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Firm growth type and capital structure persistence

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ABSTRACT

We find that growth type (identified by a two-way sort on firm initial market-to-book ratio and asset tangibility) can parsimoniously predict significantly dispersed and persistently distinct future leverage ratios. Growth type is persistent; growth-type-sorted cross-sections of corporate fundamental variables (such as tangible versus intangible investment style) are also meaningfully persistent. As economic and market conditions improve, low growth type firms are keener to issue new debt than equity, whereas high growth type firms are least likely to issue debt and keenest to issue equity. These findings demonstrate that firms rationally invest and seek financing in a manner compatible with their growth types. Consistent with a generalized Myers–Majluf framework, growth type compatibility enables distinct growth types and hence specifications of market imperfection or informational environments to persist. Growth type is apparently a fundamental factor for capital structure persistence.

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1. Introduction

Lemmon et al. (2008) document a pattern of persistently distinct leverage ratios. They argue that unexplained initial leverage heterogeneities largely contribute to this persistence and suggest that standard leverage determinants in the literature, such as market-to-book ratios, tangibility, profitability and firm size, have little business in explaining capital structure persistence. Since many empirical models in the literature rely on these leverage determinants, they conclude that "...our findings paint a somewhat dim picture of existing empirical models of capital structure...".

This paper shows that firm growth type, which is able to parsimoniously predict the persistence of cross-sections of many corporate variables, can explain an economically significant part of persistently distinct leverage ratios. What we call firm growth type is firm asymmetric information type which to some extent is related to firm asset type. It is well recognized in the literature that types of asset and asymmetric information are important in specifying market imperfections and affecting firm growth (e.g., Myers, 1977; Myers and Majluf, 1984; Zingales, 2000). Less emphasized in the literature, however, is the fact that these firm characteristics and hence market imperfections faced by firms are surprisingly persistent, creating non-ergodic corporate behavior.

First, asset type market imperfection that gives rise to agency conflicts (e.g., Myers, 1977) can be persistent; some firms always have more tangible than intangible assets; conversely, other firms always have more intangible than tangible assets. Second, the asymmetric information type market imperfection can also be relatively stable over time; some firms may always have more asymmetric information about assets-in-place than about growth opportunities, and other firms may always have more asymmetric information about growth than about assets-in-place.

The finance literature has shown that the types of asset and asymmetric information, often correlated in reality, affect the capital structure. First, firms with more tangible assets relative to intangible assets—including growth opportunities—tend to have higher leverage ratios (e.g., Myers, 1977). Second, it is well known that asymmetric information about assets-in-place as described by Myers and Majluf (1984) underlies Myers' (1984) pecking order in financing where new equity is a last resort. But while the asymmetric information about assets-in-place tends to inhibit new equity issuance, the asymmetric information about growth opportunities can facilitate new equity issuance by high growth firms. The latter result is predicted by the generalized Myers–Majluf

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model developed by Cooney and Kalay (1993) and Wu and Wang (2005).[1] Firms with more asymmetric information about growth are keener to use equity financing because costs of their new equity can be much lower than predicted by the classic Myers–Majluf model.

A cornerstone of behavioral corporate finance is the premise that new equity issues at high stock valuations—where uncertainty about growth opportunities tends to increase with the level of growth prospects—are mainly responses to market overvaluations (Stein, 1996). The insight from the generalized Myers–Majluf model suggests that this overvaluation assumption is not necessarily true. The overvaluation concept is deeply rooted in the classic Myers and Majluf (1984) view about the adverse selection effect which arises from the market's overvaluation about assets-in-place (Harris and Raviv, 1991). Equilibrium behavior is, however, different for issuing firms where asymmetric information arises mainly from growth opportunities. In other words, equity issues are not typically lemons for high growth type firms even fraught with lots of asymmetric information about growth opportunities.

This paper does not assume any irrational behavior of either managers or investors. We simply start with the traditional corporate finance valuation framework of assets-in-place versus growth opportunities under asymmetric information. We use two firm fundamental variables: the market-to-book (MB) ratio and asset tangibility (Tang) to characterize firm growth type explicitly. In a world with asymmetric information, a combination of a low MB ratio and high Tang tends to characterize low growth type firms where asymmetric information tends to arise more from assets-in-place than from growth. Conversely, a combination of a high MB ratio and low Tang tends to reflect high growth type firms where asymmetric information is likely to arise more from growth than from assets-in-place. The remaining less lopsided combinations such as a high MB and high Tang, and a low MB and low Tang, indicate a mixed growth type.

We use initial MB ratios and Tang to perform a two-way independent sort with breakpoints at medians. We define the initial average of a variable as a time-series average over the first 3 years after the initial public offering (IPO). Our initial-sorted three groups of COMPUSTAT non-financial and non-utility US firms of low, mixed and high growth types (G1, G2, and G3) show significant differences in group mean leverage ratios at every cross section for event years through year 20 and calendar years for 1971–2005. Identified at the birth of corporate public life, firms of low growth type (G1) on average always have high future leverage ratios, firms of high growth type (G3) always have low future leverage ratios, and firms of mixed growth type (G2) stay persistently in between.

Our growth type view can be best understood under a concept of "growth type compatibility", that is, there is a fundamental equilibrium in which distinct growth types suggest persistently distinct corporate investment styles and distinct optimal financing arrangements in response. In this sustainable equilibrium, firms with distinct specifications of market imperfection or information environments tend to go hand in hand with persistently different growth types.

Consistent with growth type compatibility, we find that low growth type indicates persistently tangible investment style, whereas high growth type suggests relentless R&D or intangible investment style. On the financing side, growth type also dictates firms' persistently distinct pecking orders in external finance, because types of asymmetric information rationally spawn growth-type-determined pecking orders in financing. We find that with an increase in economic and market conditions via time variation in firm MB ratios, low growth type firms are keener to issue new debt than equity, whereas high growth type firms are least likely to issue debt and keenest to issue equity. This explains more equity financing activities than allowed by Myers' (1984) pecking order, which is valid only for firms mainly with asymmetric information about assets-in-place (Myers, 2003).

Growth type compatibility has many implications. The keyword is persistence. Year-by-year active financing activities that follow the growth-type-determined pecking orders actually reinforce capital structure persistence. Nonzero leverage ratios can remain unchanged after heavy equity issues even without rebalancing debt issues. We show that high growth type firms issue a lot of equity to fund their relentless R&D investments, and at the same time register considerable negative changes in retained earnings (reflecting accounting losses) as a result of the R&D investments, which typically have a slow payoff but are largely expensed in the year incurred. Consequently, while heavy issues of equity increase the total equity and pull their low leverage ratios even lower, the subsequently huge decreases in retained earnings—which as changes in internal equity typically become even more negative—reduce the total equity and hence increase the leverage ratios. This suggests a new mechanism to sustain leverage persistence. Leary and Roberts (2005) consider net debt issues to be a major rebalancing force in leverage changes due to equity issues. But we know that high growth type firms are least likely to issue new debt in response to investment needs.

The rest of the paper proceeds as follows. Section 2 provides the rationale for our growth type view on leverage persistence. Section 3 presents direct evidence for growth-type-dependent leverage persistence and shows that growth type also parsimoniously predicts persistent cross-sections of important firm fundamental variables. Section 4 shows that growth type also affects annual financing decisions largely in a consistent way. Section 5 concludes.

2. Growth type and capital structure in a generalized Myers–Majluf framework

2.1. The generalized Myers and Majluf framework

It can be argued that asymmetric information is irrelevant to new equity issuance since many firms often issue new equity even under severe information asymmetries (Fama and French, 2002, 2005), thus defying the prediction of Myers and Majluf (1984). In effect, how asymmetric information affects new equity financing depends on the type of asymmetric information. There are two types of asymmetric information: one about assets-in-place and the other about growth opportunities.

To emphasize the first, Myers and Majluf (1984) reasonably handicap the second. Thus, the classic setting does not fully explore asymmetric information about growth. Cooney and Kalay (1993) show that if asymmetric information about growth is not limited to positive net present value (NPV) from new projects as assumed in the original Myers and Majluf (1984) model, equity issuance equilibrium can change so that new equity issues can in some cases be unambiguously good news. Wu and Wang (2005) find a similar equilibrium when they incorporate private benefits of self-interested controlling shareholders or managers into the Myers–Majluf framework. The extension in Wu and Wang (2005) solves the incentive compatibility problem well recognized by Myers and Majluf (1984) but ignored by Cooney and Kalay (1993), and hence is able to impose an explicit control for investor

[1] The generalized Myers–Majluf model predicts that more asymmetric information that arises mainly from growth can facilitate new equity issues and in some cases even produce a positive announcement effect of new equity issues. This insight is important. For one thing, it helps resolve the equity-not-as-a-last-resort puzzle articulated by Fama and French (2002, 2005), that is, why small growth firms, fraught with lots of asymmetric information, rely heavily on new equity financing and do not seem to suffer the classic adverse selection effect (see also Rajan and Zingales, 1995).

Table 1
Two types of asymmetric information and implications on new equity financing.

The type of asymmetric information (AI) that predominates in a firm's valuation	
AI about assets-in-place (AIP)	AI about growth opportunities
The classic Myers and Majluf (1984) framework: • Separation of overvalued firms from undervalued firms at new equity issues • AI typically inhibits new equity issues due to adverse selection • Myers' (1984) pecking order in financing	The generalized Myers–Majluf framework's new insight: • Equity issuers are not typically lemons because even undervalued firms are likely to issue • AI can facilitate new equity issuance • Equity issuers are not typically under duress

concern about overinvestment due to managerial empire building—which can also potentially cloud new equity issuance as pointed out by Jung et al. (1996).

The generalized Myers and Majluf model described by Wu and Wang (2005) shows that more asymmetric information that arises from growth opportunities rather than assets-in-place can facilitate new equity issues, and in some cases, even produce a positive announcement effect. This cannot happen in the classic setting, in which the adverse selection effect always dominates. Myers and Majluf (1984) point out that asymmetric information about growth does not influence new equity issues if asymmetric information about assets-in-place is absent or small. Perhaps this conclusion has contributed to the prevailing impression that it is the magnitude of asymmetric information about assets-in-place, but not about growth, that is important for new equity financing decisions.[2]

Why would an increase in uncertainty that arises from growth opportunities instead facilitate rather than inhibit new equity issues under asymmetric information? The intuition is as follows. In the classic equilibrium with adverse selection, the decision to issue new equity typically separates under- and over-valued firms. However, this separation does not typically occur when asymmetric information about growth opportunities (instead of assets-in-place) predominates. In this situation, firms with undervalued growth opportunities may be willing to accept a smaller share of the NPV of new investments, because the issuers would otherwise have ended up with nothing (by skipping the new projects). This situation is likely to occur if potential issuers have few assets-in-place relative to growth opportunities and hence are less concerned about share dilution. It follows that their new equity issues are not typically lemons and accordingly the classic adverse-selection discount reduces and can even become reversed.[3] The classic concept of lemons is valid only if applied to cases where firm value and its asymmetric information arise mainly from assets-in-place.

The generalized Myers–Maljluf model provides an explanation for why high growth firms are not typical candidates to fall under duress in the sense of Myers and Majluf (1984) in issuing new equity.[4] Most importantly, this generalized Myers–Majluf model implies that if firms do not experience obvious changes in asymmetric information type, their financing behavior will be largely persistent. In other words, it is the innate firm type that underlies persistent firm financing behavior and hence capital structure.

2.2. Growth type and informational imperfection

To understand the persistence of capital structure, we need to examine the structure of market imperfection. Asymmetric information is ubiquitous, causing capital market imperfections and hence related agency conflicts. Asymmetric information that gives rise to information advantages for managers or corporate insiders can arise from a firm's assets-in-place as well as growth opportunities. It may be that some firms have more asymmetric information from assets-in-place than from growth opportunities; conversely, other firms have more asymmetric information from growth opportunities than from assets-in-place. This distinction gives rise to a firm-type phenomenon where a certain type of asymmetric information predominates in a firm. The MM theorem implies that specifications of market imperfection affect corporate capital structures. Finance research has found that different types of asymmetric information have totally different implications for corporate financing behavior.

As summarized in Table 1, if asymmetric information arises more from assets-in-place than from growth, issues of outside equity are more likely to suffer the adverse selection effect of Myers and Majluf (1984), and such firms often follow Myers' (1984) pecking order in financing. In contrast, if asymmetric information arises more from growth than from assets-in-place, an increase in asymmetric information can facilitate new equity issues as shown by the generalized Myers–Majluf model. When asymmetric information about growth dominates, new equity issuers are not expected to be typically over-valued because the undervalued firms have the incentive to issue equity as well. As a result, their new equity issuing prices are on average higher than predicted by Myers and Majluf (1984). This means that issuers whose valuations are based more on growth opportunities than assets-in-place can enjoy cheaper new equity. In one application, Wu et al. (2009) shows that despite big information gaps, high growth firms can use new equity as a natural curb on bank rent extraction which the information production literature has been silent about.

The extent of information asymmetries may vary over time, but the dominance of a particular type of asymmetric information for a particular firm is likely to persist. If so, the firm's financing behavior and hence capital structure can be persistent. To provide supporting evidence for this, our next task is to find a suitable proxy to measure asymmetric information type.

A combination of firm MB ratio and asset tangibility can reveal the type of asymmetric information that predominates in a firm's valuation. In the literature, MB ratio is commonly used as a proxy for growth opportunities and intangible assets. Assets tangibility, when used as a proxy for assets-in-place, examines asset type, which is highly correlated with the type of asymmetric information. In a world with asymmetric information, the higher a firm's

[2] Early studies, as summarized in Harris and Raviv (1991), propose various settings to contradict the central prediction of the adverse-selection effect in Myers and Majluf (1984). The later developed framework of Cooney and Kalay (1993) and Wu and Wang (2005), however, has the least deviation from the original Myers and Majluf (1984) setting. The advantage to stick to this framework is that it limits new problems to a minimum – problems that often arise due to the introduction of new assumptions or settings whose full implications are yet to be examined.

[3] Note that the rational expectation assumption imposes unbiased expected growth under asymmetric information here. The simulation results in Table 5 of Wu and Wang (2005) show that it is the increase in uncertainty over growth opportunities but not in expected growth per se that mainly causes the announcement effect of equity issuance to improve and even become positive.

[4] One may argue that if this prediction is true, managers can manipulate accounting figures so as to increase uncertainty over firm valuations (see a similar situation faced by Pastor and Veronesi (2003, 2005)). But such accounting-manipulation-driven uncertainty is much more relevant for assets-in-place than growth opportunities, not to mention that managers have to keep the level of market expectations from dropping at the same time.

MB ratio, the more likely it is for the firm to have more asymmetric information arising from growth opportunities. Likewise, the higher a firm's tangibility (under asymmetric information), the more likely it is for the firm to have more asymmetric information about assets-in-place than growth. Thus, we can use growth type to summarize the combined implications of asset and asymmetric information types as discussed above.

In our growth type view, firms can be fundamentally different depending on how their valuations are created. At one end of the spectrum there are firms whose valuation and valuation uncertainty come mainly from assets-in-place. This situation is well understood in the literature. Carlson et al. (2006) argue that after new equity issues, growth options are transferred into assets-in-place. But there are also firms that use proceeds of new equity issues to build up more growth options by investing in R&D. Thus, at the other end there are firms whose valuation and valuation uncertainty arise mainly from new investment opportunities. Such growth opportunities are pronounced among firms with innovative human or knowledge capital that underlies an investment style to emphasize intangible investments (e.g., Zingales, 2000). We shall call the first type of firm low growth type firms, and the second type of firm high growth type firms. Of course, in the real world, firms fall right across the spectrum of firm growth type with mixed type in the middle. It is, however, an empirical question whether a firm's growth type is persistent.

2.3. Initial growth type and predicted effects on capital structure

We hope to find a clean proxy for growth type. Current MB ratio is likely to be contaminated by prevailing market conditions that may indicate even irrational sentiment, and hence tends to cause controversy over its interpretations when we examine current capital structure. Therefore, we prefer to examine the relationship between the current capital structure and growth type identified as far back in the past as possible. Such a relationship exists if growth type is stable and fundamentally determines capital structure despite some time variation in MB ratios.

We define initial growth type using a two-way independent sort on a firm's initial MB ratio and asset tangibility (Tang). An initial variable is the 3-year average of annual variables in event year 0, 1, and 2. For each firm, event year 0 is its IPO year or its first data entry year if the IPO date information is not available. With breakpoints at medians, our two-way sort generates four portfolios of firms in terms of initial value: low MB and high Tang (LH), low MB and low Tang (LL), high MB and high Tang (HH), and high MB and low Tang (HL).

We rearrange the four portfolios into three firm groups. The lopsided LH firms are low-growth-type firms (G1). The lopsided HL firms are high-growth-type (G3). Under asymmetric information, low-growth-type firms (G1) are most likely to have more asymmetric information about assets-in-place than about new investment opportunities. Conversely, high-growth-type firms (G3) are most likely to have more asymmetric information about investment opportunities than about assets-in-place (AIP). For the less lopsided LL and HH firms, it is unclear which type of asymmetric information predominates. So we treat the remaining two portfolios (LL and HH) as mixed-growth-type firms (G2). There are fewer of the less lopsided LL or HH firms than the LH or HL firms because MB and Tang are highly negatively correlated. As a result, the mixed G2 firms have roughly the same number of firms as each of the two other types. The initial number of firms for the G1, G2 and G3 firm groups is 1260, 1425 and 1496 (the IPO sample), and 2670, 3600 and 3938 (the full sample), respectively.

The theoretical basis summarized in Table 1 suggests that growth type affects the relative costs of external finance with debt versus outside equity. As shown in Table 2, the financing cost structure by growth type suggests that low-growth-type firms (G1) are more debt financing oriented and high-growth-type firms (G3) are more equity financing oriented. Note that the claim that high-growth-type firms (G3) are able to issue outside equity not typically under duress can be best rationally understood in the generalized Myers–Majluf framework. Thus, we expect that firms of low growth type (G1) have high leverage ratios and firms of high growth type (G3) have low leverage ratios, with firms of mixed type (G2) being in between.

Table 2
Growth type and cost structure of external finance.

Predominant type of Asymmetric Information (AI)	Growth type	Cost structure of external finance		
		Debt		Equity
AI about AIP	Low growth (G1)	Low	→	High
		(Classic pecking order)		
Mixed	Mixed growth (G2)	↓		↑
		(Generalized view)		
AI about growth	High growth (G3)	High	←	Low

3. Persistence in capital structure and firm fundamental: A growth type view

We show evidence for growth type persistence and that at the same time migration in growth type over time is a minority case and even migration has limited effects on capital structure (Section 3.1). We document significantly dispersed and persistently distinct future leverage ratios sorted by initial growth type (Section 3.2) and demonstrate that initial growth type also underlies persistence in important firm fundamental variables (Section 3.3). Data are detailed in Appendix A.

3.1. Growth type persistence and migration effects on leverage ratios

Lemmon et al. (2008) find that initial leverage is a powerful predictor of future leverage. But initial leverage does not directly help us understand why future leverage ratios are initially determined. In effect, as shown in Fig. 1 for firms sorted into quartiles according to their initial values, respectively, MB and Tang tend to persist largely on their own. In this section, we start out to use firm-level data to examine the long-run explanatory power of initial MB and Tang in explaining future leverage ratios. We control for year $t-1$ leverage determinants: MB, Tang, profitability, firm size, industry and dividend (their slope estimates are largely consistent with the findings in the literature). Note that the last four leverage determinants as well as MB and Tang are widely used in the literature (Rajan and Zingales, 1995; Fama and French, 2002; among others).[5]

Time-varying year $t-1$ MB and Tang contain updated information on growth type as well as market noise (especially in MB). As shown in Table 3, without this updated information, both initial MB and Tang significantly explain future leverage ratios up to 20 years. More important, adding updated information on growth

[5] We have tried single sorts (into quartiles) on initial values for MB, Tang, profitability, and firm size, respectively. Only the sort on Tang produces a clearly dispersed pattern for leverage persistence. While this pattern tells a lot of truth about debt capacity from assets-in-place (or tangibility) as suggested by Myers (1977), we believe that our two-way sort that incorporates initial MB best characterizes the valuation framework of assets-in-place versus growth opportunities that is indispensable in addressing costs of new equity, for example, in Myers and Majluf (1984). Note that two-way sorts based on initial Tang and other variables than MB cannot produce a significantly dispersed pattern for leverage persistence as shown in Fig. 2 that follows later (available on request).

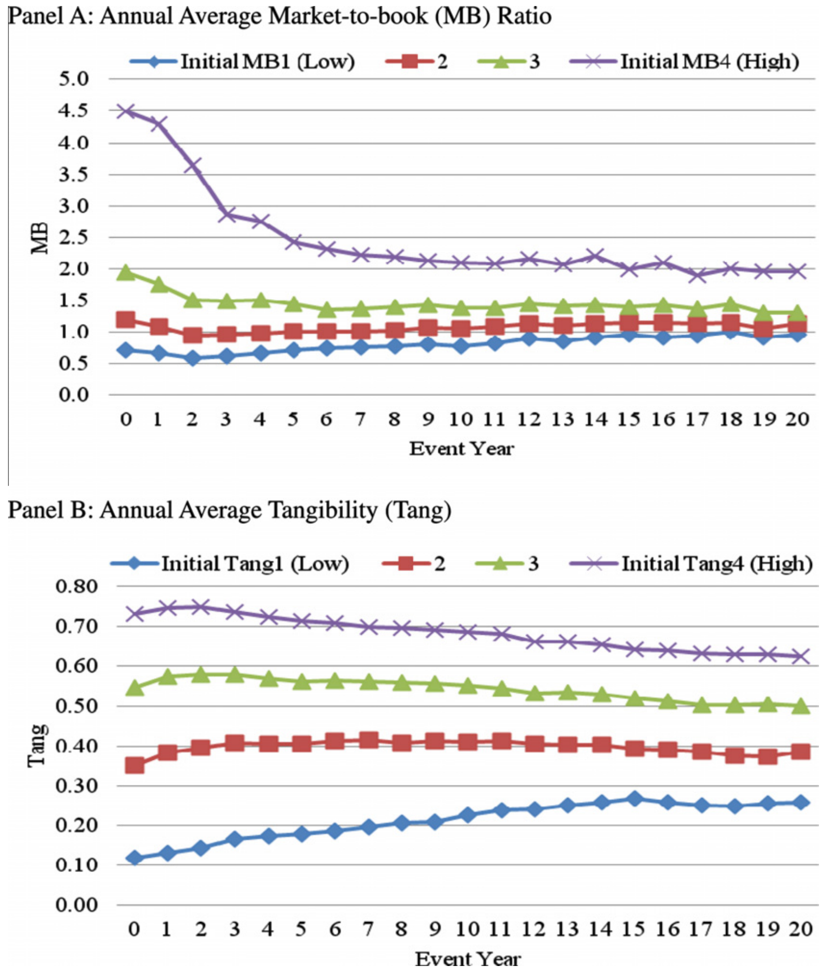


Fig. 1. Persistence in market-to-book (MB) ratio and tangibility (Tang). We sort MB ratios and Tang into quartiles according to their initial values, respectively. Each year, we calculate within-quartile mean for MB and Tang and report their evolutions over event years in Panels A and B, respectively. The full sample is used.

type cannot wash away the information content of initial growth type. While updated Tang completely overtakes initial Tang when firms age, initial MB still has long-run explanatory power beyond that contained in noisy updated MB ratios. This evidence is important because it is MB as a noisy proxy for either corporate growth opportunities or market sentiment that causes controversy over its interpretations in the literature. Our results here show that initial MB, which pushes potential market sentiment as far back in the past as possible, can explain current capital structure, leaving little implication for timely, opportunistic market timing.

Although updated Tang eventually overtakes initial Tang, tangibility is highly persistent. In effect, initial growth type can predict future growth type; in other words, much information contained in current growth type is already in initial growth type. Results in Table 4 show that majority of firms are staying in the same growth types if we update growth types over time, and their new book leverage ratios on average deviate little or slightly from their initial leverage ratios which start as 0.31 for G1, 0.25 for G2 and 0.14 for G3, respectively. In updating growth type over event time, we regroup firms each year by using the same two-way sorting as our initial sorting except that we replace initial MB and Tang with the current ones, respectively.

As shown in Panel A of Table 4, for example over 10 years, 57.8% of G1 firms are staying and their current leverage ratio on average barely changes from the initial leverage for G1 firms; at the same time, 34.1% of G1 firms migrate to updated G2 with their new leverage dropping slightly by 0.03 and merely 8.1% of G1 firms migrate to updated G3 with their leverage dropping by 0.07.

As shown in Panel B of Table 4, again over 10 years for example, 48.3% of G2 firms are staying and their new leverage on average barely changes from the initial leverage for G2 firms; at the same time, 25.9% of G2 firms migrate to updated G1 with their leverage increasing slightly by 0.03, and 25.8% of firms to G3 with their leverage dropping slightly by 0.03. The results for initial G2 on the whole indicate that G2 firms, which are in the middle of the growth type spectrum, on average show changes in leverage limited by 0.04 for any specific event year.

As shown in Panel C of Table 4, again over 10 years for example, 61.4% of G3 firms are staying and their new leverage on average increases slightly by 0.04 from the initial leverage for G3 firms; at the same time, 32.5% of G3 firms migrate to updated G2 with their leverage increasing also slightly by 0.04, and merely 6.1% of G3 firms to updated G1 with their leverage increasing notably by 0.12. Thus, like G1 firms in the opposite direction, a farther migration by G3 firms leads to a more increase in leverage.

But extreme migrations, which would disrupt leverage persistence to the greatest extent, do not pose a threat. First, extreme migrations are a minority case. Second, even in the extreme case, G3, the new leverage (equal to $0.26 = 0.14 + 0.12$ in year 10) of the mutated G1 firms that migrate from initial G3 is way below the new leverage (equal to the initial leverage of 0.31) of the genuine G1 firms. It looks that these mutated G1 firms still contain the

Table 3
Explaining future leverage ratios by initial MB and tangibility.

Event year t	Firm obs.	Initial MB	Initial Tang	MB_{t-1}	$Tang_{t-1}$	$Profit_{t-1}$	$LnSize_{t-1}$	Ind_Median_{t-1}	$DivPayer_{t-1}$	Adj. R^2
Panel A: book leverage										
5	7360	−0.0117	0.2200			−0.1195	0.0203	0.5766	−0.1030	0.191
		(−8.49)	(18.55)			(−8.77)	(14.65)	(16.21)	(−21.07)	
		−0.0084	0.0505	−0.0080	0.1854	−0.1179	0.0204	0.5214	−0.1058	0.207
		(−5.63)	(2.31)	(−5.49)	(8.98)	(−8.89)	(14.78)	(14.55)	(−21.82)	
10	4170	−0.0116	0.1570			−0.1510	0.0186	0.4660	−0.0761	0.138
		(−6.09)	(9.46)			(−6.00)	(11.03)	(9.11)	(−11.76)	
		−0.0108	−0.0188	−0.0052	0.2306	−0.1577	0.0193	0.3880	−0.0821	0.171
		(−5.63)	(−0.82)	(−3.25)	(10.84)	(−6.09)	(11.61)	(7.46)	(−12.84)	
15	2354	−0.0136	0.0943			−0.1509	0.0191	0.4974	−0.0739	0.134
		(−6.07)	(4.16)			(−4.23)	(8.90)	(8.37)	(−8.57)	
		−0.0122	−0.0623	−0.0064	0.2438	−0.1672	0.0194	0.3991	−0.0780	0.181
		(−5.58)	(−2.24)	(−2.57)	(9.72)	(−4.74)	(9.38)	(6.80)	(−9.37)	
20	1448	−0.0117	0.1197			−0.1832	0.0223	0.3368	−0.0929	0.135
		(−2.50)	(4.05)			(−2.65)	(8.18)	(4.91)	(−7.71)	
		−0.0090	0.0166	−0.0170	0.1467	−0.1614	0.0233	0.2469	−0.0964	0.161
		(−2.00)	(0.46)	(−3.71)	(4.60)	(−2.14)	(8.76)	(3.46)	(−8.09)	
Panel B: market leverage										
5	7360	−0.0344	0.2584			−0.1790	0.0253	0.5016	−0.1279	0.287
		(−19.95)	(18.57)			(−12.03)	(15.64)	(22.03)	(−19.82)	
		−0.0241	0.0728	−0.0262	0.1955	−0.1859	0.0248	0.4243	−0.1271	0.316
		(−13.21)	(2.98)	(−8.14)	(8.38)	(−13.02)	(15.43)	(17.96)	(−20.04)	
10	4170	−0.0307	0.1994			−0.2545	0.0231	0.4939	−0.0792	0.247
		(−13.21)	(10.38)			(−7.52)	(11.49)	(16.96)	(−9.73)	
		−0.0258	−0.0191	−0.0257	0.2706	−0.2739	0.0233	0.3962	−0.0837	0.298
		(−6.52)	(−0.73)	(−1.82)	(10.94)	(−7.67)	(11.56)	(10.15)	(−10.64)	
15	2354	−0.0287	0.1344			−0.2718	0.0187	0.4460	−0.0927	0.201
		(−11.39)	(4.99)			(−6.98)	(7.51)	(9.66)	(−9.38)	
		−0.0236	−0.0397	−0.0230	0.2545	−0.2970	0.0190	0.3337	−0.0961	0.259
		(−5.97)	(−1.22)	(−1.75)	(8.81)	(−7.86)	(7.92)	(6.86)	(−10.22)	
20	1448	−0.0256	0.1367			−0.4572	0.0195	0.4359	−0.1133	0.219
		(−7.84)	(4.04)			(−5.78)	(6.05)	(8.86)	(−8.10)	
		−0.0179	0.0143	−0.0474	0.1514	−0.3787	0.0207	0.3140	−0.1171	0.271
		(−4.77)	(0.35)	(−5.31)	(4.18)	(−5.27)	(6.67)	(6.19)	(−8.70)	

This table reports event-time OLS regression slope estimates and t-stats for the dependent variable, leverage at event year t, on initial MB (market-to-book), initial Tang (tangibility), MB_{t-1}, $Tang_{t-1}$, $Profit_{t-1}$ (profitability), $LnSize_{t-1}$ (log of total assets), Ind_median_{t-1} (industry median book and market leverage ratios in Panels A and B, with the 38 Fama–French industries), and $DivPayer_{t-1}$ (dummy variable = 1 for dividend payers and 0 for non-payers). The sample consists of the merged CRSP/COMPUSTAT US firms excluding utilities and financials for 1971–2005. An initial value is the average of three annual values over event years 0, 1 and 2. For each firm, event year 0 is its IPO year or its first COMPUSTAT data entry year if its IPO date information is not available from SDC. Book leverage is the sum of short- and long-term debt divided by total assets. Market leverage is the sum of short- and long-term debt divided by the sum of total debt and market equity. Panels A and B report results for book and market leverage ratios, respectively. For the sake of saving the place, only results for event years 5, 10, 15 and 20 are reported. t-stats in parentheses are based on the White-robust standard errors.

G3 low-debt-capacity characteristic so as to impede their mutated leverage ratios from reaching the genuine G3 level.

These meaningful changes in leverage due to migration in growth type over time suggest that if there were many firms that randomly changed growth types and if there were no long-lived effect from initial growth type on future leverage ratios, we would not observe growth-type-related leverage persistence. Growth type is persistent, anchoring persistent leverage ratios.

3.2. Future leverage ratios sorted by initial growth type

To show a direct connection between growth type and capital structure persistence, Fig. 2 plots group means of leverage ratios of the three initial growth types for each event year up to year 20. A persistent pattern emerges: annual average leverage ratios by growth type, regardless of whether they are measured by book (Panel A) or by market leverage (Panel B), stay separate over time. The leverage persistence pattern also holds after including those firms where we take their first COMPUSTAT data entry year as the IPO year (Panels C and D). These plots confirm that firm growth type can explain leverage persistence.

We then examine if growth-type-determined leverage persistence also holds in calendar time. As shown in Fig. 3, the three mean leverage ratios continue to stay apart over calendar years. Not surprisingly, corporate capital structure when measured by book leverage (Panel A) varies less with the market and economy than when measured by market leverage (Panel B). But despite the ups and downs of market conditions and even market sentiment, the gaps persist in the group mean leverage among the three predetermined growth types. Note that the annual gaps between the growth types are statistically significant in terms of group means and medians of leverage (not shown but available on request).

One may suspect that the leverage persistence patterns mainly reflect an industry effect, because each of our growth types may exclusively contain a cluster of specific industries. But as shown in Fig. 4, where we control for individual industry medians according to the Fama–French classification of 38 industries, the persistence patterns are still evident for industry-adjusted leverage among the three initial industry-adjusted growth types. Note that industry-adjusted leverage is defined as leverage ratio minus industry median leverage, and initial industry-adjusted growth type is from a two-way sort based on initial MB minus initial industry median MB, and initial Tang minus initial industry median Tang. This means that growth type remains a basic factor for leverage persistence even after controlling for an industry effect. We believe that growth type is more fundamental than an industry identity in determining capital structure.

The implication of our evidence on leverage persistence in relation to initial growth type is unambiguous. In empirical studies on capital structure, researchers often use MB as a proxy for investment opportunities. It is well known that MB ratios also contain information about not only macroeconomic conditions (Korajczyk

Table 4
Transition of growth type and book leverage changes over event years.

Event year, *t*	No. of firms	Staying		Migrating			
		% of Firms	Change in leverage	% of Firms	Change in leverage	% of Firms	Change in leverage
Panel A: transition from initial G1 to updated growth types in year t							
		To updated G1		To updated G2		To updated G3	
3	2559	79.9	0.02	18.1	0.01	2.0	0.02
5	2209	71.0	0.00	26.0	−0.01	3.0	−0.07
10	1419	57.8	0.00	34.1	−0.03	8.1	−0.07
15	846	48.1	0.00	40.1	−0.03	11.8	−0.07
20	568	43.5	0.03	42.4	−0.03	14.1	−0.03
Panel B: transition from initial G2 to updated growth types in year t							
		To updated G2		To updated G1		To updated G3	
3	3170	60.0	0.03	23.2	0.04	16.7	0.01
5	2568	56.1	0.02	23.9	0.03	20.0	−0.02
10	1503	48.3	0.00	25.9	0.03	25.8	−0.03
15	877	51.3	0.00	23.1	0.02	25.5	−0.04
20	572	53.1	−0.02	22.0	0.03	24.8	0.00
Panel C: transition from initial G3 to updated growth types in year t							
		To updated G3		To updated G2		To updated G1	
3	3343	70.0	0.03	25.8	0.06	4.2	0.08
5	2627	66.3	0.02	28.4	0.07	5.3	0.09
10	1277	61.4	0.04	32.5	0.04	6.1	0.12
15	650	53.4	0.03	37.2	0.05	9.4	0.11
20	322	57.1	0.04	32.6	0.08	10.2	0.09

This table reports the results of the transition of initial growth type to updated growth type for event year 3, 5, 10, 15 and 20. Panels A–C show the percentage of firms involved in each move and the corresponding average change in book leverage ratio for initial growth type, G1 (low), G2 (mixed) and G3 (high), respectively. In each event year *t*, we update growth type by using the same two-way sorting as our initial sorting except that initial MB and tangibility are replaced by annual MB and tangibility in event year *t*, respectively. Initial leverage ratio is the average of annual leverage ratios over event year 0, 1 and 2. The initial leverage ratios for G1, G2 and G3 are 0.31, 0.25, and 0.14, respectively. Change in leverage is the current book leverage for an updated growth type in year *t* minus the initial leverage for the initial growth type that transits to the updated growth type. The full sample is used.

and Levy, 2003) but also possible market misvaluations (Stein, 1996). This makes inference difficult.

Hovakimian (2006) and Kayhan and Titman (2007) argue that the historical average of past MB ratios is more likely to measure investment opportunities than temporary market conditions and misvaluations. They point out that the misevaluation-based market timing factor proposed by Baker and Wurgler (2002) mainly captures the factor's component of the time-series average of past MB ratios. But ''long-term market timing'' of Kayhan and Titman (2007) or perhaps "average" market timing concerns still cloud the implications of a historical average of MB ratios. In contrast, our growth type is identified from the earliest possible dates, and is least likely to have causality in favor of a market timing determination. One may argue that if market timing drives an IPO, the initial growth type is inevitably entangled with the IPO market timing. But Alti (2006) shows market conditions for both cold and hot IPOs do not seem to have a long lasting effect on future capital structures because he finds that the immediate IPO effect on leverage is largely erased within a couple of years.

3.3. Future firm fundamentals sorted by initial growth type

As shown in Panel A of Table 5, the three group means of MB ratios change slowly over time, where we report annual averages for the four packed periods, year 3–5, 6–10, 11–15, and 16–20. The low growth type group (G1) climbs from 0.71 in the early years to 1.01 in the final 5 event years while the high growth type group (G3) decreases from 2.45 to 2.04 in the same setting. Likewise, the two lopsided groups also show some converging development in terms of Tang, decreasing in G1 and increasing in G3. Despite these converging tendencies, the lopsidedness in MB and Tang that starts at the very beginning and defines the three growth-types does not seem to disappear over time. This is consistent with Fig. 1. As indicated by the *t*-stats, the differences in group means are always significant in Panel A of Table 5.

Panel A of Table 5 also shows that growth type is negatively correlated with firm size. This comes as no surprise given that firm size is positively correlated with tangibility. While firms of all growth types grow, the gaps in firm size, despite the tendency to narrow, remain significant over the 20-year period. Note that firm size is measured in logarithm and the dollar size gaps actually are much larger.

Panel B of Table 5 shows that profitability and growth type are consistently negatively related. On average, profitability is steadily around 13% per annum for G1 firms, around 11.5% for G2 firms, and the smallest for G3 firms over time. Low and mixed growth firms (G1 and G2) are always significantly more profitable than high growth firms, although the improvement in profitability (from losses in the earlier years to 7.16% per annum in the last 5 years) is pronounced for G3 firms. If we separate profitable firms from loss-making firms each year, however, we see that profitable G3 firms on average, catching up G2 firms, deliver significantly higher profits than do profitable G1 firms in the year 11–15 and 16–20 periods. In effect, the negative relationship between profitability and growth type is largely driven by loss-making firms, as explicitly shown in the right block of Panel B of Table 5. The dispersion (between profitability > 0 and profitability < 0) in *ex post* profitability across the growth types suggests that larger swings in profitability go with higher growth type. This is consistent with the nature of increasing uncertainty over better growth prospects for firms with higher growth opportunities.

Panel C of Table 5 further details how the three growth types persistently differ in terms of asset growth rate and investment style. The patterns are clear as well. As firms age, on average, low growth type (G1) firms always have significantly lower annual asset growth than high growth type (G3) firms. This is shown in the left block of Panel C. Given our definition of growth type, firms of different growth types are expected to place different emphases on tangible and intangible investments. As shown in the rest of

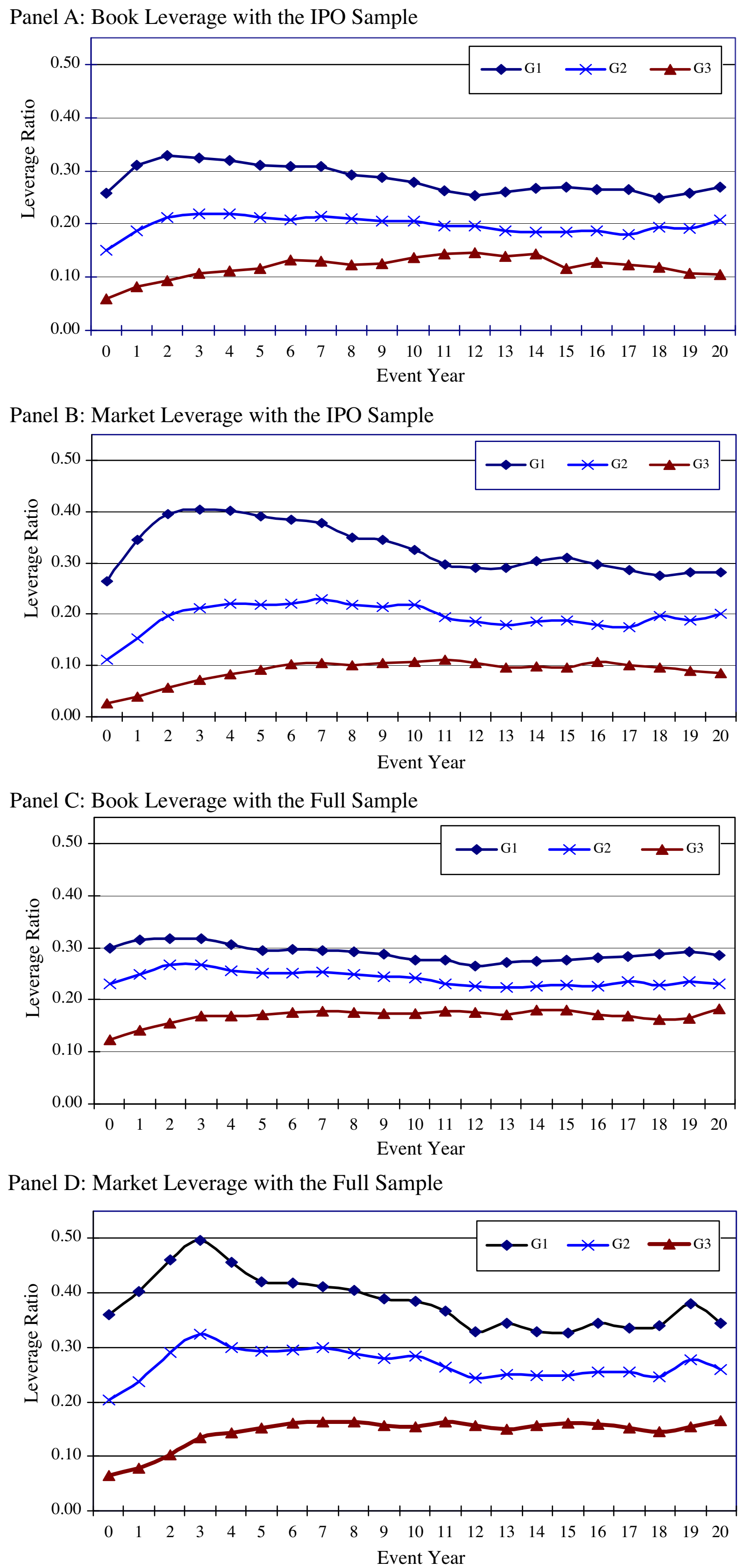
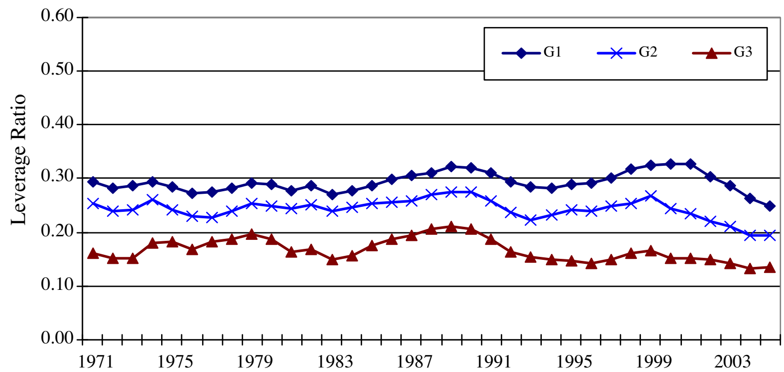


Fig. 2. Event time evolutions of leverage ratios sorted by initial growth type. The three groups are formed according to their initially identified growth type: G1 (low), G2 (mixed) and G3 (high). We calculate group mean leverage ratios by initial growth type for each event year and then plot them over event time. Panels A and B report book and market mean leverage ratios using the IPO sample, and Panels C and D show the plots using the full sample, respectively. Book leverage is the sum of short- and long-term debt divided by total assets. Market leverage is the sum of short- and long-term debt divided by the sum of total debt and market equity. The full sample consists of the merged CRSP/COMPUSTAT US firms excluding utilities and financials for 1971–2005, and includes IPO firms that have the IPO date information from SDC for 1971–2003.

Panel A: Book Leverage with the Full Sample



Panel B: Market Leverage with the Full Sample

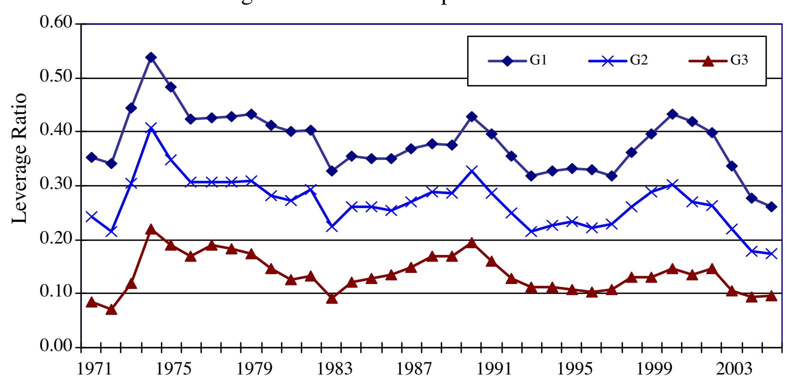


Fig. 3. Calendar time evolutions of leverage ratios sorted by initial growth type. We calculate group mean leverage ratios by initial growth type for each calendar year and plot them over time. See the formation of firm groups of the three growth types (G1, G2 and G3) and the definition of leverage ratios in the notes of Fig. 2. The full sample is used.

Panel C, the tangible versus intangible investment styles indeed persistently differ across the growth types. To show the differences, for example, in the year 6–10 period, firms of low (G1), mixed (G2) and high growth type (G3) have an average annual capital expenditure, Capex (tangible investments), of 7.60%, 7.00%, and 5.35% of the previous year's total assets. But they make annual average investments in R&D (intangible investments), in reversed order, of 2.32%, 4.39%, and 12.58% of the previous year's total assets, respectively. The differences by growth type are all statistically significant.

The persistently distinct investment styles suggest that low growth type firms (G1) focus their investments on tangible assets, and high growth type firms (G3) tilt their investments overwhelmingly toward intangibles which are likely based on human capital or knowledge capital. More precisely, while the persistent gap in the tangible investments (Capex/A) between G1 and G3 is some 2% of total assets, the persistent gap in the intangible investments (R&D/A) between them is big, about 10% of total assets in absolute value. Apparently, high growth type (G3) firms make relentless investments in intangibles; this is likely to be what underlies their high MB ratios over time.

Panel D of Table 5 further reports the persistent differences in sales growth, cash holdings and likelihood of paying dividends. As shown in the left block of Panel D, low-growth-type firms (G1) have significantly lower annual sales growth rate than mixed-growth-type firms (G2), which in turn have significantly lower sales growth rate than high-growth-type firms (G3). For example, in the year 6–10 period, the average sales growth rates are 12.20%, 13.91%, and 22.19%, respectively. Here as well, like as was shown for intangible investment, G3 firms stand out in annual sales growth. Sales reflect real economic activities, and the high MB ratios of G3 firms do have an obviously fundamental content.

As shown in the two remaining blocks of Panel D of Table 5, G3 firms have by far the largest cash holdings, and are least likely to pay dividends. For example, during the period from year 6 to year 10, on average, G1, G2 and G3 firms have cash holdings of 8.27%, 13.17%, and 32.35% of the previous year's total assets, and their probabilities to pay dividends are 64.21%, 42.12%, and 15.63%, respectively. These differences between G1, G2 and G3 firms are persistent and significant.

The finding of pronouncedly high cash holdings for G3 firms should not give rise to the free cash flow concern, because G3 firms have persistently high MB ratios. Using a sample of 89 US firms with large cash holdings for 1986–1991, Mikkelson and Partch (2003) also document that high cash holdings are unlikely to hurt firm valuation, since these firms have high R&D investments and asset growth. All this suggests that high cash holdings here allow relentless investments in intangibles; and at the same time the market must believe that their intangible investment is the engine for high growth, and they do deliver high growth in sales and assets. As G3 firms are least likely to pay dividends, their high valuation does not seem to need dividend signaling. But, given the least profitability of G3 firms as shown in Panel B of Table 5, where are their high cash holdings from? We will give the answer in the next section.

In summary, we show that growth type parsimoniously and meaningfully cuts firm fundamentals to produce persistent patterns for many corporate finance variables. Low-growth-type firms (G1) focus on tangible investments and grow with a tangible-investment style. In contrast, high-growth-type firms (G3) make much more intangible investments and grow with an

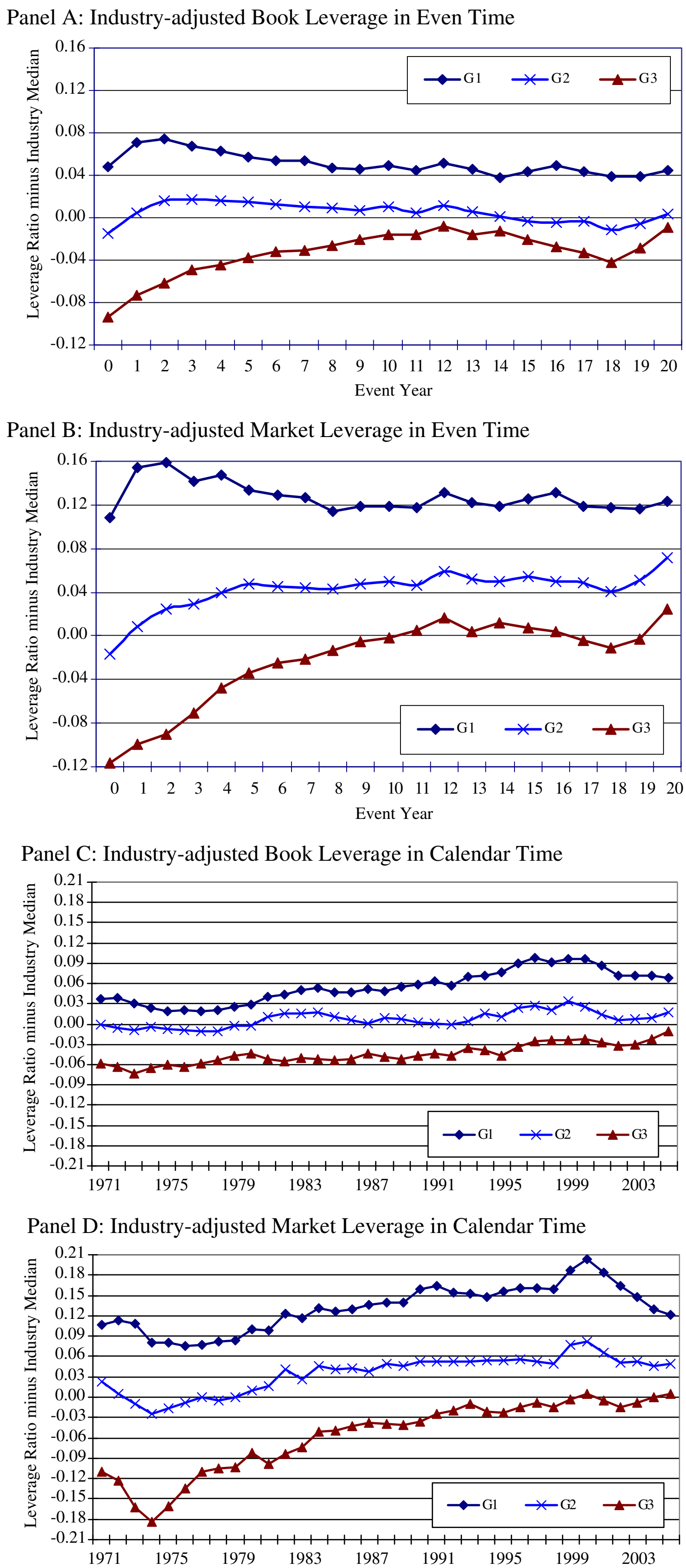


Fig. 4. Industry-adjusted leverage ratios. Panels A and B report evolutions in event time and Panels C and D show evolutions in calendar time. We form the firm groups G1–G3 the same way as in Fig. 2 except that the two-way sort is based on initial MB minus its initial industry median and initial Tang minus its initial industry median. The Fama–French classification of 38 industries and the full sample are used.

Table 5
Persistently distinct firm fundamentals across initial growth types.

Event year	Pooled mean			t-stat for mean difference		Pooled mean			t-stat for mean difference		Pooled mean			t-stat for mean difference	
	G1	G2	G3	G1–G2	G2–G3	G1	G2	G3	G1–G2	G2–G3	G1	G2	G3	G1–G2	G2–G3
Panel A: market-to-book ratio, tangibility, and firm size															
	Market-to-book (MB) ratio					Tangibility (Tang)					LnSize				
3–5	0.71	1.25	2.45	−31.14	−36.62	0.67	0.52	0.31	40.07	55.33	18.86	18.27	17.84	15.02	13.29
6–10	0.83	1.22	2.19	−24.17	−32.66	0.64	0.54	0.33	30.60	56.61	19.15	18.59	18.16	14.82	12.61
11–15	0.97	1.29	2.15	−15.15	−21.13	0.60	0.52	0.35	18.16	35.58	19.44	19.01	18.51	8.62	10.54
16–20	1.01	1.32	2.04	−10.06	−12.37	0.58	0.50	0.35	13.42	24.71	19.70	19.42	18.83	4.29	8.44
Panel B: profitability (%)															
	Profitability					Profitability > 0					Profitability < 0				
3–5	13.68	10.13	−1.82	12.05	27.64	14.98	15.72	15.04	−4.09	3.38	−10.49	−17.54	−27.82	5.22	11.22
6–10	14.07	12.21	2.19	7.51	26.71	15.37	15.94	14.98	−3.62	5.34	−10.04	−16.66	−24.74	5.50	8.00
11–15	12.21	11.76	5.30	1.55	14.48	13.88	14.86	14.67	−5.05	0.86	−8.09	−14.05	−23.07	4.67	6.83
16–20	12.37	12.09	7.16	0.82	8.59	13.72	14.67	14.77	−4.07	−0.33	−9.12	−13.23	−21.50	2.55	4.52
Panel C: asset growth, tangible and intangible investment style															
	Asset growth rate (%)					Tangible investment or $Capex_t/Asset_{t-1}$ (%)					Intangible investment or $R\&D_t/Asset_{t-1}$ (%)				
3–5	9.65	13.46	22.75	−6.07	−9.35	7.11	7.32	5.54	−1.47	13.99	2.07	4.65	14.48	−21.16	−42.01
6–10	12.48	13.91	18.41	−2.38	−4.90	7.60	7.00	5.35	4.97	14.82	2.32	4.39	12.58	−19.27	−39.53
11–15	8.78	10.89	16.62	−2.80	−4.97	7.02	6.41	5.13	4.56	10.11	2.81	4.67	11.32	−13.20	−24.57
16–20	7.54	7.43	12.48	0.14	−4.36	6.31	5.87	4.63	3.06	8.63	2.91	4.34	10.17	−9.52	−18.64
Panel D: sales growth, cash holdings and likelihood of paying dividends															
	Sales growth rate (%)					$Cash_t/Asset_{t-1}$ (%)					%Payers				
3–5	12.36	17.22	30.93	−5.96	−10.77	7.37	14.54	38.38	−20.68	−35.81	56.20	32.60	10.25	21.87	28.17
6–10	12.20	13.91	22.19	−2.93	−7.94	8.27	13.17	32.35	−14.52	−32.69	64.21	42.12	15.63	21.85	31.69
11–15	6.11	9.53	17.55	−4.40	−6.26	9.99	13.48	29.16	−7.85	−20.93	65.93	48.06	23.28	13.88	20.92
16–20	7.89	8.17	13.20	−0.31	−3.90	8.49	11.54	26.13	−7.29	−18.19	66.38	50.97	29.79	9.50	12.85

This table reports the evolutions of firm characteristics by initial growth type. Firm characteristics include market-to-book (MB) ratio, tangibility (Tang), and firm size (Panel A), profitability (Panel B), asset growth rate and investment style (Panel C), and sales growth rate, cash holdings and likelihood of paying dividends (Panel D). Asset and sales growth rates in year t are defined as the change in total assets and sales from year $t-1$ to year t, divided by total assets and sales in year $t-1$, respectively. Tangible and intangible investments are Capex and R&D in year t divided by total assets in year $t-1$, respectively. Cash holdings is a balance sheet variable, Cash in year t, divided by total assets in year $t-1$. %Payers is the percentage of dividend payers of a firm group in year t. The three groups are formed according to their initially identified growth type: G1 (low), G2 (mixed) and G3 (high). The event years are packed into four periods. The full sample is used.

intangible-investment style. In line with this pattern, G1 firms continue to have low MB and high Tang, enjoy steady profitability and are most likely to pay dividends. In sharp contrast, G3 firms continue to have high MB and low Tang, achieve by far higher growth rates in sales and assets, and somehow are able to stockpile much more cash. It is this persistence in firm fundamental that underlies the stability of growth type. But unless we understand the relationship between growth type and financing behavior, it is difficult to make any inferences about how leverage persistence is maintained. We examine this issue in the next section.

4. Growth type and persistence in short-term financing behavior

In a sense, investment and financing are two interconnected halves of corporate finance. We have already showed the persistence of growth-type-related investment style and capital structure. In this section, we will show that growth type also affects financing mix for new investment in a persistent way (Section 4.1) and consistently influences year-by-year external finance (Section 4.2).

4.1. Financing mix sorted by initial growth type

For each growth type, we calculate the group means for the three funding sources of new investment: annual net debt issues, net equity issues and changes in retained earnings, respectively, over event time. Fig. 5 plots out these variables starting from year 3. Note that we skip the first 3 years (year 0, 1 and 2) to purge the IPO phenomenon in which new equity issues in IPO can reach more than 50% of total assets for G3 firms (not reported in the figure here). Comparing across the three growth types, while there is not much difference in net debt financing (shown in Panel A), distinct patterns emerge for both net equity issues (Panel B) and changes in retained earnings (Panel C).

As shown in Panel B of Fig. 5, year-by-year issues of outside equity line up well with the growth types. For almost 20 years, G3 firms issue significantly more equity than both G1 and G2 firms, albeit converging down eventually. G2 firms issue more equity than G1 firms until about year 11, although there is not much difference between G1 and G2 later. The evidence about heavy equity financing by G3 firms is especially interesting. Heavy equity financing makes it possible for G3 firms to stockpile cash and fund

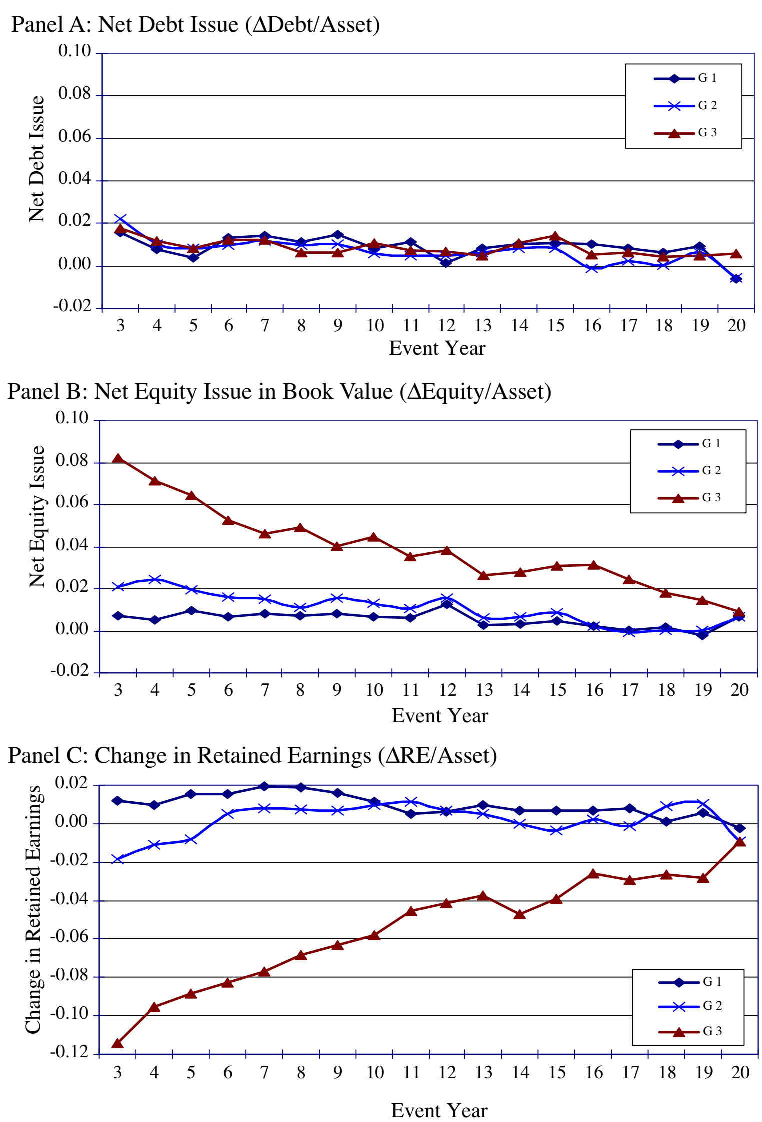


Fig. 5. Financing mix sorted by initial growth type. Financing mix includes three financing sources that are net debt issue (Panel A), net equity issue (Panel B) and changes in retained earnings (Panel C), all scaled by total asset. We calculate group means of each financing source by initial growth type for each event year and plot them over time. See the formation of firm groups of three growth types (G1, G2 and G3) in the notes of Fig. 2. The full sample is used.

R&D investments for a multiyear period. This explains their high cash holdings documented in Table 5.

In studying the optimal cash holdings, Opler et al. (1999) find that the determinants of cash holdings are closely related to the determinants of debt, but leave the question: "To what extent are cash holdings and debt two faces of the same coin?" Our finding here reveals that high growth type underlies high cash holdings that are achieved typically through new equity issues; and as shown in the previous section, high growth type firms have significantly lower leverage (debt) ratios.

The heavy equity financing by G3 firms would reduce their nonzero leverage ratios considerably if there were no force rebalancing them. As shown in Panel C of Fig. 5, changes in retained earnings also persistently differ across the growth types. G2 is less than G1 most of time. G3 is less than both G1 and G2 for almost 20 years, albeit eventually converging upward (in the negative territory). It is interesting that the pattern is more pronounced for high growth type firms (G3). Their huge decreases in retained earnings (as a result of relentless R&D investments) tend to mirror their huge new equity issues, as shown in Panel B. This suggests that for high growth type firms (G3), it is the huge decreases in retained earnings (reducing internal equity) that naturally prevent heavy equity financing from decreasing their nonzero leverage ratios. This mechanism of maintaining leverage persistence is different from the proactive one in which net debt issues are the main rebalancing force against new equity issues (Leary and Roberts, 2005). We will show in the next section, G3 firms are least likely to issue new debt in response to investment needs.

For high growth type firms (G3), their huge decreases in retained earnings or big accounting losses simply reflect the expensing or amortizing of their relentless R&D or intangible investments that pay off slowly. Despite uncertainty about their growth prospects, the market continues to expect high future payoffs (including those arising from future investments and "liquidating dividends" due to takeovers), as evidenced by their high MB ratios. Although the market may overestimate future payoffs from time to time, the fact that only G3 firms are persistently able to use mainly new equity to fund relentless investment in R&D for an extended period of time, say, at least 10 years is unlikely to do with exploitable market timing.

Given that the choice of IPO may reflect initial market timing, why do the firms that we identify as high growth type at IPO still persistently rely on new equity financing as they grow? If one sticks with the exploitable market timing argument of Stein (1996) and Baker and Wurgler (2002), one has to come to the conclusion that these firms are always able to exploit outside investors because of market overvaluations that occur persistently, not just at IPO. However, persistence of this kind is incompatible with exploitable market timing as a timely and opportunistic phenomenon. In contrast, the generalized Myers–Majluf view suggests that it is growth type rather than market timing per se that dictates firms' distinct preferences in external finance.

Corporate preferences in external finance seem intricate. For one thing, Fama and French (2005) find no overarching pattern for asymmetric information costs, or more precisely, adverse selection costs, to prevent new equity issues—that is, most firms seem to issue equity more frequently than suggested by Myers and Majluf (1984). We show next that our growth type view can shed new light on this puzzling finding.

4.2. Growth type and time-variation in external finance

Managers have incentive to time the market. Market timing for external finance occurs when a firm's external finance increases in response to better market conditions or investment opportunities via a higher market-to-book ratio for whatever reasons. The notion of market timing is very general but it is largely a phenomenon of within-firm variation.

Short-term variation in year-by-year leverage ratios often contains detailed information about both tradeoff forces and effects of information asymmetries. These tradeoff forces and asymmetric information effects interact with market conditions, as described by various theories. Researchers have attempted to compare competing theoretical predictions. Research designs in previous studies vary from the Logit models (e.g. Hovakimian et al., 2001) to the augmented or modified adjustment models (e.g., Shyam-Sunder and Myers, 1999; Fama and French, 2002), and can also be as straightforward as portfolio sorts (e.g., Fama and French, 2005). Perhaps because all the theories have significant overlaps, results from this literature taken together are mixed regarding which theory dominates (Fama and French, 2002, 2005).

Our task here is less burdensome. We simply aim to show how growth type interacts with time-varying firm characteristics in affecting external finance. We wish to purge an IPO effect, if any, from our analysis. So we use the full sample but exclude the initial period that we employed to identify the firm growth type (event years 0–2). But including the data from these earlier years does not qualitatively alter our regression results (available on request).

We use a pooled OLS regression with firm fixed effects to demonstrate within-firm variations, and with growth-type dummies to pick up growth type effect. Our firm characteristics, commonly used in the literature, are market-to-book (MB), tangibility (Tang), profitability (Profit), firm size (LnSize), Industry Median Leverage (Ind_median), and dividend payer status (DivPayer, a dummy variable), all lagged by one year. We standardize all continuous variables so that their slope estimates are economically comparable. In Section 4.2.1, we focus on the results for MB and profitability, both having traditional tradeoff and pecking order implications. In Section 4.2.2, we discuss the results for the other leverage determinants we use.

4.2.1. Regression results for market-to-book (MB) ratio and profitability

Market-to-book ratio. As shown in Table 6, for all growth types, an increase in MB ratio significantly facilitates both net issues of debt (ΔDebt/Asset) and equity (ΔEquity/Asset). The results are similar if we measure net equity issues by market value (as shown in the next two columns). It is not really surprising as economic and market conditions improve, firms tend to increase external finance for new investments. As widely shown in the literature, issues of outside equity tend to follow issuers' stock price run-ups (Asquith and Mullins, 1986; Korajczyk et al., 1990; Jung et al., 1996).

Recently, Fama and French (2005) have shown that most firms issue new equity quite often, and they conclude that the asymmetric information costs described in Myers and Majluf (1984) are not relevant to equity issuance at large, as new equity does not look like last resort financing. This puzzle can be resolved, as we already mentioned before, by the generalized Myers–Majluf view, which points out that the costs of asymmetric information depend on the type of asymmetric information rather than the magnitude of asymmetric information per se.

In Myers and Majluf (1984) classic framework with predominant asymmetric information about assets-in-place, the costs of asymmetric information can make firms skip new investments of positive NPV's, only if the adverse share dilution effect from taking outside equity overwhelms the benefits from the new investments. Thus, even in the classic setting, market conditions that work through year-by-year market-to-book ratios can alter the non-issuing decision from time to time. According to the survey study of Graham and Harvey (2001), managers confirm that they do consider firm valuations when deciding on new equity issues.

Table 6
Explaining dynamic external finance.

	ΔDebt/Asset$_t$		ΔEquity/Asset$_t$			
	Book value		Book value		Market value	
MB$_{t-1}$						
G1	0.221	(8.72)	0.179	(10.0)	0.243	(13.7)
G2	0.137	(9.75)	0.229	(23.1)	0.263	(26.7)
G3	0.046	(6.83)	0.243	(51.0)	0.296	(62.4)
Tang$_{t-1}$						
G1	0.043	(2.90)	0.031	(2.97)	0.000	(−0.01)
G2	0.016	(1.18)	0.097	(9.93)	0.035	(3.57)
G3	0.028	(1.77)	0.188	(17.1)	0.079	(7.20)
Profit$_{t-1}$						
G1	0.151	(10.2)	−0.069	(−6.65)	−0.051	(−4.91)
G2	0.113	(9.76)	−0.149	(−18.3)	−0.122	(−15.2)
G3	0.034	(4.19)	−0.283	(−49.6)	−0.196	(−34.5)
LnSize$_{t-1}$						
G1	−0.248	(−11.1)	−0.179	(−11.4)	−0.147	(−9.43)
G2	−0.206	(−10.2)	−0.238	(−16.7)	−0.179	(−12.7)
G3	−0.178	(−8.49)	−0.511	(−34.7)	−0.488	(−33.3)
Ind_median$_{t-1}$						
G1	−0.034	(−2.72)	0.001	(0.11)	−0.007	(−0.78)
G2	−0.075	(−6.29)	−0.006	(−0.68)	−0.031	(−3.71)
G3	−0.074	(−5.24)	−0.004	(−0.36)	−0.032	(−3.20)
DivPayer$_{t-1}$						
G1	0.146	(13.8)	0.008	(1.09)	−0.002	(−0.30)
G2	0.135	(11.9)	0.006	(0.74)	0.006	(0.70)
G3	0.089	(5.45)	0.018	(1.54)	0.010	(0.88)
Firm FE		Yes		Yes		Yes
Obs.		76,454		76,454		76,454
R^2		0.180		0.512		0.533

This table reports the results from the full sample pooled OLS (panel) regressions with a firm fixed effect (FE) for external finance on a list of determinants of capital structure. The dependent variable, ΔDebt, is the net debt issue. ΔEquity is the net equity issue in book value, that is the sale minus the purchase of common and preference stock, or in market value, that is the split adjusted change in shares outstanding times the split adjusted average stock price (see Fama and French, 2005). The dependent variable is scaled by total assets at *t*. Interacted with all explanatory variables, dummy variables for the three initial growth type groups (low, G1, mixed, G2, and high, G3) pick up individual group mean estimates. All variables are standardized for individual firms. We drop the data for event year 0, 1 and 2 which are used for producing the three growth types. Intercept estimates are not reported. *t*-stats are in parentheses.

This gives rise to market timing. Dynamic costs and benefits of external finance drive firm market timing behavior. Firms time the market especially with new equity issues: they issue equity when stock prices run up and business conditions become more favorable. Bayless and Chaplinsky (1996) find that the announcement effects of equity issues are on average significantly better during high issuing volume periods (hot market) than during low issuing volume periods (cold market).

This is consistent with what we call fair market timing view based on time-varying asymmetric information about assets-in-place (Korajczyk et al., 1990, Korajczyk et al., 1992) and the dynamic adverse selection model (Lucas and McDonald, 1990). But this traditional market-condition-based view is silent about why high growth firms find new equity issues especially attractive despite a lot of uncertainty. This is the situation where the uncertainty over growth (new investment's NPV) is likely to increase with growth prospects, befitting high growth firms fraught with asymmetric information about growth. Thus, the generalized Myers–Majluf view fills this void in a fair market timing framework without assuming expected firm overvaluation due to market irrationality.

Comparing net issues of debt and equity, the slope estimates for MB indicate distinct growth-type-determined pecking orders in external finance, consistent with the generalized fair market timing view. As shown in Table 6, both debt and equity issues by low-growth firms (G1) significantly respond to rising MB ratios, with slope estimates of 0.221 and 0.179, respectively. Given that regression variables are standardized, this means that an increase in MB by one time-series standard error will marginally increase net debt issue by 0.221 and net equity issue by 0.179 of the total asset. In other words, G1 firms on average are keener to issue debt than equity as economic and market conditions improve.

The responses by mixed (G2) and high growth (G3) firms are also significant. For debt issues, the slope estimate for MB is 0.137 for G2 and 0.046 for G3. For equity issues, the slope estimate is 0.229 for G2 and 0.243 for G3, and these estimates do not change qualitatively if equity issues are in market value. Thus, G3 firms are least likely to issue debt and keenest to issue equity. The findings suggest that growth type dictates firms' distinct pecking orders in external finance, making market timing to be a second-order effect.[6]

Profitability. In the literature, profits are the paramount reason for a tradeoff adjustment force due to the tax-shield (Modigliani and Miller, 1963). The profitability-based tradeoff force works in the right direction in within-firm year-by-year variations of capital structure. As shown in Table 6, an increase in profitability significantly increases debt issues by G1 and G2 firms, but this is much less pronounced for G3 firms (slope estimates are 0.151, 0.113, and 0.034, respectively). At the same time, however, an increase in profitability seems to cause all growth types to issue significantly less equity as the slope estimates for Profit are all negative. The sensitivity to Profit in favor of debt over equity issues is clearly consistent with the tradeoff force among G1 and G2 firms typically being profitable.[7]

This pattern for within-firm external finance in response to time-varying profitability also seem to suggest Myers' (1984) pecking order where new equity is deemed to be a last resort, although this classic pecking order has trouble with high growth type firms. Our findings are in line with what other researchers have found. For example, Frank and Goyal (2003) find that Myers' (1984) pecking order works well for firms with more tangible assets—likely to be G1 and to some extent G2 firms in our opinion. In addition, Fama and French (2002) find that the two competing theories of tradeoff and pecking order can have significant overlaps.

High growth type (G3) firms are the main focus of this paper. As shown in Table 6, when their losses increase (due to relentless investment in R&D), G3 firms are keenest to issue new equity. This within-firm effect is a pronounced result (slope estimate of −0.283 and a *t*-stat equal to −49.6), echoing the plots of financing mix in Fig. 5. But the traditional tradeoff force as considered in Leary

[6] One may argue that the growth-type-based pecking orders in external finance are also consistent with the traditional tradeoff explanation based on Myers (1977). It suggests that an increase in MB ratio reflects more investment opportunities and hence more potential for the debt overhang problem; it follows that high growth firms in particular are more likely to go for new equity when it comes to external finance. But Myers (1977) does not explain why outside equity investors are willing to provide "cheap" equity for these firms, and such a behavior is apparently at odds with Myers and Majluf (1984).

[7] In traditional tradeoff theory, firms weigh the costs and benefits of debt at the margin to maintain optimal capital structures. The costs of debt come from concerns over bankruptcy and agency conflicts such as assets substitution (Jensen and Meckling, 1976) and debt overhang (Myers, 1977), while the benefits of debt arise from, for example, the tax shield (Modigliani and Miller, 1963) and the disciplining role of debt (Jensen, 1986; Stulz, 1990). This theory emphasizes capital structure adjustment towards optimal targets if shocks push firms away from their optimum targets (see also a dynamic framework in Fischer et al. (1989) and Goldstein et al. (2001)). The tradeoff theory can also give rise to leverage persistence. But in terms of tradeoff force via profitability, there are debt conservatism which weakens tradeoff force (Graham, 2000) and mechanical mean reversion in leverage ratios (Chang and Dasgupta, 2009). See also a muted valuation effect of tax benefits of debt in Fama and French (1998) for U.S. firms and Wu and Xu (2005) for Japanese firms. Our results about G1 and perhaps G2 firms, however, are consistent with the tradeoff theory.

and Roberts (2005) is the weakest here because G3 firms are least likely to issue debt. Losses here mainly reflect the fact that G3 firms expense or amortize vigorous intangible investments in R&D which typically pay off slowly. And the market expects these firms to produce high future payoffs eventually. This market expectation is able to support the high market valuations without firm dividend signaling. All this suggests that evidence of accounting losses and lack of dividends may not necessarily imply financial constraints especially in intangible investments. As explained by the generalized Myers–Majluf model, high growth type firms can tap into outside equity—not typically under duress as described by Myers and Majluf (1984).

In summary, while Fama and French (2005) rightfully conclude that an overarching pecking order described by Myers (1984) does not seem to be consistent with data, we show that types of asymmetric information spawn growth-type-determined pecking orders in external finance. This also complements the traditional tradeoff theory because the profitability-based tradeoff force is the weakest for G3 firms. In addition, the market timing evidence here that all firms tend to step up external finance with improving market conditions or rising investment opportunities or both (via market-to-book ratios) is totally different from the finding in Baker and Wurgler (2002). They show that low leverage firms tend to raise funds when market conditions are good whereas high leverage firms tend to raise funds when market conditions are poor. As Hovakimian (2006) points out, this main finding of Baker and Wurgler (2002) is mainly from cross-firm variation rather than within-firm variation in capital structure, and hence cannot be really interpreted as market timing evidence (see also Liu, 2009).

4.2.2. Other leverage explanatory variables

The results for the other variables are largely circumstantial, and we focus our discussions on those with high significance. As shown in Table 6, unlike debt issues, new equity issues (if we also consider market equity) by higher growth types (G2 and G3) respond significantly to an increase in tangibility. In particular, the response of new equity issues by G3 firms is the strongest (slope estimate of 0.188 with a *t*-stat of 17.1 in book equity); this contributes to the lowering of their leverage ratios. Recall that the well-known positive relationship between tangibility and leverage ratios in the literature is a cross-sectional phenomenon. But here the evidence is from time variation. Thus, there is no obvious contradiction. This result suggests that despite a growth in G3 asset tangibility which is strongly persistent, G3 firms can hardly change their low ranks in the cross section of tangibility as well as leverage ratio among all firms.

As a pure control variable, firm size tends to be negatively correlated to a dependent variable with total assets being its denominator. As shown in Table 6, there are significantly negative slope estimates for firm size everywhere. But the within-firm evidence is likely to indicate that firms seek less external finance when they grow bigger—a firm maturity effect. Interestingly, growth type also presets the paths of maturity: for G1 firms, the maturity effect is stronger in net debt issues (with a slope estimate of −0.248) than in net equity issues (−0.179); in contrast, for G3 firms, the maturity effect is much stronger in net equity issues (with a slope estimate of −0.511) than in net debt issues (−0.178).[8] The maturing process, however, is slow as shown in Fig. 5.

The results for the industry median leverage and the dividend payer dummy are significant for all growth types only with debt issues. The findings suggest that more debt issues follow a decrease in industry median leverage, perhaps reflecting a general mean reversion in leverage ratios. In addition, dividend payers are more likely to issue more debt.

5. Conclusion

This paper shows that three distinct growth types, which are easily identified according to a two-way sort on initial firm MB ratio and asset tangibility, can span significantly dispersed and persistently distinct leverage ratios: firms of low growth type (G1) have significantly high leverage, firms of high growth type (G3) have low leverage, and firms of mixed growth type (G2) are significantly in the middle over at least 20 years.

While it is well known in the literature that important firm characteristics such as MB ratio and tangibility in the current year significantly affect investment and financing decisions in the next year, this paper documents that effects of initial growth type on corporate decisions even in distant future are strong. The three distinct growth types are persistent; growth-type-sorted cross-sections of corporate fundamental variables (such as tangible versus intangible investment style) are also meaningfully persistent. In addition, there are persistent patterns for firm financing behavior. As economic and market conditions improve, low growth type firms are keener to issue new debt than equity, whereas high growth type firms are least likely to issue debt and keenest to issue equity. These findings demonstrate that firms rationally invest and seek financing in a manner compatible with their growth types.

Consistent with a generalized Myers–Majluf framework, growth type compatibility enables distinct growth types and hence specifications of market imperfection to persist. As a result, pecking order in financing depends on the type of asymmetric information (assets-in-place versus growth) rather than the magnitude of asymmetric information per se. This growth-type-determined pecking order argument accommodates fair market timing and does not require firm overvaluation as a premise, suggesting that if managers cannot change firm growth type, they cannot alter long-run capital structure through market timing.

This paper also complements the traditional tradeoff view on leverage persistence. We find that the external finance sensitivity to profitability in favor of debt over equity issues is consistent with the traditional tradeoff interpretation for lower growth type firms which typically are profitable. High growth type firms are typically least likely to issue debt, and their strongly negative sensitivity of equity issues to profitability means that they heavily issue new equity and register huge losses (reducing internal equity) due to relentless intangible investments in R&D which typically pay off slowly. This mechanism of an increase in external equity and a decrease in internal equity to affect nonzero leverage ratios in opposite directions is added to the traditional tradeoff explanation for debt issues to counterbalance equity issues in maintaining leverage persistence. Thus, growth type sheds new light on capital structure persistence.

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[8] The firm size effect on new equity issues is also consistent with the argument for a firm size as a proxy for dominance of asymmetric information type (Wu et al., 2005).

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Appendix A. Data description

Our full sample is from the COMPUSTAT database for the period from 1971 to 2005. Our initial public offering (IPO) sample, as a subsample, excludes spin-offs and unit offers and includes COMPUSTAT firms that have an IPO date (using information from Securities Data Company, SDC) between January 1, 1971 and December 31, 2003.

We process the data for our COMPUSTAT firms as follows. (1) We exclude utilities (SIC 4900–4949) and financials (SIC 6000–6999). (2) For each firm, we define event year 0 as the year in which SDC reports the firm's IPO date, or if the IPO date is not available, the first year in which COMPUSTAT reports its market equity value, or stock price (Data item: 199) times Common Shares Outstanding (54). (3) We exclude firms that have annual market equity data for less than 3 years consecutively. (4) We intersect the COMPUSTAT firms in year *t* with CRSP (NYSE, AMEX and NASDAQ) firms that have share codes of 10 and 11 and have market equity data for December of year *t* to be in the CRSP sample of that year. (5) We require non-missing data to calculate book and market leverage, market-to-book ratio, tangibility, profitability and firm size. (6) We restrict book and market leverage ratio to be no greater than unity, and market-to-book ratio to be no greater than 20.

Restrictions up to this point leave 132,546 firm year observations. We further trim firm year observations for these variables: tangibility, profitability, firm size, asset growth rate, sales growth rate, Capex, cash holdings, net debt issue, net equity issue (in book and market value), and change in retained earnings, by the top and bottom 0.5% of each variable, and we do this simultaneously to avoid excessive trimming. We end up with 122,909 firm year observations. The construction of our annual variables is detailed in Appendix B.

Appendix B. Annual variable definition

All the numbers in the parentheses refer to the COMPUSTAT data item number.

Total debt	Short-term debt (34) + Long-term debt (9)
Market equity	Stock price (199) ∗ Common shares outstanding (54)
Asset	Total assets (6)
Leverage	
(i) Book leverage	Total debt/Asset
(ii) Market leverage	Total Debt/(Total debt + Market equity)
Market-to-book (MB)	[Market equity + Total debt + Preferred stock (10) − Deferred tax (35)]/Asset
Tangibility (Tang)	[Inventory (3) + Property, plant and equipment (8)]/Asset
Profitability (Profit)	Operating income before depreciation (13)/Asset
Firm size (LnSize)	Natural log of (Asset ∗ 1,000,000), where Asset is deflated by GDP deflator (in 2000 dollar)
Ind_median	Median industrial leverage according to the Fama and French classification of 38 industries
DivPayer	Dummy variable: 1 for dividend payer and 0 for non-payer
Asset growth rate	$[\text{Asset}_t - \text{Asset}_{t-1}]/\text{Asset}_{t-1}$
Sales growth rate	$[\text{Sales}_t\ (12) - \text{Sales}_{t-1}]/\text{Sales}_{t-1}$
Investment	$\text{Capex}_t\ (128)/\text{Asset}_{t-1}$; $\text{R\&D}_t\ (46)/\text{Asset}_{t-1}$ (note that R&D missing values are replaced by zero)
Cash holdings	$\text{Cash}_t\ (1)/\text{asset}_{t-1}$
%Payers	The percentage of dividend payers (of a firm group)
ΔDebt	Net debt issue = Long term debt issuance (111) − Long term debt reduction (114)
ΔEquity	Net equity issue
(i) Book value	[Sale of common and preference stock (108) − Purchase of common and preference stock (115)]
(ii) Market value	$[\text{Shares}_t\ (25) * \text{Adjust}_t\ (27) - \text{Shares}_{t-1} * \text{Adjust}_{t-1}] * [\text{Price}_{t-1}\ (199)/\text{Adjust}_{t-1} + \text{Price}_t/\text{Adjust}_t]/2$
ΔRE	$\text{Retained earnings}_t\ (36) - \text{Retained earnings}_{t-1}$

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