Synergistic Content, Strategic Contracts: Optimal Licensing in Online Video Supply Chains with Platform-Produced Complementarities

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Abstract. This paper investigates how cross-content synergies between licensed programs and platform-produced content (PPC) affect the optimal licensing contract structure in the online video supply chain. A sequential-move Stackelberg game is formulated, wherein a content studio sets quality and a platform determines pricing under two contractual regimes: buyout and account-sharing. Two empirically motivated spillover parameters are embedded to capture (i) the demand boost from licensed content to PPC and (ii) the reverse spillover from PPC to the studio's portfolio. First, the studio's preference exhibits a structural break determined by the relationship between unit copyright fee and account-sharing parameters. When the unit copyright fee is relatively low compared to the account-sharing price weighted by consumer quality sensitivity, studios prefer account-sharing contracts in high-demand markets but favor buyout contracts in low-demand markets. When the unit copyright fee is relatively high, this preference reverses. The complementarity effects from platform content systematically reduce the market size thresholds required for account-sharing adoption. Second, the platform's choice follows a threshold rule where account-sharing becomes optimal when baseline market potential exceeds a critical level determined by production costs, account-sharing parameters, and copyright fees, all adjusted by complementarity strength. This demonstrates how backward spillovers make revenue-sharing attractive even at smaller market sizes. Third, supply chain efficiency exhibits non-monotonic behavior with respect to contract parameters, where complementarity expands account-sharing optimality regions while simultaneously amplifying buyout's inherent market-share advantages. Although account-sharing aligns incentives and maximizes total supply-chain profit under strong complementarity, its implementability remains constrained by frictions in per-video revenue attribution.

Keywords: Online video supply chain, platform-produced content, complementary effects, buyout contract, account-sharing contract, Stackelberg game

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1 Introduction

China's online-video market has expanded at a double-digit rate over the past decade. By mid-2020, the number of unique viewers had reached 888 million, equivalent to 94.5 per cent of the country's Internet population, while industry-wide revenue surpassed RMB 102 billion in 2019 (Data source: The 46th China Statistical Report on Internet Development). To sustain this momentum, leading platforms—among them iQiyi, Tencent Video and Youku—simultaneously license professionally produced programmes from independent studios and invest heavily in original, platform-produced content (PPC). Two contractual instruments dominate these licensing relationships: (i) a buyout contract, in which the platform pays an upfront, quality-contingent fee and retains all subsequent viewer revenue, and (ii) an account-sharing contract, in which the studio forsakes the upfront fee and instead receives a pre-negotiated share of realised revenue.

Empirical evidence indicates that the two content types are not demand-independent: a hit licensed drama increases viewership of the platform's proprietary variety shows, whereas a successful platform series rejuvenates demand for the studio's back catalogue. This bilateral demand spillover—hereafter referred to as the *PPC complementarity effect*—is reshaping how vertical partners select contractual governance structures. Despite its documented importance, the operations literature has yet to examine how such spillovers alter the relative attractiveness of buyout versus account-sharing agreements. Prior analytical work either restricts attention to one-shot buyout arrangements or treats licensed content as the sole demand driver, thereby precluding an assessment of complementarity-driven incentive realignment.

We bridge this gap by embedding two empirically grounded spillover parameters into a parsimonious two-stage Stackelberg game. A profit-maximizing studio (leader) chooses program quality; a monopolistic platform (follower) then sets the subscription price. The effective market potential, defined as the sum of baseline demand and total complementary effects, is shown to be the pivotal sufficient statistic governing contract selection. A closed-form threshold on this potential is derived that determines when the studio switches from buyout to account-sharing; an analogous threshold governs the platform's preference as a function of the per-unit copyright fee. Complementarity is shown to expand the parameter region in which account-sharing is optimal, yet it also amplifies the innate market-share advantage of buyout contracts. Although account-sharing theoretically maximizes total supply-chain profit by aligning quality and pricing incentives, its adoption is attenuated by practical frictions in per-video revenue attribution. To the best of our knowledge, this study is the first to provide quantitative guidance on how PPC complementarity reshapes contractual governance in vertically separated video supply chains.

2 Literature Review

2.1 Online Video Supply Chain Models

The choice of contractual structures in online video supply chains is a central theme in operations management. Seminal work by Armstrong (1999)[1] on pay-TV markets pioneered the analysis of payment structures, demonstrating that the choice between a lump-sum transfer and a per-subscriber fee is critical for the adoption of exclusive content. This insight has been extended to digital contexts; for instance, Kim and Mo (2018)[2] compared free versus paid distribution channels for digital video, showing that distributors favor free services when content value is low. Jiang et al. (2022)[3] emphasized the importance of end-to-end network intelligence optimization, underscoring the need for models that capture strategic interactions among supply chain actors. Collectively, these studies highlight that contractual governance in digital content supply chains is driven by the dynamic allocation of demand risk and revenue upside between creators and platforms. However, by overlooking the demand spillovers generated by PPC, these models preclude an analysis of how such complementarities systematically alter the relative attractiveness of buyout versus account-sharing contracts for both the platform and the studio.

2.2 Supply-Chain Optimization and Game-Theoretic Analysis

Game theory, particularly the Stackelberg framework, has become a standard tool for modeling sequential decisions—such as quality investment followed by pricing—in digital platform supply chains. Regarding coordination mechanisms, Song and Zhao (2022)[4] investigated supply chain coordination for e-commerce, comparing risk-penalty versus flat-rate contracts, which resonates with the incentive alignment challenge in video licensing. Further, research on contract design in adjacent fields, such as Kim et al.'s (2021)[5] study on online advertising deals and Jiang and He's (2021)[6] analysis of low-price guarantees in dual channels, highlights the critical importance of designing incentive-compatible mechanisms in complex market environments. This body of work establishes that decisions within video supply chains are strategically interdependent, necessitating a holistic optimization approach rather than a tier-by-tier one. Our paper contributes to this stream by incorporating PPC complementarity into a sequential-move game framework and deriving closed-form thresholds that govern the choice of contractual governance.

2.3 Platform-Produced Content and Complementarity

While user-generated content (UGC) has received considerable attention, professionally produced PPC remains relatively understudied in the operations literature. From an economic perspective, two products are complements when the consumption of one increases the marginal utility of the other. Applied to video platforms, successful PPC can attract subscribers and increase viewership of licensed content in the platform's catalogue, while a rich licensed library provides a larger audience base for PPC. This

is supported by Rong et al. (2019)[7], who found that accessible content resources are essential for enhancing user stickiness, with price playing a secondary role. Research like Yin et al. (2020)[8] on UGC investment and pricing decisions, though focusing on a different content type, highlights the relevance of network effects and investment synergies within a platform's ecosystem. Complementary studies, such as Wang et al. (2021)[9] on provision strategies under trial effects and Chi et al. (2021)[10] on pricing modes for short video platforms, further explore the impact of content strategy on platform performance. In summary, the complementarity perspective suggests that PPC is not merely an additional product line but a strategic asset that generates synergistic value for the entire content portfolio. Our study contributes to this emerging discourse by operationalizing this insight—embedding complementarity parameters into a formal supply chain model to quantify their impact on the optimal licensing contract structure, thereby addressing a clear gap in the literature.

3 Model

3.1 Players, Sequence, and Information Structure

We consider a vertical supply chain composed of a single risk-neutral studio (hereafter "the studio", denoted as S) and a monopolistic, risk-neutral platform (hereafter "the platform", denoted as P). The studio produces one video program whose quality $q \in \mathbb{R}^+$ is chosen once and is observable to both parties. The platform then distributes the program exclusively through a subscription service. The interaction unfolds in three stages:

Stage 1 (contracting): The parties agree on one of two licensing regimes—buyout (B) or account-sharing (A).

Stage 2 (quality): Under the selected regime, the studio chooses q and incurs convex cost $C(q) = cq^2/2$, where $c > 0$.

Stage 3 (pricing and consumption): The platform sets subscription price p, after which viewers decide whether to subscribe.

The platform incurs no marginal distribution cost. All parameters are common knowledge, and the solution concept is sub-game-perfect equilibrium solved by backward induction.

3.2 Demand with Complementarity

Let $\alpha \geq 0$ denote the incremental utility that the licensed program confers on the platform's PPC catalogue, and $\beta \geq 0$ the reverse spillover from PPC to the studio's outside products. Baseline market potential is $a > 0$. The market share of platform products is A, the market share of complementary products is B:

$$A = a(1 + \beta), B = b(1 + \alpha). \quad (1)$$

Maintaining the linear specification widely used in the operations literature, the demand function for the products of the film production company is D_1, the demand function for complementary products on the platform is D_2

$$D_1(p,q) = A - p + \mu q \ , D_2(p,q) = B - p \tag{2}$$

where the inequality $\mu < 1$ ensures price elasticity dominates quality elasticity, consistent with empirical estimates for digital-content markets.

3.3 Notation and Parameter Definitions

For brevity, Table 1 summarizes all notation. Superscripts B and A refer to buyout and account-sharing, respectively; subscripts S and P identify the studio and platform.

Table 1. Model symbols and explanations

Type	Symbol	Description
Decision variables	p	Subscription price charged by the platform
	q	Quality level chosen by the studio
Profit functions	Π	Expected profit under each contract
Buyout contract parameters	w	Unit copyright fee per unit of quality
Account-sharing parameters	U	Account-sharing price (fee per viewer paid by the platform to the studio)
Demand parameters	μ	Consumer sensitivity to quality ($0 < \mu < 1$)
	a	Baseline market potential
	b	Baseline demand for PPC
Cost parameters	c	Studio's cost coefficient for quality ($c > 0$)
Complementarity parameters	α	Licensed program's complementary effect on platform PPC
	β	Platform PPC's complementary effect on studio's other products

3.4 Buyout Contract

Under a buyout contract, the studio first commits to a quality level q^B and bears the associated production cost. Upon observing this quality, the platform acquires the exclusive broadcast rights by paying a linear copyright fee wq^B, where the parameter w reflects both the platform's marginal willingness to pay for quality and the weight placed on quality in the licensing contract. The platform subsequently sets the subscription price ps^B to maximize its own profit, knowing that all viewer revenues will accrue solely to it. Combining these elements with the demand function yields the following Stackelberg game structure.

$$\max_{q^B} \Pi_S^B = wq^B - (cq^2)/2 \tag{3}$$

$$\text{s.t. } q^B > 0$$

$$max_{p^B} \Pi_P^B = [a(1+\beta) - p^B + \mu q^B]\, p^B - w\, q^B + [b(1+\alpha) - ps^B]\, ps^B \tag{4}$$

$$\text{s.t.}\begin{cases} q^B=argmax\Pi_S^B(q^B) \\ p^B>0 \end{cases}$$

Solving by backward induction and from $\partial\Pi_P^B/\partial p^B=0$ and $\partial\Pi_P^B/\partial ps^B=0$, we obtain the optimal price p^{B*} ps^{B*}

$$p^{B*}=(a\ \alpha+\mu\ q+a)/2;\ ps^{B*}=(\alpha\ b+b)/2 \tag{5}$$

From $\partial\Pi_S^B/\partial q^B=0$, we obtain the optimal quality level q^{B*}.

$$q^{B*}=w/c \tag{6}$$

Substituting (6) into (5), we obtain the optimal pricing decision for the platform as follows:

$$p^{B*}=(ac\beta+w\mu+ac)/(2c) \tag{7}$$

Substituting equations (6) and (7) into the market demand function D^B, we obtain

$$D^{B*}=a(1+\beta)-(ac\beta-w\mu+ac)/(2c) \tag{8}$$

Correspondingly, the profit of studio is

$$\Pi_S^{B^*}=w^2/(2c) \tag{9}$$

The profit of the platform is

$$\Pi_P^{B^*}=[a^2c^2(\beta^2+b^2+2\beta+1)+2acw\mu(\beta+1)+2b^2c^2(\alpha+1)+\mu^2w^2-4cw^2]/(4c^2) \tag{10}$$

Online video supply

$$\Pi^{B*}=\Pi_S^{B^*}+\Pi_P^{B^*}=[a^2c^2(\beta^2+b^2+2\beta+1)+2acw\mu(\beta+1)+2b^2c^2(\alpha+1)+\mu^2w^2-2cw^2]/(4c^2) \tag{11}$$

Since the expectations and profits of the studio and the platform must be positive ($\Pi_S^{B^*}>0,\Pi_P^{B^*}>0$), and without loss of generality, let $0<w<w_u$, where, $w_u=\left[a\mu(\beta-1)-\sqrt{b^2(2c-\mu^2)(\alpha+1)^2+2a^2c(\beta+1)^2}\right]c/(2c-\mu^2)$.

3.5 Account-sharing Contract

Under the account-sharing contract, the studio first sets quality q^A and incurs the associated convex production cost $c(q^A)^2/2$. The platform then schedules the content and, after launch, remits a per-viewer fee U to the studio. Combining these elements with the demand function yields the following Stackelberg game structure.

$$\max_{q^A}\Pi_S^A=(a(1+\beta)-p^A+\mu q^A)U-\left(cq^{A^2}\right)/2 \tag{12}$$

$$\text{s.t. } q^A>0$$

$$max_{p^A}\Pi_P^A=(a(1+\beta)-p^A+\mu q^A)(p^A-U)+(b(1+\alpha)-ps^A)ps^A \tag{13}$$

$$\text{s.t}\begin{cases} q^A=\text{argmax}\Pi_S^A(q^A) \\ p^A-U>0 \\ p^A>0 \end{cases}$$

Solving by backward induction and from $\partial\Pi_P^A/\partial p^A=0$ and $\partial\Pi_P^A/\partial ps^A=0$, we obtain the optimal price p^{A*} and ps^{A*}

$$p^{A*}=(a\beta+a+U+q^R\mu)/2 \quad ps^{A*}=(\alpha\, b+b)/2 \tag{14}$$

From $\partial\Pi_F^A/\partial q^A=0$, we obtain the optimal quality level q^{A*}

$$q^{A*}=\mu U/2c \tag{15}$$

(15)

Substituting (15) into (14), we obtain

$$p^{A*}=(2ac\beta+\mu^2U+2U+2a)/(4c) \tag{16}$$

Substituting p^{A*} and q^{A*} into the demand function D^A, we obtain

$$D^{A*}=(2ac\beta+\mu^2U+2U+2a)/(4c) \tag{17}$$

Correspondingly, the profit of the studio is

$$\Pi_S^{A*}=U[4ac(\beta-1)-U(4c-\mu)]/(8c) \tag{18}$$

The profit of the platform is

$$\Pi_P^{A*}=\left[4U^2-8a(\beta+1)U+4(1+\beta)^2a^2+4b^2(\alpha+1)c^2-4U(U-a(1+\beta))\mu^2c+U^2\mu^4\right]/(16c^2) \tag{19}$$

The total profit of the online video supply chain is

$$\Pi^{A*}=\Pi_F^{A*}+\Pi_P^{A*}=[(2a^2(\beta+1)^2+4b^2(\alpha+1)^2)c^2-4U^2+2(U-2a(1+\beta))\mu^2cU+U^2\mu^4]/(16c^2) \tag{20}$$

The account-sharing contract is only valid when the video pricing is higher than the account-sharing price （$p^A > U$）, and both the film and television company and the video platform have positive expected profits and actual profits ($\Pi_S^{A*}>0, \Pi_P^{A*}>0$). Without loss of generality, let $U < U_u = 4ac/(4c-\mu^2)$ and $c > \mu^2/2$.

4 Analysis and Comparative Statics

In practice, the choice of online video supply chain model usually lies with the studio. By comparing the profit of the studio under the two contracts, we have the following proposition. Here, A_1 is the threshold that makes $\Pi_F^B = \Pi_F^A$.

Proposition 1 (Studio's Preference Under Different Market Conditions)

The studio's contract preference is determined by the relationship between baseline demand aa a and a critical threshold that depends on complementarity parameters and market characteristics.

(i) when $a > [(2c - \mu^2)^2 U^2 + 4w^2(4c - \mu^2)]/4c\,(1 + \beta)\,(-U\,\mu^2 + 2U\,c + 2w\,\mu)$, the buyout is optimal;

(ii) when $a < [(2c - \mu^2)^2 U^2 + 4w^2(4c - \mu^2)]/4c\,(1 + \beta)\,(-U\,\mu^2 + 2U\,c + 2w\,\mu)$, account-sharing is optimal.

The proposition emerges from comparing the studio's profit functions Π_S^B and Π_S^A. The critical insight is that the parameter w (unit copyright fee) creates a structural break in the studio's preferences. When w is high relative to the account-sharing parameters, the upfront payment under buyout becomes expensive, making account-sharing attractive in high-demand markets where the revenue-sharing upside compensates for the lack of guaranteed payment. Conversely, when ww w is low, buyout provides attractive guaranteed revenue, particularly valuable in uncertain demand environments. The complementarity effect $(1 + \beta)$ in the denominator shows that stronger backward spillovers reduce the threshold for account-sharing adoption, as the studio captures additional value from its portfolio through increased PPC-driven demand.

Proposition 2 (Platform's Contract Choice)

The platform's contract preference follows a threshold rule based on the effective baseline demand relative to complementarity-adjusted market parameters.

(i) When $a < [(4c - \mu^2)\,U^2 + 4w^2]/4c\,U\,(1 + \beta)$, buyout is optimal;

(ii) When $a > [(4c - \mu^2)\,U^2 + 4w^2]/4\mathrm{c}\ \mathrm{U}\ (1 + \beta)$, account-sharing is optimal.

This simplified form emerges under the condition that certain second-order interaction effects become negligible relative to primary market forces. The threshold $[(4c - \mu^2)\,U^2 + 4w^2]/4c\,U\,(1 + \beta)$ represents a break-even point for total supply chain value creation.

The numerator $(4c - \mu^2)\,U^2 + 4w^2$ captures the combined cost burden: the first term reflects the efficiency loss from quality under-investment in account-sharing (since $4c - \mu^2$ ensures the studio's quality choice remains suboptimal), while $4w^2$ represents the direct copyright cost under buyout. The denominator $c\,U\,(1 + \beta)$ represents the revenue-generating capacity scaled by complementarity effects.

When baseline market size (a) is small, the fixed costs of buyout become more attractive because the uncertain revenue streams under account-sharing may not compensate for the efficiency losses. As market size grows, the shared upside under account-sharing outweighs these inefficiencies, making variable revenue structures optimal. The $(1 + \beta)$ term shows how backward spillovers reduce the threshold, making account-sharing attractive even at smaller market sizes.

Proposition 3 (Supply Chain Efficiency Under Complementarity)

The total supply chain's optimal contract choice exhibits a non-monotonic relationship with the account-sharing parameter U, creating distinct regions of contract optimality.

(i) When $w < U\,\mu/2$:

if $a < [(4c^2 + 2c\,\mu^2 - \mu^4)\,U^2 + 4(\mu^2 - 2c)\,w^2]/4\mathrm{c}\ \mu\ (1 + \beta)\ (\mathrm{U}\mu - 2\mathrm{w})$, buyout is optimal;

if $a > [(4c^2 + 2c\,\mu^2 - \mu^4)\,U^2 + 4(\mu^2 - 2c)\,w^2]/4c\,\mu\,(1+\beta)\,(U\mu - 2w)$, account-sharing is optimal.

(ii) When $w < U\,\mu/2$:

if $a > [(4c^2 + 2c\,\mu^2 - \mu^4)\,U^2 + 4(\mu^2 - 2c)\,w^2]/4c\,\mu\,(1+\beta)\,(U\mu - 2w)$, buyout is optimal;

if $a < [(4c^2 + 2c\,\mu^2 - \mu^4)\,U^2 + 4(\mu^2 - 2c)\,w^2]/4c\,\mu\,(1+\beta)\,(U\mu - 2w)$, account-sharing is optimal.

This proposition results from comparing total supply chain profits Π^B and Π^A. The complexity arises because total efficiency depends on how well each contract aligns the incentives of both parties simultaneously. The critical parameter $w - U\,\mu/2$ determines the relative efficiency of the two contracts. When this difference is negative, account-sharing better aligns incentives in high-demand markets, while buyout is superior in low-demand situations. When positive, this relationship reverses.

Supply Chain Coordination Insights:

Incentive Alignment: Account-sharing contracts naturally align studio quality incentives with platform pricing decisions, as both parties share in the revenue upside. This alignment is particularly valuable when market potential is high and complementarity effects are strong.

Risk Distribution: Buyout contracts shift demand risk entirely to the platform while guaranteeing studio revenue. This arrangement is efficient when the platform has better risk-bearing capacity and when complementarity effects allow the platform to capture spillover value.

Complementarity Amplification: The factor (1+β) appears in all denominators, showing that backward spillovers systematically reduce the thresholds for account-sharing optimality. This occurs because β\beta β creates additional value that is naturally shared under account-sharing but fully captured by the platform under buyout.

The non-monotonic relationship with respect to market parameters reflects the complex interaction between risk-sharing, incentive alignment, and value capture in the presence of complementarity effects.

5 Conclusion

This paper develops a comprehensive analytical framework to understand how platform-produced content complementarity fundamentally reshapes contractual governance in online video supply chains. Through a sequential-move Stackelberg game incorporating bidirectional spillover effects, we derive precise threshold conditions that reveal when studios and platforms should optimally choose between buyout and account-sharing contracts.

Our analysis yields three principal insights with significant economic implications. First, the studio's contract preference exhibits a structural break determined by the relationship between unit copyright fees and account-sharing parameters weighted by consumer quality sensitivity. When copyright fees are relatively low, studios prefer account-sharing in high-demand markets but favor buyout arrangements in uncertain en-

vironments, with this preference pattern reversing when copyright fees are high. Second, the platform's decision follows a threshold rule where account-sharing becomes optimal when baseline market potential exceeds a critical level determined by production costs and complementarity strength. Backward spillovers systematically reduce the market size thresholds required for account-sharing adoption, making revenue-sharing attractive even in smaller markets. Third, supply chain efficiency exhibits non-monotonic behavior where complementarity expands account-sharing optimality regions while amplifying buyout's market advantages through risk transfer.

The derived threshold conditions offer actionable management insights for industry practitioners. Content studios can strategically cultivate complementarity through backward spillover channels, creating licensed content that drives viewership to their broader catalog and establishing cross-promotional partnerships to shift negotiations toward favorable revenue-sharing arrangements. Platforms should maintain buyout arrangements when copyright fees remain below critical thresholds to capture full spillover benefits while transferring demand risk, but anticipate renegotiation pressures as complementarity strengthens and consider proactive transitions to hybrid arrangements. For supply chain coordinators, our framework provides transparent decision rules for designing standardized revenue-sharing templates that maximize total welfare, revealing that industry efficiency requires coordinated complementarity-enhancing investments rather than unilateral strategies that may trigger unexpected value redistribution.

This study establishes that platform-produced content complementarity is a fundamental driver of vertical contract design in digital media supply chains. The precise threshold conditions enable data-driven contract selection that optimally balances risk allocation, incentive alignment, and value capture in the presence of cross-content synergies. As digital content industries evolve toward integrated ecosystems where licensed and original content reinforce each other, understanding these complementarity-driven governance dynamics becomes essential for sustainable competitive advantage and efficient supply chain coordination.

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