Capital Structure and the Franchise Decision: A Knightian View

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First Draft
Comments Welcome
This version: June 2024

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Abstract

Motivated by Bewley's Knightian view of innovative entrepreneurs, we explore the role that ambiguity, along with risk, may have to the capital structure explanation of the franchise decision. Ambiguity has a distinct behavior from risk, decreasing the value of the contingent claims that cautious external investors hold on firms' assets in place and growth options. Using a large panel of U.S. public innovative firms, we confirm that ambiguity helps to explain corporate leverage as conjectured by dynamic capital structure theory. Also, franchise firms' leverage responds more to ambiguity than the typical firm. Our results have important implications for the capital constraint hypothesis of the franchising literature. Ambiguity (unlike risk) can help explain lenders inertia and non-participation in businesses characterized by a highly dissagregated vertical network of (relatively small) local operations and economic value driven predominantly by growth options and intangible assets. Thus the incentive of some innovative entrepreneurs to franchise and bypass the binding capital constraint.

Keywords: franchising, dynamic capital structure, ambiguity.

JEL Classification Codes: C33, D81, G32, L23, M21, O33

1. Introduction

Franchising has become a prominent organizational choice of innovative entrepreneurs seeking to capture the economic value of a brand name or new idea through a vertical network of local outlets. Despite its popularity, the fundamental question of why some entrepreneurs choose to franchise is still an open debate in business and economics.

One influential strand of the franchising literature, answers this question building from asymmetric information and agency theories pioneered by Akerlof (1970), and Jensen and Meckling (1976). Under this view, franchising is the optimal organizational choice of entrepreneurs that seek to alleviate the corporate governance problem that comes with the high degree of disaggregation of local operations.

Another view, widely supported on the street but not empirically (Rubin, 1978; and Norton, 1995), is the old capital scarcity theory pioneered by Oxenfeldt and Kelly (1969).[1] In a nutshell, the choice of some innovative entrepreneurs to franchise responds to the fact that franchisees provide capital that has no close substitutes. Norton (1995), brings an alternative explanation to the capital constraint hypothesis: as a capital structure feature of franchise businesses. The hypothesis follows from modern corporate finance

[1] See also, Hunt (1974), Caves and Murphy (1976), Brickley and Dark (1987), Martin (1988), Justis and Judd (1989), Carney and Gedajlovic (1991), Lafontaine (1992), Martin and Justis (1993), and Lafontaine and Kaufmann (1994).

theories of capital structure.[2] Franchisors' binding capital constraint obeys to the fact that the typical franchise business is organized as a highly dissagregated vertical network of (relatively small) local operations and economic value driven predominantly by growth options and intangible assets that are too specific.[3] Thus, the observed relatively higher cost of debt and lower leverage of franchise firms. To ilustrate, in the U.S. from 1994 to 2019, franchisors median quasi-market leverage was 18.23%, that is, less than half the median quasi-market leverage of innovative firms (see Figure 1).

A well-known problem with capital structure theories that focus on only risk, is that they cannot account for stylized facts of corporate debt in the U.S. (Frank and Goyal, 2008). For example, Strebulaev (2007) points at the *low leverage puzzle* or the observation that two out of five firms in the U.S. from 1965 to 2000 had an average corporate quasi-market leverage of 20% or less. Lee (2014), Agliardi, Agliardi, and Spanjers (2016), Attaoui, Cao, Duan, and Liu (2021), Izhakian, Yermack, and Zender (2022), and Chen, Ho, Yan, Yeh, and Yu (2023) argue that the apparent lack of explanatory power of

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[2] The choice of corporate debt as a source of capital is assumed to be driven by the trade-off between financial distress costs and tax benefits and/or its informational role as a signal of firms' solvency (Myers, 1977; Myers and Majluf, 1984; Harris and Raviv, 1991; and Leland, 1994, 1998). For the more recent literature, see the survey by Strebulaev and Whited (2012).

[3] Lafontaine (1992), Carney and Gedajlovic (1991), Martin and Justis (1993), and Norton (1995) provide empirical support to the growth opportunities hypothesis. Rubin (1978), Mathewson and Winter (1985), Klein (1980), Klein and Leffler (1981), and Carlton and Perloff (1994), provide evidence in support of the intangible capital hypothesis. Finally, Evans (1987), Carney and Gedajlovic (1991), and Peterson and Rajan (1994), provide evidence that new venture firms, which constitute a large number of franchise firms, are unable to access the capital markets because of agency costs.

theory is the result of assuming confident Bayesian investors. *Cautious* investors concerned with ambiguity, will have a much lower target leverage than the one predicted otherwise. In the case of severe lack of confidence about firms' future prospects, lenders may choose to not participate at all in the investment venture, what Bewley (2001) called the inertia assumption. We argue that this should be the expected behavior of franchise firms.

The influential literature on Knightian uncertainty or ambiguity, also referred as a preference towards robustness, pioneered by Knight (1921), Keynes (1921), and Shackle (1949), argues that ambiguity introduces a distinct behavioral response to risk. Ellsberg (1961) and related experiments (for a survey see Camerer and Weber, 1992), demonstrate that when facing ambiguity, choices cannot be rationalized by any probability belief consistent with the Bayes-Savage paradigm. In order to avoid any confusion, we follow Epstein and Schneider (2010) and refer to ambiguity as that part of uncertainty distinct from risk where decision makers acknowledge their lack of confidence about the future.

Thus, our first goal in the present article is to assess theoretically and empirically the capital constraint hypothesis of the franchising literature under ambiguity. To our knowledge, we are the first to explore the relevance that ambiguity may have for the capital constraint hypothesis of franchising. Hence our first contribution is to the franchising literature. We also contribute to the corporate finance literature as we provide empirical support to dynamic capital structure models under ambiguity.

Our conceptual framework builds from the model of Rigotti (2004), but instead of assuming imprecise beliefs a là Bewley (2001), we view decision makers holding multiple-priors preferences as in Gilboa and Schmeidler (1989).[4] Investors hold some reference prior about the odds of the firm's future prospects, but because of their lack of confidence they also hold a statistically close set of plausible priors around the reference prior. The difference between innovative entrepreneurs and external investors is that innovative entrepreneurs are *decisive*. They always undertake any investment opportunity because of their unusual confidence (Bewley, 2001; Rigotti, 2004).

We test empirically the hypothesis that ambiguity, along with risk, should matter for the corporate capital structure problem using a large longitudinal panel of U.S. public firms with patents over the period 1994 to 2019.[5] Given the trade-off theory conjecture that firms' financing choices are driven by some long-run optimal (target) leverage, we adopt the standard two-stage estimation procedure of the empirical capital structure

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[4] One drawback of this approach is that cannot attain separation between ambiguity and ambiguity attitude. Models that admit separation are the smooth ambiguity model of Klibanoff, Marinacci, and Mukerji (2005, 2009) and the α-MEU model of Marinacci (2002). However, as pointed out by Schröder (2020) and Beissner, Lin, and Riedel (2020), α-maxmin preferences can be dynamically inconsistent and intractable in discrete time. In this regard, applied work using these models has been so far mostly numerical. Finally, smooth ambiguity preferences imply smooth (not kinked) indifference curves, which cannot explain inertia in the markets, a critical feature in our case under study.

[5] The choice of dates obeys to our focus on innovative entrepreneurs and consequent use of the Kogan, Papanikolau, Seru, and Stoffman (2017) or KPSS dataset of patents granted by the U.S. Patent and Trademark Office (USPTO) proxying firms' growth opportunities.

literature.[6] In the first step of the longitudinal econometric analysis, we estimate firms' target leverage ratios using standard and more robust panel data (PD) regressions.[7] Consistent with the dynamic capital structure conceptual approach adopted, we also run dynamic PD regressions using the continuous updating (CUE-GMM) feasible and efficient estimator of Hansen, Heaton, and Yaron (1996).[8]

In the second step of the econometric analysis, we use the estimates from first-step regressions to calculate firms' leverage targets and current deviations from observed leverage, which according to theory should help to predict firms' financing choices. To this purpose, we run multinomial logit regressions to look at four alternative financing choices: issue debt, issue equity, retire debt, and repurchase equity. For completeness, we conclude the econometric exercise assessing empirically the speed of adjustment (SOA) of firms leverage estimating a partial adjustment model.

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[6] That is, assuming that the target actually exists. One strand of the literature is in favor of its existence based on the survey evidence in Graham and Harvey (2001), who show that 71% of CFO's surveyed responded positively to the question of tracking some kind of leverage target. Hovakimian, Opler and Titman (2001), Leary and Roberts (2005), and Öztekin and Flannery (2012) provide additional empirical support. However, based on the same survey evidence, part of the literature claims that managers do not track a target leverage ratio (see e.g., Yin and Ritter, 2020; and references therein).

[7] In particular, we apply the generalized LSM-estimator of Gervini and Yohai (2002). For an extensive rigorous discussion of robust statistics, see Tukey (1960, 1962), Huber (1981), Rousseeuw and Yohai (1984), Hampel, Ronchetti, Rousseeuw, and Stahel (1986), Yohai (1987), and Staudte and Sheather (1990). For a discussion of recent robust statistics methods see Maronna, Martin, Salibían-Barrera, and Yohai (2019).

[8] The estimation of the system-GMM is implemented using Kripfganz (2019) **xtdpdgmm** package in STATA, which accounts for unobserved firm-specific heterogeneity and allows the inclusion of nonlinear moment conditions if required as suggested by Ahn and Schmidt (1995).

We show theoretically and empirically that ambiguity, along with risk, helps to explain firms' corporate leverage as hypothesized by dynamic capital structure models under ambiguity. Consequently, it helps to explain the capital constraint hypothesis of franchising without relying on agency costs. Under our view, decisive entrepreneurs have an incentive to franchise in order to bypass the capital constraint that arises endogenously from external cautious investors robust beliefs about firms' future prospects. Furthermore, ambiguity can also explain the common practice in the franchising industry to impose a very low debt capacity to potential franchisees.

The rest of the paper is organized as follows. We discuss the model in section 2. The robust empirical application of the model is presented in section 3. In section 4, we discuss the relevance of the results for the capital constraint hypothesis of franchising. We conclude in section 5.

2. The Model

Dynamic capital structure models are standard in corporate finance (see Strebulaev and Whited 2012, section 2.3). These models adopt a contingent claims framework that in the case of corporate leverage, builds from the trade-off model. We incorporate ambiguity and endogenous heterogeneous beliefs into the model, adopting the distinction between innovative entrepreneurs and investors of Bewley (2001) and Rigotti (2004).

Note that in order to keep the model simple, and focus on our main research goal, we assume that firm's technology and output are exogenous. This assumption help us to avoid the delicate observation that assets in place may not be traded assets (Leland, 1994 footnote 11; Goldstein et al., 2001; Strebulaev and Whited, 2012). This is especially relevant for firms with significant growth options and too specific intangible assets, like franchise firms. Methodologically, it will also allow us to follow closely the setup in Goldstein et al. (2001), where investment and operating costs by assumption do not affect the firm's cash flows, and then cash flows in operations can be assumed equivalent to earnings before interest and taxes (EBIT).

2.1. Decisive Entrepreneurs and Cautious Investors

Consider a *Bewley-type* production economy (Bewley, 2001),[9] indexed discretely by time $t \in [0, T = \infty]$ and a (countable infinite) state-space Ω that represents the set of all $\{\omega\}_{\theta=1}^{\Theta}$ plausible events in the economy with probability $\mathbb{P}: \mathcal{F} \longrightarrow [0,1] \equiv \sum_{\omega_t \in \Theta} p_{t,\omega}$. A compact metric space with Borel σ-algebra $\mathcal{B}(\Omega)$ completed by $\mathbb{P}$-null sets and information structure $\{\mathcal{F}_t\}_{t=0}^{T}$ defined by the history of realizations that defines the state-space of the economy $\omega_t \in \Omega$, where $\mathcal{F}_0 = \{\emptyset, \Omega\}$ and $\mathcal{F}_T = 2^{\Omega}$. Let $u = \theta + 1$ be the

[9] Bewley class of models assume incomplete markets and heterogeneous beliefs.

up economic state, and $d = \theta - 1$ the down economic state. One way to visualize this technical setup is as an event tree with time-state nodes (t, ω) and up and down branches.

There is a single aggregate output (the numeraire) $Y_t = \left[\int_0^1 Y_{i,t} \mathrm{d}i\right]$ where $Y_{i,t} = \sum_i Y_{i,n,t}$ is the perfectly elastic intermediate output supplied by $n \in (1, \cdots, \overline{N})$ production outlets operated by a continuum, with measure one, of i price-setting monopolistically competitive firms.[10] The number of production outlets $\overline{N}$ depends on the level of dissagregation of the local operation within the firm (Ilut and Saijo, 2021). Franchise firms can be differentiated from the typical firm based on this dimension, as they are characterized by a large number of production outlets: $n \to \overline{N}$.

Let $p_{t,\omega} \in (\Omega, \mathcal{F}_{t+1}, \mathbb{P})$ denote the (t, ω)-one-step-ahead conditional probability i.e., the prior about the next step of the economy in the tree at $t+1$, which depends only on information available up to time t.[11] We follow Goldstein et al. (2001) and assume that potential investors (both innovative entrepreneurs and external investors) evaluate the firm's future prospects tracking firm's (log) earnings $r_{i,t} = ln\, \mathit{\Pi}_{i,t}$, where $\mathit{\Pi}_{i,t} =$

[10] A Cobb-Douglas aggregate production function modeled as in Aiyagari (1994), and subject to aggregate productivity shocks governed by a Markov process (Krusell and Smith, 1998).

[11] To achieve dynamic consistency it is critical to consider one-step-ahead conditional probabilities (Epstein and Schneider, 2003 pp. 16-17). Note that multiple-priors price-functionals are also time-consistent (Riedel, 2009).

$\exp(\sum_{s=1}^{t} r_{i,s})\mathit{\Pi}_{i,0}$ represents the firm's stream of future cash flows in operations, with initial cash flow $\mathit{\Pi}_{i,0}$ given. The earnings' data generating process (DGP) follows:

$$r_{i,t} = \varrho r_{i,t-1} + (1-\varrho)\mu_i(X_t) + \sigma_i u_{i,t}, \tag{1}$$

where μ_i is the long-run expected growth rate of earnings, which depends on the true latent state process $\{\omega_t\}$ of the economy, some time-homogeneous Markov chain $X_t(\omega_t = \boldsymbol{\theta})$ adapted to $\mathcal{F}_t$; σ_i denotes the constant diffusion parameter; and $u_{i,t}$ is an *i.i.d.* n-dimensional normal zero-mean exogenous temporary (productivity) shock (Gorbenko and Strebulaev, 2010).

Under ambiguity, beliefs about future earnings, instead of being represented by a single probability measure $p_{t,\omega}$, are represented by a set $P_{t,\omega} \subset (\Omega, \mathcal{F}_{t+1}, \mathbb{P})$ of multiple probability measures. Intuitively, lack of confidence about the latent state of the economy makes decision makers entertain several models about the DGP driving earnings. Formally, they hold some common reference prior $\hat{p}_{t,\omega} \in P_{t,\omega}$ about next period's state of the economy and firms' future earnings, but because of their lack of confidence, they also entertain other plausible close distorted priors $p_{t,\omega} \in P_{t,\omega}$. We restrict the set $P_{t,\omega}$ to conform to the space of statistically close parameterized models around the reference model and do not exclude the reference prior from the set at all times t. These technical conditions guarantee that the expected log-likelihood ratio between reference and distorted priors converges to the unconditional value of one-period relative entropy or Kullback-Leibler (KL) discrepancy $\mathbb{D}(p\|\widehat{p}) = -\mathbb{E}\left[ln(\frac{p}{\widehat{p}})\right]$ satisfying the bound:

$$\mathbb{D}_t(p_{t,\omega}\|\widehat{p}_{t,\omega}) \leq \eta_t, \tag{2}$$

where $\mathbb{D}_t(p_{t,\omega}\|\widehat{p}_{t,\omega})$ is a pseudo-metric as it is not symmetric and does not satisfy the triangular inequality; and η_t is a parameter related to the level of confidence that decision makers have on their reference models. Relative entropy follows from information theory where corporate problems can be interpreted as strategic games against *Nature*, which always picks the worst-case scenario from the set of all plausible scenarios with probability $p^*_{t,\omega} \in P_{t,\omega}$.[12]

Firm's i earnings average growth rate μ_i is perceived as ambiguous lying in the interval $\left[\underline{\mu}_i, \overline{\mu}_i\right] = \left[\widehat{\mu}_i - z_{i,t}(n), \widehat{\mu}_i + z_{i,t}(n)\right]$, where $\widehat{\mu}_i$ can be interpreted as the benchmark firm's earnings growth rate under some reference prior $\widehat{p}_{t,\omega}$, and $z_{i,t}(n)$ is the expected loss or gain as a consequence of decision makers' lack of confidence about the business future prospects.[13] If economic agents are confident about their reference models, then $z_{i,t}(n) = 0$ and the interval collapses to the singleton $\widehat{\mu}_i$, with $\eta_t = 0$ and (2) collapsing to an equality. Otherwise, $z_{i,t}(n) > 0$, $\eta_t > 0$ and the size of the interval

[12] As we will see next, the worst-case scenario depends on the contingent claim hold on the firm's assets.

[13] Note that we follow Merton's (1980) observation that mean returns are relatively harder to predict than volatility, and consequently restrict ambiguity to the drift of the DGP.

denotes the level of ambiguity, which is assumed to be an increasing monotone function of the level of disaggregation within the firm n plus the decision makers' lack of confidence. Although we assume that no decision maker in the economy has superior information, they may differ in their attitudes towards ambiguity (Rigotti, 2004).

Firms are run by infinitely lived decisive innovative entrepreneurs, who are radically different than the rest of the investors in the economy. Despite ambiguity, which they acknowledge, decisive entrepreneurs always undertake investment ventures as confident Bayesian decision makers will do. But, unlike Bayesian decision makers their choices rely on factors beyond rationality e.g., animal spirits a là Keynes (Rigotti, 2004). This unusual attitude may come from the opinion that new innovations, successful or not, constitute an externality that reduces the overall uncertainty (in the broad sense) of the economy by creating new knowledge that stimulates new innovations, a loop that feedbacks into the economy indefinitely.

There is also a group of infinitely lived external potential providers of capital. Unlike decisive entrepreneurs, they are cautious investors with a preference towards robustness, given their lack of confidence about the firm's future prospects. As we will show next, within this group of cautious investors, debt-holders will show themselves to be relatively more cautious than equity-holders because of their different worst-case scenario priors. Note that in the specific case of a franchise firm equity-holders or franchisees are not passive investors i.e., they actively manage one or more production outlets. However, they are constrained managers vertically subordinated to the franchisor. We now proceed to discuss the capital structure problem.

2.2. The Dynamic Capital Structure Problem

As we mentioned before, we follow the standard contingent-claim approach of dynamic corporate finance models. Thus, we need to consider the investors' side of the capital structure problem plus some technical conditions. We adopt standard assumptions of arbitrage-free and liquid dynamic capital markets (Skiadas, 2009 section 5.1.2). The first fundamental theorem of asset pricing plus dynamic consistency guarantees the existence of a present value function at each time-state node (t, ω) in the tree, induced by some time-zero present value function. The liquidity assumption implies that if investors can trade at time-zero in a way that results in some cash flow, then at any time-state node (t, ω) investors will be able to trade in a way that cancels out all future payments of the cash flow.

We derive the optimal financial structure of the firm from forward prices of contingent claims on future earnings. To this purpose, we start assuming that for any probability $p_{t,\omega} \in P_{t,\omega}$ there exists a risk-neutral strictly positive measure $q_{t,\omega} \in Q_{t,\omega}$, which is said to be an equivalent martingale measure of $p_{t,\omega}$, if $P(\omega) = 0 \Leftrightarrow Q(\omega) = 0$ for every event ω.[14]

Besides investing in the firms, investors have access to a risk-free asset that it is in zero net supply and pays a constant gross return $R = \exp(r_f)$, such that $r_f > \mu$ and $\rho = \frac{1}{1+r_f}$ denotes the discount rate in the economy with (Q, ρ) denoting the present value function that prices all securities in the economy. Under the risk neutral measure $q_{t,\omega} \in Q_{t,\omega}$, the firm's long-run expected growth rate of earnings is equal to $\mu = r_f - \delta$, where δ is the constant payout rate. Firms can issue debt as a callable consol that pays a fixed coupon C until default or being retired, which is tax deductible at the constant corporate tax rate $\tau \in (0,1)$. When the firm chooses to issue debt we follow Yang (2013) and assume that first recalls its outstanding debt.[15] Finally, it is common knowledge in the economy that there is a trade-off between the tax benefits of issuing debt and the expected

[14] The change of measure to risk-adjusted (neutral) equivalent probabilities is not trivial for the case of non-traded real assets. However, in our setting it follows naturally from our choice of an observable state variable instead of the (unobservable) unlevered value of the firm.

[15] Given the assumption of consols (discount bonds), it is safe to assume that bonds can be called at par value at any time. Also the second assumption of retiring outstanding debt before issuing new debt seeks to avoid the complication of having to consider agency costs due to conflicts of interest between debt-holders with different seniority. All these assumptions serve the purpose of making the model tractable.

bankruptcy costs of debt in the event of default, which occurs the first time that the market value of equity falls to zero from above.[16]

2.2.1 Decisive entrepreneurs' market valuations

At each date t, the decisive entrepreneur observes realized earnings and chooses the coupon C that maximizes shareholders' long-term welfare i.e., the present value of the expected firm's (after taxes) dividend stream $(1-\tau)(\delta\Pi - C)$. Note that the entrepreneur needs to choose simultaneously the optimal time $t' := \inf\{s > 0 | E_s \leq 0\}$ to default that maximizes the market value of firm's equity under the reference risk-neutral measure $\hat{q}_{t,\omega}$:

$$\hat{E}_t = \max_{C,t'>t} \left\{ \sum_{s=t}^{T} \rho^{s-t} \mathbb{E}^{\hat{q}} \left[\frac{\varphi_t}{\varphi_{s+1}} (1-\tau)(\delta\Pi_s - C) \mathbf{1}_{t'>s} \middle| \Pi_s \right] \right\}, \tag{3}$$

where $\mathbb{E}^{\hat{q}}$ is the expectation operator under the reference risk-neutral measure $\hat{q}_{t,\omega}$, which should be interpreted as a forward price of risk (Skiadas, 2009 section 5.3.2); $\mathbf{1}_{t'>s}$ is an indicator function; $\frac{\varphi_t}{\varphi_{s+1}}$ is an adjustment factor that reflects changes in the total number of shares with φ_{s+1} denoting the number of shares outstanding after issuing/retiring shares in period s; and the rest of the variables are defined as before. The solution to

[16] We do not model explicitly personal taxes. One can assume that the effective corporate tax rate incorporates the effects from differential personal tax rates (Yang, 2013).

equation (3) gives the optimal lower default bound of the firm's cash flow $\Pi_D = \gamma_D C$ with $\gamma_D < 1$ (Goldstein et al., 2001).

The economic interpretation of equation (3) is as follows. At each date t, the firm can issue or retire/repurchase any amount of debt and equity. Moreover, as long as $(1-\tau)(\delta\Pi - C) \geq 0$, the firm is solvent and liquid, equity-holders collect non-negative dividends, and the entrepreneur chooses the amount of external debt(equity) to issue or retire(repurchase). Otherwise, the firm stops being liquid and equity-holders will require capital injections into the firm (at no cost) if they want to keep alive the option to default.[17] They will stop injecting more capital into the firm when the realized firm's cash flow equals the lower bound $\Pi = \Pi_D$ i.e., the firm becomes insolvent and the market value of equity $\hat{E}_t$ is zero. In the event of default, the firm is liquidated with no liquidation payoff to equity-holders and the absolute priority rule corresponding to chapter 7 of the U.S. banruptcy code is enforced. Equity-holders lose the asset value of the firm plus the tax benefits from debt. Debt-holders lose the stream of coupons and recover a fraction $\alpha \in [0,1]$ of the asset value of the firm.

The decisive entrepreneur's market value of debt under the reference risk-neutral measure $\hat{q}_{t,\omega}$ is:

[17] The assumption simplifies the analysis and is not critical for our research goal. In any case one can adopt a linear-quadratic representation of the cost to issue/repurchase equity as in Yang (2013).

$$\widehat{D}_t = \sum_{s=t}^{T} \rho^{s-t}\, \mathbb{E}^{\hat{q}}[C\mathbf{1}_{\min(t'+t_r)>s} + C(1+r_f{}^{-1})\mathbf{1}_{t_r=s<t'} + (1-\alpha)V_D\mathbf{1}_{t'=s<t_r}|\Pi_s], \quad (4)$$

where t_r is the retirement time of debt; $V_D = (1-\alpha)(1-\tau)\frac{\Pi_D}{r_f-\mu}$ is the liquidation value of the firm at the time of default t'; and the rest of the variables are defined as before.

The first term in equation (4), is the present value of the expected coupon payments until default received by the lenders. The second term, is the value of retired debt (par value plus interest), and the third term is the present value of the recovered part of the asset value of the firm by the lenders at the time of default. Note that despite assuming risk neutrality, risk enters into the analysis as a mean-preserving spread, characterized by the firm's earnings volatility. Risk positively affects the value of the claim hold by the equity-holders i.e., a call option on the assets in place of the firm; but negatively affects the value of the claim hold by the creditors as they write a put option on the assets of the firm, asking for an extra compensation for default risk.

2.2.2 Cautious equity-holders' valuations

Potential external providers of capital to the firm are cautious investors. They have a preference towards robustness given their lack of confidence about the firm's future prospects. They choose the optimal stopping time $t' > t$ to default that maximizes the market value of the firm's equity, but unlike decisive entrepreneurs, under the worst-case scenario risk-neutral measure $q^*_{t,\omega}$ (as long as $t' < \infty$, see Riedel, 2009 section 3.2):

$$E_t^* = \max_{t'>t} \min_{q^*\in Q} \left\{ \sum_{s=t}^{T} \rho^{s-t} \mathbb{E}^{q^*} [(1-\tau)(\delta^* \Pi_s - C) \mathbf{1}_{\infty > t' > s} | \Pi_s] \right\}, \quad (5)$$

where $\mathbb{E}^{q^*}$ is the expectation operator under the worst-case scenario risk-neutral measure $q^*_{t,\omega}$; δ^* is the worst case scenario dividend payout rate; and the rest of the variables are defined as before. The optimal default lower bound under the worst-case scenario risk-neutral measure $q^*_{t,\omega}$ is $\Pi_d^* = \gamma_d^* C < \Pi_d$ with $\gamma_d^* < \gamma_d < 1$ (Attaoui et al., 2021).

The economic interpretation of the dynamic **maxmin** optimization problem (5) is as follows. At each date t, cautious equity-holders solve first the inner constrained minimization problem to identify the worst-case scenario with probability measure $q^*_{t,\omega}$, and then solve the stopping time problem. This allows them to calculate the certainty equivalent of the continuation value function E_s under the worst-case scenario risk-neutral measure $q^*_{t,\omega}$.

Note that unlike risk, ambiguity lowers the value of the option to default. Moreover, the worst-case scenario for equity-holders is when default occurs at the time they perceive their investment in the firm to be most valuable i.e., the long-run growth rate of earnings is at its highest level $\overline{\mu} = \mu + z$ (the payout rate $\delta^* = r - \mu - z$ is at its minimum).

The external equity-holders' market value of debt under the worst-case scenario risk-neutral measure $q^*_{t,\omega}$ is:

$$D_{E,t}^* = \min_{q^*\in Q} \left\{ \sum_{s=t}^{T} \rho^{s-t} \mathbb{E}^{q^*} \left[C \mathbf{1}_{\min(t'+t_r)>s} + C(1+{r_f}^{-1}) \mathbf{1}_{t_r = s < t'} + (1-\alpha) V_{E,d}^* \mathbf{1}_{\infty > t' = s} \middle| \Pi_s \right] \right\}, \quad (6)$$

where $V_{E,d}^{*} = (1-\alpha)(1-\tau)\frac{\Pi_d^*}{r_f-\mu-z}$ is the asset value of the firm at the time of default under equity-holders' worst-case scenario; and the rest of the variables are defined as before.

2.2.3 Debt-holders' market valuations

Cautious creditors anticipate the optimal default lower bound Π_D^* set by the cautious equity-holders. However, for debt-holders the worst-case scenario is when the firm's earnings is at its lowest level $\underline{\mu} = \mu - z$ (the payout rate $\delta^* = r - \mu + z$ is at its maximum) because this is when default is more likely. Thus debt-holders' market value of debt prior to default under the worst-case scenario risk-neutral measure $q_{t,\omega}^*$ is:

$$D_{D,t}^{*} = \min_{q^*\in Q}\{\sum_{s=t}^{T}\rho^{s-t}\,\mathbb{E}^{q^*}[C\mathbf{1}_{\min(t'+t_r)>s} + C(1+{r_f}^{-1})\mathbf{1}_{t_r=s<t'} + (1-\alpha)V_{D,d}^{*}\mathbf{1}_{\infty>t'=s}|\Pi_s]\},\quad(6)$$

where $V_{D,d}^{*} = (1-\alpha)(1-\tau)\frac{\Pi_d^*}{r_f-\mu+z} < V_{E,d}^{*}$ is the liquidation value of the firm under debt-holders' worst-case scenario; and the rest of the variables are defined as before. Note that debt-holders' valuations of debt are less than equity-holders' valuations of debt. Consequently, cautious debt-holders should ask for a commesurate compensation over default risk for bearing default ambiguity.

Note that heterogeneity arises *ex-post endogenously* even if one assumes ex-ante common multiple priors. Moreover, if one makes the assumption supported empirically of segmented capital markets, then we can argue that investors choose to disagree optimally (Attaoui et al., 2021 section 4.2). Further, if the entrepreneur and/or equity-holders refuse to issue the consol at the market valuation $D^*_{D,t}$, then they will lose the opportunity to capitalize the tax shield.

2.2.4 The decisive entrepreneur financing decision revisited

The timing of events in the financing decision under ambiguity and segmented capital markets can be summarized as follows:

1. The decisive entrepreneur chooses the optimal coupon C and time to default t' that maximizes shareholders' long-term welfare under external equity-holders' worst-case scenario risk-neutral measure.
2. Debt is issued to cautious debt-holders at the market value $D^*_{D,t}$.
3. External equity-holders choose the bankruptcy threshold lower bound Π^*_d.

Under ambiguity, at each date t, earnings are realized and everyone updates beliefs to market prices that adjust instantaneously to cautious investors' expectations. Thus, decisive entrepreneurs choose the optimal coupon and time to default that maximizes the value of the firm under equity-holders' worst-case scenario risk-neutral measure $q^*_{t,\omega}$ solving the following Hamilton-Jacobi-Bellman recursive functional equation:

$$E^*_t = \max_{C,t^{'}} \left\{ \delta^* \Pi_t - C + \min_{q^* \in Q} \rho \mathbb{E}^{q^*} [q^*_t E_{t+1}(\Pi^u_{t+1}) + (1 - q^*_t) E_{t+1}(\Pi^d_{t+1})] \right\} \mathbf{1}_{\infty > t' \geq s}, \quad (7)$$

$$\text{s.t. } (1-\tau)(\mathit{\Pi}_t - C) - (\delta^* \mathit{\Pi}_t - C) = 0, \tag{8}$$

where q_t^* is the worst-case scenario risk-neutral measure for the up state of the economy and $(1-q_t^*)$ for the down state of the economy, respectively; equation (8) is the *balancing* budget constraint; and the rest of the variables are defined as before. The optimal coupon C^* and time to default $(t')^*$ determine the optimal (target) capital structure of the firm. Note that the equilibrium is well defined as long as $C^* > 0$ and $(t')^* < \infty$. The debt capacity of the firm is:

$$D^{max} = \max_C D^*_{D,t}. \tag{9}$$

Clearly, the more cautious are the external providers of capital, the lower are market valuations, and in the extreme case of complete lack of confidence on the future prospects of the firm, the target (optimal) debt capacity of the firm becomes zero.

3. Empirical Analysis

3.1. Data

3.1.1. Firm level data

We use annual firm level data from the KPSS patent dataset constructed by Kogan et al. (2017)[18] and the CRSP/COMPUSTAT merged database, from the fiscal years 1994

[18] https://github.com/KPSS2017/Technological-Innovation-Resource-Allocation-and-Growth-Extended-Data.

through 2019. To be included in the full sample, firms should be public with at least one patent issued and have total assets in excess of 10 million dollars. We do not include regulated and financial firms (2-digit SIC codes 49, 60-69). For comparative purposes, we use a second sample that only includes public firms with patents in sectors dominated by franchise firms (2-digit SIC codes 54, 56, 58, 59, 70, 72, 73, 75, 82, and 83).

We provide a description of firm-level variables in Table 1. Summary statistics of firm-level variables for the two unbalanced panels of firms plus the sub-sample of franchisors (SIC code 6794) are provided in Table 2. We note that the typical innovative firm for the sample period under analysis, has a quasi-market leverage of 40.47% that is 1.05 times the median quasi-market leverage of firms in franchise sectors. And is 2.22 times higher than the median quasi-market leverage of franchisors. Moreover, franchise businesses (as well as franchisors) are relatively smaller in size, spend more in R&D, proxying for the *intangibility* of assets, and have patents that in average have a relatively higher market value, proxying for firms' growth opportunities.

3.1.2. Ambiguity and risk factors

We use the ambiguity index KUNC of Viale et al. (2014) that is based on the Kullback-Leibler divergence as proxy of ambiguity. Unlike other ambiguity measures in the related literature e.g., the variance risk premium (VRP), and macroeconomic and financial uncertainty indexes, KUNC is consistent with the ambiguity literature in economics and finance and displays properties desirable in an empirical measure of ambiguity. Intuitively, the measure is constructed as a forward-looking market-based proxy of investors' ambiguity about future business conditions. Viale et al (2014), explain the empirical construction of KUNC, which is based on the argument that robust decision makers should use a set of priors rather than a single prior when making choices under ambiguity.

Firms' aggregate earnings risk is proxied by implied market volatility (VIX). Following Frank and Goyal (2009), we also include in the analysis expected inflation, which can be viewed as an alternative proxy for firms' aggregate earnings risk. In Table 3, Panel A, we provide summary statistics of the proxies used for risk and ambiguity. In Panel B, we report their correlation matrix. As expected, VIX and expected inflation are somehow correlated probably because market volatility, in part, responds to expectations about shifts in monetary policy tied to inflation.

3.2. The determinants of firms' leverage targets

In this subsection, we report results from the first step of the two-stage longitudinal empirical analysis. We estimate firms' quasi-market target leverage ratios, and test the hypothesis that quasi-market leverage targets respond to changes in ambiguity, alongside with risk. We control for firms' characteristics that the corporate finance literature finds to be related with corporate leverage (Frank and Goyal, 2009). The dependent and explanatory variables are defined in Table 1.

In Table 4, we include estimates from static PD regressions. In the first column of the table we report estimates for the full sample of firms obtained by using a fixed effects (Fe) estimator.[19] The high value of residual correlation suggests the presence of cross-sectional dependence across SIC clusters. Moreover, leverage ratios are censored variables. Consequently, we assess the potential problem of model misspecification that plagues the related empirical literature, running more robust regressions. First, we use the robust MM estimator of Gervini and Yohai (2002) with estimates reported in the second column of Table 4. Second, we run a random effects double-censored Tobit estimator with estimates reported in the third column of Table 4.

Consistent with dynamic capital structure theory, risk (*ln VIX*), ambiguity (*ln kunc*), firms' growth opportunities (*pat value/assets*), firms' size (*ln kunc*), firms' profits (*ni/sales*), and asset tangibility (*rnd/sales*) are all contemporaneously related to firms' quasi-market leverage (*qml*), with all coefficients having the correct sign. Robust estimates reported in columns (MM) and (Tb), show that all explanatory variables are

[19] Results from the Hausman test, not provided to save space, lead us to reject the null hypothesis in favor of a fixed effects panel data model.

economically significant and robust to model misspecification. In Table 5, we report estimates of the same PD regressions for the sample of firms in franchising sectors. Robust (MM) and (Tb) estimates are similar to those reported for the full sample. However, the impact of ambiguity on the quasi-market target leverage is almost twice the impact observed for the full sample of firms. We view this evidence as support to the conjecture that franchise firms' capital structure is affected relatively more to ambiguity than the typical firm as discussed previously.

Next, we examine the dynamic impact that temporary shocks from ambiguity and risk may have on firms' quasi-market target leverage. To this purpose, we estimate a system-GMM dynamic model of the firm's quasi-market leverage.[20] In Table 6, we report regression estimates for both the full sample of firms in Panel A, and the sub-sample of firms in franchising sectors in Panel B. We make the following observations. First, we confirm previous evidence from the related capital structure empirical literature that corporate leverage targets show persistence. However, besides contemporaneous (temporary) effects, we do not find evidence of *direct* permanent effects from risk and ambiguity. Of course temporary effects may still build up through the leverage target.

[20] We use the continuous updating GMM (CUE-GMM) estimator of Hansen, Heaton, and Yaron (1996) implementing Kripfganz (2019) **xtdpdgmm** package in STATA. The implementation incorporates linear and nonlinear moment conditions as suggested by Ahn and Schmidt (1995).

3.3. Firms' financing choices and the speed of adjustment (SOA)

In this section, we report results from second step regressions. In Table 7, we include estimates from multinomial logit regressions assuming a static leverage target, for the choices of issuing debt versus issuing equity or not issuing (the base outcome). In Table 8, we report similar estimates for the choices of retiring debt versus repurchasing equity or doing nothing. In Table 9, we show estimates from simialr multinomial logit regressions assuming a dynamic leverage target for the choices of issuing debt versus issuing equity or doing nothing, and in Table 10 for the choices of retiring debt versus repurchasing equity or doing nothing.

We highlight the following results. On average, for all innovative firms, a local one standard deviation from the target leverage decreases the odds of issuing debt by 3.70% if assuming a static quasi-market leverage target, and 20.60% if assuming a dynamic quasi-market leverage target. On the other hand, for franchise firms the deviation does not seem to exert a marginal effect. Moreover, for all firms a local one standard deviation increases the odds of issuing equity by 5.39% if one assumes a static quasi-market leverage target, and by 70.20% if one assumes a dynamic quasi-market leverage target. For franchise firms, the same local deviation increases the odds of issuing equity by 5.30% if assuming a static quasi-market leverage target, and by 7.80% if assuming a dynamic quasi-market leverage target. Robustness checks assuming a static book-leverage target gives similar results.

In Table 11, we report estimates of the OLS regression of the speed of adjustment (SOA) for all firms in Panel A, and firms in franchising sectors in Panel B, assuming a static quasi-market leverage target. The SOA for the full sample is 16.02%, and 15.63% for franchise firms. If one assumes a dynamic quasi-market leverage target, as shown in Table 12, the adjustment drops significantly to 1.44% for all firms (Panel A), and remains close to the previous result, at 14.62% for franchise firms (Panel B).

Overall, the evidence confirms previous findings in the related empirical literature. First, changes in quasi-market leverage ratios are largely explained by changes in equity market value (Welch, 2004). Second, corporate leverage targets are time-invariant, with firms rebalancing their leverage occasionally because of temporary shocks and frictions. Last but not least, the robustness of the results obtained for the restricted sample of franchise firms confirms our suspicion that *heterogeneous* institutional factors play a crucial role in the optimal level of firms' corporate leverage. Furthermore, the results seem to support the trade-off hypothesis with some important caveats (see Table 13). As pointed out by Strebulaev (2007), standard cross-sectional tests of financing choices do not constitute a clear rejection or acceptance of the underlying theory.[21] We note that results from the Hausman-McFadden test for the independence of irrelevant alternatives (IIA) assumption inherent in multinomial logit models lead us to reject the null of independence across financing choices.

3.4. Robustness Checks

We perform several robustness checks to our main empirical results. First, we investigate the effect of expected inflation on corporate leverage. In Table 14, we provide results from multinomial logit panel regressions for the choices of issuing debt versus issuing equity versus doing nothing, for all firms (Panel A), and for firms in franchising sectors (Panel B), assuming a static quasi-market leverage target. On average, for all public innovative firms, a local one standard deviation in expectations about future inflation increases the odds of issuing debt by 1.70% and decreases the odds of issuing equity by 7.43%. In Table 15, we provide results from multinomial logit panel regressions for the choices of retiring debt versus repurchasing equity versus doing nothing, for all firms (Panel A), and firms in franchising sectors (Panel B), assuming a static quasi-market leverage target. A local one standard deviation in expectations about future

[21] Unobserved heterogeneity, frictions, and temporary shocks make difficult the interpretation of empirical results (Lemmon, Roberts and Zender, 2008; and Yin and Ritter, 2020).

inflation has a marginal effect of 0.10% over the odds of retiring debt, and increases the odds of repurchasing equity by 7.86%. In Tables 15 and 16, we report estimates from similar multinomial logit panel regressions for all firms (Panel A), and firms in franchising sectors (Panel B), but assuming a static book leverage target. Results are very similar to those in the main empirical analysis assuming a static quasi-market leverage target.

Finally, in Table 18 we report estimates of SOA regressions assuming a static book-leverage target. The results suggest a much higher speed of adjustment when assuming a book leverage target than a quasi-market target of 28.64% for all firms, and a similar one of 16.12% for firms in franchising sectors.

4. Capital structure and the franchising decision

The typical franchise business is characterized by a highly disaggregated vertical local operation. Because franchisors are decisive entrepreneurs, as shown above, their target leverage will always be higher than the target leverage of the franchisees, who are cautious equity-holders. However, they acknowledge the existence of a binding capital constraint imposed by external investors ambiguity, especially debt-holders, who under extreme ambiguity may choose to not participate in the investment venture at all. Thus, some decisive entrepreneurs may have an incentive to franchise in order to bypass the capital constraint as it is common knowledge that potential franchisees (equity-holders) are less cautious than debt-holders.

Ambiguity can also explain the common practice in the franchising industry to impose a very low debt capacity to potential franchisees, which as shown above depends on the level of disaggregation of the franchising network of outlets. In this regard, franchisors have an incentive to appropriate the tax benefits of debt available to them given the *leverage buffer* provided by the franchisees. That is, as $n \to \overline{N}$ then $z > r - \mu$ and the dividend payout rate to franchisees may become strictly negative at all times $t > 0$, independently of the level of debt. Because a negative market value of equity contradicts limited liability, then it must be that $D^{max} = 0$, and the target leverage ratio of franchisees becomes zero. De Fraja and Piga (1999), and De Jong, Jiang, and Verwijmeren (2011), discuss the leverage of franchise firms. They show that franchisors' leverage is negatively related to franchisees' leverage, with the effect becoming stronger the larger the number of outlets franchised. However, their hypothesis is based on agency costs, and does not follow from the dynamic capital structure problem of the firm.

5. Conclusion

Consistent with dynamic capital structure theory under ambiguity, we provide theoretical and empirical support to the capital constraint hypothesis of franchising as an optimal capital structure choice under ambiguity. We show that decisive entrepreneurs have an incentive to franchise in order to bypass the capital constraint that arises endogenously from external cautious investors robust beliefs. Ambiguity can also explain the common practice in the franchising industry to impose a very low debt capacity to potential franchisees.

Further empirical results show that: 1) temporary shocks to market risk and expected inflation both exert a directly proportional impact on firms' target leverage, while ambiguity exerts a negative impact, which is much more significant for firms in franchising sectors; 2) changes in quasi-market leverage ratios are largely explained by changes in equity market value; and 3) firms have static corporate leverage targets, rebalancing their leverage occasionally because of temporary shocks from risk and ambiguity.

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Table 1. Variable Definitions

This table provides the description and source of the variables used in empirical analyses.

Dependent Variables	**Description**	**Source**
qml	Quasi market leverage (Current liabilities + Long term debt) / (Book Value of Debt + Market Value of Equity)	CRSP/COMPUSTAT merged database
bl	Book leverage (Current liabilities + Long term debt) / Total Assets	CRSP/COMPUSTAT merged database
Explanatory Variables		
VIX	CBOE volatility index	FRED database
kunc	Investors' ambiguity or Knightian uncertainty index	Viale, García-Feijóo & Giannetti (2014)
inf	Expected inflation annualized (not seasonally adjusted)	FRED database
sales	Total sales revenues	CRSP/COMPUSTAT merged database
ni	Net income	CRSP/COMPUSTAT merged database.
rnd	Research & Development Expenses	CRSP/COMPUSTAT merged database
pat	Patents market value	Kogan, Papanikolaou, Seru & Stoffman (2017)
assets	Total assets	CRSP/COMPUSTAT merged database

Table 2. Summary Statistics – Firm Specific Variables

This table provides the description and source of the variables used in empirical analyses.

Variables		# Obs.	Mean	Median	Std. Dev.	Min	Max
All Firms							
bl	%	9,220	59.05	60.36	17.45	0.00	100.00
Δbl	$Mill.	8,834	0.00	0.00	0.12	-1.00	1.00
qml	%	9,220	42.54	40.47	18.94	0.17	100.00
Δqml	$Mill.	8,834	0.00	0.00	0.11	-0.94	0.89
lev deficit	$Mill.	8,485	0.01	0.03	0.18	-1.06	0.78
sales	$Mill.	9,220	47,086.99	10,853.42	156,605.70	0.74	3,600,928.00
ni	$Mill.	9,220	2,501.90	291.28	12,218.86	-198,833.00	292,417.20
rnd	$Mill.	9,220	1,158.60	20.02	5,918.86	-0.08	111,977.50
pat	$Mill.	9,220	34.65	1.78	139.24	0	4,357.90
assets	$Mill.	9,220	61,448.76	11,037.54	216,202.30	10.07	3,642,130.00
Firms in Franchise Sectors							
bl	%	1,099	61.91	63.10	19.45	0.00	100.00
Δbl	$Mill.	1,051	0.00	0.00	0.13	-0.99	0.98
qml	%	1,099	42.68	38.78	20.98	2.08	100.00
Δqml	$Mill.	1,051	0.00	0.00	0.11	-0.91	0.57
lev deficit	$Mill.	1,009	0.01	0.05	0.20	-0.77	0.54
sales	$Mill.	1,099	46,892.18	14,292.96	91,310.05	38.66	750,437.80
ni	$Mill.	1,099	2,279.80	388.86	8,095.69	-29,257.22	105,402.30
rnd	$Mill.	1,099	1,458.20	0.09	6,552.50	0.00	91,809.25
pat	$Mill.	1,099	43.81	0.00	190.52	0.00	3,326.44
assets	$Mill.	1,099	49,043.73	11,909.05	111,635.90	29.28	1,480,997.00
Franchisors							
bl	%	26	51.53	49.78	7.37	37.81	64.71
Δbl	$Mill.	25	0.00	0.00	7.97	-18.98	20.30
qml	%	26	19.85	18.23	6.27	7.64	32.82
Δqml	$Mill.	25	0.00	0.01	0.07	-0.12	0.12
lev deficit	$Mill.	24	-0.09	-0.11	0.08	-0.22	0.06
sales	$Mill.	26	4,164.58	4,046.92	1,733.68	1,287.75	7,790.22
ni	$Mill.	26	228.74	181.32	665.20	-1,700.01	1,330.87
rnd	$Mill.	26	424.71	452.78	238.42	41.16	892.10
pat	$Mill.	26	8	9	2	3	11
assets	$Mill.	26	9,598.98	10,082.06	5,097.52	1,883.86	18,356.64

Table 3. Summary Statistics – Risk, Ambiguity and Inflation Factors

This table provides summary statistics and correlation matrix between risk, ambiguity, and inflation factors used in empirical analyses for the sample period 1994-2019, t-stats in black denote significance at 95% level.

Panel A – Summary Statistics

Variables	**# Obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**
VIX	26	19.43	5.91	11.09	32.70
kunc	26	0.18	0.24	0.08	0.99
inf	26	19.43	5.91	11.09	32.70

Panel B – Correlation Matrix

	ln VIX	*ln kunc*	*ln infl*
ln VIX		-0.28	0.51
ln kunc			0.11
ln inf			

t-values – 95% significance level (t-critical: 2.07)

	ln VIX	*ln kunc*	*ln infl*
ln VIX		1.34	**2.70**
ln kunc			0.51
ln inf			

Table 4. Robust Static Model - Quasi Market Leverage (All Firms)

This table provides estimates of the static model for *qml* for all public firms with patents except regulated and financial firms (SIC2s 49, 60-69). Dependent and explanatory variables are defined in Table 1; α is a constant; ψ_i is a firm specific dummy for unobserved fixed effects; s_t is a time specific dummy for unobserved fixed effects; and $\varepsilon_{i,t}$ is the error term. Variable definitions are provided in Table 1. Sample period: 1994-2019.

$$qml_t^i = \alpha + \beta_{ln\ VIX}\, ln\, VIX_t + \beta_{ln\ kunc}\, ln\, kunc_t + \beta_{ni/sales} ni/sales_t^i + \beta_{rnd/sales} rnd/sales_t^i + \beta_{pat/assets} pat/assets_t^i + \beta_{ln\ assets} ln\ assets_t^i + \psi_i + s_t + \varepsilon_{i,t}$$

We use: 1) a (within-industry) pair-wise differenced fixed effects panel data regression estimator (Fe); 2) the robust MM estimator of Gervini and Yohai (2002) that combines an initial high breakdown S estimator with a subsequent redescending M estimator a là Huber (1973); and 3) a double censored Tobit estimator. Robust standard errors in parenthesis are adjusted by industry clusters and calculated using the sandwich estimator. The Hausman test between models at the bottom of the table has null hypothesis that coefficients are not different. The random effects double censored Tobit estimator has a lower limit of 0 and an upper limit of 1 with likelihood function calculated using a Gauss-Hermite quadrature with 12 integration points. The likelihood-ratio (LR) test has null that the full maximum-likelihood model is not statistically different than the restricted model that includes only a constant term in the regression equation. Statistical significance is reported as follows: *** = 1 % statistical significance, ** = 5% statistical significance, and * = 10% statistical significance.

QML	**(Fe)**	**(MM)**	**(Tb)**	***t-stat/t-stat/z*-stat**	***p-value***
ln VIX	0.1102	0.0901	0.1086	13.97/16.60/21.74	$0.00^{***}/0.00^{***}/0.00^{***}$
	(0.0079)	(0.0054)	(0.0050)		
ln kunc	-0.0032	-0.0038	-0.0033	-2.49/-3.92/-2.20	$0.01^{***}/0.00^{***}/0.03^{**}$
	(0.0013)	(0.0010)	(0.0015)		
ni/sales	-0.1349	-0.6333	-0.1384	-2.39/-10.80/-17.04	$0.02^{**}/0.00^{***}/0.00^{***}$
	(0.0565)	(0.0586)	(0.0081)		
rnd/sales	-0.3621	-0.7973	-0.4580	-1.88/-6.28/-7.21	$0.06^{*}/0.00^{***}/0.00^{***}$
	(0.1923)	(0.1269)	(0.0635)		
pat/assets	-9.7662	-10.6362	-10.4858	-7.72/-5.13/-14.69	$0.00^{***}/0.00^{***}/0.00^{***}$
	(1.2657)	(2.0727)	(0.7138)		
ln assets	0.0271	0.0319	-0.0198	4.59/7.05/10.42	$0.00^{***}/0.00^{***}/0.00^{***}$
	(0.0059)	(0.0045)	(0.0019)		
α	-0.1323		-0.0464	-2.03/-/-1.86	$0.04^{**}/0.06^{*}$
	(0.0653)		(0.0249)		

Statistics					
#Observations	8,485	Wald-$\chi^2(6)$ *p-value*	809.59	#Obs. uncensored	8,470
SIC Groups	381		(0.0000)	Left-censored	0.00
R^2	0.1238	Break point	50	Right-censored	15.00
F(6,380)	82.95	M-estimator	3.44	Log likelihood	4,920.03
p-value	(0.0000)	S-estimator	1.55	Wald test - $\chi^2(6)$	1,086.90
σ_η	0.14	Scale	0.13	*p-value*	(0.0000)
σ_ε	0.12	Efficiency	85%	LR test $\sigma_\eta = 0$ - $\chi^2(1)$	4,302.09
$\rho_{\eta_i, Xb}$	-0.11			*p-value*	(0.0000)
ρ	0.56			σ_η	0.13
Hausman-$\chi^2(6)$	20.62			σ_ε	0.13
p-value	(0.0021)			ρ	0.52

Table 5. Robust Static Model - Quasi Market Leverage (Firms in Franchise Sectors)

This table provides estimates of the static model for *qml* for public firms with patents in franchise sectors SIC2s: 54, 56, 58, 59, 70, 72, 73, 75, 82, and 83. Dependent and explanatory variables are defined in Table 1; α is a constant; ψ_i is a firm specific dummy for unobserved fixed effects; s_t is a time specific dummy for unobserved fixed effects; and $\varepsilon_{i,t}$ is the error term. Variable definitions are provided in Table 1. Sample period: 1994-2019.

$$qml_t^i = \alpha + \beta_{ln\ VIX}\, ln\, VIX_t + \beta_{ln\ kunc}\, ln\, kunc_t + \beta_{ni/sales} ni/sales_t^i + \beta_{rnd/sales} rnd/sales_t^i + \beta_{pat/assets} pat/assets_t^i + \beta_{ln\ assets} ln\ assets_t^i + \psi_i + s_t + \varepsilon_{i,t}$$

We use: 1) a (within-industry) pair-wise differenced fixed effects panel data regression estimator (Fe); 2) the robust MM estimator of Gervini and Yohai (2002) that combines an initial high breakdown S estimator with a subsequent redescending M estimator a là Huber (1973); and 3) a double censored Tobit estimator. Robust standard errors in parenthesis are adjusted by industry clusters and calculated using the sandwich estimator. The Hausman test between models at the bottom of the table has null hypothesis that coefficients are not different. The random effects double censored Tobit estimator has a lower limit of 0 and an upper limit of 1 with likelihood function calculated using a Gauss-Hermite quadrature with 12 integration points. The likelihood-ratio (LR) test has null that the full maximum-likelihood model is not statistically different than the restricted model that includes only a constant term in the regression equation. Statistical significance is reported as follows: *** = 1 % statistical significance, ** = 5% statistical significance, and * = 10% statistical significance.

QML	**(Fe)**	**(MM)**	**(Tb)**	***t-stat/t-stat/z*-stat**	***p-value***
ln VIX	0.0643	0.0845	0.0601	2.45/4.76/3.90	$0.02^{**}/0.00^{***}/0.00^{***}$
	(0.0262)	(0.0178)	(0.01540)		
ln kunc	-0.0074	-0.0040	-0.0078	-2.40/-1.86/-1.70	$0.02^{**}/0.07^{*}/0.09^{*}$
	(0.0031)	(0.0021)	(0.0046)		
ni/sales	-0.3669	-0.4906	-0.3758	-2.92/-3.26/-8.48	$0.00^{***}/0.00^{***}/0.00^{***}$
	(0.1256)	(0.1504)	(0.0443)		
rnd/sales	-2.9687	-3.3641	-2.7939	-2.78/-2.38/-5.36	$0.01^{***}/0.02^{**}/0.00^{***}$
	(1.0672)	(1.4158)	(0.5211)		
pat_value/assets	-13.0902	-11.9459	-14.4372	-3.39/-3.48/-4.37	$0.00^{***}/0.00^{***}/0.00^{***}$
	(3.8598)	(3.4295)	(3.3028)		
ln assets	0.0457	0.0612	0.0358	2.22/4.08/5.23	$0.03^{**}/0.00^{***}/0.00^{***}$
	(0.0206)	(0.0150)	(0.0068)		
α	-0.1569		-0.0405	-0.64/-0.47	0.52/0.64
	(0.2447)		(0.0864)		
Statistics					
#Observations	1,009	Wald-χ^2(6) *p-*	84.66	#Obs. uncensored	1,004
SIC Groups	45	*value*	(0.0000)	Left-censored	0.00
R^2	0.1313	Break point	50	Right-censored	5.00
F(6,380)	10.88	M-estimator	3.44	Log likelihood	524.00
p-value	(0.0000)	S-estimator	1.55	Wald test - $\chi^2(6)$	137.55
σ_η	0.17	Scale	0.13	*p-value*	(0.0000)
σ_ε	0.13	Efficiency	85%	LR test $\sigma_\eta = 0$ - $\chi^2(1)$	577.89
$\rho_{\eta_i, Xb}$	-0.16			*p-value*	(0.0000)
ρ	0.59			σ_η	0.15
Hausman-χ^2(6)	12.06			σ_ε	0.13
p-value	(0.0606)			ρ	0.57

Table 6. GMM Dynamic Model – Quasi Market Leverage

This table provides regression estimates of the System GMM dynamic panel data model of *qml* for all public firms with patents except regulated and financial firms (SIC2s 49, 60-69) in Panel A, and public firms with patents in franchise sectors SIC2s: 54, 56, 58, 59, 70, 72, 73, 75, 82, and 83 in Panel B. Dependent and explanatory variables are defined in Table 1; k is the lag order of the DGP; q=k is the maximum lag order, without any loss of generality we assume an AR(1) process; ψ_i is a firm specific dummy for unobserved fixed effects; s_t is a time specific dummy for unobserved fixed effects; and $\varepsilon_{i,t}$ is the error term. Variable definitions are provided in Table 1. Sample period: 1994-2019.

$$qml_t^i = \alpha + \sum_{k=1}^{K} \rho_k\, qml_{(t-k)}^i + \sum_{k=0}^{K} \beta_{ln\,VIX,k}\, ln\,VIX_{t-k} + \sum_{k=0}^{K} \beta_{ln\ kunc,}\ \ ln\,kunc_{t-k} + \beta_{ni/sales} ni/sales_t^i + \beta_{rnd/sales} rnd/sales_t^i + \\ + \beta_{pat/assets} pat/assets_t^i + \beta_{ln\ assets} ln\ assets_t^i + \psi_i + s_t + \varepsilon_{i,t}\ \ for\ \ t = q+1, \cdots, T$$

We use the continuous updating GMM (CUE-GMM) estimator of Hansen, Heaton, and Yaron (1996) implementing Kripfganz (2019) **xtdpdgmm** package in STATA. The implementation for Panel A incorporates (18) linear and (1) nonlinear moment conditions and for Panel B (20) linear and (1) nonlinear moment conditions as suggested by Ahn and Schmidt (1995) under homoskedasticity and absence of serial correlation. The instruments for the forward orthogonal deviations equation in Panel A are the endogenous variable *qml* with lags (2/4) and the pre-determined variables *ln VIX* and *ln kunc* with lags (1/2) and in Panel B the endogenous variable *qml* with lags (2/4) and the pre-determined variables *ln VIX* and *ln kunc* with lags (1/4). The instruments for the equation in levels in both Panels are *qml* lagged one period and the control variables *ni/sales*, *rnd/sales*, *pat/assets* and *ln assets*. GMM-type instruments are curtailed and collapsed to standard instruments to reduce the number of instruments. Robust standard errors are adjusted by industry clusters and calculated using the sandwich estimator. Statistical significance is reported as follows: *** = 1 % statistical significance, ** = 5% statistical significance, and * = 10% statistical significance.

Panel A : All Firms				
Instruments = 19	**# Obs. = 8,098**		**# SIC groups = 381**	
QML	**Coefficient**	**Std. Error**	***t*-stat**	***p*-value**
qml_{t-1}	0.4587	0.1013	4.53	0.0000***
$ln\ VIX_t$	0.0597	0.0249	2.40	0.0017***
$ln\ VIX_{t-1}$	-0.0160	0.0228	-0.70	0.4830
$ln\ kunc_t$	-0.0204	0.0057	-3.59	0.0000***
$ln\ kunc_{t-1}$	0.0030	0.0030	0.06	0.9550
ni/sales	-1.2035	0.5984	-2.01	0.0000***
rnd/sales	-17.4050	5.9518	-2.92	0.0040***
pat/assets	-9.0533	7.9138	-1.14	0.2530
ln assets	0.0668	0.0250	2.67	0.0080***
α	-0.1813	0.2205	-0.82	0.4120
Arellano-Bond AR first diff. & Sargan-Hansen tests				
AR(1) = -1.08 (0.2805)				
AR(2) = -0.94 (0.3448)				
AR(3) = 0.20 (0.8448)				
Sargan-Hansen test for overid. restr. (χ^2_9) = 11.86 (0.2210)				

Panel B : Firms in Franchise Sectors				
Instruments = 21	**# Obs. = 961**		**# SIC groups = 45**	
QML	**Coefficient**	**Std. Error**	***t*-stat**	***p*-value**
qml_{t-1}	0.4918	0.0957	5.14	0.0000***
$ln\ VIX_t$	0.1424	0.0328	4.35	0.0000***
$ln\ VIX_{t-1}$	-0.0205	0.0239	-0.86	0.3950
$ln\ kunc_t$	-0.0189	0.0047	-4.03	0.0000***
$ln\ kunc_{t-1}$	0.0048	0.0032	1.50	0.1420
ni/sales	-0.1540	0.0383	-4.02	0.0000***
rnd/sales	-5.0542	1.7634	-2.87	0.0060***
pat/assets	-6.8416	5.7638	-1.19	0.2420
ln assets	0.1321	0.0250	5.29	0.0000***
α	-1.3790	0.3010	-4.58	0.0000***
Arellano-Bond AR first diff. & Sargan-Hansen tests				
AR(1) = -3.49 (0.0005)				
AR(2) = 1.01 (0.3127)				
AR(3) = 0.40 (0.6910)				
Sargan-Hansen test for overid. restr. (χ^2_{11}) = 9.28 (0.5964)				

Table 7. Multinomial Logit Model – Debt/Equity Issues with Static Quasi Market Leverage Target

This table provides regression estimates of a multinominal logit model for the vector of choices $(\boldsymbol{\alpha_j})$ to not issue debt or equity versus 1) issue debt; or 2) issue equity using a random effects estimator with unstructured covariance matrix given the vector $\mathbf{x}_i$ of regressors including firms' characteristics. Sample period: 1994-2019.

$$Prob(Y_i = j|\mathbf{x}_i) \equiv p_{ij} = \frac{exp(\mathbf{x}_i'\boldsymbol{\alpha_j})}{1+\sum_{k=1}^{J} exp(\mathbf{x}_i'\boldsymbol{\alpha_k})}$$

The sample includes all public firms with patents except regulated and financial firms (SIC2s 49, 60-69) in Panel A, and public firms with patents in franchise sectors SIC2s: 54, 56, 58, 59, 70, 72, 73, 75, 82, and 83 in Panel B. The random effects implementation obeys the infeasibility of a fixed effects estimator given the curse of dimensionality. The pseudo-likelihood function is calculated using a Gauss-Hermite quadrature with 16 integration points and the Broyden–Fletcher–Goldfarb–Shanno (BFGS) numerical optimization algorithm. Robust standard errors are adjusted by industry clusters and calculated using the sandwich estimator. Statistical significance is reported as follows: *** = 1 % statistical significance, ** = 5% statistical significance, and * = 10% statistical significance.

Panel A : All Firms						
# Observations = 8,485	**# SIC groups= 381**					
		Issue Debt			**Issue Equity**	
	Coefficient	**Std. Error**	**Marginal Δ**	**Coefficient**	**Std. Error**	**Marginal Δ**
leverage deficit	-0.9587	0.1669***	-0.037	2.1905	0.2616***	0.053
ln VIX	-0.4053	0.0482***	-0.019	0.0497	0.0592	0.005
ln kunc	0.0045	0.0307	-0.004	0.1810	0.0345***	0.020
ni/sales	-0.0014	0.2095	-0.047	6.9758	0.9720***	0.194
rnd/sales	0.2047	0.7576	0.000	0.6022	1.0432	0.003
pat/assets	-7.7374	15.4298	-0.004	41.7810	15.7869***	0.012
ln assets	0.0066	0.0159	0.014	-0.2352	0.0215***	-0.045
Statistics						
Log pseudo-likelihood	-7,225.50					
Wald test - $\chi^2(6)$	2,281.29					
p-value	(0.0000)					
Hausman-McFadden test - $\chi^2(6)$	0.61					
p-value	(0.9962)					

Panel B : Firms in Franchise Sectors						
# Observations = 1,009	**# SIC groups= 45**					
		Issue Debt			**Issue Equity**	
	Coefficient	**Std. Error**	**Marginal Δ**	**Coefficient**	**Std. Error**	**Marginal Δ**
leverage deficit	-0.5047	0.4639	-0.033	2.3775	0.7482***	0.058
ln VIX	-0.5003	0.1929***	-0.027	0.3952	0.2127*	0.016
ln kunc	0.1561	0.1034	0.015	0.4355	0.1251***	0.041
ni/sales	1.4296	0.8089*	-0.008	8.8216	2.1585***	0.123
rnd/sales	-0.3547	3.1693	-0.012	12.1221	3.0639***	0.037
pat/assets	-121.0392	59.4094**	-0.031	17.0638	62.6641	0.007
ln assets	0.04544	0.0592	0.029	-0.3707	0.0739***	-0.054
Statistics						
Log pseudo-likelihood	-838.34					
Wald test - $\chi^2(6)$	945.76					
p-value	(0.0000)					
Hausman-McFadden test - $\chi^2(12)$	2.20					
p-value	(0.9990)					

Table 8. Multinomial Logit Model – Debt/Equity Retirements/Repurchases with Static Quasi Market Leverage Target

This table provides regression estimates of a multinominal logit model for the vector of choices $(\boldsymbol{\alpha}_\mathbf{j})$ to not retire debt or repurchasing equity versus 1) retire debt; or 2) repurchase equity using a random effects estimator with unstructured covariance matrix given the vector $\mathbf{x}_i$ of regressors including firms' characteristics. Sample period: 1994-2019.

$$Prob(Y_i = j|\mathbf{x}_i) \equiv p_{ij} = \frac{exp(\mathbf{x}_i'\boldsymbol{\alpha}_\mathbf{j})}{1 + \sum_{k=1}^{J} exp(\mathbf{x}_i'\boldsymbol{\alpha}_\mathbf{k})}$$

The sample includes all public firms with patents except regulated and financial firms (SIC2s 49, 60-69) in Panel A, and public firms with patents in franchise sectors SIC2s: 54, 56, 58, 59, 70, 72, 73, 75, 82, and 83 in Panel B. The random effects implementation obeys the infeasibility of a fixed effects estimator given the curse of dimensionality. The pseudo-likelihood function is calculated using a Gauss-Hermite quadrature with 16 integration points and the Broyden–Fletcher–Goldfarb–Shanno (BFGS) numerical optimization algorithm. Robust standard errors are adjusted by industry clusters and calculated using the sandwich estimator. Statistical significance is reported as follows: *** = 1 % statistical significance, ** = 5% statistical significance, and * = 10% statistical significance.

Panel A : All Firms						
# Observations = 8,485	**# SIC groups= 381**					
	Retire Debt			**Repurchase Equity**		
	Coefficient	**Std. Error**	**Marginal Δ**	**Coefficient**	**Std. Error**	**Marginal Δ**
leverage deficit	-1.4162	0.3178***	-0.011	-1.7467	0.2915***	-0.036
ln VIX	0.0158	0.0634	0.002	-0.4042	0.0502***	-0.017
ln kunc	-0.0659	0.0403	-0.001	-0.2621	0.0293***	-0.033
ni/sales	0.7697	1.6650	0.026	-3.7873	1.0712***	-0.089
rnd/sales	-1.8237	1.5360	-0.005	-0.6926	1.7865	-0.002
pat/assets	18.4521	17.1834	0.004	-6.3338	16.4603	-0.003
ln assets	-0.2400	0.0252***	-0.031	0.0032	0.0171	0.007
Statistics						
Log pseudo-likelihood	-6,415.11					
Wald test - $\chi^2(6)$	2,713.36					
p-value	(0.0000)					
Hausman-McFadden test - $\chi^2(6)$	0.22					
p-value	(0.9998)					
Panel B : Firms in Franchise Sectors						
# Observations = 1,009	**# SIC groups= 45**					
	Retire Debt			**Repurchase Equity**		
	Coefficient	**Std. Error**	**Marginal Δ**	**Coefficient**	**Std. Error**	**Marginal Δ**
leverage deficit	-1.2960	0.7641*	-0.010	-1.3489	0.5277***	-0.036
ln VIX	0.4658	0.1977**	0.008	-0.3086	0.1553**	-0.017
ln kunc	-0.1344	0.1193	-0.002	-0.1195	0.0804	-0.019
ni/sales	4.3814	2.0627**	0.044	-3.8712	1.4160***	-0.072
rnd/sales	-11.5602	14.9778	-0.016	-3.4017	5.4036	-0.011
pat/assets	-41.5795	113.9887	-0.004	14.0768	68.0444	0.004
ln assets	-0.4303	0.0709***	-0.031	-0.0156	0.0513	0.005
Statistics						
Log pseudo-likelihood	-724.32					
Wald test - $\chi^2(6)$	422.28					
p-value	(0.0000)					
Hausman-McFadden test - $\chi^2(13)$	17.80					
p-value	(0.1652)					

Table 9. Multinomial Logit Model – Debt/Equity Issues with Dynamic Quasi Market Leverage Target

This table provides regression estimates of a multinominal logit model for the vector of choices $(\boldsymbol{\alpha}_\mathbf{j})$ to not issue debt or equity versus 1) issue debt; or 2) issue equity using a random effects estimator with unstructured covariance matrix given the vector $\mathbf{x}_i$ of regressors including firms' characteristics. Sample period: 1994-2019.

$$Prob(Y_i = j|\mathbf{x}_i) \equiv p_{ij} = \frac{exp(\mathbf{x}_i'\boldsymbol{\alpha}_\mathbf{j})}{1+\sum_{k=1}^{J} exp(\mathbf{x}_i'\boldsymbol{\alpha}_\mathbf{k})}$$

The sample includes all public firms with patents except regulated and financial firms (SIC2s 49, 60-69) in Panel A, and public firms with patents in franchise sectors SIC2s: 54, 56, 58, 59, 70, 72, 73, 75, 82, and 83 in Panel B. The random effects implementation obeys the infeasibility of a fixed effects estimator given the curse of dimensionality. The pseudo-likelihood function is calculated using a Gauss-Hermite quadrature with 16 integration points and the Broyden–Fletcher–Goldfarb–Shanno (BFGS) numerical optimization algorithm. Robust standard errors are adjusted by industry clusters and calculated using the sandwich estimator. Statistical significance is reported as follows: *** = 1 % statistical significance, ** = 5% statistical significance, and * = 10% statistical significance.

Panel A : All Firms						
# Observations = 8,485	**# SIC groups= 381**					
		Issue Debt			**Issue Equity**	
	Coefficient	**Std. Error**	**Marginal Δ**	**Coefficient**	**Std. Error**	**Marginal Δ**
leverage deficit	-2.8704	0.2836***	-0.206	5.7990	0.4391***	0.702
ln VIX	-0.5637	0.0534***	-0.027	0.2241	0.0628***	0.011
ln kunc	-0.0518	0.0311*	-0.015	0.2994	0.0372***	0.035
ni/sales	-2.9558	0.3673***	-0.135	13.1346	0.9280***	0.418
rnd/sales	-48.8119	4.8970***	-0.206	99.5189	7.4110***	0.705
pat/assets	14.4448	15.3190	0.006	11.7315	15.8772	0.002
ln assets	0.1660	0.0232***	0.077	-0.5337	0.0297***	-0.086
Statistics						
Log pseudo-likelihood	-7,052.57					
Wald test - $\chi^2(6)$	2,272.08					
p-value	(0.0000)					
Hausman-McFadden test - $\chi^2(6)$	1.04					
p-value	(0.9839)					
Panel B : Firms in Franchise Sectors						
# Observations = 1,009	**# SIC groups= 45**					
		Issue Debt			**Issue Equity**	
	Coefficient	**Std. Error**	**Marginal Δ**	**Coefficient**	**Std. Error**	**Marginal Δ**
leverage deficit	-0.8684	0.4679*	-0.051	2.5090	0.6948***	0.078
ln VIX	-0.6685	0.2089***	-0.039	0.8991	0.2927***	0.035
ln kunc	0.1478	0.1086	0.007	0.5019	0.1208***	0.050
ni/sales	1.6204	0.8197*	-0.011	9.5607	2.2144***	0.137
rnd/sales	-2.7459	3.0184	-0.028	17.8515	4.3283***	0.060
pat/assets	-109.7725	57.0066*	-0.027	-9.9619	66.8223	0.003
ln assets	0.1006	0.0659	0.054	-0.5436	0.0973***	-0.073
Statistics						
Log pseudo-likelihood	-836.25					
Wald test - $\chi^2(6)$	1,018.16					
p-value	(0.0000)					
Hausman-McFadden test - $\chi^2(12)$	4.12					
p-value	(0.9812)					

Table 10. Multinomial Logit Model – Debt/Equity Retirements/Repurchases with Dynamic Quasi Market Leverage Target

This table provides regression estimates of a multinominal logit model for the vector of choices $(\boldsymbol{\alpha}_\mathbf{j})$ to not retire debt or repurchasing equity versus 1) retire debt; or 2) repurchase equity using a random effects estimator with unstructured covariance matrix given the vector $\mathbf{x}_i$ of regressors including firms' characteristics. Sample: 1994-2019.

$$Prob(Y_i = j|\mathbf{x}_i) \equiv p_{ij} = \frac{exp(\mathbf{x}_i'\boldsymbol{\alpha}_\mathbf{j})}{1+\sum_{k=1}^{J} exp(\mathbf{x}_i'\boldsymbol{\alpha}_\mathbf{k})}$$

The sample includes all public firms with patents except regulated and financial firms (SIC2s 49, 60-69) in Panel A, and public firms with patents in franchise sectors SIC2s: 54, 56, 58, 59, 70, 72, 73, 75, 82, and 83 in Panel B. The random effects implementation obeys the infeasibility of a fixed effects estimator given the curse of dimensionality. The pseudo-likelihood function is calculated using a Gauss-Hermite quadrature with 16 integration points and the Broyden–Fletcher–Goldfarb–Shanno (BFGS) numerical optimization algorithm. Robust standard errors are adjusted by industry clusters and calculated using the sandwich estimator. Statistical significance is reported as follows: *** = 1 % statistical significance, ** = 5% statistical significance, and * = 10% statistical significance.

Panel A : All Firms

# Observations = 8,485	**# SIC groups= 381**					
		Retire Debt			**Repurchase Equity**	
	Coefficient	**Std. Error**	**Marginal Δ**	**Coefficient**	**Std. Error**	**Marginal Δ**
leverage deficit	1.7439	0.4463***	0.153	-3.3401	0.4115***	-0.182
ln VIX	0.1607	0.0653**	0.006	-0.5446	0.0545***	-0.024
ln kunc	-0.0256	0.0418	0.002	-0.3119	0.0308***	-0.041
ni/sales	2.5042	0.8262***	0.057	-7.2492	0.8278***	-0.138
rnd/sales	26.1367	7.8075***	0.133	-58.0478	6.8690***	-0.182
pat/assets	-2.5195	22.3817	-0.001	6.8485	16.8818	0.005
ln assets	-0.3549	0.0331***	-0.045	0.1782	0.0264***	0.066
Statistics						
Log pseudo-likelihood	-6,346.29					
Wald test - $\chi^2(6)$	2,666.35					
p-value	(0.0000)					
Hausman-McFadden test - $\chi^2(6)$	-3.47					
p-value	-					

Panel B : Firms in Franchise Sectors

# Observations = 1,009	**# SIC groups= 45**					
		Retire Debt			**Repurchase Equity**	
	Coefficient	**Std. Error**	**Marginal Δ**	**Coefficient**	**Std. Error**	**Marginal Δ**
leverage deficit	0.6192	0.9480	-0.010	-1.7483	0.4952***	-0.036
ln VIX	0.6461	0.3029**	0.008	-0.6978	0.1780***	-0.017
ln kunc	-0.0359	0.1290	-0.002	-0.2112	0.0897**	-0.019
ni/sales	3.4029	2.2882	0.044	-3.7586	1.4148***	-0.072
rnd/sales	-10.4067	16.4040	-0.016	-8.3161	5.3494	-0.011
pat/assets	-81.3919	128.8371	-0.004	35.2790	68.2510	0.004
ln assets	-0.4818	0.1018***	-0.031	0.1133	0.0587*	0.005
Statistics						
Log pseudo-likelihood	-724.32					
Wald test - $\chi^2(6)$	422.28					
p-value	(0.0000)					
Hausman-McFadden test - $\chi^2(13)$	5.73					
p-value	(0.9553)					

Table 11. Speed of Adjustment (SOA)

with Static Quasi Market Leverage Target

This table provides regression estimates of the partial adjustment model of *qml* for all public firms with patents except regulated and financial firms (SIC2s 49, 60-69) in Panel A, and public firms with patents in franchise sectors SIC2s: 54, 56, 58, 59, 70, 72, 73, 75, 82, and 83 in Panel B. Variable definitions are provided in Table 1. Sample:1994-2019.

$$\Delta QML_{i,t} = \Lambda_{i,t} \widehat{leverage\ deficit}_{qml,i} + \xi_t$$

We use: 1) a panel data population-averaged estimator with standard errors adjusted by industry clusters; and 2) an OLS estimator with standard errors adjusted for the error in variables problem assuming a maximum lag order of 5 following Newey-West (1987). Statistical significance is reported as follows: *** = 1 % statistical significance, ** = 5% statistical significance, and * = 10% statistical significance.

Panel A : All Firms				
Population Averaged Estimates				
ΔQML	**Coefficient**	**Std. Error**	**z-stat**	**p-value**
$\widehat{leverage\ deficit}_{qml,t}$	-0.1930	0.0098	-19.73	0.0000***
α	0.0011	0.0014	0.80	0.4220
with Newey-West std. errors & t-stats				
$\widehat{leverage\ deficit}_{qml,t}$	-0.1612	0.0081	-19.83	0.0000***
α	0.0011	0.0011	1.03	0.3010
Statistics				
# Obs. = 8,469				
R^2 = 0.15				
R^2-adj = 0.15				
Wald test - $\chi^2(1)$ = 389.28				
p-value = (0.0000)				

Panel B : Firms in Franchise Sectors				
Population Averaged Estimates				
ΔQML	Coefficient	Std. Error	z-stat	p-value
$\widehat{leverage\ deficit}_{qml,t}$	-0.2044	0.0241	-8.47	0.0000***
α	0.0017	0.0047	0.36	0.7160
with Newey-West std. errors & t-stats				
$\widehat{leverage\ deficit}_{qml,t}$	-0.1563	0.01942	-8.04	0.0000***
α	0.0020	0.0032	0.63	0.5310
Statistics				
# Obs. = 1,006				
R^2 = 0.07				
R^2-adj = 0.07				
Wald test - $\chi^2(1)$ = 71.74				
p-value = (0.0000)				

Table 12. Speed of Adjustment (SOA)

with Dynamic Quasi Market Leverage Target

This table provides regression estimates of the partial adjustment model of *qml* for all public firms with patents except regulated and financial firms (SIC2s 49, 60-69) in Panel A, and public firms with patents in franchise sectors SIC2s: 54, 56, 58, 59, 70, 72, 73, 75, 82, and 83 in Panel B. Variable definitions are provided in Table 1. Sample:1994-2019.

$$\Delta qml_{i,t} = \Lambda_{i,t} \widehat{leverage\ deficit}_{qml,i,t} + \xi_t$$

We use: 1) a panel data population-averaged estimator with standard errors adjusted by industry clusters; and 2) an OLS estimator with standard errors adjusted for the error in variables problem assuming a maximum lag order of 5 following Newey-West (1987). Statistical significance is reported as follows: *** = 1 % statistical significance, ** = 5% statistical significance, and * = 10% statistical significance.

Panel A : All Firms				
Population Averaged Estimates				
ΔQML	**Coefficient**	**Std. Error**	***z*-stat**	***p*-value**
$\widehat{leverage\ deficit}_{qml,t}$	-0.0044	0.0012	-3.52	0.0000***
α	-0.0002	0.0005	-0.32	0.7500
with Newey-West std. errors & *t*-stats				
$\widehat{leverage\ deficit}_{qml,t}$	-0.0144	0.0020	-7.15	0.0000***
α	0.0002	0.0009	0.27	0.0016
Statistics				
# Obs. = 8,469				
R^2 = 0.01				
R^2-adj = 0.01				
Wald test - $\chi^2(1)$ = 12.40				
p-value = (0.0004)				

Panel B : Firms in Franchise Sectors				
Population Averaged Estimates				
ΔQML	Coefficient	Std. Error	*z*-stat	*p*-value
$\widehat{leverage\ deficit}_{qml,t}$	-0.5165	0.0434	-11.90	0.0000***
α	0.0037	0.0180	0.20	0.8380
with Newey-West std. errors & *t*-stats				
$\widehat{leverage\ deficit}_{qml,t}$	-0.1462	0.0160	-9.16	0.0000***
α	0.0052	0.0034	1.54	0.1250
Statistics				
# Obs. = 1,006				
R^2 = 0.09				
R^2-adj = 0.09				
Wald test - $\chi^2(1)$ = 141.69				
p-value = (0.0000)				

Table 13. Capital Structure Hypotheses

This table provides the expected sign and value of the coefficient of leverage deficit based on different capital structure theories assuming a partial adjustment model.

Capital Structure Theories
Trade-off $\beta < 0$ Firms exploit tax shield benefits and consequently are less likely to issue debt. .
Pecking order Following the pecking order theory, firms rank their financing sources from internal funds to debt and then to equity. The strategy to issue debt may depend: 1) more on cash shortage than lagged leverage i.e., $\beta = 0$; 2) on unexpected negative shocks to the firm's value i.e., $\beta > 0$; and 3) financial distress when firms have a preference towards issuing equity i.e., $\beta < 0$.
Market timing $\beta > 0$ Firms are more likely to issue equity when equity is overvalued.
Random strategy $\beta = 0$ The strategy to issue debt is unrelated to the leverage deficit. Debt issues have no correlation with economic factors.

Table 14. Robustness Check − Debt/Equity Issues with Expected Inflation

This table provides regression estimates of a multinominal logit model for the vector of choices $(\boldsymbol{\alpha}_\mathbf{j})$ to not issue debt or equity versus 1) issue debt; or 2) issue equity using a random effects estimator with unstructured covariance matrix given the vector $\mathbf{x}_i$ of regressors including firms' characteristics. Sample: 1994-2019.

$$Prob(Y_i = j|\mathbf{x}_i) \equiv p_{ij} = \frac{exp(\mathbf{x}_i'\boldsymbol{\alpha}_\mathbf{j})}{1+\sum_{k=1}^{J} exp(\mathbf{x}_i'\boldsymbol{\alpha}_\mathbf{k})}$$

The sample includes all public firms with patents except regulated and financial firms (SIC2s 49, 60-69) in Panel A, and public firms with patents in franchise sectors SIC2s: 54, 56, 58, 59, 70, 72, 73, 75, 82, and 83 in Panel B. The random effects implementation obeys the infeasibility of a fixed effects estimator given the curse of dimensionality. The pseudo-likelihood function is calculated using a Gauss-Hermite quadrature with 16 integration points and the Broyden–Fletcher–Goldfarb–Shanno (BFGS) numerical optimization algorithm. Robust standard errors are adjusted by industry clusters and calculated using the sandwich estimator. Statistical significance is reported as follows: *** = 1 % statistical significance, ** = 5% statistical significance, and * = 10% statistical significance.

Panel A : All Firms						
# Observations = 8,485	**# SIC groups= 381**					
		Issue Debt			**Issue Equity**	
	Coefficient	**Std. Error**	**Marginal Δ**	**Coefficient**	**Std. Error**	**Marginal Δ**
leverage deficit	-0.8294	0.1607***	-0.033	2.0414	0.2410***	0.050
ln infl^e	0.5942	0.0630***	0.017	-0.5321	0.0743***	-0.011
ln kunc	0.0189	0.0289	-0.003	0.2061	0.0365***	0.023
ni/sales	0.0094	0.2112	-0.044	6.7826	0.9474***	0.188
rnd/sales	0.3485	0.7699	0.001	0.6322	1.0174	0.003
pat/assets	-22.4417	16.4901	-0.010	44.4755	16.4907***	0.014
ln assets	0.0366	0.0189*	0.021	-0.2337	0.0230***	-0.046
Statistics						
Log pseudo-likelihood	-7,224.70					
Wald test - $\chi^2(6)$	2,209.76					
p-value	(0.0000)					
Hausman-McFadden test - $\chi^2(6)$	-0.44					
p-value	-					
Panel B : Firms in Franchise Sectors						
# Observations = 1,009	**# SIC groups= 45**					
		Issue Debt			**Issue Equity**	
	Coefficient	**Std. Error**	**Marginal Δ**	**Coefficient**	**Std. Error**	**Marginal Δ**
leverage deficit	-0.5530	0.4651	-0.035	2.4230	0.7453***	0.059
ln infl^e	0.3995	0.1803**	0.012	-0.3382	0.1826*	-0.007
ln kunc	0.1741	0.0968*	0.017	0.4451	0.1330***	0.042
ni/sales	1.7110	0.8239**	0.000	8.4063	2.1746***	0.114
rnd/sales	0.0736	3.3347	-0.010	11.9982	3.0664***	0.037
pat/assets	-148.0978	61.4206**	-0.038	31.9628	60.7984	0.011
ln assets	0.0495	0.0699	0.030	-0.3779	0.0824***	-0.055
Statistics						
Log pseudo-likelihood	-841.22					
Wald test - $\chi^2(6)$	954.62					
p-value	(0.0000)					
Hausman-McFadden test - $\chi^2(13)$	4.14					
p-value	(0.9808)					

Table 15. Robustness Check – Debt/Equity Retirements/Repurchases with Expected Inflation

This table provides regression estimates of a multinominal logit model for the vector of choices ($\boldsymbol{\alpha}_\mathbf{j}$) to not retire debt or repurchasing equity versus 1) retire debt; or 2) repurchase equity using a random effects estimator with unstructured covariance matrix given the vector $\mathbf{x}_i$ of regressors including firms' characteristics. Sample: 1994-2019.

$$Prob(Y_i = j|\mathbf{x}_i) \equiv p_{ij} = \frac{exp(\mathbf{x}_i'\boldsymbol{\alpha}_\mathbf{j})}{1 + \sum_{k=1}^{J} exp(\mathbf{x}_i'\boldsymbol{\alpha}_\mathbf{k})}$$

The sample includes all public firms with patents except regulated and financial firms (SIC2s 49, 60-69) in Panel A, and public firms with patents in franchise sectors SIC2s: 54, 56, 58, 59, 70, 72, 73, 75, 82, and 83 in Panel B. The random effects implementation obeys the infeasibility of a fixed effects estimator given the curse of dimensionality. The pseudo-likelihood function is calculated using a Gauss-Hermite quadrature with 16 integration points and the Broyden–Fletcher–Goldfarb–Shanno (BFGS) numerical optimization algorithm. Robust standard errors are adjusted by industry clusters and calculated using the sandwich estimator. Statistical significance is reported as follows: *** = 1 % statistical significance, ** = 5% statistical significance, and * = 10% statistical significance.

Panel A : All Firms						
# Observations = 8,485	**# SIC groups= 381**					
		Retire Debt			**Repurchase Equity**	
	Coefficient	**Std. Error**	**Marginal Δ**	**Coefficient**	**Std. Error**	**Marginal Δ**
leverage deficit	-1.2214	0.3072***	-0.011	-1.3948	0.2788***	-0.028
ln infl^e	0.2719	0.0904***	0.001	0.6432	0.0786***	0.013
ln kunc	-0.0948	0.0405**	-0.003	-0.2279	0.0280***	-0.030
ni/sales	0.7797	1.6830	0.026	-3.7582	1.0899***	-0.089
rnd/sales	-1.8864	1.5260	-0.005	-0.7641	1.7651	-0.002
pat/assets	16.5434	16.6658	0.004	-22.9400	16.6589	-0.009
ln assets	-0.2441	0.0267***	-0.031	0.0003	0.0179	0.006
Statistics						
Log pseudo-likelihood	-6,435.78					
Wald test - $\chi^2(6)$	2,732.24					
p-value	(0.0000)					
Hausman-McFadden test - $\chi^2(6)$	2.98					
p-value	(0.8112)					

Panel B : Firms in Franchise Sectors						
# Observations = 1,009	**# SIC groups= 45**					
		Retire Debt			**Repurchase Equity**	
	Coefficient	**Std. Error**	**Marginal Δ**	**Coefficient**	**Std. Error**	**Marginal Δ**
leverage deficit	-1.2935	0.7554*	-0.009	-1.5118	0.5613***	-0.036
ln infl^e	-0.4274	0.1888**	-0.003	0.2049	0.1505	0.006
ln kunc	-0.1259	0.1265	-0.004	-0.1198	0.0786	-0.016
ni/sales	4.2155	2.1032**	0.042	-3.5641	1.3287***	-0.068
rnd/sales	-11.7586	14.6408	-0.016	-2.6138	5.2186	-0.008
pat/assets	-28.3507	111.4417	-0.003	2.9765	69.6113	0.001
ln assets	-0.4496	0.0864***	-0.031	-0.0318	0.0613	-0.003
Statistics						
Log pseudo-likelihood	-726.23					
Wald test - $\chi^2(6)$	467.97					
p-value	(0.0000)					
Hausman-McFadden test - $\chi^2(12)$	33.34					
p-value	(0.0009)					

Table 16. Robustness Check – Debt/Equity Issues

with Static Book Leverage Target

This table provides regression estimates of a multinominal logit model for the vector of choices $(\boldsymbol{\alpha}_\mathbf{j})$ to not issue debt or equity versus 1) issue debt; or 2) issue equity using a random effects estimator with unstructured covariance matrix given the vector $\mathbf{x}_i$ of regressors including firms' characteristics. Sample: 1994-2019.

$$Prob(Y_i = j|\mathbf{x}_i) \equiv p_{ij} = \frac{exp(\mathbf{x}_i'\boldsymbol{\alpha}_\mathbf{j})}{1 + \sum_{k=1}^{J} exp(\mathbf{x}_i'\boldsymbol{\alpha}_\mathbf{k})}$$

The sample includes all public firms with patents except regulated and financial firms (SIC2s 49, 60-69) in Panel A, and public firms with patents in franchise sectors SIC2s: 54, 56, 58, 59, 70, 72, 73, 75, 82, and 83 in Panel B. The random effects implementation obeys the infeasibility of a fixed effects estimator given the curse of dimensionality. The pseudo-likelihood function is calculated using a Gauss-Hermite quadrature with 16 integration points and the Broyden–Fletcher–Goldfarb–Shanno (BFGS) numerical optimization algorithm. Robust standard errors are adjusted by industry clusters and calculated using the sandwich estimator. Statistical significance is reported as follows: *** = 1 % statistical significance, ** = 5% statistical significance, and * = 10% statistical significance.

Panel A : All Firms						
# Observations = 8,485	**# SIC groups= 381**					
		Issue Debt			**Issue Equity**	
	Coefficient	**Std. Error**	**Marginal Δ**	**Coefficient**	**Std. Error**	**Marginal Δ**
leverage deficit	-2.3359	0.2942***	-0.062	1.3961	0.2251***	0.040
ln VIX	-0.3668	0.0479***	-0.017	-0.0365	0.0578	0.001
ln kunc	0.0087	0.0311	-0.003	0.1642	0.0340***	0.018
ni/sales	-0.3497	0.2282	-0.063	7.8602	0.9366***	0.234
rnd/sales	0.0561	0.8588	-0.001	1.0349	1.0462	0.005
pat/assets	-17.0108	17.5883	-0.008	48.4608	17.5818***	0.015
ln assets	-0.0007	0.0155	0.010	-0.2103	0.0211***	-0.041
Statistics						
Log pseudo-likelihood	-7,174.23					
Wald test - $\chi^2(6)$	2,096.24					
p-value	(0.0000)					
Hausman-McFadden test - $\chi^2(6)$	1.52					
p-value	(0.9582)					
Panel B : Firms in Franchise Sectors						
# Observations = 1,009	**# SIC groups= 45**					
		Issue Debt			**Issue Equity**	
	Coefficient	**Std. Error**	**Marginal Δ**	**Coefficient**	**Std. Error**	**Marginal Δ**
leverage deficit	-2.7266	0.6700***	-0.081	1.3005	0.5038***	0.036
ln VIX	-0.4426	0.1954**	-0.021	0.2666	0.2214	0.010
ln kunc	0.1615	0.1055	0.017	0.4144	0.1296***	0.039
ni/sales	1.8003	0.9956*	-0.006	9.6234	1.9575***	0.139
rnd/sales	4.1282	3.1997	0.014	7.2632	3.0474**	0.018
pat/assets	-147.1065	66.1109**	-0.037	44.6418	57.1344	0.012
ln assets	0.02539	0.0593	0.016	-0.3326	0.0788***	-0.047
Statistics						
Log pseudo-likelihood	-825.89					
Wald test - $\chi^2(6)$	649.31					
p-value	(0.0000)					
Hausman-McFadden test - $\chi^2(6)$	3.16					
p-value	(0.9943)					

Table 17. Robustness Check – Debt/(Equity) Retirements/(Repurchases) with Static Book Leverage Target

This table provides regression estimates of a multinominal logit model for the vector of choices ($\boldsymbol{\alpha}_\mathbf{j}$) to not retire debt or repurchasing equity versus 1) retire debt; or 2) repurchase equity using a random effects estimator with unstructured covariance matrix given the vector $\mathbf{x}_i$ of regressors including firms' characteristics. Sample: 1994-2019.

$$Prob(Y_i = j|\mathbf{x}_i) \equiv p_{ij} = \frac{exp(\mathbf{x}_i'\boldsymbol{\alpha}_\mathbf{j})}{1 + \sum_{k=1}^{J} exp(\mathbf{x}_i'\boldsymbol{\alpha}_\mathbf{k})}$$

The sample includes all public firms with patents except regulated and financial firms (SIC2s 49, 60-69) in Panel A, and public firms with patents in franchise sectors SIC2s: 54, 56, 58, 59, 70, 72, 73, 75, 82, and 83 in Panel B. The random effects implementation obeys the infeasibility of a fixed effects estimator given the curse of dimensionality. The pseudo-likelihood function is calculated using a Gauss-Hermite quadrature with 16 integration points and the Broyden–Fletcher–Goldfarb–Shanno (BFGS) numerical optimization algorithm. Robust standard errors are adjusted by industry clusters and calculated using the sandwich estimator. Statistical significance is reported as follows: *** = 1 % statistical significance, ** = 5% statistical significance, and * = 10% statistical significance.

Panel A : All Firms						
# Observations = 8,485	**# SIC groups= 381**					
	Retire Debt			**Repurchase Equity**		
	Coefficient	**Std. Error**	**Marginal Δ**	**Coefficient**	**Std. Error**	**Marginal Δ**
leverage deficit	-0.6320	0.2717**	-0.005	-1.0612	0.2788***	-0.025
ln VIX	0.0779	0.0619	0.003	-0.3230	0.0527***	-0.015
ln kunc	-0.0666	0.0386*	-0.001	-0.2400	0.0291***	-0.032
ni/sales	0.6238	1.2130	0.023	-4.4934	1.1084***	-0.102
rnd/sales	-2.8807	1.6056*	-0.006	-1.8411	1.7758	-0.005
pat/assets	10.2612	18.7457	0.003	-22.8295	18.2290	-0.009
ln assets	-0.2517	0.0237***	-0.033	-0.0136	0.0181	0.003
Statistics						
Log pseudo-likelihood	-6,439.22					
Wald test - $\chi^2(6)$	2,616.30					
p-value	(0.0000)					
σ_d	0.1088					
Hausman-McFadden test - $\chi^2(6)$	0.48					
p-value	(0.9980)					
Panel B : Firms in Franchise Sectors						
# Observations = 1,009	**# SIC groups= 45**					
	Retire Debt			**Repurchase Equity**		
	Coefficient	**Std. Error**	**Marginal Δ**	**Coefficient**	**Std. Error**	**Marginal Δ**
leverage deficit	-1.0315	0.7120	-0.009	-0.5511	0.5921	-0.016
ln VIX	0.4829	0.1826***	0.010	-0.1689	0.1491	-0.013
ln kunc	-0.0727	0.1302	-0.002	-0.0720	0.0786	-0.018
ni/sales	4.2134	2.0305**	0.043	-4.3281	1.4566***	-0.078
rnd/sales	-8.9008	14.6284	-0.013	-1.4915	6.0235	-0.004
pat/assets	-78.7534	134.1843	-0.007	-6.9551	69.1031	0.000
ln assets	-0.4355	0.0656***	-0.032	-0.0566	0.0490	-0.003
Statistics						
Log pseudo-likelihood	-729.00					
Wald test - $\chi^2(6)$	454.08					
p-value	(0.0000)					
σ_d	0.0373					
Hausman-McFadden test - $\chi^2(6)$	-10.95					
p-value	-					

Table 18. Robustness Check - Speed of Adjustment (SOA) with Static Book Leverage

This table provides regression estimates of the partial adjustment model of *bl* for all public firms with patents except regulated and financial firms (SIC2s 49, 60-69) in Panel A, and public firms with patents in franchise sectors (SIC2s: 54, 56, 58, 59, 70, 72, 73, 75, 82, and 83) in Panel B. Variable definitions are provided in Table 1. Sample:1994-2019.

$$\Delta bl_{i,t} = \Lambda_{i,t} \widehat{leverage\ deficit}_{bl,i,t} + \xi_t$$

using a: 1) panel data population-averaged estimator with standard errors adjusted by industry clusters and calculated using the sandwich estimator; and 2) OLS estimator with standard errors adjusted for the error in variables problem assuming a maximum lag order of 5 following Newey-West (1987). Statistical significance is reported as follows: *** = 1 % statistical significance, ** = 5% statistical significance, and * = 10% statistical significance. Sample:1994-2019.

Panel A : All Firms				
Population Averaged Estimates				
ΔQML	**Coefficient**	**Std. Error**	***z*-stat**	***p*-value**
$\widehat{leverage\ deficit}_{bl,t}$	-0.3580	0.0253	-14.16	0.0000***
α	0.0097	0.0019	5.17	0.0000***
with Newey-West std. errors & *t*-stats				
$\widehat{leverage\ deficit}_{bl,t}$	-0.2864	0.0200	-14.34	0.0000***
α	0.0077	0.0019	6.28	0.0000***
Statistics				
# Obs. = 8,469				
R^2 = 0.15				
R^2-adj = 0.15				
Wald test - $\chi^2(1)$ = 200.62				
p-value = (0.0000)				
Panel B : Firms in Franchise Sectors				
Population Averaged Estimates				
ΔQML	Coefficient	Std. Error	*z*-stat	*p*-value
$\widehat{leverage\ deficit}_{bl,t}$	-0.1930	0.0098	-19.73	0.0000***
α	0.0011	0.0014	0.80	0.4220
with Newey-West std. errors & *t*-stats				
$\widehat{leverage\ deficit}_{bl,t}$	-0.1612	0.0081	-19.83	0.0000***
α	0.0011			
Statistics				
# Obs. = 1,006				
R^2 = 0.07				
R^2-adj = 0.07				
Wald test - $\chi^2(1)$ = 389.28				
p-value = (0.0000)				

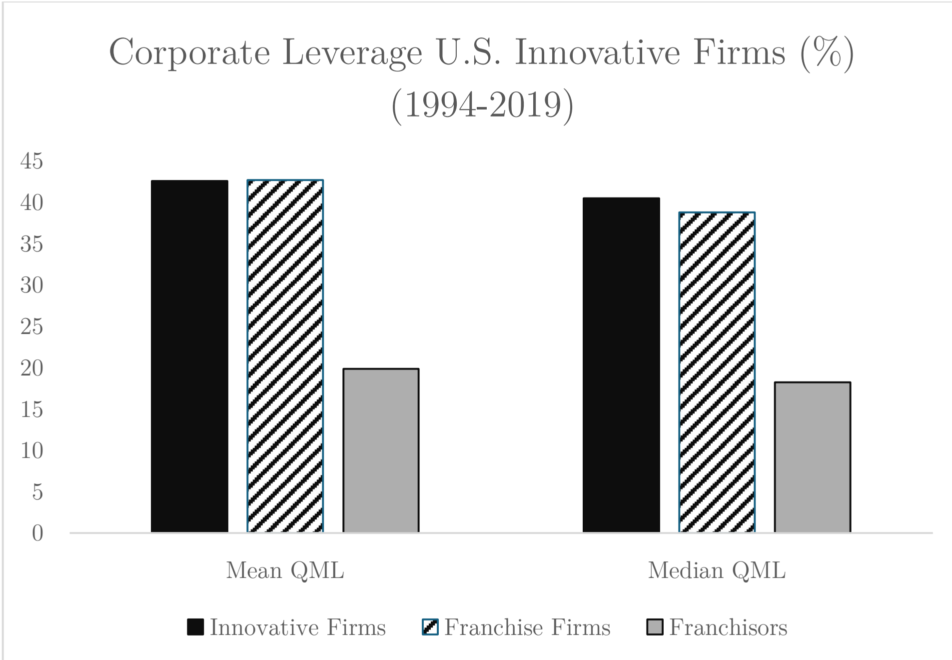

Figure 1. This chart plots mean and median quasi-market corporate leverage ratios for: 1) all U.S. innovative public firms except regulated and financial firms (SIC2s 49, 60-69); 2) public firms with patents in franchise sectors (SIC2s: 54, 56, 58, 59, 70, 72, 73, 75, 82, and 83); and 3) Franchisors i.e., firms with SIC code 6794. The sample period is 1994-2019. Source: Compustat/CRSP merged database.