.128]	[0.176]	[0.179]	[0.176]	[0.176]
Uncertainty (-1)	-0.003	0.006	-0.003	-0.004	-0.003	-0.004
	[0.023]	[0.022]	[0.023]	[0.023]	[0.023]	[0.023]
Firm FE	Yes	No	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes	Yes
Industry FE	No	Yes	No	No	No	No
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,202	7,202	7,202	7,202	7,202	7,202
Adj. R2	0.41	0.20	0.41	0.42	0.41	0.42

Note. OLS estimations of Equation 2. Sample period: 2005-2015. Unbalanced panel of all firms in our sample. Dependent variable: gross fixed capital investment rate (I/FA_{-1}). Regressors are defined in Section III and described in Table 2. We alternatively include firm fixed-effects, year fixed-effects and industry fixed-effects. Standard errors in parentheses are clustered at the firm level.