UNIVERSIDADE DE SÃO PAULO
FACULDADE DE ECONOMIA, ADMINISTRAÇÃO E CONTABILIDADE
DEPARTAMENTO DE ADMINISTRAÇÃO
PROGRAMA DE PÓS-GRADUAÇÃO EM ADMINISTRAÇÃO

DOES THE NATURE OF LARGE PROJECTS AFFECT THE FINANCING DECISIONS OVER THE INVESTMENT PERIOD?

A NATUREZA DOS GRANDES PROJETOS AFETA AS DECISÕES DE FINANCIAMENTO DURANTE O PERÍODO DE INVESTIMENTO?

Eduardo Ottoboni Brunaldi

Orientador: Prof. Dr. Eduardo Kazuo Kayo

São Paulo

Setembro 2018

Prof. Dr. Vahan Agopyan

Reitor da Universidade de São Paulo

Prof. Dr. Fábio Frezatti

Diretor da Faculdade de Economia, Administração e Contabilidade

Prof. Dr. Moacir de Miranda Oliveira Júnior

Chefe do Departamento de Administração

Prof. Dr. Eduardo Kazuo Kayo

Coordenador do Programa de Pós-Graduação em Administração

EDUARDO OTTOBONI BRUNALDI

DOES THE NATURE OF LARGE PROJECTS AFFECT THE FINANCING DECISIONS OVER THE INVESTMENT PERIOD?

A NATUREZA DOS GRANDES PROJETOS AFETA AS DECISÕES DE FINANCIAMENTO DURANTE O PERÍODO DE INVESTIMENTO?

Tese apresentada ao Departamento de Administração da Faculdade de Economia, Administração e Contabilidade da Universidade de São Pauo como parte dos requisitos para obtenção do título de Doutor em Ciências

Área de concentração: Finanças

Orientador: Prof. Dr. Eduardo Kazuo Kayo

Versão Original

São Paulo

Setembro 2018

FICHA CATALOGRÁFICA
Elaborada por Rafael Mielli Rodrigues – CRB-8/7286
Seção de Processamento Técnico do SBD/FEA/USP

Brunaldi, Eduardo Ottoboni
Does the nature of large projects affect the financing decisions over the investment period? / Eduardo Ottoboni Brunaldi. – São Paulo, 2018.
72 p.

Tese (Doutorado) – Universidade de São Paulo, 2018.
Orientador: Eduardo Kazuo Kayo.

1. Capital de giro 2. Estrutura de capital 3. Capex 4. Pesquisa e desenvolvimento I. Universidade de São Paulo. Faculdade de Economia, Administração e Contabilidade. II. Título.

CDD –658.15244

DEDICATÓRIA

À minha esposa, Ayla, e à minha família.

AGRADECIMENTOS

Primeiramente, gostaria de agradecer a minha esposa, Ayla, pelo apoio e suporte incondicionais em todos os momentos e por me fazer uma pessoa melhor e mais feliz.

Aos meus pais, Mariângela e José Eduardo, pelo amor, respeito e dedicação ao longo da minha vida.

À minha mãe, Mariângela, que incondicionalmente esteve ao meu lado em todos os momentos da minha vida, sempre abrindo mão de si.

Ao meu pai, José Eduardo, pelo exemplo de cárater, de dedicação e amor.

Ao meu irmão, Vitor, pelo companheirismo e exemplo de profissional.

Ao meu orientador, Prof. Dr. Eduardo Kazuo Kayo, pela disposição e imensa dedicação ao longo de todo o processo da Pós-Graduação.

Aos membros da banca, Prof. Dr. Roy Martelanc, Prof. Dr. Edison Simoni e Prof. Dr. Herbert Kimura, por colocarem o seu tempo à disposição para crítica construtiva do trabalho.

Ao Prof. Dr. Heitor Almeida, pela oportunidade de estudar na Universidade de Illinois em Urbana-Champaign.

Aos diversos professores com os quais tive a oportunidade de aprender e me desenvolver como pesquisador: Prof. Dr. Almir Ferreira de Souza, Prof. Dr. José Roberto Securato, Prof. Dr. Raphael Corbi, Prof. Dr. Luiz Paulo Fávero, Prof. Dr. Jae-won Choi.

À Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) pelo apoio financeiro durante o curso de Doutorado.

Aos meus colegas da Universidade de Illinois, Filipe Correia, Tomás Urani e Igor Swinerd, pela amizade, discussões acadêmicas e críticas a respeito do presente trabalho.

Aos meus colegas da USP, pelo acompanhamento da trajetória e pelo companheirismo: Gustavo Oliveira, Thiago Góes, Matheus Albergaria, entre outros.

Às secretárias do PPGA, Cintia, Daniela e Heloisa, pela disponibilidade, carinho e paciência.

RESUMO

BRUNALDI, E. O. (2018). A natureza de grandes projetos afeta as decisões de financiamento durante o período de investimento?. Tese de Doutorado. Faculdade de Economia e Administração, Universidade de São Paulo, São Paulo.

Neste trabalho, desenvolvemos um modelo teórico baseado em Tirole (2006) em que a natureza de grandes projetos de investimentos, a saber: CAPEX, Pesquisa e Desenvolvimento e Capital de Giro, afeta as decisões de financiamento durante o período de investimentos. Nossa amostra é composta por empresas americanas e refere-se ao período de 1980 a 2017. Nós adotamos uma série de análises econométricas e gráficas para testar nossas hipóteses. Os resultados são robustos e consistentes com a teoria do Trade-off. As proposições do modelo são empiricamente verificadas: (i) nos projetos de CAPEX, as empresas usam capital próprio para financiar o projeto em seus estágios iniciais e dívida para os estágios finais; (ii) durante um investimento de P&D, empresas diminuem seu endividamento, financiando o projeto com recursos próprios externos. Adicionalmente, para grandes investimentos em capital de giro, nossos resultados sugerem que as firmas usam recursos internos durante os estágios iniciais do projeto e, em seguida, trocam a fonte de financiamento para dívida, objetivando a redução do desvio em direção ao endividamento alvo.

ABSTRACT

BRUNALDI, E. O. (2018). Does the nature of large projects affect the financing decisions over the investment period?. Doctoral Thesis. Faculdade de Economia e Administração, Universidade de São Paulo, São Paulo.

We develop a theoretical model based on Tirole (2006) where the nature of large investments, namely capital expenditure, research and development and working capital, affects the financing choice during the investment period. We use a sample comprised by American companies in the 1980-2017 period. We employ several econometric and graphic analyses to test our hypotheses. Our results are robust and consistent with Trade-off Theory predictions. Our model's propositions are empirically verified for all cases: (i) In CAPEX projects, firms use equity to finance the initial stages and debt to finance the last stages; (ii) throughout the R&D investment period, firms decrease debt and use equity to finance the project. Additionally, for large working capital projects, we show that firms use internal resources in the initial periods and, then, switch the source to debt, aiming the reduction of the deviation from the target leverage.

Contents

List of Figures

List of Tables

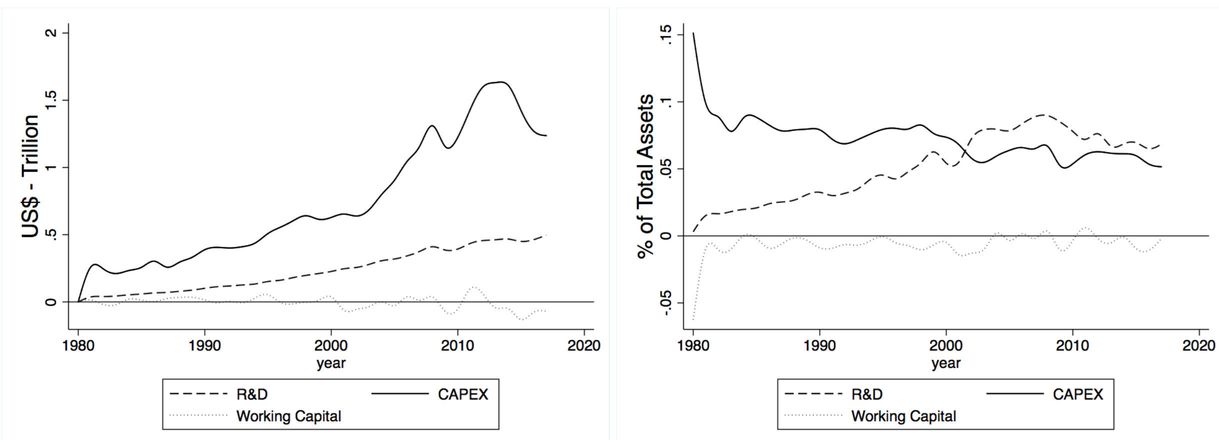
1 Introduction

1.1 Research Question

Corporate finance studies focused largely on the relationship between capital structure and firm value. Since Modigliani and Miller's propositions, many papers have been developing theories in attempt to explain this relationship but, until now, none of them has achieved consensus among researchers. Hall (1992) advocates that this relationship perhaps is incomplete because only two dimensions are considered, requiring the inclusion of a third one: investments. The inclusion of this new dimension not only maintained basics questions unanswered, but created others. To explore how this three-dimensional interaction works, it is crucial to establish causal effect across them. Hereupon, the nature of investment may play an important role because their specific characteristic affects firms' and project's attributes, such as agency costs and expected pledgeable income to support new financing contracts.

Dudley (2012) shows that large investments are financed, firstly, with (internal and external) equity and, as these investments are converted into assets-in-place, firms issue debt in order to balance financial flexibility and the costs and benefits of debt in a way consistent with the Trade-off Theory. However, it is notorious that as Dudley (2012) uses just an aggregate investment measure (i.e. the sum of CAPEX, R&D and working capital), particularities of each type of investment were overlapped by capital expenditure as it represents the largest amount during the entire period. In this sense, his conclusions may be biased, decreasing their generalization capacities. However, this argument stand-alone is not able to decrease the explanation power of Dudley's (2012) results. We, therefore, analyze the evolution of all investment types from 1980 on. The results are presented by Figure 1, reinforcing our argument related to the overrepresentation of CAPEX over the other investments types. Figures 1a and 1b present the evolution of investment over time both in (nominal) amount and in relative terms. In absolute terms, CAPEX has been increasing over time, reaching US$ 1 trillion dollars in 2006 and US$ 1.6 trillion dollars in 2014. In turn, during the period from 1978 to 2017, R&D has not exceeded more than 40% of the amount invested in CAPEX. Working capital is even less representative than R&D, representing at most 11% of CAPEX. After we scale the amount by total assets, the scenario alters: while the investment in R&D has been increasing over time, CAPEX has been decreasing over time. In 2006, for instance, the investment of R&D and CAPEX relative to total assets were similar.

Figure 1: Evolution of Investment



(a) Absolute

(b) Scaled by total assets

Dudley (2012), Öztekin and Flannery (2012), Ovtchinnikov (2010), Faulkender et al. (2012), Zhou et al. (2016), Flannery and Rangan (2006), Chang et al. (2014), among others, advocate the existence of a target leverage behavior through strong empirical evidence. In addition, Graham and Harvey (2001) survey concludes that the majority of firms has either a target ratio or a range of leverage upon which their decisions are based on. Literature lists the adjustment costs as the determinant of the speed at which firms adjust their capital structure. In this sense, Faulkender et al. (2012) defend the cash flow to be a source of adjustment cost sinking: the excess and the lack of cash flow require a manager's active access to capital market to either raise or distribute cash, making marginal the adjustment costs, increasing the speed of adjustment. Analogously to cash flow, Dudley (2012) advocates that large investments play a similar role. As large investments require an amount of resources that firms usually do not have, they usually need to access the capital markets to raise them. In this sense, if managers pursuit a target leverage, the investment period represents an appropriate period to adjust. We, extending this perspective, defend that investment nature plays an important role in this decision. Literature states that CAPEX, R&D and working capital differ regarding on pledgeability capacity, uncertainty and information asymmetry and these facts may affect how firms finance them. However, due to Dudley (2012) research strategy, questions related to the effect of investment nature on financing decisions remain unanswered.

In order to fill some of these gaps, the purpose of the present dissertation is to provide evidence that helps answering the following questions: Does the type of large projects affect the financing decisions over the investment period? By type of investment, we refer to CAPEX, R&D and working capital. Also, the present research extends the analysis to verify whether these decisions change during the investment period consistent with the predictions of the traditional corporate finance theories, to be known: Trade-off Theory, Pecking Order Theory and Market Timing. Extending Dudley (2012), we defend that the type of investment is a determinant of financing behavior during the investment period.

The identification relies on the assumption that the nature of investment affects the pledgeable income related to the project that, in turn, affects temporarily the feasibility and optimality of a debt contract. To support this assumption, we develop a theoretical model based on the Tirole (2006), where probability of success of a project is decomposed into two probabilities: an idiosyncratic one that depends on the nature of the investment and a managers' behavior probability. The model results in three propositions. The first and general proposition is that, if a manager intends to hide project information from the market, a debt contract may not be temporarily feasible. The second states that R&D investments are too risky to support a debt contract, while, in the third one, the proposition states that debt may not be the sole optimal contract for R&D projects. We use a sample comprised by annual data available on COMPUSTAT that refers to the 1980-2017 period.

Our results show that, first, no traditional theory is able to solely explain firms financing behavior during non-investment period: firms tend to use equity even when there is borrowing capacity and firms issue equity when share prices are high and make capital structure decisions pursuing a target leverage. Second, we show that our model are able to provide plausible explanation on how investment nature affects financing decisions in a dynamic perspective .

At the initial stages of the CAPEX investment period, we evidence that firms become more underlevered than they already are at the preceding year of the investment period, when firms retire a substantial amount of debt. At these stages, firms use preferentially equity to finance it and, as the project evolves, we observe a decrease in the deviation from target leverage as a response to an increase in leverage: the debt issuance probability increases 0.41% with the execution of 1% of the project. This project financing sequence is consistent with our first proposition and to the target pursuit behavior proposed by the Trade-off Theory. Moreover, under financial constraints, firms increase the use of equity during initial stages until the last one, when the additional assets and the pledgeable income increase the borrowing capacity. Because adjustment is costly, the speed of adjustment (SOA) varies over the investment period to balance the need for resources and the benefits and costs from adjustment in a way that the firm appropriates the entire benefit of debt without additional costs. Our extension test shows that, even after a windfall cash flow, firms do not anticipate the adjustment toward the target.

The R&D literature provides arguments that support our specific R&D propositions, whose empirical implication is that the leverage decreases during the entire investment period, as a response of equity financing choice (Hall, 1992, Himmelberg and Petersen, 1994, Brown et al., 2009, Brown and Petersen, 2009). Consistent with our propositions, we observe a decreasing leverage during the entire R&D investment period. This is a result of a persistent net debt retirement and net equity issuance, whose probabilities increase over stages. The execution of 1% of the R&D project increases 0.21% the probability of a debt retirement and/or use of equity. This behavior, in turn, is also consistent with Trade-off predictions in which growth increases the financial distress likelihood and, therefore, should not be financed with debt. However, our results suggest that managers do not take the advantage of the marginal adjustment costs period to adjust their capital structure, even if the project generates cash flow earlier than planned. Similar to what we observe in CAPEX, financially constrained firms use more equity than unconstrained.

Literature lacks empirical studies focused on the relationship between capital structure decisions and working capital management. Researchers may have difficulty of interpretation because it is extremely endogenous. Despite the difficulties, Chiou et al. (2006), Hill et al. (2010) and Baños-Caballero et al. (2010) find a negative relationship between this kind of investment and leverage, concluding that managers tend to avoid funding that requires monitoring, information sharing or issuance costs. Our results support the general proposition as they evidence that firms just use debt to finance the last stage of working capital projects. The initial stage seems to be internally financed. This behavior suggests that managers make financing decisions taking into account the deviation from target leverage and the source is chosen aiming its reduction. Our extension test reinforces this conclusion since a cash flow windfall may increase the SOA of underlevered firms.

1.2 Research Shortcomings

The first shortcoming of the present thesis relates to the geographic scope as it focuses exclusively on United States capital market and American firms. The choice of this region relates to the fact that American capital markets is the most developed, liquid and relevant in the world.

The second shortcoming relates to causality channel proposed by the thesis. Even though the results may be supportive to the theoretical model presented in Chapter 2, the methodological design is unable to show whether, *de facto*, the results are causal, driven by the proposed channel. Other shortcoming correlated to the latter relates to the lack of data at project level so that we have to make strong assumptions to measure the size, length, start and end date projects, for instance.

2 Theoretical Background and Theoretical Model

2.1 Trade-off Theory: Evolution

The corporate finance literature has been robustly evolving since the seminal Modigliani and Miller's propositions (Modigliani and Miller, 1958, 1963). Over the last 25 years, the main capital structure theories - namely, Trade-off Theory and Pecking Order Theory - have been empirically tested throughout different perspectives and markets and none of them, individually, has been able to provide consensual answers to capital structure determinants. In fact, some papers defend the complementarity aspect of the aforementioned theories. For instance, De Jong et al. (2011) conclude that pecking order is the first-best predictor of issuance decisions and trade-off, in turn, performs better on repurchasing.

On the other hand, Fama and French (2005) evidence that Pecking Order Theory predictions have been continuously violated and this theory ",...as the complete model of capital structure proposed by Myers (1984) and Myers and Majluf (1984), is dead" (Fama and French, 2002, p. 580). However, this matter is far from general consent and several papers still explore whether firms make financing decisions in a hierarchical preferences: from internal resources and debt to equity, if necessary.

The Trade-off Theory defends, in short, the existence of an optimal capital structure in which the leverage costs and benefits are balanced so the firm value is maximized. Originally, the leverage costs are related to the probability of financial distress and firm bankruptcy while the benefits are comprised by tax-shields. To the best of our knowledge, Robichek and Myers (1966) is the first to indicate problems related to Modigliani and Miller (1958) and Modigliani and Miller (1963) propositions. According to the latter, in the presence of taxes, "all-debt"- firm would be optimal. Robichek and Myers (1966), in turn, propose that:

> "the market value of the firm would be an increasing function of leverage for firms with little or no debt, but that the value of he firms ultimately declines

> if leverage is carried too far..." (p. 19)

And conclude:

> "...optimum leverage is at the point where the present value of the rebate associated with a marginal increase in leverage is equal to the present value of the marginal cost of the disadvantages of leverage..." (p.20)

In the following 40 years, this subject has been widely discussed and scrutinized, but far from a consensual stand-point. In fact, Trade-off Theory models have been continuously evolving. In its dynamic strand, firms have target capital structure and, when shocks perturb their actual leverage away from their target, managers make financing decisions to rebalance it back. The speed at which firms make this reversion is directly related to adjustment costs. So, in a frictionless state of the world, firms would immediately adjust when actual and target leverage divert from each other. On the other extreme state, if the adjustment costs are too high, no capital structure calibration would be made. In this way, as the real world is in the midst of both states of nature, firms would adjust frequently but not immediately. Empirical studies such as Flannery and Rangan (2006), Flannery and Hankins (2013) and Huang and Ritter (2009) show that firms cover their leverage gap in a speed that varies from 25% to 40% per year.

Literature usually employs either two-stages OLS or partial adjustment models with Arellano and Bond (1991) Blundell and Bond (1998) generalized method of moments (GMM) estimators to estimate the SOA. Chang and Dasgupta (2009) criticize the latter model suggesting that it is not possible to distinguish whether the firms indeed pursuit a target leverage or this behavior is just a mechanical mean-reversion captured by the econometrics. In fact, this issue could overvalue the coefficient but, after surveying 392 chief financial officers, Graham and Harvey (2001) show that 81% of their sample firms indeed takes into account either a target leverage or a range when making financing decisions, corroborating the Trade-off Theory predictions.

Moreover, the aforementioned techniques also assume, mistakenly, homogeneous SOA of all sample firms, overlooking potential heterogeneity (Elsas and Florysiak, 2011). Facing this, a large strand of literature explores on how characteristics at firm, industry and country level may affect how firms adjust their capital structure.

2.1.1 Heterogeneity in Capital Structure Adjustment: Firms, Industry and Country Effects

At firm-level, Cook and Tang (2010) and Korajczyk and Levy (2003) show that financially unconstrained firms adjust faster than constrained. In addition, Faulkender et al. (2012) evidence another heterogeneity: constrained firms adjust slower when underleveraged and faster when overleveraged. Yet, Lockhart (2014) makes a within analysis of underleveraged group and find that these firms with line of credit availability are associated with higher SOA.

Bankruptcy costs also play an important role in capital structure. Firms with high cash flow volatility are riskier and are more likely to default, increasing the expected bankruptcy costs. Also, the level of cash flow is usually an important covenant in credit line contracts (Sufi, 2009) and as high cash flow volatility may provoke its violation, debt contracts could have their full or partial revocation, shorten maturity or interest increasing (Acharya et al., 2014). This situation provides ambiguous arguments to predict either higher or slower SOA. Papers that advocate for a higher SOA argue that firms decrease on leverage either because they face higher costs (Borochin and Yang, 2017) or as a response for decrease on target leverage or because of both reasons. The immediate consequence would be a faster adjustment. On the other hand, the high bankruptcy costs may be the consequence of high leverage and because of capital markets anticipate a high probability of default, firms become financially constrained and the SOA decreases.

Several studies evidence that transaction cost *per se* would not be the unique driver of speed of adjustment. For instance, Faulkender et al. (2012) show that cash flow (excess or lack) increases the managers' incentives to access the capital markets, sinking marginal adjustment costs. Facing this, their results suggest that managers use these opportunities to choose an appropriate financing source to adjust actual leverage toward their target. Similarly, Dudley (2012) defends that the same mechanism occurs during the investment period of large projects that require external resources.

Industry may also effect not only firms structural characteristics but also how they make financing decisions. For instance, firms within industry that have high level of research and development expenses, so-called "equity dependent" industries (Brown and Petersen, 2009), tend to have less benefits on adjustment behavior. Because of the R&D projects have longer maturity and are riskier than capital expenditure, these firms tend to be constantly underleveraged and may not adjust their capital structure or when they do, this movement is slow.

The other way round is also valid: external industry context may exert some influence on the development of business as well as on how firms respond to these external environment (Dess and Beard, 1984, Chen et al., 2017, Aldrich, 2008) and macroeconomic conditions (Korajczyk and Levy, 2003). In the context of dynamic capital structure, these responses are conditional to how industry context incentives firms to operate optimally. Deregulation, for instance, alters substantially the environment by raising the degree of competition among firms, increasing the incentives to firms operate efficiently, making firms to adjust faster their capital structure (Ovtchinnikov, 2010). It is important to mention, though, that these both external influences may, first, not affect all the industries within a country and, secondly, macroeconomic conditions of a given country may affect industries differently.

In this sense, the institutional context of countries may also influence managerial decisions. The regulation and development of the capital markets and business environment, taxes and macroeconomic conditions, for instance, have a catalyzing effect on the incentives of adjustment. Extensive theoretical and empirical literature evidence the association between institutional characteristics and leverage adjustments. For instance, capital market development eases firms access to cheaper funding, implying not only more levered firms (Faulkender and Wang, 2006) but also faster SOA (Öztekin and Flannery, 2012). Also, Öztekin and Flannery (2012) cross-country analysis evidences that firms, on average, adjust 21% annually, but making a between country analysis, the speed may vary from 4% (Columbia) to 41% (New Zealand). This 37 percentage-point range reinforces the importance of differences across countries and the caution on generalization of target behavior of firms.

Macroeconomic conditions play an important role on firms financial planning, regardless the ability of firms. Liquidity shocks, for instance, impede raising funds with ease. Also, inflationary process, associated with economic instability (Pindyck and Solimano, 1993), may divert managerial priorities from optimization of capital structure to survivorship issues so that firms have more incentive to adjust at good states of nature rather than recessions (Hackbarth et al., 2006).

2.2 Endogeneity Between Financing and Investment Decisions: Perspectives of Capital Structure Theories

The relationship between capital structure and investment decisions has a vast literature in finance and economics strands in academia. An important aspect of investments refers to their pledgeability. Tirole (2006) explores this feature as an assumption of his theoretical model in which debt is the first-best financing source as it inhibits moral hazard problem between lender and borrower.

By the Trade-off Theory perspective, investment nature may affect financing decisions through risk and maturity channels. That is, depending on how long the debt-financed investment takes to start generating cash flow enough to pay down its installments, firms may have to use internal resources or their savings to cover these gaps. In this scenario, the implicit riskiness associated to investment nature may have a multiplier effect in the likelihood of financial flexibility reduction, increasing the probability of financial distress.

In the aforementioned situation, Trade-off Theory predicts that firms, initially, finance their investments with more expensive sources to avoid financial distress, i.e., internal resources or equity. However, as the growth opportunities becomes assets-in-place and generates cash flow, the source is switched to debt in a target pursuit logic. This rationale is consistent with Dudley (2012) who evidences this mechanism in large aggregated investment projects.

The Agency Theory also predicts similar propositions: firms are more likely to undergo asset substitution (Jensen and Meckling, 1976) and underinvestment problems (Myers, 1977) if the project is entirely debt-financed. That is, borrowers will prefer either to forego the project or to invest in high-risk project in order to maximize their wealth at the cost of the lenders. Anticipating this behavior, lenders will require higher risk premium and borrowers will only accept this condition substituting the original project by a riskier one. This logic takes to a circular movement effect.

On the other hand, Pecking Order Theory predicts a different financing hierarchy. Due to information asymmetry, firms will choose to finance their investment, firstly, with internal resources. After this source runs out, firms issue debt until their full capacity so that, if necessary, equity is issued. In this sense, the greater information asymmetry related to an specific investment, the higher the risk premium. Even though many papers have scrutinized this theory such as Shyam-Sunder and Myers (1999), Frank and Goyal (2003) and Fama and French (2005), none of them discuss explicitly how investment nature could affect the preference ranking over financing sources.

2.2.1 Investment Natures: Capital Expenditure, Research and Development and Working Capital

Researches on R&D investment have become relevant as the technological development increased the importance of intangible-intensive firms, the most valuable companies in the world. Initially, literature had focused on the relationship between R&D and internal resources in theoretical (e.g. Kamien and Schwartz (1978), Spence (1979)) and empirical perspectives (e.g. Elliott (1971)). Hall (1992) is the first to explore its negative relationship with leverage. Himmelberg and Petersen (1994) present results consistent to Hall (1992) and evidence that R&D-intensive small firms pay almost no dividend (0.8%), rarely issue equity (8.2%) and the gauged amount of debt is modest (5.8%). Bah and Dumontier (2001) use an expanded sample of firms from US, UK and Europe and conclude that intensive-R&D firms share characteristics regarding to lower leverage and dividend payments.

The Williamson's Transaction-Costs Economics (TCE) also provides theoretical background to predict how assets and financing decisions would be related. In fact, Williamson (1988) affirms "...the value of a pre-emptive claim declines as the degree of asset specificity deepens" (p. 580) so that "the costs of...debt financing rises more rapidly" (p. 581). The author, then, concludes that "highly deployable assets will be financed with debt, equity is favored as assets become highly nonredeployable" (p. 581). In short, TCE predicts that (1) R&D investments would be primarily financed with equity as the risk premium for debt would be unbearable and (2) CAPEX and working capital would be financed with debt. It is important to mention that the predictions relate to an average R&D, CAPEX and working capital investments. Clearly, it is possible to have specific CAPEX or working capital whose specificity decreases considerably their redeployability.

Along with the asset specificity matter, information asymmetry plays an important role in financing decisions. As substantial portion of R&D project value comes from the exclusivity and uniqueness, intangible-intensive firms would employ a secrecy strategy, actively maintaining outsiders uninformed. The implication, as predicted in Myers and Majluf (1984), would be a great equity discount rate.

On the other hand, CAPEX and working capital are recognized by their high deployability, considered as credit multiplier in Kiyotaki and Moore (1997) model due to its pledgeability in debt contracts (Almeida and Campello, 2007, 2010). However, this subject is not straightforward. For instance, if CAPEX investments are debt-financed, firms can face moral hazard problems. Also, the value of some working capital components can be questionable: the book value of inventory in real economy might be not so valuable as it is considered in theory; the receivables may be doubtful accounts or low rating payers. Welch (2004) criticizes the use of book values since it is not necessarily the correct liquidation value of the assets, being just "plug numbers" to equalize the balance sheet.

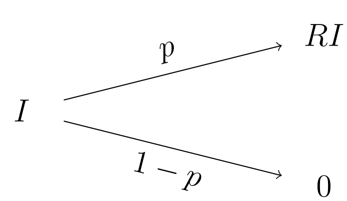
Moreover, making predictions based on models that overlook dynamic issues may produce myopic propositions. Dudley (2012) corroborates this matter, evidencing a financing source dynamism within project period. Even though the author uses an aggregated investment measure, he evidences the existence of a financing hierarchy within investment period similar to a target leverage pursuit in which agency problems and financial flexibility issue seem to be well-balanced.

2.3 Theoretical Model

Our following theoretical model is adapted from Tirole (2006):

2.3.1 No Reward in Failure State

Suppose that a firm, owned by an entrepreneur, with cash equals to A wants to undertake an investment I, and as $A < I$, the entrepreneur has to raise funds that equals to $I - A$. If undertaken, the project has the probability of success and failure equal to p and $1 - p$, respectively. It is important to mention the existence of an entrepreneur (p_{i_E}) and an investor ($p_{i_{Inv}}$) probabilities where, assuming a symmetric information environment, p_{i_E}=$p_{i_{Inv}}$. So, we refer to them as p. If the project succeeds, the project yields RI, proportional to I, and 0, if fails. In the following scheme, we present this rational.



Assuming that the aggregated probability of success (p) of the project can be decomposed into two probabilities. First, the idiosyncratic probability (p_i), related to the type of investment (i.e R&D, CAPEX or working capital), where $p_{i_{WC}} > p_{i_{CAPEX}} > p_{i_{R\&D}}$. The second probability refers to entrepreneur's moral hazard, that increases the probability of success just if she behaves, as follows:

$$p = \begin{cases} p_i + \varepsilon & and \quad B = 0 \\ p_i & and \quad B > 0 \end{cases} \tag{1}$$

Accordingly, if the entrepreneur behaves, the probability of success will be $p_i + \varepsilon$ and if she misbehaves, p_i, where $p_i + \varepsilon > p_i$. In case of misbehavior, the entrepreneur expropriates private benefits of BI, proportional to I. To limit I as finite and to impose that $A > 0$, we establish that:

$$(p_i + \varepsilon)R < I + \frac{(p_i + \varepsilon)B}{\Delta p}$$

where $\Delta p = (p_i + \varepsilon) - p_i = \varepsilon$

Imposing that NPV is positive only if entrepreneur behaves: $(p_i + \varepsilon)R > 1$ and negative if entrepreneur misbehaves: $1 > (p_i R + B)$. The loan agreement establishes that the net revenue R is split between the lender's (R_L) and the borrower's portion (R_B), where $R = R_L + R_B$. Also, the loan contract is subject to two constraints:

$$\varepsilon R_B I \geq BI \tag{IC}$$

$$(p_i + \varepsilon)(R - R_B)I \geq I - A \tag{IBe}$$

The incentive constraints (IC) is interpreted as follows: the increase in the borrower's revenue portion by behaving has to be at least equal to the private benefit received by the entrepreneur if she misbehaves. The break-even constraint (IBe), in turn, imposes that the project's pledgeable income has to be as big as the amount borrowed from the investors.

The definition of the entrepreneur's net utility is equal to the total surplus resultant from the investment: $U_B = ((p_i + \varepsilon)R - 1)I$. As the entrepreneur tends to maximize her own utility, she will invest as much as possible, subject to the aforementioned constraints.

2.3.2 Reward in Failure State

So far, the model establishes the conditions to enable a loan agreement between the borrower and lender. However, the funding structure is still undetermined. Suppose, now, that the entrepreneur has 100% of the shares of the firm, and intends to finance the investment I through equity issuance. So, in exchange of $1 - \alpha$ of the firm, the investors agree to finance the project. In this case, the entrepreneur, in turn, would have the remainder α of the firm.

In case of success, the return of the project R^S, is split in a way that the investors take $(1 - \alpha)R^S$ while the entrepreneur, αR^S. However, in case of failure, the entrepreneur takes αR^F, where R^F is the liquidation value of the assets. The latter is determined by the demand of secondary asset markets that, in turn, is negatively related to the asset uniqueness. We define R to be equal to the increase in profit given success, i.e. $R \equiv R^S - R^F$.

The existence of a reward in case of failure implies that the marginal NPV per unit of investment is $(p_i + \varepsilon)R + R^F > 1$, while the marginal pledgeable income is negative $(p_i + \varepsilon)(R - \dfrac{B}{\varepsilon}) + R^F < 1$, condition that imposes finitude to I. Then, the entrepreneur's utility is:

$$U_B = ((p_i + \varepsilon)R + R^F - 1)I$$

The optimal contract maximizes the entrepreneur's expected compensation in a way that:

$$U_B = \max_{R_B^S, R_B^F, I} ((p_i + \varepsilon)R_B^S + (1 - (p_i + \varepsilon))R_B^F - A)$$

subject to the following new constraints:

$$\varepsilon(R_B^S - R_B^F)I \geq BI \tag{IC_a}$$

$$(p_i + \varepsilon)(R^S - R_B^S)I + (1 - p_i - \varepsilon)(R^F - R_B^F)I \geq I - A \tag{IBe_a}$$

Including IBe_a is the objective function, the entrepreneur's utility is, then:

$$U_B = ((p_i + \varepsilon)R^S + (1 - (p_i + \varepsilon)R^F) - 1)I$$

subject to IC_a.

Suppose, finally, that optimal contract is the equity issuance. Therefore, $R_B^F > 0$ is optimal in all cases. Now consider an increase of $\phi R_B^S > 0$, and to compensate it, a proportional decrease of $\phi R_B^F < 0$ in way to keep the investors' expected profitability and entrepreneur's utility constants:

$$(p_i + \varepsilon)\phi R_B^S + (1 - (p_i + \varepsilon))\phi R_B^F = 0$$

In this case, IBe_a is slack, a contradiction. Accordingly, the optimal contract (first-best) is the one where $R_B^F = 0$, that is, a debt contract.

2.3.3 Propositions

From the prior model, it is possible to extract three propositions:

Proposition 1: A debt contract is not feasible if the investor's probability of success goes below a feasibility threshold, p_i^*, deviating from the entrepreneur's probability of success.

There are two cases that fit in this first proposition: Information Asymmetry and Uncertainty. In the first case, suppose that the same entrepreneur does not want to share information related to a specific project to the market as a result of commercial strategy. As the entrepreneur is known by the market, ε is known too. That is, IC is assumed to hold. In this sense, p_i may divert between entrepreneur (p_{i_E}) and investors ($p_{i_{Inv}}$), where, due to market's risk aversion, $p_{i_E} > p_{i_{Inv}}$. Regarding to IBe, there is a threshold (p_i^*) in which the debt contract becomes feasible. This threshold is:

$$(p_i^* + \varepsilon)(R - R_B)I = I - A \implies p_i^* = \frac{1}{1 + R_L} - \varepsilon \tag{2}$$

If ($p_{i_{Inv}}$) $< p^* \leq$ (p_{i_E}), the contract is not feasible. However, over time, as the investment evolves and starts generating positive cash flow, the market may capture this positive signs through financial and operational reports, asymmetry decreases until $p^* \leq (p_{i_{Inv}}) \simeq (p_{i_E})$ and the contract becomes feasible.

The same mechanism occurs in the uncertainty case. That is, due to the uncertainty related to the project capacity have enough (expected) pledgeable income to support the contract (p^*), managers start financing the project with the equity. As the investment evolves and the uncertainty decreases, p_i^* equals to p^* and contracts becomes feasible.

Proposition 2: Because of the risky nature of R&D projects, debt contract may not be feasible.

Suppose a firm, whose entrepreneur is known by the market, wants to undertake one R&D and one CAPEX projects. We assume that the market evaluates the projects separately. So, if $p^* \geq p_{i_{CAPEX}}$ and $p_{i_{CAPEX}} > p_{i_{R\&D}}$, then, $p^* > p_{i_{R\&D}}$. Accordingly, IC is violated and debt contract is not feasible.

Proposition 3: Because of the uniqueness of R&D projects, debt contract may not be the sole optimal contract.

The argument that refutes the optimality of equity contracts is that if $R^F > 0$, IBe_a is slack and this contract is not an optimal choice. However, R^F is interpreted as the liquidation value of the new investment assets whose value is determined by the secondary assets markets. As the liquidation value is negatively related to uniqueness, R^F may be 0, implying that equity and debt issuances are able to maximize the entrepreneur's utility without any bounding constraints (IC_a and IBe_a) being slack.

3 Data, Sample and Variables

3.1 Data and Sample

The sample features the annual data from COMPUSTAT for the period from 1980 to 2017. Financial (SIC 6000-6999) and regulated utilities (SIC 4900-4949) are excluded. Moreover, firms with missing total assets or common equity, total assets lower than US$ 10 million, and firms that experience either an annual assets or sales growth greater than 100% (mergers & acquisitions) are excluded too. Because the investment analyses occur over the consecutive years, there was imposed that firms should have at least 5 consecutive observations. To decrease the effect of outliers, all the variables are winsorized at 1^{st} and 99^{th} percentile and censored leverage to be between 0 and 1.

3.2 Investment Variables

The measure for CAPEX is:

$$CAPEX_{i,t} = \frac{CapitalExpenditure_{i,t}}{TA_{i,t} - CHE_{i,t}}$$

where TA is the total assets and CHE is cash and short term investments. The definition of working capital is:

$$WorkingCapital_{i,t} = \frac{(ACT_{i,t} - CHE_{i,t}) - (LCT_{i,t} - DLC_{i,t})}{TA_{i,t} - CHE_{i,t}}$$

where ACT is the current asset, LCT is the current liabilities and DLC is the short term debt. The investment in working capital is, then, the difference between the one period and the contemporaneous working capital, as follows:

$$\Delta WorkingCapital_{i,t} = WorkingCapital_{i,t} - WorkingCapital_{i,t-1}$$

Finally, the measure of R&D expenses is as follows:

$$R\&D_{i,t} = \frac{XRD_{i,t}}{TA_{i,t} - CHE_{i,t}}$$

where XRD is the total research and development expenses.

3.3 Definition of Investment Projects and Stages

The definition of large investment projects are based on Dudley (2012): the beginning of a large investment occurs when the firm's investment rate is equal or greater than 1.5 times the median rate in its industry (3-digit SIC). The end of this project, consequently, occurs when the firm's investment rate drops to a level lower than 1.5 times its industry median. Because the investment project is defined as a multiplier of industry's investment rate, two situation are commonly faced: consecutive investment years and overlapping investment (e.g. more than 1 project occurring simultaneously) in a given year.

As in Dudley (2012), because it is not possible to exactly distinguish when a project begins and ends when they occur in consecutive years, they are treated them as one project. Regarding large investments that occur in the same year, the procedure applied follows Dudley's (2012) procedure: in projects with length greater than 5 years, a new investment project begins every time the investment rate in a given year is equal or greater than 1.5 times the firm's investment rate in the previous years since the beginning of the original project. To illustrate the procedure, suppose a firm A whose investment rate in 1990 raises to 3% while its industry median is 2%. Therefore, the first investment year is 1990. In addition, suppose that this firm keeps its investment rate greater than 2% until 2000 when it drops to 1%, implying on a 10-year-investment period. However, applying a within-period analysis, in the first 5 years the investment rate remains 3%, and from 1995 on, it raises to 4.5% (1.5 × 3%), remaining flat until 2000. Following Dudley's procedures, this 10-year-period would be split into two, i.e. from 1990 to 1994 and from 1995 to 2000.

Table 1 reports the distribution of the projects in the sample. Before the split procedure, as exemplified above, the sample comprises 11,612 CAPEX projects whose mean length is 2.72 years, 3,211 R&D projects whose mean length is 5.94 years and 14,892 working capital projects whose mean length is 1.19 year. After the split, an increase in the number of CAPEX projects (12,001 projects with mean length of 2.63 years) and on the number of R&D projects (4,247 projects with mean length of 4.49 years) are observed

As our intention is to analyze accurately the average financing behavior during each type of investment, the years in which a given firm underwent more than one type of investment are disregarded. After this restriction, the final sample is comprised 9,156 CAPEX projects of a mean investment: US$ 352 million (or 14% of total assets); 1,951 R&D projects of a mean investment: US$ 230 million (or 22.5% of total assets) and 14,892 working capital projects of a mean investment: US$ 102 million (or 9.7% of total assets).

Table 1: Number and Length of Investment projects

	Before Split							After Split						
	N	Mean	25^{th}	50^{th}	75^{th}	99^{th}	Max	N	Mean	25^{th}	250^{th}	75^{th}	99^{th}	Max
Panel A - CAPEX														
With overlap														
Number of projects	11,612							12,001						
Length (in years)		2.72	1	2	3	15	37		2.63	1	2	3	13	33
No overlap														
Number of projects	9,156							9,433						
Length (in years)		2.74	1	2	3	15	33		2.65	1	2	3	13	33
Panel B - R&D														
With overlap														
Number of projects	3,211							4,247						
Length (in years)		5.94	2	4	8	29	38		4.49	1	3	6	22	37
No overlap														
Number of projects	1,943							2,623						
Length (in years)		5.32	1	4	5	24	37		4.05	1	3	5	19	37
Panel C - Working Capital														
Number of projects	14,892							14,892						
Length (in years)		1.19	1	1	1	3	5		1.19	1	1	1	3	5

In order to uniform the analysis of the projects, the length of the projects are categorized into stages. For CAPEX and R&D projects, we split the investment period into terciles; Stages 1, 2 and 3 refer to the years that belongs to the bottom 33^{th}, from 33^{th} to 66^{th} and to the top 33^{th} percentile of the investment period distribution, respectively. Because of the shorter length of working capital projects, their investment period are decomposed into two categories based on the median: Stages 1 and 2 refer to the years that belong to the bottom 50^{th} and top 50^{th} of the investment period distribution, respectively. Then, Stage 0 is established as the year that immediately precedes the investment period.

3.4 Summary Statistics

The literature provides extensive specification referring to the estimation of target leverage. Following prior literature (Flannery and Rangan, 2006, Flannery and Hankins, 2013, Dudley, 2012, Chang et al., 2014), the predicted target leverage is the fitted value from the regression of contemporary actual leverage on lagged firms characteristics, controlled by firm and year fixed-effects. In the Equation (1), we present our specification:

$$\begin{aligned} L\hat{ev}_{i,t} = \alpha_i + \beta_1 Q_{i,t-1} + \beta_2 Prof_{i,t-1} + \beta_3 Tang_{i,t-1} + \beta_4 Size_{i,t-1} + \beta_5 SES_{i,t-1} \\ + \beta_6 DR\&D_{i,t-1} + \beta_7 R\&D_{i,t-1} \end{aligned} \tag{1}$$

where Q is the market-to-book ratio; $Prof$ is the profitability, $Tang$ is the firms' tangibility ; $Size$ is the natural logarithm of total assets; SES is the ratio of selling expenses and total assets ; $DR\&D$ is a dummy variable that assumes 1 if the firm invested in R&D in a given year and $R\&D$ is the research and development expenses. In the Table 2, we define properly all the variables we use in this thesis and also present the summary statistics.

Our average firm is slightly overlevered, regardless the leverage measure, is profitable and invests either in CAPEX or in R&D. We, then, split the sample into three groups: Group 1 represents the firms that underwent at least one large CAPEX project; Group 2 represents the firms that underwent at least one large R&D project and Group 3, in turn, represents the firms that we observe at least one large WC project. The results are presented by Table 3.

Table 2: Summary Statistics - Full Sample

Variable	Definition	Mean	SD	Median	N
Q	Ratio of Total Assets minus Book Equity plus Market Equity and the Total Assets	1.623	1.066	1.290	96,760
Tangibility	Ratio of Net Property, Plant, Equipment and the Total Assets	0.313	0.232	0.256	108,039
Profitability	Ratio of Earnings before Interest and Taxes and the Total Assets	0.062	0.128	0.076	108,203
Size	Natural Logarithm of Total Assets	5.931	2.039	5.732	108,218
Depreciation	Ratio of Total Depreciation and Total Assets	0.049	0.032	0.042	107,886
Book Leverage	Ratio of Total Debt (Long Term plus Short Term) and Total Assets	0.258	0.226	0.224	108,218
Market Leverage	Ratio of Total Debt (Long Term plus Short Term) and Total Assets minus Book Equity plus Market Equity	0.205	0.200	0.155	96,608
Book Target	Fitted value of book leverage regressed on firms characteristics	0.243	0.071	0.238	83,248
Market Target	Fitted value of market leverage regressed on firms characteristics	0.201	0.100	0.196	83,248
Total Assets	Nominal Value of Total Assets (Millions)	4,182	19,944	325	108,218
CAPEX	Ratio of Total Capital Expenditure and Total Assets	0.070	0.065	0.051	106,994
R&D	Ratio of Total Research and Development Expenses and Total Assets	0.055	0.189	0	108,218
ΔWC	Difference between contemporaneous working capital and the lagged working capital	-0.005	0.078	0	108,218
Dividends	Ratio of Cash Flow Dividends and Total Assets	0.014	0.050	0.003	106,898
Net Equity Issuance	Ratio of the difference between Equities Issuance and Repurchase and Total Assets	0.001	0.084	0	100,616
Net Debt Issuance	Ratio of the difference between Debt Issuance and Payment and Total Assets	0.003	0.116	0	100,954
Financial Deficit	Ratio of Net Debt plus Equity Issuances and Total Assets	0.014	0.125	0	106,898

No surprisingly, 81.6% and 86.4% of the sample experienced at least one large CAPEX or WC projects, respectively. Also, as expected, Group 2 represents less than one third of the entire sample. In the three most-right columns in Table 3, we present the t-test of the differences across groups. Overall, the summary statistics is consistent with literature. R&D-intensive firms are, on average, more intangible, less tangible, have lower leverage, issue more equity and, evidently, invest more in R&D in comparison with Groups 1 and 3. Moreover, R&D firms are substantially underleveraged (4%), regardless the type of leverage we use. On the other hand, we find difference statistically significant between the latter groups, however, none has economic relevance. This result is somewhat expected since 83.5% Group 3 firms are comprised by Group 1 ones.

Table 3: Summary Statistics - Groups

	CAPEX			R&D			WC			t-test		
	Mean	SD	N	Mean	SD	N	Mean	SD	N	1-2	2-3	1-3
Q	1.657	1.101	79,408	1.947	1.340	30,166	1.643	1.094	83,982	-0.291***	0.304***	0.014***
Tangibility	0.336	0.230	88,211	0.219	0.170	32,824	0.311	0.229	93,440	0.117***	-0.091***	0.025***
Profitability	0.064	0.130	88,297	0.031	0.171	32,826	0.060	0.131	93,495	0.033***	-0.029***	0.004***
Size	5.898	2.007	88,304	5.698	2.154	32,829	5.801	2.000	93,510	0.199***	-0.103***	0.096***
Depreciation	0.051	0.032	88,083	0.046	0.029	32,749	0.049	0.031	93,256	0.005***	-0.002***	0.002***
Book Leverage	0.248	0.218	88,304	0.187	0.203	32,829	0.249	0.224	93,510	0.060***	-0.061***	-0.001
Market Leverage	0.197	0.195	79,297	0.135	0.168	30,126	0.197	0.197	83,894	0.061***	-0.062***	-0.000
Book Target	0.245	0.070	68,833	0.228	0.073	26,565	0.239	0.070	72,812	0.017***	-0.011***	0.006***
Market Target	0.203	0.100	68,833	0.177	0.108	26,565	0.195	0.100	72,812	0.027***	-0.018***	0.008***
Total Assets	4,094	20,307	88,304	5,260	22,372	32,829	3,477	15,795	93,510	-1166***	1783	616***
CAPEX	0.078	0.068	87,462	0.064	0.056	32,534	0.070	0.065	92,560	0.014***	-0.006***	0.008***
R&D	0.059	0.200	88,304	0.164	0.317	32,829	0.060	0.200	93,510	-0.105***	0.104***	-0.000
ΔWC	-0.005	0.078	88,304	-0.009	0.100	32,829	-0.004	0.082	93,510	0.003***	-0.004***	-0.001***
Dividends	0.015	0.049	87,309	0.013	0.055	32,514	0.014	0.051	92,404	0.001***	-0.001**	0.000**
Net Equity Issuance	0.002	0.087	82,078	0.008	0.114	29,884	0.002	0.087	86,858	-0.006***	0.006***	-0.000
Net Debt Issuance	0.005	0.106	82,489	0.003	0.107	30,744	0.003	0.118	87,236	0.001**	0.000	0.002***
Financial Deficit	0.015	0.128	88,304	0.019	0.148	32,829	0.014	0.127	93,510	-0.004***	0.005***	0.001***

All variables are defined in Table 2. Data are taken from COMPUSTAT. The three rightmost columns represent the t-test of the difference between means. ***, ** and * represent the statistical significance levels at one percent, five percent, and ten percent.

4 Capital structure decisions during stages

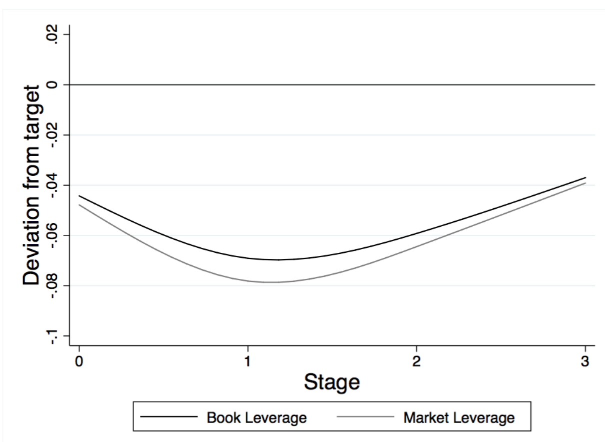
4.1 Adjustment behavior during projects

Figure 2 shows the median deviation from target as the actual leverage minus target leverage during investment period of our three categories. We use the median in this specific analysis since the mean of the difference between an actual value and its OLS fitted value is zero. The dash line refers to the book leverage while the solid one, to the market leverage. At Stage 0 of all types of investments firms are underlevered, mainly in the CAPEX and R&D cases, where, using book (market) measure, the initial deviations are 4.4% (4.8%) and 7.3% (4.6%), respectively. As the investment starts, we observe increase in the deviations for CAPEX and R&D: in the first case, book (market) deviation increases 2.2pp (3.1pp) while in the second one, it increases more than 4.0pp in both variables. From the Stage 2, we evidence a divergent behavior between CAPEX and R&D, consistent with the essence of our theoretical model that establishes different influence in financing behavior during the stages based on the type of investment. In the CAPEX case, deviation starts decreasing in a movement consistent with the Trade-off Theory: at the Stages 2 and 3, the book (market) deviation decreases to 5.9% (6.4%) and 3.7% (3.9%), respectively. So far, the evidence referring to CAPEX is consistent with our Proposition 1. Regarding to R&D, this analysis is not enough to deliberate the consistency with our Propositions 2 and 3. On the other hand, we observe an interesting divergence between market and book leverage variables that it is interesting to discuss briefly.

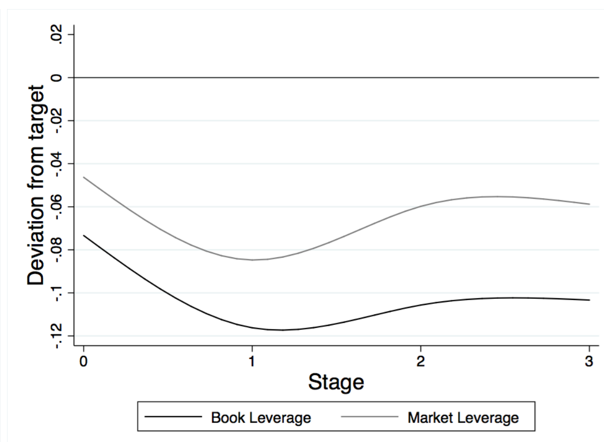
In the case of book variable, the median deviation varies from -11.6% to -10.6% from the Stage 1 to 2. This difference is statistically but non-economically significant. At the Stage 2 and 3, the difference neither economically nor statistically significant whose Wilcoxon-Mann-Whitney test has a z-score of -0.269. When we use the market variable, this difference is less smooth. At first sight, the almost 2.6pp-decrease in the deviation from Stages 1 to 3 might suggest a target pursuit movement. However, we interpret this decrease as the market incorporation of value generated by R&D projects. It is important to mention, though, that this "pricing" adjustment is incomplete due to asymmetric information related to these projects.

The same divergence between market and book measures occurs at Stage 1 in WC investment period. At first sight, we are not able to affirm that the deviation from target neither rejects nor supports our Proposition 1. However, it seems that managers take the opportunity at which the adjustment costs are sunk and choose the financing source in a way to adjust their capital structure toward firms' target.

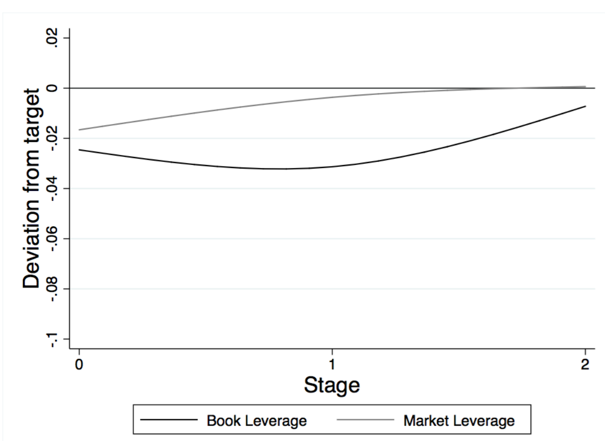
Figure 2: Deviation from Target



(a) Capital Expenditure



(b) Research and Development



(c) Working Capital

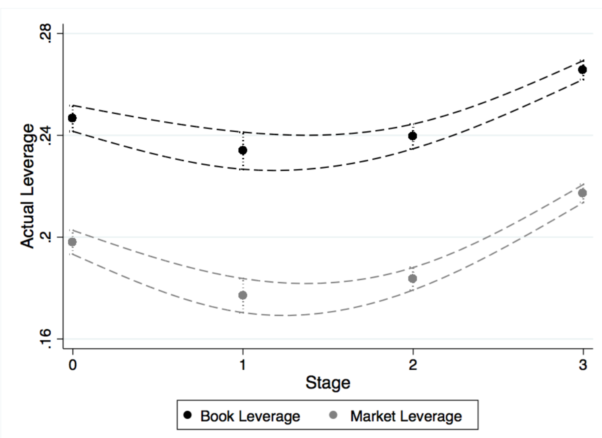
Figure 3 shows the evolution of both actual and target leverage over the stages. In the left column, we observe firms' actual leverage during the investment period of the categories while, in the right column, we present the evolution of firms' target leverage along the stages. The scatters represent the mean leverage and the dash lines, the 95% interval confidence.

Figures 3a and 3b refer to the CAPEX. Regarding to the actual leverage, we observe a decrease of almost 1.3pp (2.0pp) in its mean at the Stage 1, from 24.7% (19.8%) to 23.4% (17.7%). This decrease is subtle but significant as its t-test is 2.77 (4.95). And from the intermediary stage on, firms actively increase their book (market) leverage in almost 4pp reaching 26.6% (21.7%) in the end of investment period. On the other hand, the evolution of the target leverage over the stages shows that the target increases after the beginning of the project and stays flat, suggesting to be the firm's new target level. In both cases, we evidence a subtle increase of almost 1pp, suggesting that, on one side, growth opportunities are becoming assets-in-place and increasing asset pledgeability (Dudley, 2012) and, on the other one, the project is generating positive cash flow what decreases asymmetry with the market and the uncertainty regarding to the project, enabling debt contract. Jointly, these evidence with the decreasing deviation in the Figure 2a support our Proposition 1.

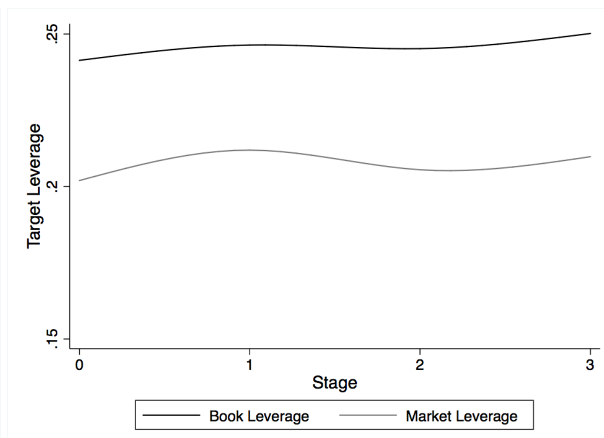
The actual leverage (Figure 3c) during R&D project contrasts with CAPEX: leverage decreases during the entire investment period. At the Stage 0, book (market) leverage is 20.5% (15.3%) and at the last one, 18.4% (12.4%). The differences between Stage 0 and all other stages are statistically and economically significant, that is, at the end of investment period, the firms are more leveraged than they were in the precedent year of the period. The differences between Stages 1 and 2 and between Stages 2 and 3 have no statistical significance, regardless the leverage variable we use. Regarding to the target leverage (Figure 3d), we observe a spike at Stage 1 that possibly refers to a mechanical increase on assets, consequence of an equity issuance. After this stage, the target leverage declines because of the low-pledgeability of new assets. These evidence and the behavior observed in Figure 2b reinforce our Propositions 2 and 3.

The bottom figures (Figures 3e and 3f) show the evolution of actual and target leverages during working capital projects. The results are consistent with the active target behavior evidenced in Figure 2c. During the investment period, the initial book (market) leverage is 27.5% (22.4%). At Stage 1, it decreases 2.2pp (1.9p) to 25.3% (20.5%). And, in the end of the period, the leverage rises to 28% (23%). These results are consistent with the financing behavior of Proposition 1. Moreover, they are supportive to Chiou et al. (2006), Baños-Caballero et al. (2010) and Hill et al. (2010) results as it suggests that managers prefer internal equity rather than debt to finance large working capital projects.

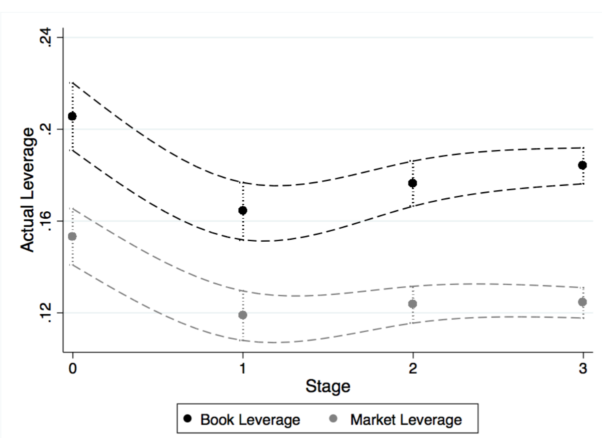
Figure 3: Actual Leverage and Target Leverage



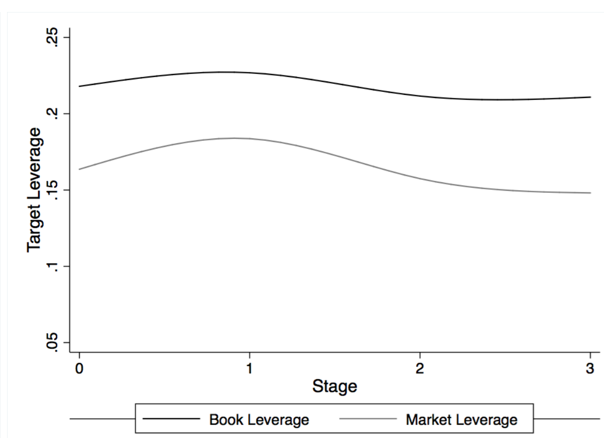
(a) Capital Expenditure



(b) Capital Expenditure

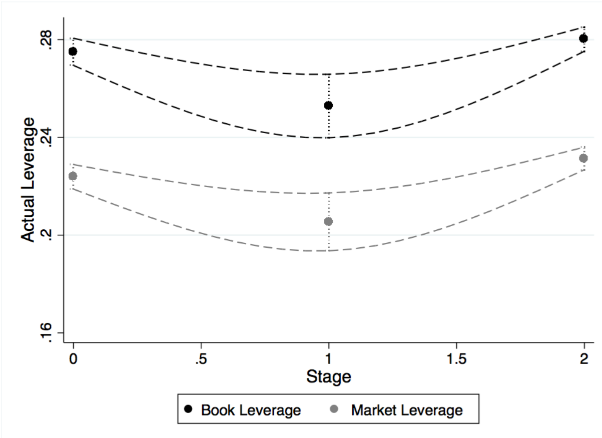


(c) Research and Development

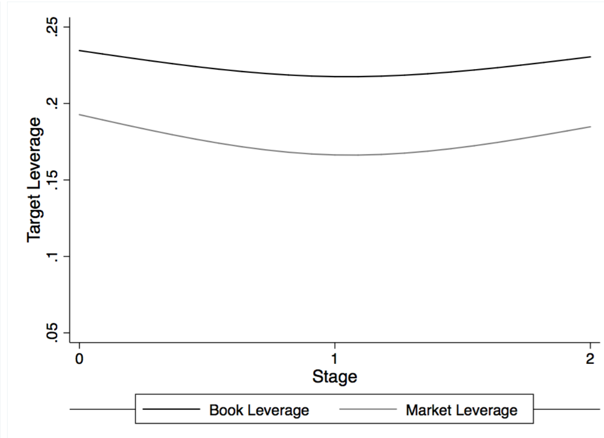


(d) Research and Development

Figure 3: Actual Leverage and Target Leverage (cont.)



(e) Working Capital



(f) Working Capital

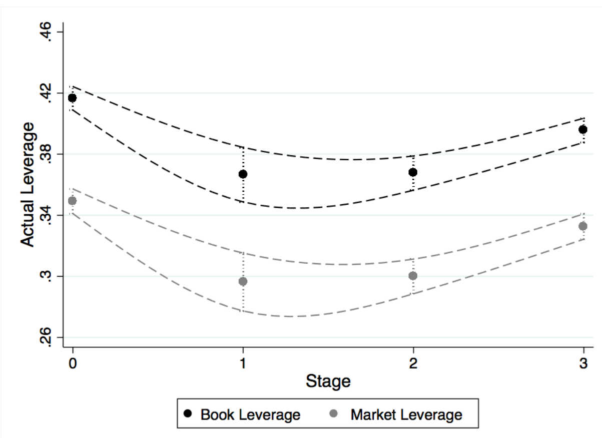
4.1.1 Overlevered Firms - CAPEX and R&D Cases

Facing the capital structure behavior that we evidence in the CAPEX and R&D investment periods, one could justify the behavior using inertia hypothesis: the firm being underlevered at Stage 0 means an *a priori* preference for (internal or external) equity; and, therefore, during an investment period of both natures, managers choose the usual source to finance them, maintaining their underlevered status. To test this hypothesis, we split our samples into subsets, imposing the firm to be overlevered at Stage 0 for both cases.

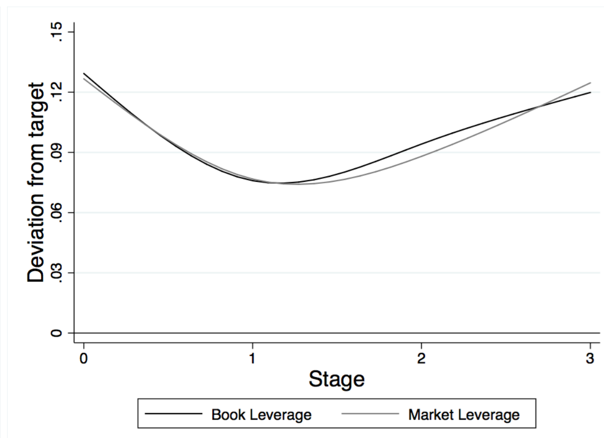
Our results presented in the Figure 4 reject this alternative explanation. In the case of CAPEX, we note a change in firms' leverage from Stage 0 to 1: these firms are substantially overlevered at Stage 0, regardless the leverage measure we use and, at Stage 1, as the investment begins, the deviation decreases. And from Stage 2, firms increase their leverage, increasing their overlevered condition. The U-shaped slope observed in the actual leverage evidence that, at initial stages, equity is indeed their primary financing source. The same slope is observed in Figure 4a, reinforcing the active equity financing in early stages of CAPEX investment and a change of sourcing in late ones.

In the R&D instance, the results suggest that the equity is, in fact, their main financing source during this period, evidenced by a substantial and significant decrease of more than 5pp in their leverage and, consequently, a reduction in their deviation from target of almost 5pp. We, however, find neither the leverage nor the deviation in a monotonic decrease, as expected, because intensive-R&D firms are mostly underlevered and imposing an extreme state of nature at Stage 0 for the, may select few observation and firms whose financing behavior are not generalizable. In fact, the status at Stage 1 are comprised by only 72 observation. .

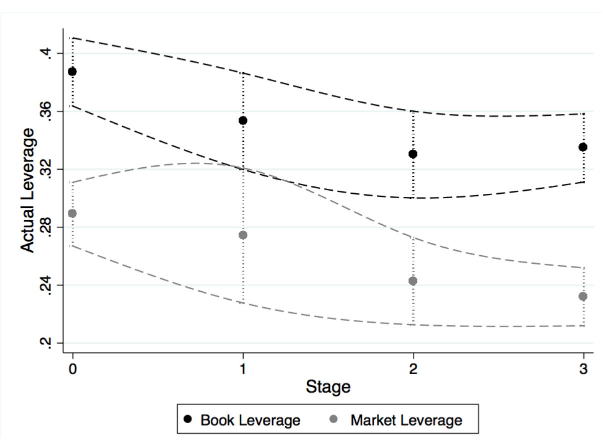
Figure 4: Financing Behavior in Overlevered Firms



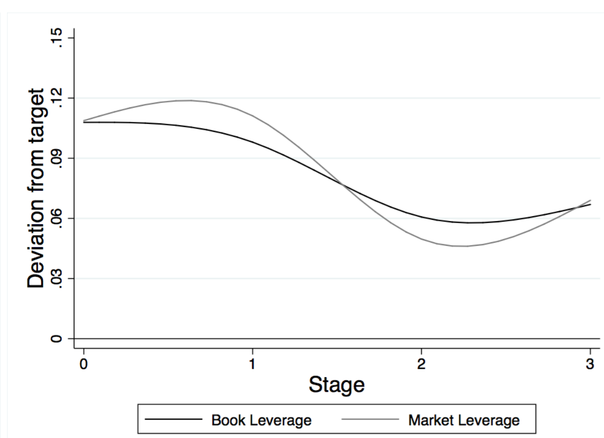
(a) Capital Expenditure



(b) Capital Expenditure



(c) Research and Development

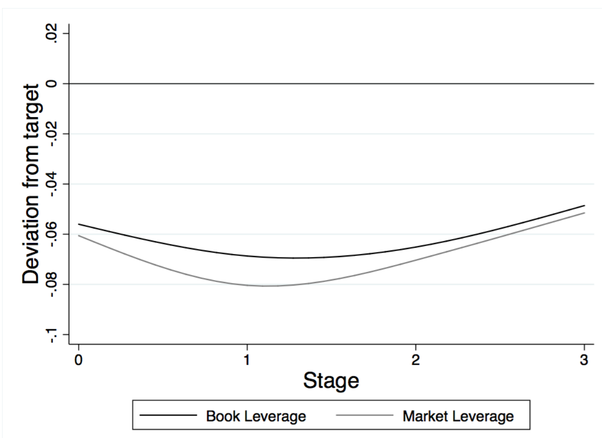


(d) Research and Development

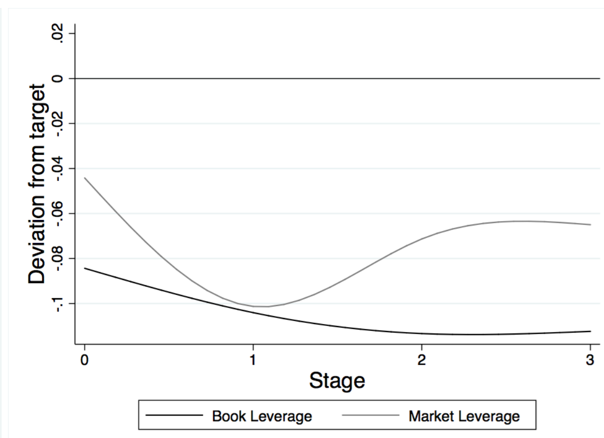
4.1.2 Serial Investors

Besides the inertia hypothesis, one could justify our results raising another one: one-off hypothesis. That is, neither the target behavior nor the financing source switching would exist if a serial investors undergo projects due to reputation effect. These type of firms usually has easier and cheaper access to capital markets so the investment nature would interfere less in debt contract. In order to test this other hypothesis, we split our sample into subsets, imposing the firms to undertake at least three projects in the sample period. For brevity, Figure 5 presents the just the deviation from target, but the financing source is textually discussed.

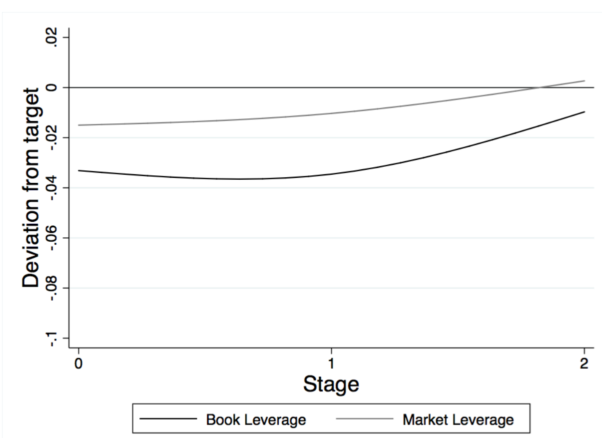
Figure 5: Financing Behavior in Serial Investors Firms



(a) Capital Expenditure



(b) Research and Development



(c) Working Capital

All the results rejects the one-off hypothesis. In the case of CAPEX, at Stage 0, firms have a median book (market) deviation of -5.60% (-6.06%). At the first stage, the deviation increases to -6.87% (8.04%) and decreases to -6.51% (-7.04%) at the subsequent stage. In the final stage, then, the deviation decreases even more: -4.86% (-5.15%). Analyzing the mean leverage, from Stage 0 to 1, it decreases 1.5% (2.0%) from 23.5% (19.04%) to 22% (17%) From Stage 1 to 2, this level is virtually maintained and, at the final stage, it increases to 24.7% (20.4%).

In the case of R&D, the Figure 5b is similar to Figure 2b. The deviation decreases as the project evolves. The market one present divergent slope due to market incorporation of the project value to the firm's. This is reinforced observing the mean leverage: from Stage 0 to 1, it decreases 3.4% (4.6%) from 20% (14.9%) to 16.6% (10.3%) From Stage 1 to 2, we evidence an non-significant increase of 1.5% (2%) whose t-test is -0.90 (-1.53). At the last stage, the leverage is the same.

Last but not least, serial investor of working capital investment behaves similarly to the average, adjusting their capital structure at the end of the period. Their leverage is 26.1% (21.5%) at Stage 0 and it decreases to 24.3% (19.4%) at Stage 1. In the Stage 2, it reaches 27.1% (22.7%).

4.2 Capital Structure Behavior During Stages

In this subsection, we explore the explanatory capacity of the corporate finance theories (Trade-off, Pecking Order and Market Timing) to explain the financing behavior during a large investment. According to Pecking Order Theory, firms have a financing preference for internal resources and debt; if the need is not fulfilled by these two sources, firms issue equity. Therefore, if firms behave according to this theory during the investment periods, the change in the leverage should be completely explained by the financial deficit (net equity issuance plus net debt issuance, scaled by total assets) (Shyam-Sunder and Myers, 1999, Dudley, 2012, Frank and Goyal, 2003).

If managers behave according to Market Timing (Baker and Wurgler, 2002) during investment period, we should observe that, as the share price rises, the managers would prefer to issue equity instead of debt. In order to analyze this behavior, we follow Kayhan and Titman (2007) and Dudley (2012) and include an interaction variable of FD and Q. This variable captures the effect of the market value on the financial deficit. If managers indeed time the market in order to take advantage of high share prices, we would see a negative and significant coefficient on this variable during the stages.

We also include two variables to capture the adherence of the capital structure decisions to Trade-off theory: $Deviation_{t-1}$ and $\Delta Target$. This theory predicts the deviation from target to be negatively related to the change in leverage during non-investment period, intensifying during the investment period. So, if firms make financing decisions to close the gap between target and actual leverage, the coefficient of $Deviation_{t-1}$ should be negative and $\Delta Target$, positive. Equation 2 presents our final specification:

$$\begin{aligned}\Delta \hat{Lev}_{i,t} = \alpha_i + \beta_1 FD_i, t + \beta_2 Deviation_{t-1} + \beta_3 \Delta Target + \beta_4 Ret_{t-1} + \beta_5 Q_{t-1} \\ + \beta_6 FD \times Q_{t-1} + \beta_7 Prof_{t-1} + \theta_1 Stages_n + \theta_2 Stages_n \times FD \\ + \theta_3 Stages_n \times Deviation_{t-1} + \theta_4 Stages_n \times FD \times Q_{t-1} \quad (2)\end{aligned}$$

where $\theta Stages_n$ represents a vector of dummy variables that refer to the project's stage of each type of investment.

To facilitate the presentation of the results, we split Table 4 into two subtables (4(a) and 4(b)) to facilitate the reading. We present the results regarding to non-investment period in Table 4(a). Consistent with Dudley (2012), the financial deficit presents coefficient far from the predicted by Pecking Order, varying from 35.4% to 39.3%, being an evidence that debt is not the sole financing choice. The negative coefficient on $Deviation_{t-1}$ and the positive coefficient on $\Delta Target$ are evidence that the changes in the actual leverage, at non- investment periods, are related to the pursuit of a target leverage. Finally, the negative coefficient on the interaction variable $FD_{i,t} \times Q_{t-1}$ indicates that, at non-investment periods, changes in leverage are negatively related to high shares prices, even when we use book leverage, rejecting the mechanical explanation for the relationship, which suggests that managers take into account the market to issue equity when share prices are high. Overall, the results indicate that no corporate finance theory solely is able to explain firms' financing decisions, at non-investment periods.

Table 4(a): Financing Theories - Effect of Stages - Non-investment Period

	CAPEX		R&D		Working Capital	
Variables	$\Delta MarketLev$	$\Delta BookLev$	$\Delta MarketLev$	$\Delta BookLev$	$\Delta MarketLev$	$\Delta BookLev$
$FD_{i,t}$	0.393***	0.374***	0.354***	0.361***	0.394***	0.373***
	(0.015)	(0.020)	(0.013)	(0.016)	(0.018)	(0.023)
$Deviation_{t-1}$	-0.361***	-0.310***	-0.378***	-0.328***	-0.368***	-0.315***
	(0.011)	(0.008)	(0.012)	(0.008)	(0.014)	(0.009)
$\Delta Target$	0.580***	0.525***	0.583***	0.503***	0.620***	0.513***
	(0.023)	(0.032)	(0.024)	(0.032)	(0.029)	(0.037)
Ret_{t-1}	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Q_{t-1}	0.007***	-0.002**	0.008***	-0.000	0.008***	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$FD_{i,t} \times Q_{t-1}$	-0.094***	-0.053***	-0.075***	-0.046***	-0.092***	-0.047***
	(0.008)	(0.013)	(0.006)	(0.010)	(0.010)	(0.015)
$Prof_{t-1}$	0.070***	0.066***	0.070***	0.054***	0.072***	0.059***
	(0.009)	(0.010)	(0.008)	(0.009)	(0.010)	(0.011)

All variables are defined in Table 2. The coefficients are estimated using an OLS regression. Data are taken from COMPUSTAT. In the parentheses, we present the robust standard errors. ***, ** and * represent the statistical significance levels at one percent, five percent, and ten percent, respectively.

Table 4(b) presents the results during the investment periods. During the CAPEX projects, the coefficients support our Proposition 1 and the capital structure behavior evidenced by Figures 2a and 3a. At Stages 0, 1 and 2, we observe the negative sign of financial deficit, but significant coefficient just in market leverage. At Stage 3, FD changes to a positive sign, suggesting the increase in the use of debt. We interpret these coefficients as evidence that, during initial stages, the non-feasibility of a debt contract and a need for substantial amount of resources makes firms resort to equity. For instance, at Stage 2, the coefficients are interpreted as an increase of equity of 4.8% (10.4%). At the last stage, consistent with our theoretical model, the use of debt increases to a level at least similar to the non-investment period, consistent with the U-shaped slope in Figure 2a. Regarding Market Timing variable, no coefficient shows consistence in its signs and significance at any stages, implying that we are not able to affirm that managers time the market during investment periods more intensively than they do at non-investment period. This lack of evidence reinforces our identification: the use of equity in the initial stages is not a response to high share prices but a temporary non-feasibility of the debt contract. The coefficients of $Deviation_{t-1}$ evidenced at Stages 0 may be capturing a sudden change in the leverage, with neither theoretical importance nor a economic significance.

In the case of R&D, our results are consistent with the financing behavior already evidenced in Figures 2b and 3b and with our Propositions 2 and 3. The negative coefficient of FD at the preceding year of investment period denotes an active and intensive use equity in a significant magnitude. In the case of book leverage, the coefficient is enough to almost eliminate the effect of leverage at this stage. It is important to mention, though, that the lack of significance of almost all variables that we include to capture the adherence of financing decisions to capital structure theories does not allow us to affirm that R&D firms does not follow any of them. In fact, the results, so far, suggest that intangible-intensive firms do not seem: (1) to adjust their capture structure when adjustment costs are marginal, (2) to follow the hierarchical financing preference predicted by POH and (3) to time the market to issue equity when share prices are high. However, the Trade-off Theory predicts that, as growth increases the costs of financial distress and exacerbates the asset substitution problem (Frank and Goyal, 2009), investments on growth, as R&D, should be financed with equity. By this perspective, the leverage behavior observed in the last subsection is consistent with Trade-Off Theory.

Finally, the coefficients related to working capital are supportive to our prior evidence that non debt source is preferred to finance this type of investment. Albeit our financing deficit coefficients are not consistently significant, their negative signs support the behavior evidenced in Figure 3e. Moreover, the significance of $Deviation_{t-1}$ at Stage 2 supports what we observe graphically in Figure 2c: firms choose the financing source in order to decrease the gap between actual leverage and target. Overall, the results corroborates the graphical analysis reported in the prior subsection.

Table 4(b): Financing Theories - Effect of Stages - Investment Period

	CAPEX		R&D		Working Capital	
Variables	$\Delta MarketLev$	$\Delta BookLev$	$\Delta MarketLev$	$\Delta BookLev$	$\Delta MarketLev$	$\Delta BookLev$
Stage 0	-0.025***	-0.018***	-0.007*	-0.008*	-0.012***	-0.007***
	(0.001)	(0.001)	(0.004)	(0.005)	(0.001)	(0.002)
$\times FD_{i,t}$	-0.056	-0.007	-0.091	-0.205**	-0.048	-0.033
	(0.038)	(0.051)	(0.070)	(0.093)	(0.038)	(0.042)
$\times FD_{i,t} \times Q_{t-1}$	0.012	-0.015	0.013	0.041	0.015	0.006
	(0.016)	(0.026)	(0.019)	(0.031)	(0.018)	(0.023)
$\times Deviation_{t-1}$	-0.037**	-0.025**	-0.010	-0.054	-0.034**	-0.018
	(0.015)	(0.012)	(0.033)	(0.039)	(0.014)	(0.012)
Stage 1	-0.029***	-0.020***	-0.010**	-0.010**	-0.001	0.001
	(0.003)	(0.003)	(0.004)	(0.005)	(0.004)	(0.004)
$\times FD_{i,t}$	-0.119**	-0.053	-0.041	-0.204*	-0.102	-0.090
	(0.050)	(0.067)	(0.074)	(0.120)	(0.079)	(0.093)
$\times FD_{i,t} \times Q_{t-1}$	0.030	-0.006	0.017	0.054	0.040	0.026
	(0.020)	(0.035)	(0.020)	(0.033)	(0.032)	(0.047)
$\times Deviation_{t-1}$	-0.063***	-0.028	-0.038	0.010	-0.047	-0.066
	(0.023)	(0.023)	(0.037)	(0.034)	(0.050)	(0.042)
Stage 2	-0.022***	-0.018***	-0.012***	-0.010***	0.005***	0.007***
	(0.002)	(0.002)	(0.003)	(0.004)	(0.001)	(0.002)
$\times FD_{i,t}$	-0.104***	-0.048	-0.045	-0.022	-0.120***	-0.047
	(0.033)	(0.035)	(0.043)	(0.058)	(0.038)	(0.050)
$\times FD_{i,t} \times Q_{t-1}$	0.024**	0.001	0.008	-0.023	0.039**	-0.004
	(0.011)	(0.015)	(0.013)	(0.014)	(0.015)	(0.025)
$\times Deviation_{t-1}$	-0.003	-0.012	-0.059*	-0.007	-0.046***	-0.061***
	(0.016)	(0.012)	(0.030)	(0.024)	(0.014)	(0.013)
Stage 3	-0.007***	-0.006***	-0.009***	-0.009***		
	(0.001)	(0.001)	(0.003)	(0.003)		
$\times FD_{i,t}$	0.015	0.081***	-0.044	-0.044		
	(0.022)	(0.030)	(0.035)	(0.040)		
$\times FD_{i,t} \times Q_{t-1}$	0.005	-0.050***	0.001	-0.011		
	(0.009)	(0.015)	(0.012)	(0.012)		
$\times Deviation_{t-1}$	0.016	-0.018*	-0.040	-0.036		
	(0.011)	(0.010)	(0.033)	(0.024)		
Firm fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	60,736	60,835	53,284	53,379	44,439	44,511
R-squared	0.362	0.330	0.373	0.338	0.388	0.361

All variables are defined in Table 2. The coefficients are estimated using an OLS regression. Data are taken from COMPUSTAT. In the parentheses, we present the robust standard errors. ***, ** and * represent the statistical significance levels at one percent, five percent, and ten percent, respectively.

4.3 Financial Deficit Under Financial Constraints

The effect of financial constraints on financing decisions has been scrutinized for the last 30 years. Many papers provide evidence that financial constrained firms behave differently from unconstrained ones (Korajczyk and Levy, 2003, Faulkender et al., 2012, Dudley, 2012). In order to analyze the effect of financial constraints during different types of projects, we split the sample based on credit rating. The use of having or not credit rating as a financial constraints measure has been extensive in literature. Faulkender and Wang (2006) state that unrated firms have no access to capital markets, where interest rates are more competitive, and, therefore, have to raise external resources through expensive contracts with financial intermediaries.

As the table is lengthy, we proceed in the same way as in Table 4. Tables 5(a) and 5(b) report the effect of financial constraints on financing decisions for CAPEX, R&D and working capital throughout non-investment and investment periods, respectively. During the former, our results are consistent with literature. First, we sow that financially unconstrained firms are likely to use significantly more leverage to finance their activities, since the coefficient of FD is significantly greater for unconstrained firms. Moreover, these firms have a greater sensibility to deviations from target and to changes in target, captured by $Deviation$ and $\Delta Target$. Also, the higher coefficient of $FD \times Q$ for unconstrained indicates that constrained firms have a greater difficulty to issue equity, even when share prices are high. As we state in the previous subsections, the financing behavior of our sample firms cannot be solely explained by a singular capital structure theory.

Overall, the results in Table 5(b) reinforce our proposition, evidencing that investment nature affect how financing decisions are made during the period even under financial constraints. In the case of CAPEX, at the initial stages of investment period, the financing deficit decreases the explanation power over the leverage change for constrained firms. This suggests that, as the investment starts, the uncertainty over projects increases, hampering borrowing capacity of financially constrained firms that, during non-investment period, already face difficulties to raise external non-equity resources. This fact makes necessary the increase of alternative financing rather than debt. The raising capacity and the consequent raised amount, though, are smaller even their investment projects (median) being equal or greater than the unconstrained ones, as we observe in Table 5(c). At the last stage, the investment increase seems to smooth the financial constraints as they raise debt enough to reach leverage from the non-investment period. In fact, according to our theoretical novel, the CAPEX projects have already broken-even and the marginal pledgeable income can support new financing contracts. We refer to marginal pledgeable income as the additional one to that originated at non-investment period.

Table 5(a): Effects of Financial Constraints - Financing Theories - Non-investment Period

	CAPEX		R&D		Working Capital	
	Constrained	Unconstrained	Constrained	Unconstrained	Constrained	Unconstrained
$FD_{i,t}$	0.371***	0.446***	0.336***	0.409***	0.387***	0.413***
	(0.016)	(0.026)	(0.014)	(0.025)	(0.021)	(0.030)
$Deviation_{t-1}$	-0.386***	-0.407***	-0.402***	-0.424***	-0.394***	-0.414***
	(0.014)	(0.018)	(0.016)	(0.019)	(0.019)	(0.021)
$\Delta Target$	0.547***	0.693***	0.555***	0.720***	0.579***	0.732***
	(0.025)	(0.057)	(0.027)	(0.063)	(0.033)	(0.070)
Ret_{t-1}	-0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Q_{t-1}	0.009***	0.006***	0.010***	0.005***	0.009***	0.006**
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)
$FD_{i,t} \times Q_{t-1}$	-0.088***	-0.121***	-0.071***	-0.101***	-0.094***	-0.102***
	(0.007)	(0.014)	(0.007)	(0.013)	(0.009)	(0.015)
$Prof_{t-1}$	0.056***	0.086***	0.057***	0.105***	0.056***	0.094***
	(0.009)	(0.023)	(0.009)	(0.024)	(0.011)	(0.025)

All variables are defined in Table 2. The coefficients are estimated using an OLS regression where the dependent variable is the change in market leverage. Data are taken from COMPUSTAT. In the parentheses, we present the robust standard errors. ***, ** and * represent the statistical significance levels at one percent, five percent, and ten percent, respectively.

For unconstrained firms, the CAPEX nature seems to influence the financing sources similarly to the constrained firms. Our results suggest that the both groups differs in in the raising capacity, the price share dependence and the target pursuit behavior. Firstly, the lower sensitivity to financial deficit and price share suggest, as expected, that unconstrained firms have an easier and cheaper access to external resources and less dependence to high price share to issue equity. Moreover, the significant and negative coefficient for *Deviation* at Stage 2 show that these firms strive to anticipate the adjustment toward the target, consistent with Trade-off Theory.

In the case of R&D projects, the results suggest an homogeneous financing behavior across both groups and that the main difference relates to the share price dependence. That is, similar to unconstrained firms that undertake large CAPEX projects, unconstrained R&D firms seem to be less sensitive to high share price to finance their investment with equity, even though the invested amount is substantially relatively greater for constrained firms. The difference in R&D investment between constrained and unconstrained firms is greater than 10%, according to Table 5(c). In the two most-right columns, we observe the financial constraints effects in working capital projects. As expected, the results suggest that financially constrained firms tend to use more equity than unconstrained firms.

Table 5(b): Effects of Financial Constraints - Financing Theories - Investment Period

	CAPEX		R&D		Working Capital	
	Constrained	Unconstrained	Constrained	Unconstrained	Constrained	Unconstrained
Stage 0	-0.023***	-0.032***	-0.004	-0.010	-0.015***	-0.002
	(0.002)	(0.003)	(0.004)	(0.011)	(0.002)	(0.003)
$\times FD_{i,t}$	-0.058	-0.134	-0.105	-0.041	-0.086*	0.041
	(0.039)	(0.106)	(0.074)	(0.159)	(0.044)	(0.070)
$\times FD_{i,t} \times Q_{t-1}$	0.009	0.063	0.018	-0.021	0.025	-0.014
	(0.017)	(0.047)	(0.019)	(0.066)	(0.019)	(0.035)
$\times Deviation_{t-1}$	-0.034*	-0.057***	0.009	-0.041	-0.044***	0.004
	(0.019)	(0.021)	(0.039)	(0.063)	(0.016)	(0.023)
Stage 1	-0.030***	-0.039***	-0.006	-0.016	-0.002	0.010
	(0.003)	(0.006)	(0.005)	(0.010)	(0.004)	(0.011)
$\times FD_{i,t}$	-0.112*	-0.144*	-0.033	-0.183	-0.188**	0.000
	(0.060)	(0.082)	(0.070)	(0.171)	(0.086)	(0.157)
$\times FD_{i,t} \times Q_{t-1}$	0.012	0.044	0.007	0.131**	0.063*	0.018
	(0.020)	(0.035)	(0.017)	(0.066)	(0.034)	(0.059)
$\times Deviation_{t-1}$	-0.089***	-0.070**	-0.020	-0.056	-0.064	0.104
	(0.030)	(0.032)	(0.048)	(0.056)	(0.048)	(0.121)
Stage 2	-0.019***	-0.037***	-0.008**	-0.009	0.005***	0.004
	(0.002)	(0.004)	(0.003)	(0.008)	(0.002)	(0.003)
$\times FD_{i,t}$	-0.089**	-0.129**	-0.097**	0.128	-0.108***	-0.096
	(0.039)	(0.052)	(0.043)	(0.086)	(0.040)	(0.087)
$\times FD_{i,t} \times Q_{t-1}$	0.017	0.038*	0.015	-0.010	0.038**	0.028
	(0.012)	(0.021)	(0.013)	(0.030)	(0.017)	(0.031)
$\times Deviation_{t-1}$	-0.001	-0.057**	-0.040	-0.032	-0.026	-0.075***
	(0.020)	(0.024)	(0.034)	(0.055)	(0.017)	(0.029)
Stage 3	-0.006***	-0.012***	-0.005*	-0.014*		
	(0.002)	(0.003)	(0.003)	(0.008)		
$\times FD_{i,t}$	0.021	-0.059	-0.045	-0.116		
	(0.025)	(0.042)	(0.038)	(0.081)		
$\times FD_{i,t} \times Q_{t-1}$	-0.003	0.049***	-0.001	0.069***		
	(0.009)	(0.019)	(0.012)	(0.025)		
$\times Deviation_{t-1}$	0.010	0.020	-0.035	-0.064		
	(0.013)	(0.019)	(0.043)	(0.049)		
Year fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	43,169	17,416	37,893	15,262	30,836	13,490
R-squared	0.387	0.464	0.396	0.485	0.418	0.487

All variables are defined in Table 2. The coefficients are estimated using an OLS regression where the dependent variable is the change in market leverage. Data are taken from COMPUSTAT. In the parentheses, we present the robust standard errors. ***, ** and * represent the statistical significance levels at one percent, five percent, and ten percent, respectively.

The significant coefficients of FD at Stages 1 and 2 suggest that constrained firms issue equity to finance a large working capital investment, regardless whether the shares prices are high or low. On the other hand, unconstrained firms seem to have financial flexibility to use other financing source, such as internal equity consistent with our prior results and literature.

Table 5(c): Median of Investment Level - Constrained versus Unconstrained Firms

	CAPEX			R&D			Working Capital		
	Constrained	Unconstrained	C-U	Constrained	Unconstrained	C-U	Constrained	Unconstrained	C-U
Stage 1	0.129	0.118	0.012***	0.149	0.056	0.093***	0.074	0.060	0.013***
Stage 2	0.122	0.119	0.001	0.165	0.049	0.116***	0.073	0.058	0.015***
Stage 3	0.106	0.108	0.002***	0.166	0.055	0.111***			

All variables are defined in Table 2. Data are taken from COMPUSTAT. The columns 4, 7 and 10 represent the difference between constrained and unconstrained firms. The significance are estimated using Wilcoxon-Mann-Whitney rank test. ***, ** and * represent the statistical significance levels at one percent, five percent, and ten percent, respectively.

4.4 Financing Sources

In this subsection, we analyze the financing sources during the investment stages. While our general proposition predicts that during initial stages firms uses equity and, as the project evolves, it is replaced by debt, the R&D propositions affirm that just equity is used to finance this type of investment. Besides that, corporate finance theories also predict a financing sequence: while Pecking Order hypothesis predicts preference for debt issuance instead of equity, Trade-off Theory predicts that firms tend to issue equity before debt during an investment period. The latter theory is consistent with Hovakimian et al. (2001), that recognizes that firms tend to use more debt to finance assets-in-place and more equity to finance growth.

To test these sequencing hypotheses, we use logistic regressions where the dependent variables assume 1 if the firm issues debt and 0 if equity is issued. We consider a security issuance if the amount issued is equal or greater than 5% of the total asset in the beginning of the year. Following the procedures of Hovakimian et al. (2001), Hovakimian et al. (2004) and Dudley (2012), we exclude firm-years observations where we observe dual issuances or neither equity nor debt is issued. As control variables, we include Korajczyk and Levy's (2003) macroeconomics variables that may affect issuance decisions. Table 6 reports results of the determinants of security issuance. We include years fixed-effects and omit the constant, in order to facilitate the interpretation of the coefficients.

Table 6: Security Issuance

	CAPEX		R&D		Working Capital	
	$Debt = 1$; $Equity = 0$		$Debt = 1$; $Equity = 0$		$Debt = 1$; $Equity = 0$	
Stages		0.407***		-0.209***		-0.045
		(0.040)		(0.074)		(0.047)
Stage 0	-0.206***		-0.212**		-0.126**	
	(0.052)		(0.107)		(0.054)	
Stage 1	0.063		-0.262**		-0.256**	
	(0.068)		(0.103)		(0.109)	
Stage 2	0.116**		-0.238***		-0.055	
	(0.048)		(0.076)		(0.048)	
Stage 3	0.343***		-0.167**			
	(0.039)		(0.070)			
$Q_{i,t-1}$	-0.196***	-0.197***	-0.170***	-0.180***	-0.169***	-0.171***
	(0.020)	(0.020)	(0.022)	(0.022)	(0.028)	(0.028)
$Profit_{i,t-1}$	2.670***	2.654***	2.405***	2.444***	2.719***	2.760***
	(0.180)	(0.178)	(0.177)	(0.177)	(0.224)	(0.225)
$Depr_{i,t-1}$	-0.926*	-1.110**	-1.593**	-1.639**	-1.655**	-1.635**
	(0.524)	(0.508)	(0.666)	(0.666)	(0.725)	(0.726)
$SES_{i,t-1}$	0.001*	0.001	0.006	0.004	0.003	0.002
	(0.001)	(0.001)	(0.016)	(0.016)	(0.022)	(0.022)
$Pre1986Tax$	0.202	0.265	0.770	0.764	0.807	0.788
	(0.752)	(0.776)	(0.916)	(0.917)	(0.908)	(0.908)
$TermSpread_{t-1}$	0.156	0.182	-0.069	-0.047	0.005	0.018
	(0.548)	(0.545)	(0.568)	(0.564)	(0.642)	(0.646)
$DefaultSpread_{t-1}$	0.133	0.140	0.015	0.009	0.038	0.031
	(0.153)	(0.151)	(0.163)	(0.164)	(0.190)	(0.191)
$CRSPVWReturn_{t-1}$	2.643	2.533	3.853**	3.816**	3.393	3.358
	(1.766)	(1.755)	(1.844)	(1.845)	(2.089)	(2.082)
Deviation	2.136***	2.153***	1.880***	1.910***	1.779***	1.783***
	(0.117)	(0.117)	(0.120)	(0.119)	(0.131)	(0.131)
Year fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,220	11,220	7,905	7,905	6,707	6,707

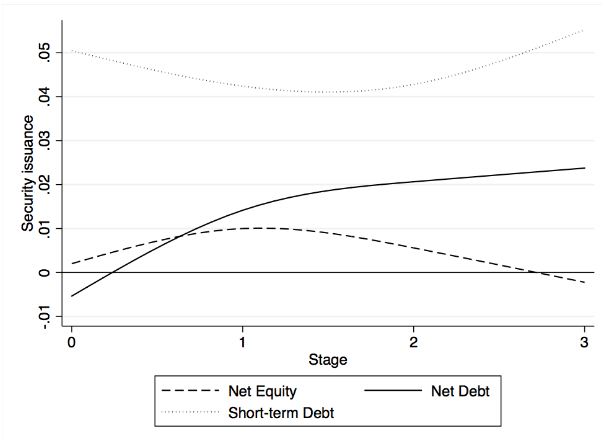
The coefficients are estimated using a logistic regression. Data are taken from COMPUSTAT. Pre-1986 Tax is a dummy which assumes 1 for years prior to 1987 and 0, otherwise. Term Spread is the difference between the long-term and short-term Treasury-bill rates . Default Spread is the is the difference between an average yield on Baa less Aaa Moody's rated bonds. CRSP VW Return is th three-month CRSP value-weighted equity market return. In the parentheses, we present the robust standard errors. ***, ** and * represent the statistical significance levels at one percent, five percent, and ten percent, respectively.

Using an aggregated investment measure, Dudley (2012) finds that, as the project evolves, the probability of a debt issuance increases, showing a preference for debt in the later stages. Our results presented in the third, fifth and seventh columns of Table 6 cast doubts on the generalization of his results: the coefficients of *Stages* show that Dudley's conclusion is only valid for CAPEX projects. The variable *Stages* refers to the percentage evolution of the project and is defined as the investment year divided by the total length of the project. In fact, the results presented on the second and third columns confirm the aforementioned evidence: firms are more likely to issue equity during the initial stages, while debt issuance is more likely to occur at the final stages of CAPEX projects. The debt issuance probability increases 0.41% with the execution of 1% of the project. This evidence is consistent with our first proposition. Figure 6a confirms the financing behavior captured by the coefficients: at Stage 0, firms retire debt substantially, explaining why firms are considerably underlevered at Stage 0. In the subsequent stage, firms issue equity (1% of total assets) and debt (1.4% of total assets) at almost the same level. In this sense, the leverage reduction evidenced in Figures 3a and temporary increase in underlevered condition is due to a proportional decrease in short-term debt as a lengthening debt maturity strategy. In fact, the dot line in Figure 6a shows that firms reduce the short-term debt in 0.081% of total assets in Stage 1. From the second stage on, long-term debt is issued at the level of 2.4% while short-term debt increases almost 1.3% of total assets.

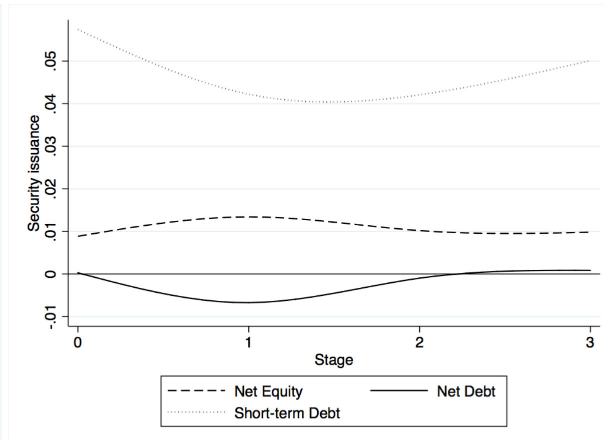
Consistent with our propositions, the coefficients of *Stages* in the R&D case suggest that equity is the primary financing source for this type of project. Coherently, Figure 6b evidences that firms retire debt aggressively at Stage 1 and issue equity during the entire investment period. The execution of 1% of the R&D project increases 0.21% the probability of a debt retirement and/or use of equity.

Finally, in the case of working capital, the results in Table 6 suggest that firms are likely to either retire debt or issue equity to finance at the initial stages. In fact, deepen this analysis using the issuance behavior presented in Figure 7a, at Stage 1, our results suggest that firms issue equity (0.7%) to retire debt (-0.5%). This explain the leverage reduction and the increase in deviation from target presented in Figures 2c nd 3e, respectively. At Stage 2, debt (short-term plus long-term) increases 0.05%. In this perspective, firms would finance the working capital investment, initially, using internal resources and, as the project evolves, firms increase leverage in accordance to Trade-off Theory. These results are consistent with literature and our general proposition.

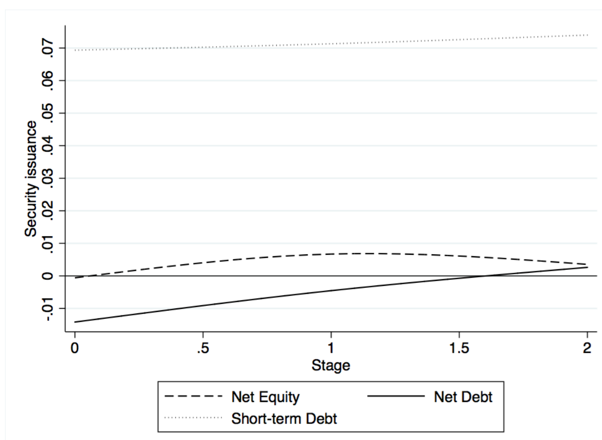
Figure 6: Security Issuance



(a) Capital Expenditure



(b) Research and Development



(a) Working Capital

4.5 Speed of Adjustment

In this section, we use the two-stage OLS model to estimate the speed at which firms adjust their capital structure. In Equation (3), we present the usual specification form:

$$Lev_{i,t} - Lev_{i,t-1} = \lambda(Lev^*_{i,1} - Lev_{i,t-1}) + \epsilon_{i,t} \tag{3}$$

where $Lev^*_{i,t}$ represents the target leverage, that we estimate according to the specification presented by Equation (1), while λ represents the speed at which firms adjust their leverage. We estimate Equation (3) using OLS estimator, controlling for year and firms fixed-effects. Table 7 reports the results. For brevity, we omit the constant.

Table 7: Speed of Adjustment

	CAPEX		R&D		Working Capital	
VARIABLES	Book Lev.	Market Lev.	Book Lev.	Market Lev.	Book Lev.	Market Lev.
$Lev_{i,t-1}$	0.356***	0.441***	0.371***	0.454***	0.360***	0.448***
	(0.007)	(0.009)	(0.008)	(0.010)	(0.008)	(0.012)
$Lev_{i,t-1} \times Stages\ 0$	0.029**	0.039***	0.018	0.004	0.029**	0.047***
	(0.012)	(0.014)	(0.034)	(0.034)	(0.012)	(0.014)
$Lev_{i,t-1} \times Stage\ 1$	0.001	0.009	-0.040	0.005	0.048	0.054
	(0.019)	(0.020)	(0.026)	(0.030)	(0.039)	(0.043)
$Lev_{i,t-1} \times Stage\ 2$	-0.011	-0.024*	-0.025	0.017	0.053***	0.024*
	(0.011)	(0.013)	(0.020)	(0.026)	(0.012)	(0.014)
$Lev_{i,t-1} \times Stage\ 3$	0.006	-0.019*	0.020	0.009		
	(0.010)	(0.010)	(0.021)	(0.032)		
Firm Fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	51,164	50,147	44,753	43,805	37,630	36,814
R-squared	0.251	0.278	0.274	0.307	0.294	0.318

All variables are defined in Table 2. The coefficients are estimated using an OLS regression. Data are taken from COMPUSTAT. In the parentheses, we present the robust standard errors. ***, ** and * represent the statistical significance levels at one percent, five percent, and ten percent, respectively.

At non-investment periods, firms adjust annually their capital structure at a speed that varies from 35.6% to 45.4%, i.e. firms, on average, take from 1.15 to 1.57 year to fill half of the deviation from target. During CAPEX, the SOA shows significant variation: at Stage 0, the SOA shows an increase that varies from 8.1% to 8.8% in comparison with the estimated at non-investment period. This result is expected since the debt retirement evidenced in Figure 6a may cause substantial adjustment in capital structure, captured by the coefficient. As the investment begins, the SOAs do not present substantial changes in comparison with the one during non-investment period. We hypothesize that the SOA varies during the investment period because firms weight their needs for cash and the adjustment benefits and costs, and these weights may vary during the period. At initial stages [1], where there is an immediate need for resources and/or immediate change in the capital structure for the subsequent periods, firms adjust faster, even this could mean an increase in the deviation, as our case. However, during the projects stages of investment, where the need for cash is less urgent and the project may be generating cash, firms manage their capital structure in a way to balance financial flexibility and the adjustment benefits and costs, even if this means slower SOA.

During R&D investment period, as expected, we do not evidence any consistent variation on SOA in comparison with the estimated during non-investment period. Even though firms that undertake R&D projects retire debt and issue equity during investment period, not only the amount is not enough to cause a sudden change in a capital structure but also, as we show previously, financing decisions for this type of investment is not made in a way consistent with adjustment behavior. This is not the same case of working capital. Analyzing the variation of the estimated SOA jointly with prior evidence, we interpret the faster SOA at Stage 0 as a result arising from the substantial debt retirement that, in turn, diverts downwardly firms' capital structure from their target (Figure 2c). As the investment begins, firms finance the project with the source that enables the reduction of their deviation from target, captured by the significant coefficient at Stage 2.

4.6 Effect of Cash Flow on Speed of Adjustment

As an important driver for the SOA, the transaction costs are generated through the managers' active access to capital markets in some way, either to distribute cash for shareholders or to issue securities. Faulkender et al. (2012) show that both negative and positive cash flow positively affect the incentive for firms to access the market, since cash excess and deficit demand managers' active behavior to either decrease the excess or to fulfill the cash deficit. Their results support firms' adjustment behavior and confirm their hypothesis that managers use this market access, when the adjustment costs are sunk, to

[1] From our perspective, the relationship between Stages 1 and 0 is unarguable.

adjust their capital structure.

In this sense, if a project is generating cash flow during the investment period, we would be able to observe the same effect on the SOA. We hypothesize that if the project is generating positive cash flow, firms anticipate their financing behavior to the initial stages in order to benefit from the adjustment that would occur at Stages 2 and 3. The positive cash flow signs to the market about the success of the project, increasing firms' asset pledgeability, enabling firms to repurchase share if underlevered or to retire debt if overlevered. We call this as anticipation hypothesis. On the other hand, according to our offset hypothesis, if the project is generating negative cash flow, firms may make financing decisions in order to offset the firm value loss caused by the cash flow. Then, firms would issue debt if underlevered or issue equity if overlevered.

No database provides information at project-level to properly analyze this matter. In addition, traditional measures for cash flow realization such as EBITDA or EBIT scaled by total assets may not capture the projects cash flow realization, even for the large ones. We, then, use operating income before depreciation to proxy projects cash flow. Normal-sized projects may not be able to affect operating cash flow, but large ones that alter the capital structure would. Because some projects may generate negative operating cash flow but positive in aggregated measure that considers the financial and taxes gains, we subtract the paid interest and taxes. Therefore, our measure for project's cash flow is as follows:

$$CF_{i,t} = \frac{OIBD_{i,t} - T_{i,t} - I_{i,t} - INVEST_{i,t}}{TA_{i,t}}$$

where $OIBD$ is the operating income before depreciation; T is the interest taxes; I is the interest paid. We collect these three variables from the cash flow statement. $INVEST$ is the firm's investment expenditure.

We use Faulkender's specification to properly investigate this matter. Following their procedures, we decompose the right side of Equation (3) as a function of the cash flow and the deviation from target in order to capture the effect of cash flow in four situations:

- Overlap when $|Dev| > |CF| \equiv (|Dev| - |CF|) \times DevLarger$
- Excess of deviation $\equiv |CF| \times DevLarger$
- Overlap when $|CF| > |Dev| \equiv |Dev| \times (1 - DevLarger)$
- Excess of cash flow $\equiv (|CF| - |Dev|) \times (1 - DevLarger)$

Equation (6) presents the full specification:

$$Lev_{i,t} - Lev^p_{i,t-1} = [\gamma_1(|Dev| - |CF|) + \gamma_2|CF|] \times DevLarger +$$
$$[\gamma_3|Dev|\ \gamma_4(|CF| - |Dev|)] \times (1 - DevLarger) + \epsilon_{i,t} \quad (6)$$

where $DevLarger$ is a dummy variable that we use to split the cases when the deviation is larger than the cash flow. The measure of debt (Lev^p) is built to not consider the cases when leverage changes passively such as the changes due to positive net income. Therefore, the debt is measure as:

$$Lev^p_{i,t-1} = \frac{DLC_{i,t-1} + DLTT_{i,t-1}}{TA_{i,t-1} + NIi,t} \quad (7)$$

where DLC and DLTT is the short-term and long-term debt in period t-1, respectively; NI is the net income available in the financial statement. In this case, when the changes in the leverage is due to the results, the left side of the Equation (6) is zero. As Faulkender et al. (2012), during the non-investment period, when the deviation is larger than the *absolute* cash flow, we expect to observe a given SOA at the level in which $|Dev|$ and $|CF|$ are overlapped (γ_1) and, from $|CF|$ to the target (γ_2), SOA may decrease, but it may still remain positive and significant. For firms whose *absolute* cash flow is larger than the deviation, we expect the firms to adjust their capital structure at a given SOA (γ_3) the entire deviation and after the target, where the cash exceeds the target, we expect the SOA

(γ_4) to drop to 0. In a nutshell, we expect the following coefficients: $\gamma_1 \approx \gamma_2 = \gamma_3 > \gamma_4 = 0$. During investment period, we expect to observe positive coefficients at the initial stages as an evidence of the anticipation or offset hypotheses. Also, we expect to observe positive coefficients at final stages as an indicative of the adjustment behavior already evidenced in the prior subsections of this paper.

Table 8 presents the results. The standard errors are clustered by firms and, for brevity, we omit the constant. Because the signals of the coefficients depend on whether the firm is underlevered (positive) or overlevered (negative), we run separate regressions for each case. The signals refer to the direction of the adjustment. In this analysis, the deviation consists on the difference between active leverage (Equation 7) and the target leverage (Equation 1).

The coefficients that refer to the non-investment period are partially consistent with our hypothesis. The F-tests between γ_2 and γ_3 show no statistical difference at the level of 5% in all cases, but γ_1 is different from the aforementioned coefficients. Also, γ_4 is statistically but non-economically significant.

Table 8: Effect of cash on speed of adjustment

Panel A - CAPEX	Underlevered				Overlevered			
		Stage 1	Stage 2	Stage 3		Stage 1	Stage 2	Stage 3
ExcessDev	0.533***	-0.068	-0.086***	-0.022	-0.234***	-0.018	-0.015	0.031
	(0.022)	(0.059)	(0.030)	(0.028)	(0.021)	(0.092)	(0.045)	(0.034)
Overlap case 1, $\|Dev\| > \|CF\|$	0.320***	-0.024	-0.011	0.038	-0.323***	-0.078	0.031	0.086
	(0.023)	(0.054)	(0.031)	(0.034)	(0.037)	(0.124)	(0.100)	(0.060)
Overlap case 2, $\|CF\| > \|Dev\|$	0.305***	0.051	-0.043	0.102***	-0.319***	-0.137	-0.095	0.046
	(0.025)	(0.046)	(0.044)	(0.033)	(0.034)	(0.156)	(0.111)	(0.066)
ExcessCF	-0.019***	0.017*	0.017**	0.012*	-0.015*	0.006	0.009	0.005
	(0.007)	(0.010)	(0.008)	(0.007)	(0.008)	(0.025)	(0.008)	(0.005)
Obs	24,516				15,530			
R^2	0.424				0.425			
Panel B - R&D	Underlevered				Overlevered			
		Stage 1	Stage 2	Stage 3		Stage 1	Stage 2	Stage 3
ExcessDev	0.544***	-0.163***	-0.101*	-0.111*	-0.226***	0.055	0.005	0.041
	(0.025)	(0.060)	(0.052)	(0.059)	(0.024)	(0.107)	(0.093)	(0.098)
Overlap case 1, $\|Dev\| > \|CF\|$	0.334***	-0.074	-0.107*	-0.058	-0.267***	-0.307**	-0.111	0.107
	(0.027)	(0.068)	(0.056)	(0.060)	(0.042)	(0.128)	(0.192)	(0.144)
Overlap case 2, $\|CF\| > \|Dev\|$	0.321***	0.000	-0.024	-0.098*	-0.287***	-0.293	-0.191*	-0.084
	(0.029)	(0.113)	(0.080)	(0.051)	(0.045)	(0.247)	(0.114)	(0.126)
ExcessCF	-0.049***	0.006	-0.005	0.016	-0.021	-0.015	-0.044	-0.019
	(0.013)	(0.031)	(0.034)	(0.027)	(0.016)	(0.089)	(0.057)	(0.042)
Obs	20,307				13,145			
R^2	0.470				0.483			

Table 8: Effect of cash on speed of adjustment (cont.)

Panel C - Working Capital	Underlevered			Overlevered		
		Stage 1	Stage 2		Stage 1	Stage 2
ExcessDev	0.554***	-0.032	0.042	-0.204***	-0.380	0.007
	(0.028)	(0.076)	(0.044)	(0.027)	(0.257)	(0.041)
Overlap case 1, $\|Dev\| > \|CF\|$	0.326***	0.291**	0.136**	-0.310***	0.513**	0.115**
	(0.027)	(0.142)	(0.065)	(0.041)	(0.256)	(0.057)
Overlap case 2, $\|CF\| > \|Dev\|$	0.357***	-0.061	0.089***	-0.300***	0.093	0.058
	(0.028)	(0.048)	(0.032)	(0.034)	(0.098)	(0.045)
ExcessCF	-0.022***	-0.005	0.017*	-0.021***	0.004	0.037**
	(0.006)	(0.025)	(0.009)	(0.006)	(0.033)	(0.017)
Obs		16,939			12,038	
R^2		0.494			0.474	

The coefficients are estimated using an OLS regression. Data are taken from COMPUSTAT. In the parentheses, we present the robust standard errors. ***, ** and * represent the statistical significance levels at one percent, five percent, and ten percent, respectively.

Our results contrast with Faulkender et al. (2012) as we evidence that, overall, underlevered and overlevered firms have similar SOA during non-investment period. The authors, on the other hand, show that overlevered firms seem to benefit more from adjustment than underlevered, so that the SOA of former firms are higher than the latter. During the investment period, our results reinforce the existence of differences across types of investments and how firms deal with this differences according to their relative position to their target.

The Panel A refers to the CAPEX. We evidence that cash only affects increasing the SOA when amount of generated cash at the last stage is higher than the deviation. The lack of consistent statistical significance of the coefficients for other stages and contexts suggests that cash does not interfere in the adjustment anticipation as we expect. We hypothesize, in these cases, that the benefits from adjustment are smaller than the financial flexibility and the agency avoided issues .

Panel B refers to R&D investment period. Our two hypotheses are rejected in the case of underlevered firms and partially not rejected for overlevered ones. In the first case, the result is somewhat expected as, according to literature and our Propositions 2 and 3, R&D firms tend to be less leverage than average, do not benefit from adjustment for many already mentioned reasons and cash would not affect this situation. This scenario fits perfectly for underlevered firms. In the case of overlevered, we observe that early cash indeed makes firms decrease leverage through equity issuance or debt payment. And, due to their leverage condition, this movement is in the same direction as target. In this sense, our anticipation hypothesis would not fit in R&D firms but our evidence reinforce their equity preference.

The bottom panel refers to working capital. For underlevered firms, the higher the absolute cash flow at the investment stages, the greater the motivation to anticipate their capital structure adjustment. This scenario is consistent with we already evidenced in the present thesis reinforcing the importance of cash flow in the investment and leverage development. For overlevered, in turn, the results show that cash does not interfere in adjustment behavior contrasting our expectations. We hypothesize, in this case, that these firms, on average, prefer the maintenance of the overlevered even when cash is early needed or generated.

5 Conclusion

This paper aims to show how the nature of the investments (CAPEX, R&D and working capital) affects the capital structure decisions during the period when a large investment is undertaken. Our identification assumption is that the type of investment affects the income pledgeability of the project and the contract feasibility. Therefore, we develop a theoretical model that emerges three propositions: (1) a debt contract may not be temporarily feasible if managers want to hide information from market; (2) because of the risky nature of R&D investments, a debt contract may be not feasible and (3) equity may share the contract optimality with debt for R&D projects.

Our results related to CAPEX are consistent with our first proposition. During large CAPEX investment period, firms increase their deviation from target, temporarily, increasing the use of equity to finance the initial stages of the investment. As the project evolves, firms increase the use of debt, decreasing the deviation from target. The probability of a debt issuance increases 0.41% as the project progresses 1%. Even though this behavior is consistent with the Trade-off theory, our evidence shows that firms do not increase significantly their annual SOA during the investment period relative to the non-investment period.

Regarding to large R&D investment, we show results supportive to our second and third propositions. Debt seems not to be intangible-intensive firms' first-order financing source. In fact, we show that firms tend to decrease leverage as the project evolves: the probability of debt retirement and/or equity issuance increases 0.21% as the project advances 1%. During our tests, we attest that the firms do not follow predictions of neither Pecking-order Hypothesis nor Market Timing nor enjoy adjustment costs sinking to close the deviation from target leverage. However, the financing behavior adheres to the Trade-off, consistent with the R&D literature. Finally, we evidence that managers finance large working investments with an internal resources and issue equity just to retire debt. As the project evolves, firms increase debt consistent with the adjustment behavior predicted by (dynamic) Trade-off Theory. In this sense, the financing behavior is consistent with our first and general proposition proposition.

References

Acharya, V., Almeida, H., Ippolito, F., and Perez, A. (2014). Credit lines as monitored liquidity insurance: Theory and evidence. *Journal of Financial Economics*, 112(3):287–319.

Aldrich, H. (2008). *Organizations and environments*. Stanford University Press.

Almeida, H. and Campello, M. (2007). Financial constraints, asset tangibility, and corporate investment. *Review of Financial Studies*, 20(5):1429–1460.

Almeida, H. and Campello, M. (2010). Financing frictions and the substitution between internal and external funds. *Journal of Financial and Quantitative Analysis*, 45(3):589–622.

Arellano, M. and Bond, S. (1991). Some tests of specification for panel data: Monte carlo evidence and an application to employment equations. *The Review of Economic Studies*, 58(2):277–297.

Bah, R. and Dumontier, P. (2001). R&d intensity and corporate financial policy: Some international evidence. *Journal of Business Finance & Accounting*, 28(5-6):671–692.

Baker, M. and Wurgler, J. (2002). Market timing and capital structure. *The Journal of Finance*, 57(1):1–32.

Baños-Caballero, S., García-Teruel, P. J., and Martínez-Solano, P. (2010). Working capital management in smes. *Accounting & Finance*, 50(3):511–527.

Blundell, R. and Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1):115–143.

Borochin, P. and Yang, J. (2017). Options, equity risks, and the value of capital structure adjustments. *Journal of Corporate Finance*, 42:150–178.

Brown, J. R., Fazzari, S. M., and Petersen, B. C. (2009). Financing innovation and growth: Cash flow, external equity, and the 1990s r&d boom. *The Journal of Finance*, 64(1):151–185.

Brown, J. R. and Petersen, B. C. (2009). Why has the investment-cash flow sensitivity declined so sharply? rising r&d and equity market developments. *Journal of Banking & Finance*, 33(5):971–984.

Chang, X. and Dasgupta, S. (2009). Target behavior and financing: how conclusive is the evidence? *The Journal of Finance*, 64(4):1767–1796.

Chang, Y.-K., Chou, R. K., and Huang, T.-H. (2014). Corporate governance and the dynamics of capital structure: New evidence. *Journal of Banking & Finance*, 48:374–385.

Chen, H., Zeng, S., Lin, H., and Ma, H. (2017). Munificence, dynamism, and complexity: How industry context drives corporate sustainability. *Business Strategy and the Environment*, 26(2):125–141.

Chiou, J.-R., Cheng, L., and Wu, H.-W. (2006). The determinants of working capital management. *Journal of American Academy of Business*, 10(1):149–155.

Cook, D. O. and Tang, T. (2010). Macroeconomic conditions and capital structure adjustment speed. *Journal of Corporate Finance*, 16(1):73–87.

De Jong, A., Verbeek, M., and Verwijmeren, P. (2011). Firms' debt–equity decisions when the static tradeoff theory and the pecking order theory disagree. *Journal of Banking & Finance*, 35(5):1303–1314.

Dess, G. G. and Beard, D. W. (1984). Dimensions of organizational task environments. *Administrative Science Quarterly*, pages 52–73.

Dudley, E. (2012). Capital structure and large investment projects. *Journal of Corporate Finance*, 18(5):1168–1192.

Elliott, J. W. (1971). Funds flow vs. expectational theories of research and development expenditures in the firm. *Southern Economic Journal*, pages 409–422.

Elsas, R. and Florysiak, D. (2011). Heterogeneity in the speed of adjustment toward target leverage. *International Review of Finance*, 11(2):181–211.

Fama, E. F. and French, K. R. (2005). Financing decisions: who issues stock? *Journal of financial economics*, 76(3):549–582.

Faulkender, M., Flannery, M. J., Hankins, K. W., and Smith, J. M. (2012). Cash flows and leverage adjustments. *Journal of Financial Economics*, 103(3):632–646.

Faulkender, M. and Wang, R. (2006). Corporate financial policy and the value of cash. *The Journal of Finance*, 61(4):1957–1990.

Flannery, M. J. and Hankins, K. W. (2013). Estimating dynamic panel models in corporate finance. *Journal of Corporate Finance*, 19:1–19.

Flannery, M. J. and Rangan, K. P. (2006). Partial adjustment toward target capital structures. *Journal of Financial Economics*, 79(3):469–506.

Frank, M. Z. and Goyal, V. K. (2003). Testing the pecking order theory of capital structure. *Journal of Financial Economics*, 67(2):217–248.

Frank, M. Z. and Goyal, V. K. (2009). Capital structure decisions: which factors are reliably important? *Financial Management*, 38(1):1–37.

Graham, J. R. and Harvey, C. R. (2001). The theory and practice of corporate finance: Evidence from the field. *Journal of Financial Economics*, 60(2):187–243.

Hackbarth, D., Miao, J., and Morellec, E. (2006). Capital structure, credit risk, and macroeconomic conditions. *Journal of Financial Economics*, 82(3):519–550.

Hall, B. H. (1992). Investment and research and development at the firm level: does the source of financing matter? Technical report, National Bureau of Economic Research.

Hill, M. D., Kelly, G. W., and Highfield, M. J. (2010). Net operating working capital behavior: a first look. *Financial Management*, 39(2):783–805.

Himmelberg, C. P. and Petersen, B. C. (1994). R & d and internal finance: A panel study of small firms in high-tech industries. *The Review of Economics and Statistics*, pages 38–51.

Hovakimian, A., Hovakimian, G., and Tehranian, H. (2004). Determinants of target capital structure: The case of dual debt and equity issues. *Journal of Financial Economics*, 71(3):517–540.

Hovakimian, A., Opler, T., and Titman, S. (2001). The debt-equity choice. *Journal of Financial and Quantitative analysis*, 36(1).

Huang, R. and Ritter, J. R. (2009). Testing theories of capital structure and estimating the speed of adjustment. *Journal of Financial and Quantitative analysis*, 44(2):237–271.

Jensen, M. C. and Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3(4):305–360.

Kamien, M. I. and Schwartz, N. L. (1978). Self-financing of an r and d project. *The American Economic Review*, 68(3):252–261.

Kayhan, A. and Titman, S. (2007). Firms' histories and their capital structures. *Journal of Financial Economics*, 83(1):1–32.

Kiyotaki, N. and Moore, J. (1997). Credit cycles. *Journal of Political Economy*, 105(2):211–248.

Korajczyk, R. A. and Levy, A. (2003). Capital structure choice: macroeconomic conditions and financial constraints. *Journal of Financial Economics*, 68(1):75–109.

Lockhart, G. B. (2014). Credit lines and leverage adjustments. *Journal of Corporate Finance*, 25:274–288.

Modigliani, F. and Miller, M. H. (1958). The cost of capital, corporation finance and the theory of investment. *The American economic review*, 48(3):261–297.

Modigliani, F. and Miller, M. H. (1963). Corporate income taxes and the cost of capital: a correction. *The American economic review*, 53(3):433–443.

Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of financial economics*, 5(2):147–175.

Myers, S. C. (1984). The capital structure puzzle. *The journal of finance*, 39(3):574–592.

Myers, S. C. and Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of financial economics*, 13(2):187–221.

Ovtchinnikov, A. V. (2010). Capital structure decisions: Evidence from deregulated industries. *Journal of Financial Economics*, 95(2):249–274.

Öztekin, Ö. and Flannery, M. J. (2012). Institutional determinants of capital structure adjustment speeds. *Journal of Financial Economics*, 103(1):88–112.

Pindyck, R. S. and Solimano, A. (1993). Economic instability and aggregate investment. *NBER Macroeconomics Annual*, 8:259–303.

Robichek, A. A. and Myers, S. C. (1966). Problems in the theory of optimal capital structure. *Journal of Financial and Quantitative Analysis*, 1(2):1–35.

Shyam-Sunder, L. and Myers, S. C. (1999). Testing static tradeoff against pecking order models of capital structure. *Journal of Financial Economics*, 51(2):219–244.

Spence, A. M. (1979). Investment strategy and growth in a new market. *The Bell Journal of Economics*, pages 1–19.

Sufi, A. (2009). Bank lines of credit in corporate finance: An empirical analysis. *Review of Financial Studies*, 22(3):1057–1088.

Tirole, J. (2006). *The Theory of Corporate Finance*. Princeton University Press.

Welch, I. (2004). Capital structure and stock returns. *Journal of political economy*, 112(1):106–131.

Williamson, O. E. (1988). Corporate finance and corporate governance. *The Journal of Finance*, 43(3):567–591.

Zhou, Q., Tan, K. J. K., Faff, R., and Zhu, Y. (2016). Deviation from target capital structure, cost of equity and speed of adjustment. *Journal of Corporate Finance*, 39:99–120.