Passive Demand and Missing IPOs

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Abstract

We show that the rise in aggregate passive ownership discourages firms from going public, opposite to the effect of stock-level benchmark subsidies. A market-wide switch from active to passive funds reallocates total asset demand from small entrants toward large incumbents and reduces the active risk-bearing capacity available to absorb new listings before index inclusion. In a model of IPO timing, these forces raise small firms' public cost of capital and can delay or even eliminate IPOs. Consistent with the model, industries more exposed to rising passive ownership experience larger declines in IPO activity; a Bartik-style instrument exploiting differential exposure to aggregate passive flows confirms this relationship. At the IPO-firm level, we directly test whether depriving an IPO candidate of active demand raises its cost of capital, using post-IPO cumulative abnormal returns (CARs) to measure compensation for idiosyncratic risk. CARs are persistently lower when more expert capital is available, and expert capital attenuates the increase in the cost of capital associated with intermediating anticipated passive ownership before index inclusion. Our findings provide a novel explanation for the long-run decline in U.S. IPOs.

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1. Introduction

Over the past two decades, U.S. equity markets have undergone a structural transformation driven by the exponential growth of passive investing. Encompassing both index funds and internally managed portfolios, passive ownership now exceeds 33.5% of the U.S. stock market (Chinco and Sammon, 2024). Concurrently, the U.S. capital markets have experienced a pronounced and sustained dearth of initial public offerings (IPOs) since their 1996 peak (Gao, Ritter, and Zhu, 2013; Doidge, Karolyi, and Stulz, 2013). This decline is economically important because public listings can relax firms' financing constraints, strengthen product-market competition, facilitate entrepreneurial activity and job creation, and generate positive spillovers for local economies (Michelacci and Suarez, 2004; Hsu, 2010; Butler, Fauver, and Spyridopoulos, 2019; Borisov, Ellul, and Sevilir, 2021). Despite considerable academic and policy attention, however, the causes and consequences of the decline, and, more broadly, the changing ways in which startups finance growth and exit, remain actively debated (Ewens and Farré-Mensa, 2020). This paper connects these two macro-level trends and proposes that the rise of aggregate passive ownership (PO) is a critical yet overlooked driver of the decline in U.S. IPO activity.

The shift toward passive investing raises the cost of capital for IPO candidates through two channels. The first is the redistribution of demand across firms: passive flows are disproportionately directed toward the largest firms in the economy (Jiang, Vayanos, and Zheng, 2025), whereas IPO candidates are typically small. As the rise in aggregate PO uniformly drains active demand, total asset demand redistributes from small to large firms, thereby pushing up the public cost of capital for small IPO candidates. The second channel is an institutional friction: index funds incorporate newly listed firms only after a delay, often of at least a quarter (Murray and Sammon, 2026), so arbitrageurs must warehouse a new listing until its passive demand arrives. Such arbitrage is risky (Gromb and Vayanos, 2010) and requires compensation, further raising the cost of capital at the IPO stage. Rising aggregate PO exacerbates this friction by reducing the capacity of active investors to intermediate new listings. Facing these two costs, startups remain private longer, which distorts their capital structure and constrains growth, or exit via acquisition to gain access to the "inclusion subsidies" enjoyed by large, index-heavy acquirers.

We formalize both channels in a stylized model of startup IPO timing. A growing private firm chooses when to sell its float to a public market with two layers of demand: passive funds mechanically absorb an increasing share of the float as the firm crosses size-based index-eligibility thresholds, subject to an inclusion seasoning lag, while expert active investors with finite risk-bearing capacity warehouse the residual float. Market clearing generates a required-return schedule that declines stepwise with index membership and firm size. The listing decision then follows a crossing rule: the firm targets the first size threshold at which its public required return falls below its private cost of capital and lists one seasoning period in advance to satisfy the index-inclusion requirement; if no such threshold exists, it never lists (Proposition 1). We then model the secular rise of aggregate PO, following Jiang et al. (2025), as a switch of a fixed pool of investor wealth from active to passive funds. The switch uniformly reduces active demand but increases passive

demand in proportion to each size group's passive tilt. Because size-based index eligibility implies that passive tilts increase with firm size, a rise in aggregate PO raises the cost of capital for groups with below-average passive tilts, namely small- and mid-cap firms (Proposition 2).

The model delivers two central predictions. First, provided that the entrepreneur's private cost of capital exceeds the public cost of capital when aggregate PO is zero, an increase in PO weakly delays the IPO. Absent the demand redistribution induced by rising PO, private firms list as early as possible[1]. As aggregate PO shifts demand from small firms toward large firms, startups postpone their listings, and this delay continues until they reach the size at which the passive tilt is neutral (Proposition 3(i)). Second, firms that expect to stop growing in the small- to mid-cap range will never IPO if the demand redistribution induced by aggregate PO is too severe, because their short-term loss of demand will never be compensated for in the long term, as the passive subsidy benefits only large-cap firms (Proposition 3(ii)).

We evaluate these predictions in two steps. Our first set of tests exploits the heterogeneous incidence of the aggregate rise in PO across industries.[2] Using a quarterly panel of two-digit NAICS industries from 2000 to 2024, we relate IPO activity to two measures of the capital available to prospective IPO issuers: the industry's PO ratio and the dollar amount of active mutual fund capital remaining in the industry. Industry and quarter fixed effects absorb persistent differences across industries and aggregate IPO cycles, so identification comes from differential changes in exposure to the aggregate rise in PO. Consistent with the model, industries with greater PO, and hence scarcer expert capital, experience larger reductions in IPO activity. A one-percentage-point increase in industry PO is associated with a 4.7% decline in IPO dollar volume and a 1.1% decline in IPO count. A Bartik-style instrument, constructed from predetermined industry exposure to the aggregate growth of PO, yields similar estimates of 4.8% and 1.3%, respectively. Conversely, a 1% increase in industry expert capital is associated with a 0.85% increase in IPO dollar volume and a 0.16% increase in IPO count; the Bartik estimate for dollar volume remains economically similar at 0.74%. The response of dollar volume alongside the response of IPO number indicates that the effect operates through both extensive and intensive margin.

Our second set of tests moves to the IPO-firm level and examines the cost-of-capital mechanism directly. We use post-IPO cumulative abnormal returns (CARs), measured from the first-day opening price, as the compensation investors require for bearing firm-specific idiosyncratic risk and therefore as a measure of the issuer's cost of capital at the IPO, after purging compensation for systematic risk. We exploit two sources of IPO-firm-level variation. The first is the expert capital available to absorb the firm's IPO float, measured by lagged active mutual-fund AUM in its industry relative to the risk-bearing burden of the offering. The second is anticipated stock-level PO, measured by the component of PO one year after the IPO that is predicted by the firm's opening float. Because opening float is determined before the CAR window begins, this measure isolates anticipated passive demand from the component of realized PO that may respond endogenously to

[1] Adding a Myers and Majluf (1984)-style information-dilution cost that declines with firm size rules out immediate listing and generates interior IPO dates at empirically plausible private discount rates.

[2] We interpret each industry as a segmented economy in the baseline model, with its own stock of expert capital.

post-IPO returns. We compute CARs using the CAPM, Fama–French three-factor, and Carhart four-factor models.

The results support both implications of the model. First, abundant expert capital persistently lowers the compensation required for bearing idiosyncratic risk: across all three factor models, a one-standard-deviation increase in expert capital is associated with 3.2–3.4 percentage points lower CARs over three months and 11.8–13.5 percentage points lower CARs over six months. Second, when index inclusion is delayed, anticipated passive demand must initially be intermediated by active investors. Consistent with this intermediation channel, a one-standard-deviation increase in anticipated PO is associated with 6.8–7.1 percentage points higher three-month CARs and 15.0–15.9 percentage points higher six-month CARs across the three factor models. Moreover, the intermediation burden is smaller when expert capital is abundant: the interaction between anticipated PO and expert capital is negative and significant over the three-month horizon, reducing the CAR associated with a one-standard-deviation increase in anticipated PO by 1.3–1.6 percentage points for one-standard-deviation increase in expert capital. The interaction becomes statistically insignificant over six months. This timing is consistent with the Russell 2000, the main passive index for most IPO firms, having adopted quarterly addition of eligible IPOs since 2004, which limits the index-inclusion delay period to approximately three months.

These results carry important welfare implications. If rising passive ownership raises the cost of capital for new entrants, high-growth startups either delay public listing, which distorts their capital structure and constrains growth, or are absorbed into large incumbents whose cannibalization concerns and vested interests create obstacles for acquirees to sustain creative innovation relative to remaining independent public firms.

Related literature. We first contribute to the literature studying the effects of passive investment on asset prices and corporate behaviors. Within this space, this work is most closely related to two studies examining the intersection of passive ownership and IPOs. Murray and Sammon (2026) find the mechanical passive demand from CRSP-tracking funds increases short-term post-IPO returns but later reverses. Gustafson, Henry, Kim, and Pisciotta (2024) document that passive demand systematically influences the IPO bookbuilding process and shortens roadshow lengths. A broader strand of this literature establishes that inelastic index fund demand generates a cost-of-capital subsidy (Kashyap, Kovrijnykh, Li, and Pavlova, 2021) that distorts a variety of corporate behaviors, including physical investment (Hanson and Kontz, 2025) and debt issuance (Rossi, Ruan, and Xia, 2023; Bretscher, Schmid, and Ye, 2023). We contribute to the literature by moving beyond these partial equilibrium effects to study how the aggregate rise of passive ownership reshapes firms' exit decisions in general equilibrium. In contrast to the view that passive demand provides cheap funding, we show that the subsidy is highly uneven: it disproportionately accrues to large public incumbents at the cost of small new entrants. This generates a prediction opposite to the partial equilibrium benchmark: rather than subsidizing and encouraging public listings, the increase of inelastic passive demand discourages IPOs and shifts exit activity toward acquisitions. These are

novel macroeconomic consequences of the rise of passive demand, in contrast to its micro price and cost-of-capital effects.

Second, we contribute to the literature examining the secular decline of U.S. IPOs and the broader "eclipse" of the public corporation (Doidge, Kahle, Karolyi, and Stulz, 2018). Existing research attributes this dearth to factors such as rising regulatory costs of public disclosure, the growing importance of intangible capital (Casella, Lee, and Villalvazo, 2023), the expansion of private capital markets that allows firms to remain private longer (Ewens and Farré-Mensa, 2020), and the operational advantages of merging with larger incumbents (Gao et al., 2013). By highlighting the distributional and equilibrium effects of rising passive investment, we provide a new explanation for the long-run decline in IPO activity. We show that the aggregate rise of passive investing acts as a structural force that reshapes startup exit decisions, creating a widening cost-of-capital wedge that makes acquisitions increasingly attractive relative to public listings. This mechanism has important implications for efficiency and welfare: under higher aggregate passive ownership, high-growth new firms face constraints on the capital structure for longer, or they excessively turn into acquisition targets, which could be socially suboptimal because they could become less innovative within big companies, due to cannibalization and operation frictions.

2. Model

2.1. Environment

2.1.1. The firm and the entrepreneur

Time is continuous on $[0, T]$, and the riskless rate is r_f. A private firm's scale grows deterministically, $K_t = e^{gt}$ with $g > 0$. Its value is subject to multiplicative news, $\mathcal{E}_t = \exp\big(\sigma z_t - \frac{1}{2}\sigma^2 t\big)$, a unit-mean martingale driven by a standard Brownian motion z. At the horizon, the firm pays $K_T\,\mathcal{E}_T$ and dissolves. The entrepreneur is risk-neutral with respect to the news and discounts at the private cost of capital $r_P > r_f$, reflecting concentrated ownership and forgone diversification. He chooses a listing date $\tau \in [0, T]$, at which he sells the entire float at the market price, or never lists. Per unit of initial scale, her objective is

$$V(\tau) \;=\; e^{-r_P \tau}\,\mathbb{E}\big[\,P_\tau\big]\,.$$

The IPO is solely an exit: its proceeds finance no investment, and listing does not affect the terminal payoff. Public required returns therefore determine the sale price, while r_P measures the cost of remaining private. Choosing $\tau = T$ is payoff-equivalent to never listing because the entrepreneur holds the firm to liquidation and receives $e^{-r_P T} K_T$ in expectation.[3]

[3]The listing date is a deterministic commitment. Because the news multiplier is a unit-mean martingale and the entrepreneur values the mean path, allowing news-contingent stopping does not change the solution (Appendix A.2, Step 5).

2.1.2. Investor and the market

Assumption 1 (Size-based index eligibility)**.** Index n admits firms of size K_n^* and above, with cutoffs ordered $1 < K_1^* < \cdots < K_N^*$. The firm becomes eligible for index n at $T_n^* = g^{-1} \ln K_n^*$, when its scale reaches the cutoff, where $T_1^* < \cdots < T_N^* < T$. Once included, the firm remains included. A listed firm joins index n at $I_n(\tau) = \max\{\tau + \Delta,\ T_n^*\}$, the later of its eligibility date and the end of its seasoning period. Here, $\Delta \in [0, T)$ is the seasoning lag, so inclusion requires both eligibility and a sufficiently seasoned listing. This lag captures the institutional exclusion of new listings from major indexes for an initial period. The baseline assumes $\Delta > 0$; Corollary 1 in Appendix A.5 establishes the corresponding result for $\Delta = 0$.[4] After n inclusions, passive funds mechanically hold the fraction Θ_n of the firm's float, corresponding to dollar demand $\Theta_n X_t$, where X_t is defined below. The fractions satisfy $0 = \Theta_0 < \Theta_1 < \cdots < \Theta_N < 1$. Each inclusion adds price-inelastic passive demand, while expert active investors absorb the remaining exposure. Passive ownership therefore increases weakly with firm size, consistent with passive flows being disproportionately allocated to the economy's largest firms (Jiang et al., 2025).

Assumption 2 (Wealth and exposure)**.** Total investor wealth grows at rate g_W, $W_t = W_0\, e^{g_W t}$, and is divided into three constant shares that sum to one: passive capital $\varphi \in [0, 1)$, expert capital $A(\varphi) = \bar{A}\,(1 - \varphi)$, and noise-trader capital $(1 - \bar{A})(1 - \varphi)$. The parameter $\bar{A}$ is the expert share when no wealth is passive. Expert capital is the specialized active capital that prices the firm's market segment. The firm's float supplies risky exposure $X_t = X_0\, e^{gt}$ in dollar-risk units. Exposure per unit of investor wealth is therefore $x_t \equiv X_t / W_t = x\, e^{\nu t}$, where $x \equiv X_0 / W_0 > 0$ and $\nu \equiv g - g_W$ is the growth rate of the firm's exposure relative to investor wealth. The baseline imposes balanced growth, $\nu = 0$. Proposition 4 in Appendix B extends the analysis to $\nu \neq 0$.[5]

A representative expert investor manages wealth $A\,W_t$. At each instant, the investor chooses a dollar position D_t in the stock and invests the remainder at r_f. As established in Lemma 2, the stock price follows $dP_t/P_t = \mu_t\, dt + \sigma\, dz_t$, with deterministic drift μ_t and constant volatility σ:

$$\max_{D_t}\ \mathbb{E}_t\Big[-\exp\Big(-\frac{\gamma}{A\,W_t}\, w_{t+dt}\Big)\Big], \qquad w_{t+dt} \;=\; A\,W_t\,(1 + r_f\,dt) \;+\; D_t\Big(\frac{dP_t}{P_t} \;-\; r_f\,dt\Big),$$

subject to no borrowing or short-sale constraints. The coefficient $\gamma/(AW_t)$ is the local representation

[4] Memberships do not lapse because the firm crosses each cutoff once from below. In practice, a firm may leave one index when it qualifies for another, such as leaving a small-cap benchmark upon entering a large-cap benchmark. In that case, component n represents the net increase in passive ownership at the n-th size threshold. The cumulative passive-ownership profile Θ_n, which is the object priced in the model, is therefore nondecreasing.

[5] The exposure path is exogenous. The variable X_t is a normalized supply of risk to be borne, and fractions of the float correspond to the same fractions of this exposure. It is a reduced-form proxy for the firm's value share of investor wealth, not the endogenous market value. With a fixed share count, literal dollar supply would depend on the stock price. This exogenous path is therefore a strong maintained assumption, but it keeps equation (1) deterministic. Balanced growth makes the schedule stationary, while $\nu \neq 0$ scales each group's premium by the common factor $e^{\nu t}$ (Proposition 4).

of relative risk aversion γ. Appendix A.1 derives the expert's linear demand,

$$D_t \;=\; \frac{A\,W_t\,(\mu_t - r_f)}{\gamma\,\sigma^2}\,.$$

At every instant, expert demand must equal the exposure not absorbed by passive funds. With M_t inclusions in force, market clearing requires

$$\underbrace{\frac{A\,W_t\,(\mu_t - r_f)}{\gamma\,\sigma^2}}_{\text{expert demand}} \;=\; \underbrace{(1-\Theta_{M_t})\,X_t}_{\text{residual exposure}}\,.$$

The wealth level cancels, so only exposure per unit of wealth x_t and expert capacity A determine the required return. Equivalently, the public cost of capital depends on the exposure left for active investors and on their risk-bearing capacity.

We maintain generic position throughout: the private cost of capital never equals a public required return ($r_P \neq R_n$ for all n, with R_n defined in Lemma 1), the eligibility dates are distinct, and the participation comparison in Proposition 1 is nonzero at the candidate listing date. Equalities create indifference but do not change the economic mechanism.

2.2. Equilibrium prices

2.2.1. The required-return schedule

Lemma 1 derives the public required return in each inclusion state. The risk premium compensates expert investors for bearing the exposure that passive funds do not absorb.

Lemma 1 (Required-return schedule)**.** *Let R_n denote the required return on the firm with n memberships in force. Under the baseline path $x_t = x$, the clearing condition of Section 2.1.2 has, at every instant, the unique solution*

$$R_n \;=\; r_f \;+\; \underbrace{\frac{\gamma\sigma^2 x\,(1-\Theta_n)}{A}}_{\text{premium for warehousing the residual float after } n \text{ memberships}}\,, \qquad n = 0, 1, \ldots, N, \quad \Theta_0 \equiv 0, \tag{1}$$

and the schedule is strictly decreasing, $R_0 > R_1 > \cdots > R_N > r_f$. Each additional inclusion transfers part of the exposure from expert investors to passive funds and therefore lowers the required return.

An unincluded firm leaves its entire exposure with expert investors. Each inclusion reduces that residual exposure and lowers the firm's public cost of capital. The schedule depends on the residual exposure and the expert capacity available to bear it, rather than directly on firm size. Because Assumption 2 specifies the exposure path exogenously, equation (1) is a reduced-form required-return schedule obtained from instantaneous mean-variance clearing against an exogenous

risky supply. It is stationary in the baseline and is not a joint solution for the firm's endogenous market-value share.

2.2.2. The price path

The required return is constant between inclusion dates and falls whenever an additional fraction of the float is absorbed by passive funds. Lemma 2 maps this required-return schedule into the price available to the entrepreneur at each possible listing date.

Lemma 2 (Price path)**.** *For a firm listed at τ, among price processes driven by the news alone, with return volatility σ and a deterministic finite-variation mean path, the unique equilibrium price consistent with instant-by-instant clearing and the terminal condition is $P_t = \bar{P}_t(\tau)\,\mathcal{E}_t$, with deterministic mean path*

$$\bar{P}_t(\tau) \;=\; K_T \exp\Big(-\int_t^T \mathcal{R}(v;\tau)\,dv \Big), \qquad \mathcal{R}(v;\tau) \;=\; R_{\#\{n:\, I_n(\tau)\le v\}}\,, \tag{2}$$

where $\mathcal{R}(v;\tau)$ is the required return at date v. The price discounts the terminal payoff using the sequence of required returns that applies after the listing.

Within each inclusion state, the mean price grows at that state's required return. The mean-growth rate falls at each inclusion date. Because all inclusion dates are deterministic and anticipated, the stock price is continuous at inclusion. Passive demand changes the expected return from R_{n-1} to R_n but does not generate an event-time price jump in this deterministic baseline. If several inclusions occur on the same date, the intervening states have zero duration.

Equation (2) has two implications for IPO timing. First, all future passive demand is already capitalized into the price at any candidate listing date, so its level alone does not reward waiting. Second, delaying the IPO changes value only when it changes the subsequent required-return path by shifting inclusion dates. Appendix A.2 records the associated price discount relative to a firm whose full passive demand has already arrived.

2.3. The listing decision

2.3.1. The marginal value of delay

Substituting equation (2) into $V(\tau) = e^{-r_P \tau}\,\bar{P}(\tau)$ gives

$$\ln V(\tau) \;=\; -\,r_P\,\tau \;+\; \ln K_T \;-\; \int_\tau^T \mathcal{R}(v;\tau)\,dv\,.$$

The three terms respectively capture discounting at the private cost of capital until the IPO, terminal scale, and the public required-return path from the IPO to the horizon. Writing $I_n(\tau) = \max\{\tau+\Delta,\ T_n^*\}$ for the date at which inclusion n begins (Assumption 1), with $I_0 \equiv \tau$ and $I_{N+1} \equiv T$,

the integral is

$$\int_{\tau}^{T} \mathcal{R}(v;\tau)\,dv \;=\; \sum_{n=0}^{N} R_n \left(I_{n+1}(\tau) \;-\; I_n(\tau) \right).$$

Each inclusion state applies its required return over the time spent in that state (Appendix A.3). Delaying the IPO shifts only inclusion dates tied to the seasoning requirement, namely those satisfying $I_n(\tau) = \tau + \Delta$. Eligibility dates beyond the seasoning period remain fixed. Differentiating yields the marginal value of delay.

Lemma 3 (Marginal value of delay)**.** *Let $m(\tau) \equiv \#\{n : T_n^* < \tau + \Delta\}$ denote the membership count immediately before a listing at τ ends its seasoning, and $R_{m(\tau)}$ that group's required return from (1). The entrepreneur's log value $\ln V(\tau)$ is continuous and piecewise linear in τ, with*

$$\frac{d \ln V}{d\tau} \;=\; R_{m(\tau)} \;-\; r_P \tag{3}$$

for $\tau \in [0,\, T-\Delta]$, with kinks only at the dates $T_n^* - \Delta$; and $d\ln V/d\tau = R_0 - r_P$ for $\tau \in (T-\Delta,\, T]$, where a listing never seasons before the horizon.

Equation (3) is the central timing condition. A marginal delay replaces one unit of private ownership, which costs r_P, with the reduction in public intermediation summarized by $R_{m(\tau)}$. The relevant public required return is the one in force when the seasoning period ends. Inclusion thresholds that the firm reaches only through subsequent growth occur at fixed dates and do not enter the derivative because delaying the IPO does not move them. Their future passive demand is already capitalized into the price at every candidate listing date.

2.3.2. The optimal policy

Equation (3) converts the IPO problem into a first-crossing rule. The firm delays while the public required return associated with the inclusion state reached at the end of seasoning exceeds its private cost of capital. It stops delaying at the first state for which the public required return is lower.

Proposition 1 (Optimal listing)**.** *Let $n^\star \equiv \min\{\, n \in \{0, 1, \ldots, N\} :\; R_n < r_P \,\}$ denote the first membership group whose required return falls below the entrepreneur's private cost of capital. Call $T_{n^\star}^*$ the passive-demand threshold date, namely the eligibility date at which passive ownership first lowers the public required return below the private cost of capital. Then:*

(i) $n^\star = 0$: the firm lists at birth, $\tau^\star = 0$.

(ii) $1 \le n^\star \le N$, with the threshold date at least one seasoning lag after birth, $T_{n^\star}^* \ge \Delta$: the firm lists one seasoning lag before the passive-demand threshold date, $\tau^\star = T_{n^\star}^* - \Delta$, at size $K_{\tau^\star} = K_{n^\star}^*\, e^{-g\Delta}$, just below the eligibility cutoff.

(iii) The firm never lists if no group qualifies, $n^\star = \infty$, or if the gain from the lower public required returns after inclusion is insufficient to offset the seasoning period's initial intermediation

cost. Formally, listing requires

$$\int_{\tau^\star}^{T} \left(r_P - \mathcal{R}(v;\tau^\star)\right) dv \;>\; 0 \tag{A}$$

If this condition fails, the firm never lists. If $T^*_{n^\star} < \Delta$, the candidate listing date is truncated at birth, at size one (Appendix A.4).

The firm delays the IPO while its public required return exceeds its private cost of capital and lists once anticipated passive demand reverses that inequality. With a positive seasoning lag, it lists one lag before the relevant eligibility cutoff so that passive demand arrives when the cutoff is reached. With immediate inclusion, it lists exactly at the cutoff (Corollary 1, Appendix A.5).

2.4. The rise of aggregate passive ownership

We now model the secular increase in aggregate passive ownership as a switch from active to passive funds. This switch reduces active risk-bearing capacity and reallocates demand toward firms with high passive tilts. Proposition 2 derives the resulting public required returns, and Proposition 3 shows that the switch weakly delays IPOs and can eliminate listings among firms that remain in the small- and mid-cap range.

2.4.1. The switch-based rise and size tilt

Following Jiang et al. (2025), we model the rise in passive investing as a switch within a fixed pool of investor wealth. As the passive share φ increases, expert capacity falls according to $A(\varphi) = \bar{A}\,(1-\varphi)$. Define $c \equiv \gamma\sigma^2 x/\bar{A}$ as the firm's public risk premium when aggregate passive ownership is zero.[6]

Assumption 1 implies that passive ownership rises with firm size through $0 = \Theta_0 < \Theta_1 < \cdots < \Theta_N < 1$. Parameterize the cumulative passive share in group n as $\Theta_n(\varphi) = \beta_n\,\varphi$, where β_n is the group's passive tilt relative to the marketwide passive share. The tilts satisfy $0 = \beta_0 < \beta_1 < \cdots < 1 < \cdots < \beta_N$ and $\beta_N\varphi < 1$. At $\varphi = 0$, all groups have the same required return; the strict ordering of passive shares applies for $\varphi > 0$. If the groups exhaust the market, the value-weighted normalization is $\sum_n W_n\,\beta_n = 1$, where W_n is group n's market-value weight. A group with $\beta_n < 1$ receives less passive demand than the market average, while a group with $\beta_n > 1$ receives more. We associate the former with small- and mid-cap firms and the latter with mega-cap firms, consistent with the mega-firm mechanism in Jiang et al. (2025) and the cross-index ownership evidence in Pavlova and Sikorskaya (2023). For simplicity, the tilts β_n are fixed as φ rises, so the switch scales passive demand across index families proportionally.

[6] The result differs when passive growth is financed by outside inflows rather than a switch from active capital. If the ratio of firm exposure to expert capacity remains unchanged while the absorbed fractions Θ_n rise, every included required return falls and the firm weakly accelerates its IPO. We maintain the switch as the secular scenario.

2.4.2. The schedule under the switch

Substituting $A(\varphi)$ and $\Theta_n = \beta_n \varphi$ into equation (1) gives the public required return for each size-based inclusion group as a function of aggregate passive ownership.

Proposition 2 (The switch and the schedule)**.** *Under the switch, the required return of membership group n is*

$$R_n(\varphi) \;=\; r_f \;+\; c\,\frac{1-\beta_n\,\varphi}{1-\varphi}\,, \tag{4}$$

the ratio of residual exposure to active-sector capacity, measured in units of the no-passive risk premium c. Its slope is $\partial R_n/\partial\varphi = c\,(1-\beta_n)/(1-\varphi)^2$. Therefore, the required return rises for $\beta_n < 1$, is unchanged for $\beta_n = 1$, and falls for $\beta_n > 1$.

The switch reduces expert capacity one for one, but it reduces the exposure assigned to experts only in proportion to the group's passive tilt. For a below-average-tilt group, expert capacity contracts faster than residual exposure, so the public cost of capital rises. The unincluded group has $\beta_0 = 0$ and receives no offsetting passive demand, so its required return rises the most. For an above-average-tilt group, passive demand grows faster than expert capacity contracts, so the public cost of capital falls.

2.4.3. Delayed and missing IPOs

The switch therefore reallocates asset demand from small firms toward large firms. Below-average-tilt groups face higher public required returns, while above-average-tilt groups receive a subsidy. Proposition 3 gives the paper's main comparative statics: aggregate passive ownership weakly delays IPOs, and the delay stops once the firm reaches the first above-average-tilt group. Let p denote the last below-average-tilt group, so $\beta_p < 1 < \beta_{p+1}$.

Proposition 3 (Delayed and missing IPOs)**.** *Part (i) assumes that the entrepreneur's private cost of capital exceeds the tilt-neutral public required return, $r_P > r_f + c$, so the firm lists at birth when aggregate passive ownership is zero.*[7] *Part (ii) restricts the tilt profile and allows the private cost of capital to vary across firms, holding the remaining primitives fixed. Then:*

(i) (Delayed IPOs.) With immediate inclusion, $\Delta = 0$, an increase in aggregate passive ownership φ successively delays the IPO until the firm qualifies for groups with higher passive tilts. The listing date increases discretely whenever φ reaches φ_n, the passive share at which group n's public required return equals the private cost of capital. After φ exceeds the final below-average-tilt threshold φ_p, the firm lists at the eligibility date of the first above-average-tilt group, T^*_{p+1}. Further increases in φ do not delay the IPO.

(ii) (Missing IPOs.) With a seasoning period, $\Delta > 0$, expert investors must bear the firm's exposure before the anticipated passive demand arrives, so listing may become unprofitable. Consider firms that remain in the small- and mid-cap range, defined by a lifetime average tilt below one:

[7] An information-dilution cost of equity issuance that declines with firm size, in the spirit of Myers and Majluf (1984), eliminates immediate listing and generates an interior IPO date.

$\int_{\tau}^{T}\left(1-\beta_{M_v(\tau)}\right)dv \geq 0$ *for every candidate plan* τ*, where* $M_v(\tau)$ *is the membership in force at date* v *and the tilt is zero during the seasoning period. Such a firm never lists when its private cost of capital is below the threshold* $\underline{r}_P(\varphi,\Delta)$*. This threshold satisfies* $\underline{r}_P(0,\Delta) = r_f + c$ *and weakly increases with aggregate passive ownership. Within the maintained population* $r_P > r_f + c$*, the set of firms that never list therefore weakly expands from the empty set (Appendix A.7). Firms with the lowest private costs of capital stop listing first, and each firm's realized listing date is nondecreasing when never listing is represented by* $\tau = T$*.*

The condition $r_P > r_f + c$ has a direct interpretation. A group with tilt one always faces the public required return $r_f + c$ because the decline in expert capacity is exactly offset by the increase in passive demand. Above-average-tilt groups always have a lower required return. Thus a firm satisfying $r_P > r_f + c$ lists at birth when $\varphi = 0$ and can always list upon reaching the first above-average-tilt group. Rising aggregate passive ownership can only delay the IPO toward that group. A positive seasoning period adds an initial interval at the high unincluded required return. For firms whose future passive tilt remains below average, the subsequent reduction in required returns may be too small to offset this initial cost, which makes $\underline{r}_P(\varphi,\Delta)$ increase with φ.

As aggregate passive ownership rises, the smallest IPOs are delayed first because the unincluded group has the lowest passive tilt. Firms then delay successively to higher size thresholds, shifting the listing-size distribution upward. Some small- and mid-cap firms never list once the initial intermediation cost exceeds the value of their subsequent public financing advantage. The participation result requires the tilt restriction in Proposition 3(ii) because above-average-tilt groups become cheaper as φ rises. Proposition 4 and Appendix A.7 show how these results extend when $\nu = 0$, which equates firm and investor-wealth growth, is relaxed.

3. Data and Measures

3.1. Data Sources and Sample Construction

We combine data from three primary sources: (i) CRSP Mutual Fund database for constructing passive fund portfolios, (ii) CRSP monthly stock file for stock prices, market equity, and IPO information, and (iii) Compustat for firm fundamentals and industry codes at NAIC two-digits, four-digits, and six-digits level.

CRSP stock universe. We obtain the CRSP monthly stock file covering January 1980 through September 2024. We retain only common equity shares issued by corporations (CORP–EQTY–COM), excluding ETFs, closed-end funds, ADRs, and REITs. Observations with zero price, zero shares outstanding, or zero market capitalization are treated as missing. Market equity is measured as the official CRSP monthly market capitalization (`mthcap`, in $thousands), converted to millions of dollars; when this field is missing, we compute it as the absolute value of price times shares outstanding (in millions). We apply limited forward-filling of up to 12 months for price, shares

outstanding, and market capitalization to address gaps within a firm's listing period, while avoiding propagation of stale data for extended absences. We remove permno–month duplicates.

Industry codes. We obtain industry classifications from Compustat's company table, including GICS codes (2-, 4-, and 6-digit) and NAICS codes (2-, 4-, and 6-digit). We link Compustat firms to CRSP using the CCM link history table, retaining link types LC, LU, and LS. For each permco, we keep the observation with the fewest missing industry codes. We exclude investment pools and funds (NAICS 5259) and real estate firms (NAICS 5311) from the analysis sample.

CRSP mutual fund data. We construct the universe of U.S. equity domestic passive funds from the CRSP Mutual Fund database. We begin with the Fund Summary file, retaining funds with CRSP objective code starting with "ED" (Equity–Domestic). We identify passive funds using the `index_fund_flag` equal to "D," forward-filling and backward-filling the flag within each fund to address gaps. We correct portfolio numbers (`crsp_portno`) using the Fund–Portfolio Mapping file, resolving discrepancies by assigning the modal portfolio number when multiple share classes report conflicting values within a fund-group–quarter.

We merge fund summary data with the Monthly Returns and Net Asset Values file to obtain fund-level total net assets (TNA) at monthly frequency. Monthly gaps in NAV data are filled by constructing a balanced panel for each fund's active period and forward-filling TNA values. Summary-level fields (objective code, index fund flag, fund name) are forward-filled up to 12 months to bridge quarterly reporting gaps.

Fund holdings and industry-level construction. We obtain portfolio holdings from the CRSP Portfolio Holdings file, retaining only positions for portfolio numbers associated with U.S. equity domestic funds. We apply the following cleaning steps: (i) drop exact duplicate rows; (ii) deduplicate on (portno, caldt, permno) for non-missing permno observations; (iii) for portfolio–date snapshots where total `percent_tna` exceeds 125%, we rescale all position weights to sum to 100%. We then filter holdings to common-stock permno observations only, using the stock flag constructed from the CRSP stock file. Holdings are merged with Compustat industry codes via permco, and collapsed to the industry–portfolio–month level by summing `percent_tna` within each industry grouper. Holdings are forward-filled up to 6 months within each portfolio to address gaps between reporting dates.

IPO sample. We construct the IPO sample from the CRSP/Compustat merged database, retaining common stock (CORP–EQTY–COM) firms with non-missing IPO dates during 2000–2024. We exclude investment pools and funds (NAICS 5259) and real estate firms (NAICS 5311) from the analysis sample. IPO issuance amount is computed as shares issued at IPO (`cshiq`) times price (`prccq`), and market value as total shares outstanding (`cshoq`) times price.

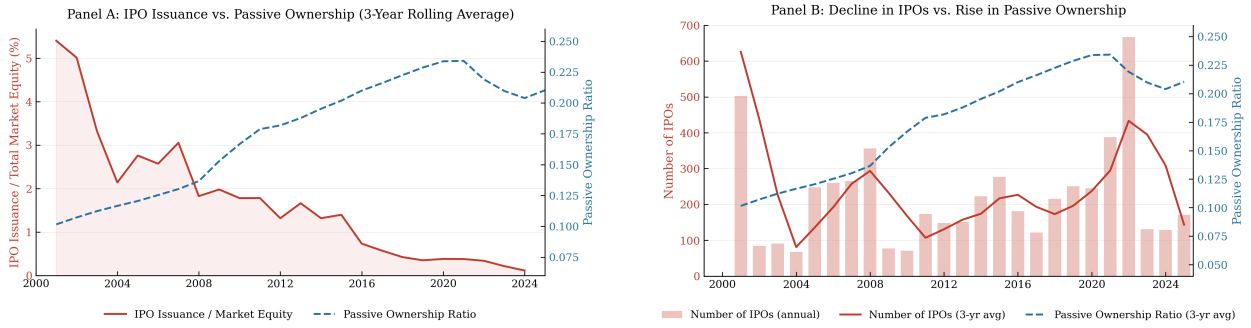
3.2. Variable construction

Aggregate passive ownership and IPO activity We define the aggregate passive ownership ratio as the total net assets of passive mutual funds divided by the total market equity of CRSP common stocks:

$$PO_t = \frac{\sum_{f \in \text{passive}} \text{TNA}_{f,t}}{\text{Total ME}_t}.$$

We measure IPO activity using two ratios. The *IPO value ratio* is the total IPO issuance amount divided by total market equity of all public firms within the relevant industry–time cell. The *IPO count ratio* is the number of IPO firms divided by the total number of public firms. Both measures are constructed at annual and quarterly frequencies.

Figure 1 displays the co-movement between aggregate IPO activity and passive ownership. Panel A shows the IPO value ratio (3-year rolling average) against the passive ownership ratio from 2000 to 2024. IPO issuance as a share of total market equity fell from over 5% to below 0.5% as the passive ownership ratio roughly doubled. Panel B shows that a similar pattern holds for IPO counts: there is a negative relationship between IPO counts (without normalization) and passive ownership.



(a) IPO value ratio vs. passive ownership

(b) IPO counts vs. passive ownership

Figure 1: Aggregate IPO activity and passive ownership ratio, 2000–2024. Panel A plots the ratio of total IPO issuance value to total market equity (3-year rolling average, left axis) against the passive ownership ratio (right axis). Panel B plots the annual number of IPOs (bars and 3-year rolling average, left axis) against the passive ownership ratio (right axis). Data begin in 2000 due to limitations in passive ownership coverage from CRSP mutual fund database.

It is worth noting that our passive ownership measure is lower than the estimate in Chinco and Sammon (2024), who report an aggregate passive share exceeding 33.5%. This discrepancy arises because their measure includes the benchmarked portion of nominally active funds and captures a broader set of institutional investors, whereas our measure is restricted to funds explicitly flagged as index funds in the CRSP database. Additionally, CRSP mutual fund data provides incomplete coverage of the mutual fund universe, with particularly high missing ratios before 2010. Addressing this measurement gap is an important direction for future work.

Industry-Level Passive Ownership We construct industry-level passive ownership ratios at the NAICS 2-digit × month level as:

$$PO_{i,t} = \frac{\sum_{f \in \text{passive}} \text{ME}_{f,i,t}}{\text{Total ME}_{i,t}},$$

where the numerator sums the market equity held by passive funds in industry i at time t, computed from fund-level TNA weighted by the fund's portfolio allocation to industry i, and the denominator is the total market equity of all common stocks in industry i. The passive ownership ratio is winsorized at the 1st and 99th percentiles to mitigate outliers driven by data coverage issues.

Figure 2 plots the passive ownership ratio over time for each GIC 2-digit industry (excluding Real Estate)[8]. There is meaningful cross-industry variation in both levels and trends. CRSP mutual fund holdings provide poor coverage before 2010, contributing to noise in the early part of the sample. The ranking of industries shifts over time: for example, Consumer Discretionary, which led in passive ownership share before 2010, falls behind other sectors in more recent years.

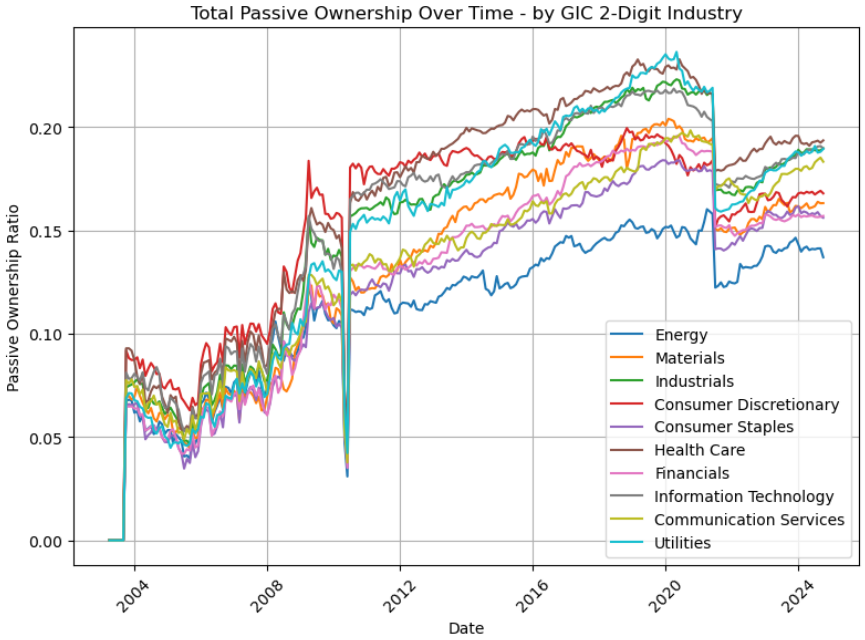


Figure 2: Passive ownership ratio by GICS 2-digit industry, excluding Real Estate. The figure plots the monthly passive ownership ratio for each GICS 2-digit sector from 2000 to 2024, computed as passive fund holdings divided by total market equity within each sector.

3.3. Firm-level measures: post-IPO returns, anticipated passive ownership, and expert capital

For the cross-section of IPO firms constructed in Section 3.2, we build the dependent variable used in Section 4, post-IPO cumulative abnormal returns, together with the two firm-level regressors,

[8] We plot GIC instead of NAICS 2-digit because GIC-2 has fewer industry groups. The pattern is similar under NAICS 2-digit groups.

anticipated passive ownership and expert-capital scarcity. We index firms by f, their two-digit NAICS industry by i, and their IPO quarter by t, and we measure returns in event time relative to the firm's first CRSP trading day, denoted $\tau = 0$.

Post-IPO cumulative abnormal returns. We cumulate returns from the opening price on the first trading day rather than from the offer price. The offer-to-open return reflects the allocation of shares at the offering and is a distinct phenomenon from the aftermarket drift we examine; excluding it isolates the latter. The event return on the first trading day is therefore the intraday open-to-close return, and on each subsequent day the standard close-to-close return; a firm without a valid opening price is assigned a zero first-day contribution measured off its closing price. Delisting returns are embedded in the CRSP daily return series.

We benchmark returns against the CAPM, the Fama-French three-factor, and the Carhart four-factor models. For each firm we estimate factor loadings $\hat{\boldsymbol{\beta}}_f$ by regressing daily excess returns $R_{f,\tau} - RF_\tau$ on the benchmark factors, the market excess return alone (CAPM); the market, size, and value factors (Fama-French); or those three plus momentum (Carhart)—over the three years following listing, requiring at least 126 daily observations. Firms below this threshold inherit the loadings of the value-weighted portfolio of same–two-digit-NAICS IPO firms, estimated over its full daily history. The expected daily return sets the pricing error to zero,

$$\widehat{E}\big[R_{f,\tau}\big] \;=\; RF_\tau + \hat{\boldsymbol{\beta}}_f' \, \mathbf{F}_\tau,$$

where $\mathbf{F}_\tau$ collects the factor realizations for the benchmark in question. The cumulative abnormal return over horizon $h \in \{3, 6\}$ months is the sum of daily abnormal returns from the first trading day,

$$CAR_f(h) \;=\; \prod_{\tau \in [0,\, h]} \big(R_{f,\tau} - \widehat{E}[R_{f,\tau}]\big),$$

where the cumulative return runs over trading days τ from listing through h months afterward. A horizon is set to missing unless the firm has at least three-month or six-month valid trading days in the window, and cumulative abnormal returns are winsorized at the 1st and 99th percentiles.

Anticipated passive ownership. Anticipated passive ownership, $aPO_f(h)$, is the passive share that would be forecast for firm f at horizon h using information available at listing; the economic motivation for forecasting from size, and for using the forecast rather than the realized one, is developed in Section 4.2. The construction has three steps. First, we compute the firm's *real opening float*: the number of public shares issued (*cshiq*, with total shares outstanding *cshoq* used when the issued count is missing) valued at the first-day opening price and deflated to constant December-2020 dollars using the CPI. Second, we measure the firm's realized passive share, $PO_f(h)$, as the average of its stock-level passive ownership over the three months centered on the month h months after listing. Third, we project realized passive ownership on a cubic polynomial in (standardized)

log real opening float, IPO-year fixed effects, and lagged aggregate passive ownership,

$$PO_f(h) \;=\; \sum_{k=1}^{3} \gamma_k \big[\log \text{Float}_f\big]^k \;+\; \delta_{y(f)} \;+\; \lambda\, PO^{agg}_{t(f)-1} \;+\; u_f,$$

and retain the fitted value as $aPO_f(h)$. We use a polynomial function because index-eligibility rules make the size-passive relationship nonlinear. The IPO-year effects $\delta_{y(f)}$ absorb the secular rise in passive ownership, so the forecast reflects a firm's size relative to its cohort rather than the calendar trend. Two features of the construction bear on interpretation. Within an IPO year, $aPO_f(h)$ is a monotone transformation of firm size and is therefore effectively a size-based forecast; and it is a generated regressor, so conventional second-stage standard errors understate sampling uncertainty.

Expert-capital (EC). We measure the expert capital facing firm f as

$$EC_f = \log\big(\text{ActiveAUM}_{i(f)}\big) - \log(\text{Float}_f \times \text{Vol}_f) = \log\left(\frac{\text{ActiveAUM}_{i(f)}}{\text{Float}_f \times \text{Vol}_f}\right).$$

where Float_f is real opening float for firm f, Vol_f is the annualized standard deviation of the firm's daily returns over the twelve months following listing, and $\text{ActiveAUM}_{i(f)}$ is the average dollar holdings of active (non-passive) funds in the firm's two-digit-NAICS industry over the same post-listing window. The numerator is the dollar risk that interim holders must warehouse and the denominator is the capital available to bear it, so a higher value of EC_f denotes *scarcer* expert capital. Both $aPO_f(h)$ and EC_f are standardized before estimation.

4. Empirical Analysis

The model delivers two empirical predictions. First, industries that experience larger increases in passive ownership, and correspondingly larger declines in expert capital, should exhibit lower IPO activity. Second, when index inclusion is delayed, firms expected to attract greater future passive demand should offer higher expected returns to compensate active investors for intermediating that demand, and this compensation should be smaller when expert capital is more abundant. This section evaluates these two predictions in turn.

Our empirical analysis evaluates the model's two predictions in turn. Section 4.1 tests the quantity implication of the model using a quarterly panel of two-digit NAICS industries. We relate IPO activity to two measures of the capital available to prospective IPO issuers: the industry's passive ownership ratio and the stock of active, or "expert" capital remaining in the industry. We first estimate the relation using realized passive ownership and then employ a Bartik-style shift-share instrument that exploits predetermined industry exposure to the aggregate rise in passive ownership. Section 4.2 turns to the firm level and tests the cost-of-capital mechanism directly. We examine whether post-IPO cumulative abnormal returns (CARs), which measure the compensation

investors require for bearing firm-specific idiosyncratic risk, are increasing in anticipated passive demand and decreasing in the expert capital available to intermediate that demand.

Table 1 reports descriptive statistics for the two samples. Panel A concerns the industry-quarter panel employed in Section 4.1. Listing activity in this panel is highly skewed: the median industry-quarter records one listing and $73 million of issuance, the mean records $3.7 billion, and at least one quarter of industry-quarters record no listing at all. Passive ownership averages 17.2% of industry market equity with a standard deviation of 8.3 percentage points, so the panel contains substantial variation both across industries and over time. Panels B and C concern the cross-section of 3,548 issuers employed in Section 4.2. Mean abnormal returns are negative at both horizons and decline as the horizon lengthens, in line with the long-run underperformance documented by Ritter (1991). Our tests do not concern that unconditional mean; they concern the cross-sectional dispersion around it.

Table 1: Summary statistics

	N	Mean	SD	P25	Median	P75
Panel A: Industry x quarter panel (NAICS-2)						
IPO volume ($M)	1,688	3,718.834	13,394	0.000	73.155	2,229.322
log(1 + IPO volume)	1,688	3.996	3.943	0.000	4.306	7.710
IPO count	1,688	2.275	4.281	0.000	1.000	2.000
log(1 + IPO count)	1,688	0.746	0.838	0.000	0.693	1.099
Industry passive ownership, PO (%)	1,688	17.157	8.251	13.289	16.816	19.650
Bartik PO instrument, lag12m (%)	1,688	3.376	2.039	2.280	3.346	4.170
log expert capital, EC	1,688	10.106	1.630	8.980	10.153	11.215
log EC, Bartik lag12m	1,688	10.268	1.626	9.154	10.315	11.360
Tobin's q	1,688	1.137	0.722	0.635	0.960	1.459
Industry momentum, t-12 to t-2 (%)	1,688	9.777	19.654	-0.905	10.854	21.000
Industry volatility, annualized (%)	1,688	29.070	9.560	22.534	27.198	33.714
Panel B: Post-IPO cumulative abnormal returns (one obs. per IPO firm)						
CAR (CAPM), 3m (%)	3,548	-3.193	36.241	-22.726	-4.699	11.673
CAR (CAPM), 6m (%)	3,544	-9.484	42.364	-36.464	-10.617	11.752
CAR (FF3), 3m (%)	3,548	-2.209	35.149	-20.709	-3.879	12.483
CAR (FF3), 6m (%)	3,544	-7.411	40.654	-32.189	-8.416	12.494
CAR (Carhart), 3m (%)	3,548	-2.124	35.185	-21.035	-3.863	12.465
CAR (Carhart), 6m (%)	3,544	-7.290	40.743	-32.511	-8.250	12.342
Panel C: Second-stage regressors (one obs. per IPO firm)						
Anticipated PO, 3m (%)	3,548	4.855	1.755	3.464	4.905	6.234
Anticipated PO, 6m (%)	3,548	5.602	2.440	4.102	5.704	7.433
Realized PO at IPO + 3m (%)	2,676	5.244	5.630	1.576	3.728	6.877
Realized PO at IPO + 6m (%)	2,698	6.141	6.448	1.722	4.507	8.474
Expert-capital, EC (arbcap)	3,548	-6.049	1.918	-7.252	-6.154	-4.851
log active AUM in industry	3,548	11.823	1.325	11.223	12.040	12.726
Post-IPO return volatility, ann. (%)	3,548	69.629	58.511	38.760	59.738	82.625
Real opening float ($M)	3,548	1,860.276	6,866.977	229.072	538.758	1,398.599

Notes. Panel A is the NAICS-2 industry × quarter estimation panel behind the baseline regressions. IPO volume is the summed market capitalization at listing of the firms that IPO in the industry-quarter, and is zero in industry-quarters without an IPO. Passive ownership PO is the market-equity-weighted passive share of the industry, expert capital is $EC = (1 - PO_{\text{industry}}) \times$ active-fund AUM, and both are measured at the end of quarter $t-1$, as are Tobin's q (winsorized at 1/99%), industry momentum (compounded value-weighted return over months $t-12$ to $t-2$) and industry volatility. Bartik versions replace the realized industry passive share with its lagged share interacted with aggregate passive ownership. Panels B and C are cross-sections of IPO firms. Cumulative abnormal returns are cumulated from the first-day opening price, net of the expected return implied by the stated factor model with betas estimated over the three years after listing, and are winsorized at 1/99%. Anticipated PO is the fitted value from the first-stage regression of realized post-IPO passive ownership on a polynomial in log real opening float, IPO-year fixed effects and lagged aggregate passive ownership; realized PO is the corresponding stock-level passive share actually observed at the horizon. Expert-capital is log(float × volatility) − log(active AUM) in the firm's NAICS-2 industry. N is the number of non-missing observations within the estimation sample, so it varies across rows only through the missingness of the variable itself. Anticipated PO and expert capital are standardized before estimation; the moments reported here are in raw units.

4.1. Baseline results: Industry OLS and Bartik IV

Specification. Does the increase of passive demand reduce IPO activity in the market? We begin by testing the first prediction of the model: industries experiencing larger increases in passive ownership, and correspondingly larger declines in expert capital, should exhibit lower IPO activity. We estimate

$$y_{i,t} \;=\; \alpha_i \;+\; \gamma_t \;+\; \beta\, PO_{i,t-1} \;+\; \Gamma' X_{i,t-1} \;+\; \varepsilon_{i,t}, \tag{5}$$

where i indexes NAICS-2 industries and t indexes calendar quarters. The dependent variable $y_{i,t}$ is either $\log(1 + \text{IPO value})$, the log of one plus the summed market capitalization at listing of all firms that go public in the industry-quarter, or $\log(1 + \text{IPO count})$, the log of one plus the number of such firms.

The key explanatory variable $PO_{i,t-1}$ is the market-equity-weighted passive share of industry i measured at the end of the preceding quarter. All specifications include industry and time fixed effects, so β is identified from within-industry deviations from the common time path of passive ownership; the secular aggregate rise in passive investing documented in Figure 1 is absorbed by γ_t and does not contribute to identification. Controls $X_{i,t-1}$ include industry Tobin's q, log market size, and, in the expert-capital specifications, lagged industry momentum and volatility. We take logs of levels rather than the issuance ratios in Figure 1 because industry fixed effects already absorb persistent differences in industry scale, and because the $\log(1 + \cdot)$ transformation retains industry-quarters with no issuance, which are informative about the extensive margin we are trying to measure. All regressors are dated prior to the listing decision.

Although the fixed-effects specification removes permanent industry differences and aggregate IPO cycles, realized passive ownership may still respond endogenously to contemporaneous industry conditions. For example, industries experiencing strong recent performance may simultaneously attract passive inflows and induce firms to time the IPO market. Measurement error in mutual-fund holdings may additionally attenuate the estimated relationship. To address these concerns, we instrument realized industry passive ownership using a Bartik-style shift-share predictor,

$$\widehat{PO}^{B}_{i,t} \;=\; w_{i,t-12} \times PO^{agg}_{t}, \tag{6}$$

where $w_{i,t-12}$ is the industry's passive share twelve months earlier and PO^{agg}_t is aggregate passive ownership. The instrument combines predetermined industry exposure with the aggregate rise in passive investing, thereby exploiting heterogeneous industry incidence of a common aggregate shift while filtering out contemporaneous industry-specific shocks.

Passive ownership and IPO activity. Panel A of Table 2 reports the results. Consistent with the first channel implied by the model, industries experiencing larger increases in passive ownership exhibit significantly lower IPO activity. In the OLS specifications, a one-percentage-point increase in passive ownership is associated with a 4.7% decline in IPO dollar volume and a 1.1% decline in IPO count. The Bartik estimates are economically similar, implying declines of 4.8%

and 1.3%, respectively. Industries with higher passive ownership not only produce fewer IPOs, but more importantly support substantially less aggregate issuance value. The decline in IPO counts nevertheless points to an extensive-margin response, consistent with some firms delaying public listing or foregoing IPOs altogether and instead exiting through acquisition.

The similarity between the OLS and Bartik estimates is reassuring. It suggests that the negative relationship is not driven primarily by contemporaneous industry shocks jointly affecting passive ownership and IPO activity. Instead, the evidence is consistent with the model's prediction that the aggregate rise in passive ownership disproportionately reduces IPO activity in industries experiencing larger increases in passive ownership.

Expert capital. Passive ownership and expert capital provide two complementary measures of the same underlying mechanism. Whereas passive ownership measures the fraction of capital delegated to investors that do not evaluate new securities, expert capital measures the dollar amount of active capital remaining to intermediate new listings. The model therefore predicts a mirror-image result: industries with more expert capital should support greater IPO activity.

Panel B of Table 2 reports the results. A 1% increase in industry expert capital is associated with a 0.85% increase in IPO dollar volume and a 0.16% increase in IPO count. The Bartik instrument for IPO dollar volume remains economically similar at 0.74%. As in the passive-ownership specifications, the response is substantially strong for issuance value. Greater intermediation capacity not only simply increases the number of firms that enter public markets, but also supports larger IPO issuance. The result here remains directionally consistent with the model's prediction that abundant expert capital encourages public listing. The control variables exhibit familiar patterns from the IPO literature. Industries with higher Tobin's q and stronger recent returns subsequently experience greater IPO activity, consistent with the market-timing evidence of Lowry (2003) and Pagano, Panetta, and Zingales (1998).

Taken together, Panels A and B provide complementary evidence for the first prediction of the model. IPO activity declines where passive ownership rises and increases where expert capital remains abundant. In both cases, our evidence shows that not only does the aggregate rise in passive ownership discourage firms from going public, but also significantly impacts the IPO dollar volume issued.

Table 2: Passive Ownership, Expert Capital, and IPO Activity

Panel A. Passive Ownership

	(1)	(2)	(3)	(4)
Dep. var.	log(1+IPO value)	log(1+IPO value)	log(1+IPO count)	log(1+IPO count)
PO ratio	-4.835***	-4.924***	-1.082***	-1.338***
	(0.846)	(0.698)	(0.137)	(0.203)
Tobin's q	0.171**	0.171**	0.005	0.005
	(0.071)	(0.071)	(0.011)	(0.011)
Estimator	OLS	2SLS	OLS	2SLS
Key regressor	PO actual	PO Bartik (12m lag)	PO actual	PO Bartik (12m lag)
Panel / FE	Industry + Quarter	Industry + Quarter	Industry + Quarter	Industry + Quarter
N	1,065	1,065	1,065	1,065
R^2	0.038	0.038	0.014	0.013

Panel B. Expert Capital

	(5)	(6)	(7)	(8)
Dep. var.	log(1+IPO value)	log(1+IPO value)	log(1+IPO count)	log(1+IPO count)
log EC	0.851**	0.743*	0.162**	0.134
	(0.364)	(0.436)	(0.072)	(0.082)
Tobin's q	0.044	0.063	0.008	0.013
	(0.157)	(0.175)	(0.037)	(0.040)
Return (2–12)	1.881**	1.882**	0.300**	0.304**
	(0.862)	(0.867)	(0.133)	(0.135)
VW volatility	-0.108	0.001	0.098	0.119
	(1.347)	(1.477)	(0.403)	(0.412)
Estimator	OLS	2SLS	OLS	2SLS
Key regressor	EC actual	EC Bartik (12m lag)	EC actual	EC Bartik (12m lag)
Panel / FE	Industry + Quarter	Industry + Quarter	Industry + Quarter	Industry + Quarter
N	1,688	1,690	1,688	1,690
R^2	0.018	0.016	0.020	0.016

This table reports estimates of the relationship between passive ownership (Panel A), expert capital (Panel B), and IPO activity in a panel of NAICS two-digit industries. The dependent variables are the logarithm of one plus total IPO issuance value in the industry-time cell (in $ millions) and the logarithm of one plus the number of firms going public in that cell. *PO ratio* is the market-equity-weighted share of the industry's market capitalization held by passive funds, measured in decimals at the end of the previous period. *log EC* is the logarithm of expert capital, defined as $(1 - PO_{i,t-1})$ times active-fund assets under management in the industry, and measures the dollar quantity of non-indexed capital allocated to the sector. The Bartik regressors replace the realized industry value with the industry's share lagged twelve months interacted with contemporaneous aggregate passive ownership. *Tobin's q* is the industry median, winsorized at 1/99%. *Return (2–12)* is the compounded value-weighted industry return from month $t-12$ to month $t-2$, and *VW volatility* is annualized value-weighted industry return volatility. All regressors are lagged one period. All specifications include additive industry and time fixed effects. Standard errors are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

4.2. Anticipated passive demand and post-IPO returns

The industry-level results establish the quantity implication of the model: IPO activity declines in industries experiencing larger increases in passive ownership and expands where more expert capital remains available. We now test the cost-of-capital mechanism directly at the IPO-firm level.

Because index inclusion generally occurs only after a delay, passive funds do not immediately absorb the shares of a newly listed firm. During the intervening period, active investors must evaluate the issuer and bear its firm-specific risk (Gromb and Vayanos, 2010). The compensation these investors require is reflected in the return that the security is priced to deliver after listing. Post-IPO cumulative abnormal returns therefore measure compensation for bearing idiosyncratic risk, after removing compensation for systematic factor exposures, and provide a measure of the issuer's cost of capital at the IPO.

This mechanism delivers two cross-sectional predictions. First, firms expected to attract greater future passive demand require active investors to intermediate a larger position before that demand arrives. Their post-IPO abnormal returns should therefore be higher. Second, this required compensation should be lower when more expert capital is available to absorb the offering's firm-specific risk. The return premium associated with anticipated passive demand should consequently be attenuated when expert capital is abundant.

Anticipated passive ownership. We denote by $aPO_f(h)$ the passive ownership of firm f at horizon h that could have been anticipated using information available at the time of listing. We construct this measure as the fitted value from a regression of realized stock-level passive ownership at horizon h on a flexible function of the firm's opening float, IPO-year fixed effects, and lagged aggregate passive ownership.

Using anticipated rather than realized passive ownership is important because realized passive ownership may respond endogenously to post-IPO returns. A firm whose stock appreciates after listing may satisfy index-eligibility thresholds sooner or receive a larger benchmark weight, mechanically increasing its realized passive ownership. Opening float, by contrast, is determined before the CAR window begins and is a central determinant of future index eligibility and benchmark weight. The fitted measure therefore isolates the component of future passive demand that active investors could reasonably anticipate at the IPO.

Expert capital and intermediation capacity. The compensation required to absorb a newly listed security depends not only on the anticipated passive demand for the stock, but also on the active capital available to bear its firm-specific risk. A large and volatile offering imposes a greater risk-bearing burden, whereas a larger stock of active mutual-fund capital in the issuer's industry increases intermediation capacity.

We measure firm-level expert capital as EC_f

$$EC_f = \log(\text{active AUM}_{i(f)}) - \log(\text{float}_f \times \text{volatility}_f),$$

where active $\text{AUM}_{i(f)}$ is lagged active mutual-fund capital in the firm's two-digit NAICS industry, float_f is the firm's real opening float, and volatility_f measures the firm's idiosyncratic risk. Higher values of EC_f therefore indicate that more expert capital is available relative to the risk-bearing burden of the offering. This measure complements the industry-level expert-capital variable in Section 4.1. The industry-level measure captures the total active capital available to support new issuance in a sector, whereas the firm-level measure scales that capital by the risk created by a particular IPO.

We estimate the following cross-sectional specification:

$$CAR_f(h) = \alpha_i + \gamma_t + b_1 aPO_f(h) + b_2 EC_f + b_3\big(aPO_f(h) \times EC_f\big) + e_f, \tag{7}$$

where $CAR_f(h)$ is the cumulative abnormal return of firm f over $h \in \{3, 6\}$ months following its IPO. The model predicts $b_1 > 0$: firms expected to attract greater passive demand require greater compensation during the period in which active investors intermediate that demand. It predicts $b_2 < 0$: abundant expert capital lowers the compensation required for bearing the offering's idiosyncratic risk. Finally, it predicts $b_3 < 0$: expert capital reduces the marginal intermediation cost created by anticipated passive demand.

We cumulate returns from the opening price on the first trading day rather than from the offer price, thereby excluding the first-day IPO return. This distinction separates the aftermarket compensation studied here from conventional IPO underpricing, which concerns the allocation and pricing of shares at the offering. We calculate abnormal returns using the CAPM, the Fama-French three-factor model, and the Carhart four-factor model. Anticipated passive ownership and expert capital are standardized before estimation, so the coefficients measure the change in cumulative abnormal returns associated with a one-standard-deviation increase in the corresponding regressor.

	(1)	(2)	(3)	(4)	(5)	(6)
CAR model	CAPM	CAPM	FF3	FF3	Carhart	Carhart
Horizon	3m	6m	3m	6m	3m	6m
aPO	0.068***	0.159***	0.071***	0.152***	0.070***	0.150***
	(0.025)	(0.027)	(0.025)	(0.026)	(0.025)	(0.026)
EC	-0.034**	-0.135***	-0.032**	-0.118***	-0.032**	-0.118***
	(0.015)	(0.024)	(0.015)	(0.023)	(0.015)	(0.023)
aPO × EC	-0.013*	0.004	-0.016**	0.003	-0.015**	0.003
	(0.007)	(0.003)	(0.007)	(0.003)	(0.007)	(0.003)
Industry + Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	NAICS-2	NAICS-2	NAICS-2	NAICS-2	NAICS-2	NAICS-2
Observations	3,548	3,559	3,548	3,559	3,548	3,559
R^2	0.147	0.165	0.126	0.131	0.126	0.131

Table 3: Passive Ownership, Expert Capital, and Post-IPO Abnormal Returns

This table reports regressions of cumulative abnormal returns (CARs) following IPOs. Columns (1) and (2) use CAPM-adjusted CARs, Columns (3) and (4) use Fama–French three-factor (FF3) adjusted CARs, and Columns (5) and (6) use Carhart four-factor adjusted CARs. The dependent variable is the cumulative abnormal return measured over the three- and six-month post-IPO horizons. The key explanatory variables are anticipated passive ownership at stock-level(aPO), expert capital (EC), and their interaction. All specifications include NAIC two-digit industry and calendar-quarter fixed effects. Standard errors, clustered at the NAICS two-digit industry level, are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Abnormal returns are computed with betas estimated over the three years following listing, and are winsorized at 1/99%.

Table 3 reports the results. Consistent with the cost-of-capital mechanism, abundant expert capital is associated with lower post-IPO abnormal returns. Across the three factor models, a one-standard-deviation increase in expert capital reduces three-month CARs by 3.2 - 3.4 percentage points and six-month CARs by 11.8 - 13.5 percentage points. All six estimates are statistically significant.

The interpretation is direct. When more active capital is available relative to the risk-bearing burden of the offering, investors require less compensation to evaluate and hold the newly listed security. The firm can therefore issue at a higher price and faces a lower cost of capital at the IPO. The persistence of the effect through six months indicates that expert-capital capacity affects not only the initial pricing of the offering, but also the compensation earned while investors continue to bear the firm's idiosyncratic risk.

Anticipated passive ownership enters positively and significantly at the 1% level in every specification. Across the three factor models, a one-standard-deviation increase in anticipated passive ownership is associated with 6.8–7.1 percentage points higher CARs over three months and 15.0–15.9 percentage points higher CARs over six months. Under the Fama–French three-factor model, for example, a one-standard-deviation increase in anticipated passive ownership raises three-month

CARs by 7.1 percentage points and six-month CARs by 15.2 percentage points. These magnitudes correspond to approximately one-fifth of the standard deviation of three-month CARs and more than one-third of the standard deviation of six-month CARs reported in Panel B of Table 1.

The coefficients are nearly invariant across the CAPM, Fama–French, and Carhart benchmarks, ranging from 0.068 to 0.071 at three months and from 0.150 to 0.159 at six months. The result is therefore not sensitive to the treatment of systematic factor exposures. Instead, it reflects compensation associated with the firm-specific risk that active investors must bear before anticipated passive demand arrives. The larger estimates at six months indicate that the return premium accumulates over the post-IPO period. This pattern is consistent with active investors earning compensation while they continue to intermediate the position, rather than with a one-time price adjustment occurring entirely at listing.

The interaction between anticipated passive ownership and expert capital is negative and statistically significant at the three-month horizon. Across the three factor models, a one-standard-deviation increase in expert capital reduces the CAR associated with a one-standard-deviation increase in anticipated passive ownership by 1.3–1.6 percentage points. This result provides the most direct evidence for the intermediation channel. Anticipated passive demand creates a larger risk-bearing burden when active capital is limited. When expert capital is abundant, the same anticipated demand can be absorbed with less compensation, reducing the issuer's cost of capital. Under the Fama–French benchmark, for example, the three-month CAR premium associated with a one-standard-deviation increase in anticipated passive ownership is approximately 8.7 percentage points when expert capital is one standard deviation below its mean, compared with approximately 5.5 percentage points when expert capital is one standard deviation above its mean.

The interaction becomes economically small and statistically insignificant at the six-month horizon. This timing is consistent with the institutional delay in index inclusion. Since 2004, the Russell 2000, the principal passive benchmark for many IPO firms, has generally added eligible IPOs on a quarterly schedule. Expert capital should therefore matter most during the initial months after listing, when active investors must absorb the shares before benchmark-driven demand arrives. Once that intermediation period has passed, expert-capital capacity no longer materially affects the cumulative return associated with anticipated passive ownership.

Taken together, the industry- and firm-level evidence supports a common cost-of-capital mechanism. At the industry level, IPO activity declines where passive ownership rises and expands where expert capital remains abundant, particularly along the intensive margin. At the firm level, anticipated passive demand raises the compensation investors require for bearing idiosyncratic risk, while abundant expert capital lowers that compensation and attenuates the short-run return premium associated with anticipated passive demand.

The quantity and pricing results therefore provide complementary evidence. The aggregate rise in passive ownership reduces the active risk-bearing capacity available to prospective issuers, discouraging IPO activity. Among firms that nevertheless go public, those requiring greater intermediation face a higher cost of capital until anticipated passive demand arrives.

5. Conclusion

This paper studies how the aggregate rise of passive ownership affects firms' decisions to go public. We distinguish the stock-level benefit of benchmark inclusion from the equilibrium effect of investors switching from active to passive funds. Because passive demand is tilted toward large firms, this switch reallocates demand away from small prospective issuers while reducing the expert capital available to bear their risk. In the model, the public cost of capital consequently rises for firms with below-average passive tilts. These firms delay listing until they reach a size group with sufficient passive demand. When index inclusion requires seasoning, expert investors must also intermediate the IPO float before that demand arrives; for firms that remain in the small- to mid-cap range, this initial intermediation cost can eliminate the IPO altogether.

The empirical results support this cost-of-capital mechanism at both the industry and IPO-firm levels. Industries experiencing larger increases in passive ownership exhibit larger declines in IPO dollar volume and the number of IPO listings, while industries with more expert capital exhibit greater IPO activity on both margins. A one-percentage-point increase in industry passive ownership is associated with a 4.7% decline in IPO dollar volume and a 1.1% decline in IPO count, with similar estimates from a Bartik-style instrument based on predetermined industry exposure to aggregate passive growth. These results show that the effect operates through both the extensive margin and the intensive margin.

At the IPO-firm level, post-IPO CARs are persistently lower when more expert capital is available and higher when the firm's anticipated passive ownership is greater. Moreover, expert capital attenuates the increase in CARs associated with anticipated passive ownership over the first three months after listing, when active investors must intermediate the anticipated passive demand. This interaction disappears over six months, consistent with passive demand arriving after the initial index-inclusion delay. The quantity and pricing evidence therefore point to the same mechanism: a reduction in active risk-bearing capacity raises the cost of intermediating prospective issuers and discourages IPO activity.

These findings contribute a novel explanation for the long-debated IPO decline, which carries important implications for firm entries, innovation, and economic efficiency. To the extent that rising passive ownership discourages public listings and channels startup exits toward acquisitions by mega-cap incumbents, high-growth new firms may be absorbed into existing large firms rather than scaling independently as public competitors. Such absorption can dampen product market competition and weaken innovation incentives, as ideas and talent that would have supported entry are instead folded into incumbents whose cannibalization concerns and vested interests are less conducive to radical innovation.

Several extensions remain for future work. First, we plan to improve the passive ownership measure by incorporating Thomson Reuters S12 holdings data alongside the CRSP fund holdings. Second, we plan to examine the substitution toward acquisition exits by studying buyout activity using counts and proceeds, as well as the IPO-to-buyout ratio.

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Appendix

A. Proofs

Throughout the appendix, "generic position" means that $r_P \neq R_n$ for every n, the eligibility dates satisfy $T_1^* < \cdots < T_N^*$, and the participation comparison in Proposition 1 is nonzero at the candidate listing date. These conditions are maintained unless stated otherwise.

A.1. Proof of Lemma 1

Proof. **Step 1 (Certainty equivalent).** If $X \sim \mathcal{N}(\mu_X, \sigma_X^2)$ and $a > 0$, the normal moment-generating function implies $\mathbb{E}\left[-e^{-aX}\right] = -\exp\left(-a\mu_X + \frac{1}{2}a^2\sigma_X^2\right)$. Therefore, maximizing $\mathbb{E}[-e^{-aX}]$ over choices that affect (μ_X, σ_X^2) is equivalent to maximizing $\mu_X - \frac{a}{2}\sigma_X^2$.

Step 2 (Expert problem). Fix a date t and the current membership group. Let W denote total investor wealth, A the expert share, and $\Theta \in \{\Theta_0, \Theta_1, \ldots, \Theta_N\}$ the fraction held by passive funds, with $\Theta_0 = 0$. Anticipating Lemma 2, the stock return over $[t, t+dt]$ is $dP_t/P_t = \mu_t\, dt + \sigma\, dz_t$, with mean $\mu_t dt$ and variance $\sigma^2 dt$. The representative expert has wealth AW, takes a dollar position D in the firm, and invests the remainder at r_f. Because the expert's other holdings are uncorrelated with the firm's news (Assumption 2), this position can be solved separately from the rest of the portfolio. End-of-instant wealth is $AW(1 + r_f\, dt) + D\,(dP_t/P_t - r_f\, dt)$, with mean $AW(1+r_f dt)+D(\mu_t - r_f)dt$ and variance $D^2\sigma^2 dt$. The instantaneous exponential-utility coefficient is $\gamma/(AW)$, the local representation of relative risk aversion γ. It differs from constant absolute risk aversion, whose coefficient would not depend on wealth. Step 1 therefore reduces the problem to

$$\max_D \;\; D\,(\mu_t - r_f)\,dt \;-\; \frac{\gamma}{2\,AW}\,D^2\,\sigma^2\,dt\,.$$

The objective is strictly concave in D. The first-order condition gives $D = AW(\mu_t - r_f)/(\gamma\sigma^2)$.

Step 3 (Clearing). The float supplies exposure $X_t = x_t W$ in dollar-risk units (Assumption 2), with $x_t = x$ in the baseline. Passive investors absorb $\Theta\, xW$ mechanically (Assumption 1). Noise traders hold no position in the firm because their holdings are uncorrelated with its news (Assumption 2). The expert therefore bears residual exposure $(1-\Theta)\, xW$. Market clearing requires

$$\frac{A\,W\,(\mu_t - r_f)}{\gamma\sigma^2} \;=\; (1-\Theta)\,x\,W \qquad\Longleftrightarrow\qquad \mu_t \;=\; r_f + \frac{\gamma\sigma^2\,(1-\Theta)\,x}{A}\,.$$

The wealth level W cancels, leaving only the exposure share x and the expert capital share A. The solution is unique because expert demand is strictly increasing in the expected excess return $\mu_t - r_f$. Substituting $\Theta = \Theta_n$ yields equation (1).

Step 4 (Monotonicity). For $n \geq 1$, $R_{n-1} - R_n = \frac{\gamma\sigma^2 x}{A}\,(\Theta_n - \Theta_{n-1}) > 0$ because $\Theta_n > \Theta_{n-1}$. Moreover, $R_N - r_f = \frac{\gamma\sigma^2 x\,(1-\Theta_N)}{A} > 0$ because $\Theta_N < 1$. Hence $R_0 > R_1 > \cdots > R_N > r_f$. □

A.2. Proof of Lemma 2

Proof. **Step 1 (Ordering of inclusion dates and membership count).** Since T_n^* is strictly increasing in n and $\max\{\cdot,\cdot\}$ is monotone in each argument, $I_n(\tau) = \max\{\tau+\Delta, T_n^*\} \le \max\{\tau+\Delta, T_{n+1}^*\} = I_{n+1}(\tau)$. Therefore, $M_v \equiv \#\{n : I_n(\tau) \le v\}$ is a nondecreasing, right-continuous step function of v. It equals 0 on $[\tau, I_1)$ and increases at each distinct inclusion date, possibly by more than one when inclusion dates coincide. Memberships are permanent because K crosses each cutoff once from below.

Step 2 (The news martingale). Write $\mathcal{E}_t = f(z_t, t)$ with $f(z,t) = \exp(\sigma z - \frac{1}{2}\sigma^2 t)$. Then $\partial f/\partial z = \sigma f$, $\partial^2 f/\partial z^2 = \sigma^2 f$, and $\partial f/\partial t = -\frac{1}{2}\sigma^2 f$. Itô's formula gives $d\mathcal{E}_t = \big(-\frac{1}{2}\sigma^2 f + \frac{1}{2}\sigma^2 f\big)dt + \sigma f\, dz_t = \sigma\, \mathcal{E}_t\, dz_t$. With constant σ, Novikov's condition holds, so $\mathcal{E}$ is a true martingale with $\mathcal{E}_0 = 1$ and $\mathbb{E}[\mathcal{E}_t] = 1$ for all t.

Step 3 (Guess and verification). Guess $P_t = \bar{P}_t\, \mathcal{E}_t$, where $\bar{P}$ is deterministic, continuous, and piecewise continuously differentiable. Since $\bar{P}$ has finite variation, $[\bar{P}, \mathcal{E}] = 0$. The product rule gives $dP_t = \mathcal{E}_t\, \dot{\bar{P}}_t\, dt + \bar{P}_t\, \sigma \mathcal{E}_t\, dz_t$, and therefore $dP_t/P_t = (\dot{\bar{P}}_t/\bar{P}_t)\, dt + \sigma\, dz_t$. Thus the return drift is $\mu_t = \dot{\bar{P}}_t/\bar{P}_t$ and the variance is σ^2 per unit time, as assumed in Appendix A.1. Lemma 1 then requires $\dot{\bar{P}}_t/\bar{P}_t = R_{M_t} \equiv \mathcal{R}(t;\tau)$. The terminal payoff implies $P_T = K_T \mathcal{E}_T$ and hence $\bar{P}_T = K_T$.

Step 4 (Terminal-value problem). Define $F(t) \equiv K_T \exp\big(-\int_t^T \mathcal{R}(v;\tau)\, dv\big)$. Then $F(T) = K_T$ and $F'(t) = \mathcal{R}(t;\tau)\, F(t)$ wherever $\mathcal{R}$ is continuous, so F solves the terminal-value problem. To establish uniqueness within the stated class, let $\bar{P}$ be any solution and define $G(t) = \bar{P}_t/F(t)$. On each segment, $G'(t) = \big(\dot{\bar{P}}F - \bar{P}F'\big)/F^2 = \big(\mathcal{R}\bar{P}F - \bar{P}\mathcal{R}F\big)/F^2 = 0$. Continuity across segment boundaries implies that G is constant, and the terminal condition gives $G(T) = 1$. Therefore, $\bar{P} = F$. The entrepreneur's expected sale price is $\mathbb{E}[P_\tau] = \bar{P}_\tau\, \mathbb{E}[\mathcal{E}_\tau] = \bar{P}_\tau$ by Step 2, which justifies the objective in Section 2.1.1. Coincident inclusion dates create zero-length segments and do not affect the formula.

Step 5 (Deterministic dates are without loss). Let $f(t) \equiv e^{-r_P t}\, \bar{P}_t(t)$ denote the value of listing at deterministic date t, where r_P is the private cost of capital. For any stopping time $\tau \le T$ adapted to the news filtration, optional stopping for the uniformly integrable martingale $\mathcal{E}$ on $[0,T]$ gives $\mathbb{E}\big[f(\tau)\, \mathcal{E}_\tau\big] \le \big(\max_t f(t)\big)\, \mathbb{E}[\mathcal{E}_\tau] = \max_t f(t)$. The deterministic maximizer attains this upper bound. □

Price discount from future passive demand. Relative to an otherwise identical firm that already has all N memberships, equation (2) implies

$$\ln\big(K_T e^{-R_N(T-t)}\big) - \ln \bar{P}_t(\tau) \;=\; \int_t^T \big(\mathcal{R}(v;\tau) - R_N\big)\, dv \;=\; \sum_{\text{future segments } n} \big(R_n - R_N\big) \times \big(\text{segment length}\big).$$

This difference is the cumulative compensation required to bear the exposure before the remaining passive demand arrives. It is compensation for risk, not an arbitrage profit. Because $\dot{\bar{P}} = \mathcal{R}\, \bar{P}$, the price begins below the fully included value and converges toward it as passive demand arrives. Investors who take positions before inclusion can reduce this discount only by supplying additional

risk-bearing capacity. This raises the price obtained at a given listing date; its effect on the optimal listing date depends on which required-return segments are reduced.

A.3. Proof of Lemma 3

Proof. **Step 1 (Final seasoning interval).** For $\tau \in (T-\Delta, T]$, every inclusion date satisfies $I_n(\tau) \geq \tau + \Delta > T$. No passive membership therefore begins before the horizon, and $\mathcal{R}(v;\tau) = R_0$ for all $v \in [\tau, T]$. Hence $\ln V(\tau) = -r_P\tau + \ln K_T - R_0(T-\tau)$ and $d\ln V/d\tau = -r_P + R_0$, which is the second branch of the lemma.

Step 2 (Segment representation on the main domain). For $\tau \in [0, T-\Delta]$, $\tau + \Delta \leq T$ and $T_N^* < T$, so every inclusion date satisfies $I_n(\tau) = \max\{\tau + \Delta, T_n^*\} \leq T$. With $I_0 \equiv \tau$ and $I_{N+1} \equiv T$, the measure of $\{v \in [\tau, T] : M_v = j\}$ is $I_{j+1} - I_j$ for each $j = 0, \ldots, N$, with zero measure when dates coincide. Therefore,

$$\int_\tau^T \mathcal{R}(v;\tau)\, dv \;=\; R_0\,(I_1 - \tau) \;+\; \sum_{n=1}^{N-1} R_n\,\big(I_{n+1} - I_n\big) \;+\; R_N\,\big(T - I_N\big).$$

Step 3 (Derivatives of inclusion dates). Each $I_n(\tau) = \max\{\tau + \Delta,\, T_n^*\}$ is continuous and is differentiable except at $\tau = T_n^* - \Delta$. Away from these dates, $I_n'(\tau) = \mathbf{1}\{\tau + \Delta > T_n^*\}$. Because the eligibility dates are strictly increasing, the set $\{n : \tau + \Delta > T_n^*\}$ equals $\{1, \ldots, m(\tau)\}$, where $m(\tau) = \#\{n : T_n^* < \tau + \Delta\}$. Thus $I_n'(\tau) = \mathbf{1}\{n \leq m(\tau)\}$ away from $\{T_n^* - \Delta\}$.

Step 4 (The derivative, case by case). On any open interval of $[0, T-\Delta]$ containing no kink date, differentiate the negative of Step 2's sum:

$$\frac{d}{d\tau}\Big[-\int_\tau^T \mathcal{R}\, dv\Big] \;=\; -\Big[\,R_0\,\big(I_1' - 1\big) \;+\; \sum_{n=1}^{N-1} R_n\,\big(I_{n+1}' - I_n'\big) \;-\; R_N\, I_N'\,\Big].$$

Case $m(\tau) = 0$: every $I_n' = 0$, so the bracket is $R_0(0-1) = -R_0$ and the derivative is R_0. Case $1 \leq m(\tau) \leq N-1$: $I_1' = \cdots = I_m' = 1$ and the rest vanish; the first term is $R_0(1-1) = 0$; in the sum, terms with $n < m$ contribute $R_n(1-1) = 0$, the term $n = m$ contributes $R_m(0-1) = -R_m$, and terms with $n > m$ contribute $R_n(0-0) = 0$; the last term is $-R_N \cdot 0 = 0$; the bracket is $-R_m$ and the derivative is R_m. Case $m(\tau) = N$: the first term is $R_0(1-1) = 0$, every summand is $R_n(1-1) = 0$, and the last term is $-R_N \cdot 1$; the bracket is $-R_N$ and the derivative is R_N. In all cases $d\ln \bar{P}/d\tau = R_{m(\tau)}$, hence $d\ln V/d\tau = R_{m(\tau)} - r_P$.

Step 5 (Telescoping identity). The identity $\sum_{n=1}^m (R_{n-1} - R_n) = (R_0 - R_1) + (R_1 - R_2) + \cdots + (R_{m-1} - R_m) = R_0 - R_m$ shows that the derivative in Step 4 equals $-r_P + R_0 - \sum_{n:\, T_n^* < \tau+\Delta} (R_{n-1} - R_n)$. A marginal delay incurs one additional instant of private ownership, removes one instant priced at the unincluded required return, and postpones every inclusion date tied to the IPO by one instant. These effects telescope to $R_m - r_P$.

Step 6 (Regularity). The function $\ln V$ is continuous on $[0, T]$. In particular, at $\tau = T - \Delta$, both branches equal $-r_P(T-\Delta) + \ln K_T - R_0\Delta$ because every inclusion date equals T. On

$[0, T-\Delta]$, $\ln V$ is piecewise linear with finitely many kinks at $\{T_n^* - \Delta\} \cap (0, T-\Delta)$. At a kink $T_n^* - \Delta$, the left and right derivatives are $R_{n-1} - r_P$ and $R_n - r_P$. More generally, defining $m_-(\tau) = \#\{n : T_n^* < \tau + \Delta\}$ and $m_+(\tau) = \#\{n : T_n^* \le \tau + \Delta\}$, the one-sided derivatives are $R_{m_-(\tau)} - r_P$ and $R_{m_+(\tau)} - r_P$. A continuous piecewise-linear function is Lipschitz and therefore absolutely continuous. Hence $\ln V(b) - \ln V(a) = \int_a^b \big(R_{m(v)} - r_P\big)dv$ on the main domain, and the fundamental theorem applies globally together with the final-interval derivative. □

A.4. Proof of Proposition 1

Proof. Let $s(\tau)$ denote the slope of $\ln V$: $s(\tau) = R_{m(\tau)} - r_P$ on $[0, T-\Delta]$ and $s(\tau) = R_0 - r_P$ on $(T-\Delta, T]$ (Lemma 3). Since $m(\tau)$ is nondecreasing and R_n is strictly decreasing in n (Lemma 1), s is nonincreasing on $[0, T-\Delta]$ and falls at each inclusion-threshold date.

Case (i): $n^\star = 0$. Then $r_P > R_0 \ge R_m$ for every m. Therefore, $s(\tau) < 0$ on $[0, T-\Delta]$ and $R_0 - r_P < 0$ on the final interval. The value $\ln V$ is strictly decreasing on $[0, T]$, so $\tau^\star = 0$.

Case (iii): $n^\star = \infty$. Then $r_P < R_N \le R_m$ for every m. Therefore, $s(\tau) > 0$ on $[0, T-\Delta]$ and $R_0 - r_P > 0$ on the final interval. The value $\ln V$ is strictly increasing on $[0, T]$, so $\tau^\star = T$. Listing at T yields $P_T = K_T$ and is payoff-equivalent to holding the firm to liquidation; we interpret this outcome as never listing.

Case (ii): $1 \le n^\star \le N$. Define $\tau^\circ \equiv \max\{0,\ T_{n^\star}^* - \Delta\}$, the candidate listing date in the proposition. By minimality and generic position, $R_n > r_P$ for $n < n^\star$ and $R_n < r_P$ for $n \ge n^\star$. On the main domain, $s(\tau) > 0 \Leftrightarrow m(\tau) \le n^\star - 1 \Leftrightarrow T_{n^\star}^* \ge \tau + \Delta \Leftrightarrow \tau \le T_{n^\star}^* - \Delta$, while $s(\tau) < 0$ for $\tau > T_{n^\star}^* - \Delta$.

If $\tau^\circ = T_{n^\star}^* - \Delta > 0$, then $\ln V$ is strictly increasing on $[0, \tau^\circ]$ and strictly decreasing on $(\tau^\circ, T-\Delta]$. Its unique maximizer on the main domain is τ°, where the left slope is $R_{n^\star-1} - r_P > 0$ and the right slope is $R_{n^\star} - r_P < 0$. If $\tau^\circ = 0$, equivalently $T_{n^\star}^* \le \Delta$, then $m_+(0) = \#\{n : T_n^* \le \Delta\} \ge n^\star$ (Appendix A.3), so the right derivative at zero is $R_{m_+(0)} - r_P \le R_{n^\star} - r_P < 0$. Since s is nonincreasing, $\ln V$ is strictly decreasing on $(0, T-\Delta]$ and is maximized at $0 = \tau^\circ$. In either case, the main-domain maximizer is $\tau^\circ = \max\{0, T_{n^\star}^* - \Delta\}$, and the listing size is $e^{g\tau^\circ} = \max\{1,\ K_{n^\star}^* e^{-g\Delta}\}$.

On the final interval, $s = R_0 - r_P > 0$ because $n^\star \ge 1$ implies $R_0 > r_P$. Thus V is strictly increasing and reaches $V(T) = e^{-r_P T} K_T$, the never-list value, at T. The global maximizer is therefore either τ° or T. Their log-value difference is

$$\ln V(\tau^\circ) - \ln V(T) \;=\; \Big[-r_P\tau^\circ + \ln K_T - \int_{\tau^\circ}^{T} \mathcal{R}(v;\tau^\circ)\,dv\Big] - \big[-r_P T + \ln K_T\big] \;=\; \int_{\tau^\circ}^{T} \big(r_P - \mathcal{R}(v;\tau^\circ)\big)\,dv\,.$$

This is condition (A). The firm lists at τ° when the expression is positive and never lists when it is negative.

Sufficient condition. No inclusion occurs before $\tau^\circ + \Delta$, so $\mathcal{R} = R_0$ on $[\tau^\circ, \tau^\circ + \Delta)$ and this interval contributes $-\Delta(R_0 - r_P)$ to condition (A). From $\tau^\circ + \Delta$ onward, the membership count is at least $n^\star$. When $\tau^\circ > 0$, inclusions $1, \dots, n^\star$ begin at $\tau^\circ + \Delta = T_{n^\star}^*$. When $\tau^\circ = 0$, at least $m_+(0) \ge n^\star$ memberships begin by Δ (Appendix A.3); the boundary instant has measure

zero. Therefore, $\mathcal{R}(v) \leq R_{n^\star}$ and the integrand is at least $r_P - R_{n^\star} > 0$, contributing at least $(T - \tau^\circ - \Delta)(r_P - R_{n^\star})$. Thus condition (A) holds whenever $(T - \tau^\circ - \Delta)(r_P - R_{n^\star}) > \Delta(R_0 - r_P)$. For $\tau^\circ > 0$, this becomes $(T - T^*_{n^\star})(r_P - R_{n^\star}) > \Delta(R_0 - r_P)$, the horizon-length condition in Proposition 1(iii). It holds for all sufficiently large T, holding the remaining primitives fixed. For $\tau^\circ > 0$, the exact segment decomposition is

$$\int_{\tau^\circ}^{T} \left(r_P - \mathcal{R}(v;\tau^\circ)\right) dv \;=\; -\,\Delta\,(R_0 - r_P) \;+\; \sum_{j=n^\star}^{N} \left(T^*_{j+1} - T^*_j\right)\left(r_P - R_j\right),$$

where $T^*_{N+1} \equiv T$. The first term is the seasoning-period cost. Each later term is the financing advantage earned over one subsequent inclusion interval. Passive demand therefore arrives gradually rather than all at once. The seasoning period is primarily the participation channel through which a rise in passive ownership eliminates marginal IPOs (Proposition 3(ii)).

Simultaneous inclusion. Suppose $\tau^\circ = T^*_{n^\star} - \Delta > 0$. For any $j \leq n^\star$, $I_j(\tau^\circ) = \max\{\tau^\circ + \Delta, T^*_j\} = \max\{T^*_{n^\star}, T^*_j\} = T^*_{n^\star}$. The membership count therefore increases from 0 to $n^\star$ at $T^*_{n^\star}$. Inclusions $n > n^\star$ occur later at their own eligibility dates. □

A.5. No seasoning period

Corollary 1 (No seasoning period)**.** *If $\Delta = 0$, condition (A) is automatic and the firm lists exactly at its passive-demand threshold date $T^*_{n^\star}$, at size $K^*_{n^\star}$, whenever $1 \leq n^\star \leq N$; it lists at birth if $n^\star = 0$ and never lists if $n^\star = \infty$.*

With $\Delta = 0$, IPO timing is determined entirely by the crossing of the public required return and the private cost of capital. The firm lists exactly at the relevant eligibility cutoff, and the participation condition disappears. A positive seasoning period shifts the IPO one lag earlier, to a size just below the cutoff, and increases the public cost of capital embedded in the IPO price. It does not change the sign of the timing comparative statics.

Proof. When $\Delta = 0$, every inclusion date is $I_n(\tau) = \max\{\tau, T^*_n\} \leq T$, and the final seasoning interval $(T - \Delta, T]$ is empty. Lemma 3's main branch therefore applies on all of $[0, T]$, with $m(\tau) = \#\{n : T^*_n < \tau\}$. If $n^\star = 0$ or $n^\star = \infty$, the slope $R_{m(\tau)} - r_P$ has a constant sign, so the corner arguments in Appendix A.4 apply. If $1 \leq n^\star \leq N$, the slope is positive for $\tau < T^*_{n^\star}$ and negative for $\tau > T^*_{n^\star}$. Hence $\ln V$ is strictly increasing and then strictly decreasing, with a unique maximum at $\tau^\star = T^*_{n^\star}$ and size $e^{gT^*_{n^\star}} = K^*_{n^\star}$. Memberships $1, \ldots, n^\star$ begin at the listing date because $I_j(\tau^\star) = \max\{T^*_{n^\star}, T^*_j\} = T^*_{n^\star}$ for $j \leq n^\star$. Since $\ln V$ is strictly decreasing on $(\tau^\star, T]$, $V(\tau^\star) > V(T)$. Thus the participation comparison holds automatically. In condition (A), the seasoning interval is empty and $r_P - \mathcal{R}(v;\tau^\star) \geq r_P - R_{n^\star} > 0$ throughout $[\tau^\star, T]$. □

A.6. Proof of Proposition 2

Proof. Substituting $A(\varphi) = \bar{A}\,(1-\varphi)$ and $\Theta_n = \beta_n\varphi$, with $\beta_0 \equiv 0$ and $c = \gamma\sigma^2 x/\bar{A}$, into equation (1) gives, for every $n = 0, 1, \ldots, N$,

$$R_n(\varphi) \;=\; r_f + \frac{\gamma\sigma^2 x\,(1-\beta_n\varphi)}{\bar{A}\,(1-\varphi)} \;=\; r_f + c\,\frac{1-\beta_n\varphi}{1-\varphi}\,.$$

The quotient rule gives

$$\frac{d}{d\varphi}\,\frac{1-\beta_n\varphi}{1-\varphi} \;=\; \frac{(-\beta_n)(1-\varphi) \;-\; (1-\beta_n\varphi)(-1)}{(1-\varphi)^2} \;=\; \frac{-\beta_n+\beta_n\varphi+1-\beta_n\varphi}{(1-\varphi)^2} \;=\; \frac{1-\beta_n}{(1-\varphi)^2}\,.$$

Therefore, $\partial R_n/\partial\varphi = c(1-\beta_n)(1-\varphi)^{-2}$, which is positive for $\beta_n < 1$, zero for $\beta_n = 1$, and negative for $\beta_n > 1$. A second derivative gives $\partial^2 R_n/\partial\varphi^2 = 2c(1-\beta_n)(1-\varphi)^{-3}$, which has the same sign. For $\beta_0 = 0$, $\partial R_0/\partial\varphi = c\,(1-\varphi)^{-2}$, strictly larger than the derivative for every $n \geq 1$ because $\beta_n > 0$. At $\varphi = 0$, $R_n(0) = r_f + c$ for every n; the signed derivatives then generate the stated divergence across groups. □

A.7. Proof of Proposition 3

Proof. Parts (i) and (ii) derive the group-specific passive-ownership thresholds and show that the candidate listing group moves weakly upward with φ. Part (iii) establishes monotonicity of participation and realized listing dates when all relevant tilts are at most one. Part (iv) shows that the delay stops at the first above-average-tilt group and characterizes the threshold private cost of capital below which the firm never lists. Together, these results prove Proposition 3. At a passive-ownership threshold, the optimizer may be set-valued; the comparative statics are then stated for the optimal-date correspondence.

Maintain $\varphi > 0$, $r_P > r_f + c$, $\beta_0 \equiv 0 < \beta_1 < \cdots < \beta_N$, and $\beta_N\varphi < 1$.

Part (i): group availability. For any group with $\beta_n < 1$, including the unincluded group, $R_n(\varphi) < r_P$ is equivalent to $c\,(1-\beta_n\varphi)/(1-\varphi) < r_P - r_f$. Multiplying by $1-\varphi > 0$ and rearranging gives

$$c\,(1-\beta_n\varphi) \;<\; (r_P-r_f)(1-\varphi) \qquad\Longleftrightarrow\qquad c-(r_P-r_f) \;<\; \varphi\,\big[\beta_n c-(r_P-r_f)\big]\,.$$

Since $\beta_n c < c < r_P - r_f$, both $c-(r_P-r_f)$ and $\beta_n c-(r_P-r_f)$ are negative. Dividing by the latter reverses the inequality and yields $\varphi < \big[(r_P-r_f)-c\big]/\big[(r_P-r_f)-\beta_n c\big] = \varphi_n$. The numerator is positive, and the denominator exceeds it when $\beta_n < 1$, so $\varphi_n \in (0,1)$. For $\beta_0 = 0$, $\varphi_0 = 1-c/(r_P-r_f)$. Moreover, $\partial\varphi_n/\partial\beta_n = c\,\big[(r_P-r_f)-c\big]/\big[(r_P-r_f)-\beta_n c\big]^2 > 0$, so the thresholds increase strictly with the tilt among groups with $\beta_n < 1$. For $\beta_n \geq 1$, the group remains available for every admissible φ. If $\beta_n c < r_P - r_f$, the same expression gives $\varphi_n \geq 1$. If $\beta_n c > r_P - r_f$, the coefficient on φ is positive while $c-(r_P-r_f) < 0$, so the inequality holds for all $\varphi \geq 0$. If $\beta_n c = r_P - r_f$, the inequality reduces to $c-(r_P-r_f) < 0$.

Part (ii): monotonicity of the candidate group. Each group is either available below a group-specific threshold or available for all admissible values of φ. Hence the available set $\mathcal{N}(\varphi) \equiv \{n \in \{0,\dots,N\} : R_n(\varphi) < r_P\}$ weakly shrinks as φ increases, and $n^\star(\varphi) = \min \mathcal{N}(\varphi)$ is nondecreasing. At $\varphi = 0$, every group has required return $r_f + c < r_P$, so $\mathcal{N}(0) = \{0,\dots,N\}$ and $n^\star(0) = 0$. The firm therefore lists at birth when aggregate passive ownership is zero (Proposition 1(i)). Because the thresholds are strictly ordered, when φ exceeds the threshold of the current marginal group, the next group becomes the new minimum. This process begins with the unincluded group at φ_0 and proceeds through the below-average-tilt groups. The first group with tilt at least one is always available and therefore bounds $n^\star$ from above. If every tilt is below one, the available set becomes empty after all thresholds have been crossed and $n^\star = \infty$. Since T^*_n and K^*_n are strictly increasing in n and independent of φ, the conditional candidate listing date and size are also nondecreasing. They are birth and size one when $n^\star(\varphi) = 0$, and $\max\{0, T^*_{n^\star(\varphi)} - \Delta\}$ and $\max\{1, K^*_{n^\star(\varphi)} e^{-g\Delta}\}$ when $n^\star(\varphi) \geq 1$.

Part (iii): participation and realized listing dates. First suppose that $\beta_n \leq 1$ for every n. Proposition 2 implies that every group's required return is nondecreasing in φ, and strictly increasing for the unincluded group and for every group with tilt strictly below one. For any fixed $\tau < T$, the path $\mathcal{R}(v;\tau)$ therefore rises pointwise, so $V(\tau;\varphi) = e^{-r_P\tau} K_T \exp\big(-\int_\tau^T \mathcal{R}\big)$ weakly falls. The never-list value $e^{-r_P T} K_T$ is independent of φ. If the firm never lists at φ, whether because $n^\star = \infty$ or because condition (A) fails, then every listing value remains below the never-list value at any $\varphi' > \varphi$. Thus the never-list region expands. The realized listing date, with never listing represented by $\tau = T$, is nondecreasing: conditional listing dates are nondecreasing by Part (ii), a listing can become a nonlisting, and a nonlisting cannot become a listing. Without the restriction $\beta_n \leq 1$, an above-average-tilt group becomes cheaper as φ rises. The improvement in post-inclusion required returns can then offset the higher seasoning-period cost, so participation need not be monotone.

Finally, fix a horizon H and let firms differ only in g. Required returns do not depend on g, so $n^\star(\varphi)$ is common across firms. Restrict attention to $1 \leq n^\star(\varphi) \leq N$. The candidate date $\max\{0,\, g^{-1} \ln K^*_{n^\star(\varphi)} - \Delta\}$ exceeds H if and only if $g < \ln K^*_{n^\star(\varphi)}/(H + \Delta)$. This interval expands with φ because $\ln K^*_{n^\star(\varphi)}$ is nondecreasing by Part (ii). The set of firms still private at H is the union of firms with candidate dates after H and firms that never list. Under the tilt restriction, both sets expand with φ.

Part (iv): termination at the tilt pivot and the missing-IPO threshold. For $\beta_n < 1$, the passive share at which group n ceases to satisfy $R_n(\varphi) < r_P$ solves $R_n(\varphi_n) = r_P$: $\varphi_n = [(r_P - r_f) - c]/[(r_P - r_f) - \beta_n c]$. This threshold increases strictly with β_n. A group with $\beta_n \geq 1$ has a required return that is nonincreasing in φ and satisfies $R_n(0) = r_f + c < r_P$, so it remains available for all admissible φ. Thus $n^\star(\varphi) = \min\{n : \varphi < \varphi_n\}$, with $\varphi_n \equiv \infty$ for groups above the pivot and $T^*_0 \equiv 0$. If $\varphi_p < \bar\varphi \equiv \min\{1, 1/\beta_N\}$, then $n^\star(\varphi) = p + 1$ for every $\varphi \in [\varphi_p, \bar\varphi)$. The listing date is therefore nondecreasing on $[0, \bar\varphi)$ and becomes T^*_{p+1} after the final below-average-tilt threshold. At $\Delta = 0$, condition (A) holds automatically, so the firm always lists.

For $\Delta > 0$ and $\varphi \leq \varphi_p$, differentiating condition (A) along the listing path at $\nu = 0$ gives $\partial_\varphi(\mathrm{A}) = -(1-\varphi)^{-2}\, c\left[\Delta + \sum_{j=n^\star}^{p}(1-\beta_j)\,\ell_j - \sum_{j>p}(\beta_j - 1)\,\ell_j\right]$, where ℓ_j is the time spent in group j. The bracket is nonnegative exactly when the duration-weighted tilt condition in the proposition holds. A uniform sufficient condition is $\Delta + (1-\beta_p)\,\ell_p(\tau^\circ) \geq \sum_{j>p}(\beta_j - 1)\,\ell_j(\tau^\circ)$ at the group-p candidate, because the bracket is smallest when $n^\star = p$. When $T_p^* \geq \Delta$, the durations are the calendar gaps $T_{j+1}^* - T_j^*$. When $T_p^* < \Delta$, the candidate is truncated at birth and the below-pivot intervals are shorter. Under the duration condition, $\partial_\varphi(\mathrm{A}) \leq 0$ for every below-pivot marginal group, so participation weakly declines. Together with the nondecreasing conditional listing date, this implies a nondecreasing realized listing date. At each threshold φ_n, $R_n(\varphi_n) = r_P$, so the objective is flat between the two adjacent candidate dates and their values coincide. The piecewise-nonincreasing participation surplus is therefore globally nonincreasing.

Threshold for the private cost of capital. Temporarily allow the private cost of capital to vary over its full domain and denote it by ρ, holding all other primitives fixed. Consider the finite candidate set $\mathcal{C}_\Delta \equiv \{0\} \cup \{\max\{0,\, T_n^* - \Delta\} : n = 1, \ldots, N\}$ from Proposition 1. For every private cost of capital, the value function is piecewise linear with kinks only at these candidate dates, and listings in the final seasoning interval are dominated. For $\tau \in \mathcal{C}_\Delta$, define $A_\tau(\rho) \equiv \int_\tau^T \big(\rho - \mathcal{R}(v;\tau)\big)\, dv$ and $G(\rho;\varphi,\Delta) \equiv \max_{\tau\in\mathcal{C}_\Delta} A_\tau(\rho)$. Each A_τ is affine and strictly increasing in ρ with slope $T - \tau > 0$. Hence G is continuous, convex, and strictly increasing in ρ. If $\rho < R_N(\varphi)$, every A_τ is negative; if $\rho > R_0(\varphi)$, A_0 is positive. Therefore, the unique threshold $\underline{r}_P(\varphi,\Delta) \equiv \inf\{\rho : G > 0\} \in [R_N(\varphi),\, R_0(\varphi)]$ separates nonlisting from listing. The firm never lists below the threshold, lists above it, and is indifferent at equality, which we resolve as never listing. At $\varphi = 0$, every required return equals $r_f + c$, so $A_\tau = (\rho - r_f - c)(T - \tau)$ and $\underline{r}_P(0,\Delta) = r_f + c$. Thus the never-list set is empty within the maintained population $r_P > r_f + c$ when aggregate passive ownership is zero.

If every candidate satisfies $\int_\tau^T (1 - \beta_{M_v(\tau)})\, dv \geq 0$, then $\partial_\varphi A_\tau = -(1-\varphi)^{-2}\, c \int_\tau^T (1 - \beta_{M_v(\tau)})\, dv \leq 0$ for each $\tau \in \mathcal{C}_\Delta$. A maximum of finitely many nonincreasing functions is nonincreasing, so G falls with φ while rising with ρ. Consequently, $\underline{r}_P(\varphi,\Delta)$ is nondecreasing, and firms with the lowest private costs of capital stop listing first. Requiring the condition for every candidate is sufficient but not necessary. By the envelope theorem for a finite maximum, local monotonicity of the threshold only requires the duration condition for candidates that attain G at $\rho = \underline{r}_P(\varphi,\Delta)$; dominated candidates may violate it.

Under exposure drift, the same derivative becomes $\partial_\varphi A_\tau = -(1-\varphi)^{-2}\, c \int_\tau^T e^{\nu v}\,(1 - \beta_{M_v(\tau)})\, dv$. With the corresponding exposure-weighted condition and the candidate set implied by Proposition 4, namely birth and eligibility-threshold dates under its curvature condition when $\nu > 0$ and interior roots included when $\nu < 0$, the same finite-envelope argument implies that $\underline{r}_P(\varphi,\Delta)$ is nondecreasing. This class restriction represents firms whose attainable size remains predominantly below the tilt pivot. Because the common model includes every cutoff before the horizon, the restriction requires the time spent above the pivot to be sufficiently short after duration weighting.

Growth and the threshold. For a nontruncated candidate with $T_{n^\star}^* \geq \Delta$, hold the marginal group $n^\star$ fixed and assume $T_N^* < T$. Let $s \equiv 1/g$, $a_j \equiv \ln K_j^*$, and $b_j \equiv r_P - R_j$, which increases

in j. The participation surplus is $A = -\Delta\,(R_0 - r_P) + \sum_{j=n^\star}^{N-1} s\,(a_{j+1} - a_j)\,b_j + (T - s\,a_N)\,b_N$. Summation by parts gives $\partial A/\partial s = -\,a_{n^\star}\,b_{n^\star} - \sum_{j=n^\star+1}^{N} a_j\,(b_j - b_{j-1}) < 0$. Thus slower growth lowers the participation surplus. Among firms with the same private cost of capital and marginal group, slower-growing firms cross the never-list threshold first. For $\varphi > \varphi_p$, the candidate is T^*_{p+1} and the derivative bracket becomes $\Delta - \sum_{j>p}(\beta_j - 1)\,\ell_j$. It is negative only when the above-pivot benefit exceeds the seasoning-period cost. Participation is therefore ambiguous beyond the pivot, and a firm that previously did not list re-enters only if the surplus crosses zero within the admissible range. □

B. Exposure drift

This section relaxes balanced growth, under which the firm's risky exposure is constant relative to investor wealth and expert capacity. Let $\nu \neq 0$ as in Assumption 2, so $R_n(t) = r_f + \lambda(t)\,(1 - \Theta_n)$. The condition $e^{\nu\Delta}\Theta_N < 1$ is substantive when $\nu > 0$. If it fails for a high-membership group, the curvature within that inclusion state changes and interior maxima can reappear. The restriction is mild for short seasoning periods but more demanding when relative exposure growth and anticipated passive ownership are both high. With exposure drift, the baseline first-crossing rule need not hold because the marginal value of delay can increase within an inclusion state and fall at an eligibility threshold.

Proposition 4 (Exposure drift)**.** *Maintain $e^{\nu\Delta}\,\Theta_N < 1$, automatic for $\nu \leq 0$, and let $\lambda(t) = \lambda_0\,e^{\nu t}$ denote the premium factor along the exposure path, with $\lambda_0 \equiv \gamma\sigma^2 x/A$. Then:*

(i) For $\tau \in (0,\, T - \Delta)$, away from eligibility-date kinks, the marginal value of delay is

$$\frac{d\ln V}{d\tau} \;=\; R_0(\tau) \;-\; R_0(\tau+\Delta) \;+\; R_{m(\tau)}(\tau+\Delta) \;-\; r_P \;=\; (r_f - r_P) \;+\; \lambda(\tau)\left[1 - e^{\nu\Delta}\,\Theta_{m(\tau)}\right], \quad \text{(B.1)}$$

which equals the required return at the end of seasoning, adjusted for the change in the unincluded required return over the seasoning period. The exposure removed at the listing date and the passive demand postponed to the end of seasoning are evaluated at different exposure levels. On the final seasoning interval, $d\ln V/d\tau = R_0(\tau) - r_P = (r_f - r_P) + \lambda(\tau)$. At $\tau = T - \Delta$, the slope jumps upward by $\lambda(T - \Delta)\,e^{\nu\Delta}\,\Theta_N$.

(ii) Within a membership segment, $d^2\ln V/d\tau^2 = \nu\,\lambda(\tau)\left[1 - e^{\nu\Delta}\,\Theta_m\right]$, and at every eligibility-threshold date the slope falls by $\lambda(\tau_n)\,e^{\nu\Delta}\,(\Theta_n - \Theta_{n-1})$. At $\nu = 0$, Proposition 1 is recovered. For $\nu > 0$, every interior stationary point on the main domain is a local minimum. Thus any listing maximum occurs at birth or immediately before an eligibility threshold, and the firm compares the best such date with never listing. Within each membership segment, the marginal value of delay rises over time because the public intermediation burden grows. The optimal threshold need not move monotonically with ν. For $\nu < 0$, the objective is concave on the main domain. Its maximizer is the first point at which the right derivative becomes nonpositive: birth, an eligibility-threshold date, the interior root $\tau_m^{\text{int}} = \nu^{-1}\ln\!\left[(r_P - r_f)/(\lambda_0\,(1 - e^{\nu\Delta}\Theta_m))\right]$ within a membership segment, or the seasoning boundary $T - \Delta$ if the derivative remains positive. Declining relative exposure can

therefore generate smooth interior IPO dates. An interior maximum may also occur on the final interval at $\tau_F = \nu^{-1}\ln\big[(r_P - r_f)/\lambda_0\big]$. *The global optimum compares the main-domain candidate, the final-interval candidate when it exists, and never listing. There exists* $\bar{\nu} > 0$ *such that the optimal policy coincides with the baseline for* $|\nu| < \bar{\nu}$. *Generic position keeps each baseline segment slope bounded away from zero, so no interior root appears and the finite-candidate ranking is unchanged. This local comparison holds* g, *the cutoff dates, and the inclusion structure fixed while* ν *varies through investor-wealth growth* g_W.

(iii) Under the switch, with $\bar{\lambda}(t) \equiv \gamma\sigma^2 x_t/\bar{A}$, $R_n(t;\varphi) = r_f + \bar{\lambda}(t)\,(1-\beta_n\varphi)/(1-\varphi)$ *and* $\partial R_n(t;\varphi)/\partial\varphi = \bar{\lambda}(t)\,(1-\beta_n)/(1-\varphi)^2$. *The signs in Proposition 2 therefore hold at every date. If every tilt is at most one, the public required-return path rises pointwise with* φ, *listing values fall, and the never-list region expands. For each* φ *away from the baseline's group-switching and participation thresholds, the optimal policy is unchanged for* $|\nu| < \varepsilon(\varphi)$.

(iv) Define the horizon-H public cost of capital embedded in the IPO price as $y_H(\tau) \equiv H^{-1}\int_\tau^{\tau+H}\mathcal{R}(v;\tau)\,dv$. *Define the passive share anticipated at the end of seasoning as* $\Theta^a(\tau) \equiv \Theta_{m^a(\tau)}$, *where* $m^a(\tau) \equiv \#\{n : T_n^* \le \tau + \Delta\}$ *is the membership count at that date. The IPO cost of capital depends on the duration-weighted exposure path:* $y_H - r_f = (\gamma\sigma^2/A)\,H^{-1}\int_\tau^{\tau+H} x_v\,(1-\Theta_{M_v})\,dv$. *If the horizon contains only the inclusion at the end of seasoning,*

$$y_H \;-\; r_f \;=\; \frac{\gamma\sigma^2 x_\tau}{A}\left[\,\frac{e^{\nu H}-1}{\nu H} \;-\; \Theta^a\,\frac{e^{\nu H}-e^{\nu\Delta}}{\nu H}\,\right].$$

As $\nu \to 0$, *this expression converges to* $y_H - r_f = (\gamma\sigma^2 x/A)\left[1-(1-\Delta/H)\,\Theta^a\right]$. *For* $H > \Delta$, *the loading on anticipated passive ownership remains negative. At a given* x_τ, *its absolute magnitude is larger than in the stationary case when* $\nu > 0$ *because passive demand absorbs a larger future exposure. The relevant empirical exposure measure is therefore contemporaneous exposure adjusted for growth over the pricing horizon, rather than contemporaneous float alone.*

Proof. **Part (i).** Write the passive share using the incremental representation $\Theta_{M_v} = \sum_n \theta_n\,\mathbf{1}\{I_n(\tau) \le v\}$, where $\theta_n = \Theta_n - \Theta_{n-1}$:

$$\int_\tau^T \mathcal{R}(v;\tau)\,dv \;=\; r_f\,(T-\tau) \;+\; \int_\tau^T \lambda(v)\,dv \;-\; \sum_{n=1}^{N}\theta_n\int_{I_n(\tau)}^T \lambda(v)\,dv\,.$$

Away from kink dates in $(0, T-\Delta)$, $I_n'(\tau) = \mathbf{1}\{n \le m(\tau)\}$ (Appendix A.3). Differentiating and using $\sum_{n\le m(\tau)}\theta_n = \Theta_{m(\tau)}$ gives $\frac{d}{d\tau}\int_\tau^T \mathcal{R}\,dv = -r_f - \lambda(\tau) + \lambda(\tau+\Delta)\,\Theta_{m(\tau)}$. Combining this expression with $d\ln V/d\tau = -r_P - \frac{d}{d\tau}\int_\tau^T \mathcal{R}\,dv$ yields equation (B.1). The middle form follows from $R_0(t) = r_f + \lambda(t)$ and $R_m(t) = r_f + \lambda(t)(1-\Theta_m)$, while the final form uses $\lambda(\tau+\Delta) = \lambda(\tau)\,e^{\nu\Delta}$. On the final interval $(T-\Delta, T)$, no inclusion occurs before the horizon, so $\mathcal{R}(v;\tau) = R_0(v)$ and $d\ln V/d\tau = (r_f - r_P) + \lambda(\tau)$. Relative to the left derivative at $T-\Delta$, where $m = N$, the slope increases by $\lambda(T-\Delta)\,e^{\nu\Delta}\,\Theta_N$.

Part (ii). Let $s(\tau)$ denote the derivative in equation (B.1) and define $B_m \equiv 1 - e^{\nu\Delta}\,\Theta_m > 0$. Within an open membership segment, $s(\tau) = (r_f - r_P) + \lambda_0\,e^{\nu\tau}\,B_m$, so $s'(\tau) = \nu\,\lambda(\tau)\,B_m$ has the

sign of ν. At an eligibility-threshold date τ_n, the slope falls by $\lambda(\tau_n)\, e^{\nu\Delta}\, \theta_n > 0$. At $T - \Delta$, it rises by Part (i). When $\nu = 0$, the slope is piecewise constant and Appendix A.4 applies.

For $\nu > 0$, any interior zero of s is an upward crossing and therefore a local minimum of $\ln V$. The final-interval slope is increasing, so that interval has no interior maximum. The upward jump at $T - \Delta$ also rules out a maximum at the boundary. Hence every listing maximum occurs at birth or immediately before an eligibility threshold, and the firm compares those values with never listing.

For $\nu < 0$, s decreases within each segment and falls at each kink, so it is nonincreasing on the main domain and $\ln V$ is concave there. The maximizer is the first point at which the right derivative becomes nonpositive: birth, an eligibility-threshold date, or the interior root of $\lambda_0 e^{\nu\tau} B_m = r_P - r_f$, namely $\tau_m^{\text{int}} = \nu^{-1} \ln\left[(r_P - r_f)/(\lambda_0 B_m)\right]$, when the root lies in group m's segment. If the derivative remains positive, the main-domain maximizer is $T - \Delta$. On the final interval, the slope $(r_f - r_P) + \lambda_0 e^{\nu\tau}$ is decreasing and may cross zero at $\tau_F = \nu^{-1} \ln\left[(r_P - r_f)/\lambda_0\right]$, which is an additional candidate. The global optimum compares the main-domain maximizer, the final-interval candidate when it exists, and never listing.

For local stability around $\nu = 0$, $\lambda_0 e^{\nu\tau} \to \lambda_0$ uniformly on the compact domain. By generic position, every baseline segment slope $R_m - r_P$, including the final-interval slope $R_0 - r_P$, is bounded away from zero. Hence for $|\nu|$ below some $\bar{\nu} > 0$, the slope retains its baseline sign in every segment, no interior root appears, and the strict baseline maximizer remains optimal by continuity. This comparison holds g, and therefore the cutoff dates T_n^* and listing sizes at the thresholds, fixed while ν varies through g_W. If g varies instead, the eligibility dates themselves change; only the identity of the optimal threshold is locally stable.

Part (iii). Under the switch, define $\bar{\lambda}(t) \equiv \gamma\sigma^2 x_t / \bar{A}$. Then $R_n(t;\varphi) = r_f + \bar{\lambda}(t)\,(1-\beta_n\varphi)/(1-\varphi)$ and $\partial R_n(t;\varphi)/\partial\varphi = \bar{\lambda}(t)\,(1-\beta_n)/(1-\varphi)^2$, so the signs in Proposition 2 hold at every date t. If every tilt is at most one, the required-return path rises pointwise with φ for every listing date. Each $V(\tau;\varphi)$ weakly falls while the never-list value is unchanged, so the never-list expansion argument in Appendix A.7, Part (iii), applies. The realized-date result is not needed here. For any fixed φ at which the baseline maximizer is strict, meaning away from group-switching and participation thresholds, the stability result in Part (ii) gives $\varepsilon(\varphi) > 0$ such that the baseline policy remains optimal for $|\nu| < \varepsilon(\varphi)$.

Part (iv). The result follows from $y_H = H^{-1} \int_\tau^{\tau+H} \mathcal{R}\, dv$ and $\mathcal{R}(v;\tau) = r_f + (\gamma\sigma^2 x_v / A)\,(1 - \Theta_{M_v})$. If the only inclusion within the horizon occurs at the end of seasoning and $x_v = x_\tau\, e^{\nu(v-\tau)}$, then $\int_\tau^{\tau+\Delta} x_v\, dv = x_\tau\,(e^{\nu\Delta} - 1)/\nu$ and $\int_{\tau+\Delta}^{\tau+H} x_v\, dv = x_\tau\,(e^{\nu H} - e^{\nu\Delta})/\nu$. Substitution gives the displayed expression because $(e^{\nu\Delta} - 1) + (1 - \Theta^a)(e^{\nu H} - e^{\nu\Delta}) = (e^{\nu H} - 1) - \Theta^a\,(e^{\nu H} - e^{\nu\Delta})$. Taking $\nu \to 0$ gives the stationary formula. Moreover, $\partial y_H / \partial \Theta^a = -\,(\gamma\sigma^2 x_\tau / A)\,(e^{\nu H} - e^{\nu\Delta})/(\nu H) < 0$ for $H > \Delta$ because $e^{\nu H} - e^{\nu\Delta}$ has the sign of ν. Finally, $(e^{\nu H} - e^{\nu\Delta})/(\nu H) = H^{-1} \int_\Delta^H e^{\nu u}\, du$ is increasing in ν and exceeds $(H - \Delta)/H$ when $\nu > 0$. □