

**Exaptation dynamics and entrepreneurial performance:  
Evidence from the internet video industry**

Kenny Ching

*School of Management*

*University College London*

k.ching@ucl.ac.uk

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**Abstract**

This paper explores entrepreneurial strategy by analyzing the Internet video industry. Data on entrants to the Chinese Internet video industry from 2006–2011 reveal how those that adapt to shift in the environment outperform less flexible firms. The paper also shows how *exaptive* processes, including strategic commitment to user communities, increase resilience in start-ups that face such shifts. These findings introduce an expanded view of entrepreneurial strategy by directly linking strategic choice to venture performance and clarifying the role of exaptation in entrepreneurship.

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## 1 Introduction

In December 2006, YouKu.com officially went live. Together with similar firms, YouKu started as a clone of YouTube.com and sought to exploit China's *exclusion* of YouTube (and other foreign Internet video firms). These clones shared a common technological base, so they competed by offering different business features toward the end of becoming the dominant Internet video-sharing firm in China. YouKu began as a pure *user-generated content* (UGC) firm whose sole offering was content uploaded by Chinese Internet users, and it enjoyed quick success as the overall Internet video market in China grew rapidly. However, the UGC business model was severely challenged following regulatory changes mandated by the Chinese government in 2008. YouKu, like many other firms in the industry, was forced to change. Yet unlike many of its peers, YouKu decided to *retain* the UGC part of its operations even as it switched to offer *professionally produced content* (PPC) – that is, content licensed from traditional media producers such as TV and movie studios – as its main offering. From this petri dish of entrepreneurial competition, YouKu and a handful of other firms eventually emerged as winners. On 10 December 2010, YouKu.com was listed on the New York Stock Exchange; it was the world's first Internet video-sharing company with a successful initial public offering of stock (Hille, 2012).

YouKu's story is hardly unique; after all, the business world is replete with examples of firms that succeeded only after a series of adaptations. Conventional wisdom presumes that the emergence of a competitive advantage requires parallel developments of new and purposefully developed sets of capabilities or innovations that are tailored to a changing environment. Yet anecdotal evidence suggests that adaptation is not always

purposeful and that ex post successful features are often alternate uses of original functions. This process is known as *exaptation*, a concept borrowed from evolutionary biology. Exaptive features are typically produced by natural selection for a function other than the one it currently performs, which is then co-opted by the new function. In the management literature, the same term often refers to the exploitation of an existing body of knowledge so as to gain a competitive advantage in an emerging industry (see e.g. Cattani, 2005, 2006; Dew, Sarasvathy, & Venkataraman, 2004; Mokyr, 2000).

Building on this body of knowledge and extending it to the nascent literature on entrepreneurial strategy, our study documents how the most successful entrants in China's Internet video industry emerged. Despite an exogenous regulatory change that ran counter to the original business model of some firms, their retention of key features in the model gave them performance benefits when they pivoted to a new business model. Our proposed explanation is confirmed by regressions in which entrants are matched by entry timing, ownership, and performance characteristics prior to the regulatory change. This evidence suggests that, in the Chinese Internet video industry, the most successful firms leveraged capabilities gained from exaptive processes as their business strategies evolved.

This paper has three principal aims. First, it answers the call to identify appropriate methodological approaches for studying exaptation. Although formal modeling has been used to describe the dynamic of this phenomenon, researchers still face the challenge of devising ad hoc research strategies for documenting when and analyzing how exaptation occurs in real-world situations. Our presentation involves outlining a novel empirical approach to the systematic study of exaptive processes and

then demonstrating that approach through analysis of the Internet video industry in China, while leveraging an exogenous regulatory shock to address potential endogeneity related issues. We propose that longitudinal large sample studies of similar nature as ours can provide the appropriate research design for studying exaptation.

Second, in documenting that industry's growth and trajectory, our paper gives the first systematic and large-scale evidence of exaptive processes in the evolution of a nascent industry and also provides novel evidence of user communities serving as complementary assets. We demonstrate how early investment in building a user community plays a complementary but also "accidental" role in a website's eventual switch to offering professional content. That finding has broad implications beyond the context of this study as researchers seek to understand the strategic role of user communities (West & O'mahony 2008; Bogers, Afuah & Bastian 2010; Boudreau 2010).

Third, we aim to disentangle the roles of luck and foresight in shaping entrepreneurial performance. In documenting the emergence and growth of a nascent industry, we show how selection and adaptation processes as well as luck play key roles in determining the success of individual entrepreneurial firms. In so doing, we also provide evidence that exaptation does not occur only within the context of technology, but also more broadly at the complementary assets level.

The paper is organized as follows. Section 2 elaborates the intellectual and empirical bases of this research. Section 3 describes the empirical setting and our research approach, which includes a novel method for studying exaptation. After reviewing how the Chinese Internet video industry developed and advancing our propositions in Section 4, in Section 5 we present the main empirical analysis along with

key robustness checks. The paper concludes in Section 6 with further discussion of our main findings and of their broader strategic implications for entrepreneurs and researchers both.

## **2 Theory and related literature**

### **2.1 Role of strategic adaptation and exaptation**

Much scholarship has concerned itself with the life cycle of an industry; measures of interest include (inter alia) the number of firms, the rates of entry and exit, and differences in performance and innovative activity. With regard to the entry of firms, evolutionary economics and strategy have been invoked in much of the literature that links the performance outcomes of entrants to their pre-entry resources and capabilities (Helfat & Lieberman 2002; Klepper 2002; Bayus & Agarwal 2007). Although this view helps us connect technological pre-determinants with the devising and execution of business models, it fails to account for industry dynamics and strategic shifts.

Ignoring firm adaptation and change is a critical omission because in highly uncertain environments – which are typical for emergent or nascent industries – few firms know *ex ante* what will become the dominant technology or business model. There will always be some who argue that breakthrough businesses are characterized by a single type of strategy and a preferred model of business selection and execution should be followed whenever feasible. Even so, the vast majority of practitioners and academic researchers in strategy hold that a strategy should reflect and respond to the environment in which the firm or organization operates (see e.g. Marx, Gans & Hsu 2014).

The literature just cited has increased awareness of the role played by change in the development of firm strategy. However, the distinction between conscious adaptation and exaptation has been largely overlooked. One reason for this oversight is the predominance of neo-Darwinian perspectives in management thinking, which has focused on the development of new strategic functions to improve environmental fitness – a process that depends on the proactive aspect of adaptation (see e.g. O'Reilly & Tushman, 2008; Thompson, 2011). The literature on exaptive processes is much smaller but has become increasingly influential. One line of inquiry in the innovation literature focuses on the interaction between exaptive and adaptive processes. Bonifati (Bonifati, 2013) argues that exaptation may lead to “degeneracy”, a property whereby structurally different elements provide overlapping functionalities and thus (as with adaptive processes) result in firms developing new functionalities. This theme is repeated in Lane (2011), who develops an adaptive–exaptive model of innovation (called “exaptive bootstrapping”) that is based on technology adoption and incorporates not only technological but also organizational and societal considerations. Even more broadly, Dew et. al. (Dew et al., 2004) noted how exaptation serves as a missing but central concept linking the evolution of technology with the entrepreneurial creation of new markets and the concept of Knightian uncertainty.

Another line of literature seeks to link a firm's exaptive processes directly to its competitive advantage. In a series of papers, Cattani (2005, 2006) instructively demonstrates how Corning's supremacy in the fiber optic industry is due to capabilities it developed *prior* to the emergence of that industry. The author shows that Corning's success results at least in part from their foresight in developing capabilities that they

could “recycle” even as they expanded into new domains. Together with Dew et. al. (Dew et al., 2004), Cattani’s work remains the main empirical bulwark upon which this burgeoning literature has rested, although larger-scale empirical work has been slow to follow.

Clearly, this broad exaptive mechanism – of a firm developing capabilities which are repurposed – should be an important one for scholars and practitioners alike, and we argue that the mechanism is one in which entrepreneurs should be especially interested. Volatile industrial settings coupled with resource shortages require entrepreneurs to stay nimble and experiment. In fact, scholars have characterized entrepreneurship as the act of performing “economic experiments” (Rosenberg, 1992). This theme is echoed in the broader stream of practitioner literature, which emphasizes the importance to entrepreneurial firms of conducting strategic experiments and so developing capabilities that can be leveraged in the future (McGrath, MacMillan, & Venkataraman, 1995). When one considers also how uncertain is the entrepreneurial process (e.g., the true value of a particular idea is most likely unknown to the entrepreneur), exaptive mechanisms are no less important than conscious adaptive mechanisms.

Yet there have been few studies examining the relation between an entrepreneurial firm’s capabilities and strategic change, and what limited research can be found is mainly of a theoretical nature. Greater clarity is needed concerning the origins of an entrepreneurial firm’s competitive advantage, since the role of strategy is fundamental to our understanding of the entrepreneurial process. The concept of exaptation can actually be extended to bridge the gap between advocates of “selection” versus “adaptation” while clarifying the roles of luck and strategy in the evolution of nascent



industries. It could well be that the most successful firms are those that developed key capabilities before changing business models – even though the *current* applications of those capabilities were previously unknown.

Our field work serves as the basis for distinguishing the roles that luck and strategy play in entrepreneurship, and we also borrow and extend Cattani's (2006) original conception of *pre-adaptation*: the part of a firm's knowledge base that is accumulated without anticipation (foresight) of all its possible subsequent uses, as when it later proves valuable for new (but previously unknown) applications. We argue that entrepreneurial firms can be endowed by their past history with knowledge for reasons unrelated to the application of that knowledge in a new setting or opportunity. In so doing, we demonstrate that the exaptation concept can help resolve the debate over the precise role of strategy in entrepreneurship. Extending Cattani's claims about the role of technological pre-adaptation, we similarly argue that it is exactly when entrepreneurs are *least* certain about the environment that they are most in need of developed capabilities that can be repurposed.

That being said, the precise effects of luck, foresight, and strategic change on entrepreneurial strategy are not easy to estimate. The paucity of empirical studies may be explained by the difficulty of observing a nascent industry from its inception while accounting fully for the contemporaneous strategic choices of entrants as well as the ultimate outcomes. Furthermore, one would want to accommodate the potential endogeneity of strategic decisions by way of some exogenous source of variation associated with a subset of firms that change their business model or strategy. Finally, the ideal empirical design for studies of this nature should also establish that the focal firms

are pursuing a common entrepreneurial opportunity; otherwise, there may be concerns that the sampled firms are not well identified. In the next section, we describe our approach to assembling a data set in which the consequences of both adaptive and exaptive processes can be reliably assessed.

### **3 Empirical setting and data**

#### **3.1 The Chinese Internet video industry**

Although existing studies (see e.g. Gans & Stern, 2003; Hsu, 2006) have contributed much to our understanding of entrepreneurial strategy, they seldom account for potential differences in the opportunities being exploited by entrepreneurs and so have difficulty isolating the effect of strategic choices. The problem is that variation among firms pursuing the focal entrepreneurial opportunity may bias results owing to systematic correlation with explanatory variables. These studies have typically sought to overcome such bias, which arises from unobserved heterogeneity, by using industry- and firm-level controls. That approach can be effective in settings where firms are easily distinguished by such observable characteristics as products and use of resources. However, control variables are of limited value when studying entrepreneurial companies in emergent industries because usually such firms neither fit well into prevailing industry categories nor possess easily observable characteristics.

The fundamental empirical challenge is therefore an identification problem: we risk conflating the marginal effect of the firm's strategic choice with the selection effect of the underlying entrepreneurial opportunity. Therefore, a simple comparison between

different strategic choices could lead to biased results because of unobserved differences in the potential of various entrepreneurial opportunities. The ideal solution to this problem would be an empirical setting in which there are multiple new ventures exploiting the same entrepreneurial opportunity; moreover, one would want to follow the full population of entrants – starting with the industry’s inception – and to have detailed data on both strategic choices and ultimate outcomes.

We most fortunately have access to just such a setting: the entrepreneurial development of China’s emerging Internet video industry. China practices an active policy of Internet censorship and so foreign websites are frequently blocked there,<sup>1</sup> with video websites such as YouTube among the most frequently censored. The system blocks content by preventing – via firewalls and proxy servers – censored websites’ “Internet protocol” addresses from being routed through. China also diverts Internet traffic from particular sites by way of so-called DNS spoofing hacks. In addition to other online video websites (e.g., Dailymotion and Vimeo), YouTube has been completely blocked from the Chinese Internet space since early 2006.

An unintended but extremely useful consequence of China’s tight Internet censorship is that it provided a fertile ground for the development of China’s *domestic* Internet video industry. Entrepreneurs exploited the exclusion of foreign Internet video firms from the Chinese market and copied the technological idea (which originated in the United States) of distributing videos over the Internet; the result was a deluge of strongly similar “clones” emerging in the Chinese Internet video industry. We leverage this unique entrepreneurial development to identify precisely a set of firms that are exploiting a common entrepreneurial opportunity – namely, that of building China’s dominant

Internet video platform.

In general, the phenomenon of Chinese clone companies, popularly referred to as “copy to China” (or “C2C” for short) has attracted increasing academic and popular attention.<sup>2</sup> As the Internet industry continues to grow rapidly in China, many domestic companies have successfully exploited entrepreneurial ideas originally developed in foreign markets. Aided by the country’s rigorously enforced censorship policy, the Internet video sector is one of the most prominent beneficiaries of this C2C phenomenon. And because the original entrepreneurial opportunity originated in the United States, we are able to preclude “founder effects” from the analysis and so can directly assess the effects of strategic covariates.

### **3.2 Empirical data**

This study is based on a newly assembled set of data on the Chinese Internet video industry; this data set covers that industry’s development from its inception (in about 2006) through mid-2011. Working in conjunction with the major telecommunication providers in China, we developed a complete list of active Chinese online video websites. Anecdotal evidence suggests that the industry may have become active slightly earlier, but Chinese authorities did not start keeping tabs on it until 2006. We augmented the list after referring to various works in the practitioner and industry literatures (e.g., Gannes 2009). Any video websites not on our final list are likely to be obscure or unregistered with the state, which in itself casts doubt on their legitimacy.

We then collected the historical cached pages of each firm on our list using the Internet Wayback Machine, which is an initiative started by the Internet Archive (a

nonprofit organization based in California, USA) and maintained with content from Alexa Internet. This service enables users to see archived versions of Web pages across time. Together with research assistants, we coded each Web page individually by direct observation and categorization; for each website, we recorded data that delineate their specific bundles of content, activities, and resources. Because many of these firms underwent rapid changes in business models, we collected and analyzed data by each quarter of the year. Altogether, we recorded data for 19 quarters, from July 2006 to March 2011.

The Internet Wayback Machine allows us to examine contemporaneous business model changes as well as the survival or failure of firms, but additional measures of interim performance are needed. We therefore obtained interim outcome variables from Baidu Index. Baidu Index is analogous to Google Trends, and records interest and search volume for individual websites. Google Trends data has been utilized successfully to measure performance for Internet based firms as it directly relates to online behavior (see e.g. Carrière-Swallow & Labbé, 2013; Luo, Zhang, & Duan, 2012). We also supplement Baidu Index data with data from iResearch, a research consultant firm in China. The iResearch firm is a commercial media consultancy that has tracked Chinese website performance and Chinese Internet users' behavior continuously since July 2006, when the service was launched. This consultancy performs functions similar to those of its US counterparts – most notably, ComScore. Firm names were matched manually to the original list at a success rate of nearly 100%. In all, 146 firms are observed in our data set.

We also collected qualitative data about how organizations responded to regulatory change and on how they made decisions concerning business models and strategy. Detailed schematics of the organization of video websites across the entire spectrum of content purveyors were reviewed with industry founders, insiders, and media analysts to ensure that we understood changes made in the business models. This background work enabled a careful determination of the nature of business model change and its effects on organizational performance. Semi-structured on-site field interviews with founders, investors, and media consultants in China were conducted in two waves over the period from April 2012 to July 2013. We conducted a total of 19 interviews, each of which lasted between one hour and an entire workday. Whenever possible, we crosschecked data with multiple sources.

#### **4 A qualitative review of development in the Chinese Internet video industry**

This section describes the dynamics of entrepreneurial competition in the Chinese Internet video industry as it unfolded over time. The first period (2006–2008) is one immediately after YouTube was introduced in the United States; the second period (2008–2011) was marked by radical regulatory change in China that invalidated the business model of some of this industry's firms. We shall focus on examining the role (if any) played by exaptive processes in the success of firms under these circumstances.

##### **4.1 Contest of business models (2006–2008)**

Although the Internet video industry originated in the United States, developments in

China took place nearly in parallel. Entrants to the nascent Chinese industry grappled with developing the optimal business model as they sought to become the country's dominant Internet video platform. In particular, there was a fierce contest between the UGC and PPC models (Artero 2010).<sup>3</sup> As mentioned in the Introduction, firms operating under the user-generated content model rely on content sourced directly from users whereas those operating as a professionally produced content purveyor rely on content purchased from content providers (e.g., television and movie studios). In the United States, YouTube is the original UGC firm and Hulu exemplifies the PPC model.

Although many Chinese sites began as pure clones of YouTube and thus offered only UGC, competing sites that focused on offering PPC emerged rapidly. Field interviews attest to the dichotomous nature of these two forms of content and to how they remain the dominant business models competing in this industry. A co-founder of a successful video site described their differences as follows:

*UGC and PPC are the two distinct forms of content ... UGC is content sourced from users while PPC is content pushed to users. YouTube popularized UGC but PPC had rapidly emerged as another form ... The state stations had been putting content on the Web for some time. Other private companies also started licensing material and putting [it] on the Web ... for example, Korean drama serials and Taiwanese variety shows.*

Although the UGC and PPC business models are based on the same technological platform,<sup>4</sup> they represent two distinct modes of firm operation. In particular, maintaining

a UGC site requires development of the specific capabilities required to support a viable user community. Thus UGC websites must develop infrastructure to enable the uploading and publishing of content by users while also providing incentives to encourage production and contribution of that content (Milliken & O'Donnell 2008). In addition, UGC websites must curate the content in an arrangement that lends itself to effective marketing; hence such sites must develop the ability to interpret uploaded content so that it can be properly classified at the outset (Villi, Moisander & Joy 2012).

These infrastructural capabilities – namely, supporting a user base and curating the content – demand significant investment by the firm, in terms of both financing and time, if its UGC operation is to remain viable (Bharadwaj et al. 2013). An executive at a PPC site added this perspective:

*UGC is a problematic area that we did not want to pursue ... it is not enough to just host any material, so you need to develop ability to understand the content ... [PPC] is simpler and more focused.*

So in contrast to UGC sites, PPC sites operated on the relatively simple basis of paying original providers for content and then streaming it. Little or no investment is required to develop a user base, nor is any investment needed for content analysis or curation. Instead, PPC sites simply relay television or movie content that has been previously broadcast. In short, UGC and PPC sites rely on completely different sets of capabilities to support their business models. Prior research on the economics of Internet-based entertainment services point to similar dynamics (see e.g. Sherman & Waterman,



2014).

#### **4.2 Regulatory change**

A quasi-exogenous event radically changed the competitive landscape just described. On 31 January 2008, China's SARFT and Ministry of Information Industry (MII) introduced *Regulations for Online Audio and Video Services*, effective immediately.

The new regulations named SARFT as the authority to administer, monitor, and regulate the industry's development. The regulations also required all online audio and video service providers to apply for an “Online Audio-Visual Broadcasting License”, with applicants agreeing to be governed by a standardized content-censoring system, receive funds only through approved sources, and to employ “standardized technology” (Bristow, 2010).

Furthermore, broad powers were conferred or transferred to those regulatory bodies and also to the major (mainly state-owned) media producers. These entities were now authorized to police and censor content found on all Internet video sites, and they focused in particular on censoring UGC sites. For example, regulations required all UGC websites to delete any illegal or undesirable content immediately upon finding it, to keep a record of such actions, and to report all details thereof to the relevant authorities. Any violator was subject to having its operating license rescinded and paying a penalty of as much as RMB 30,000 (US\$5000).

The effects of these changes were profound. In essence, the new regulations severely curtailed the effectiveness of UGC as a business model. Hence sites began to focus on transitioning toward offering PPC. Interviewees referred often to how the 2008

regulatory changes affected the industry and forced them to adapt – and also to how sudden and unanticipated the change was. As recalled by the co-founder of a previously pure-UGC site:

*The 2008 regulations really changed the market ... it isn't so much that we were hosting illegal content ... but the threat is scary. We hear tales of competitor sites being pulled off-line for hosting undesirable content ... it really forced us to start thinking about alternative business models.*

Figure 1 shows the distribution of sites in terms of the two models – UGC and PPC – from 2006 to 2011. Time is represented in units that indicate the number of quarters from the firm's earliest entry in the data set. For instance, time "1" (on the figure's horizontal axis) corresponds to the third quarter of 2006. Starting in 2008 (at about time "7") the distribution skews sharply toward PPC, in line with our expectations following the aforementioned regulatory change. Figure 1 also depicts the overall population density (i.e., number of active websites) over time. The graph reveals that, soon after the regulatory change, there was a massive shakeout in the industry before the number of new entrants began to pick up again.

**[[ INSERT Figure 1 about Here ]]**

We leverage this event as an exogenous source of variation toward the end of identifying two distinct commercialization environments. Because UGC as a business

model was severely hampered by central regulatory changes, such sites were under pressure to adapt by offering PPC. In other words, regulatory change provided an exogenous source of variation in incentives for the subset of UGC-only firms to alter their business model. Thus we take advantage of this watershed event not only to study the performance effects associated with a firm's changing of its business model but also to explain how both adaptive and exaptive processes are involved in the industry's development.

### **4.3 Propositions regarding the role of exaptation**

Internet video firms were faced with clear choices after the regulatory change. For firms that had been practicing a pure-PPC business model, there was no ostensible reason to replace or even modify their existing business model. The UGC firms, however, faced distinct choices. They could plausibly choose to “stay the course” and continue offering only user-generated content. Alternatively, they could change their business model and begin to offer professionally produced content. Although firms that began with an UGC business model were disadvantaged in the post-regulatory change environment, their initial foray into the UGC world may have allowed them to develop capabilities that they could later – though unexpectedly – leverage while moving away from their original business model.

Casting the users of a video-sharing firm as complementary assets (Teece 1986; Gans & Stern 2003) allows us to develop the main prediction explored in our quantitative analysis. In the new PPC model, previously UGC sites were plunged into expensive battles to secure licensed content to stream. By 2009, barely a year post-regulatory

change, YouKu was paying well over US\$50m a year in licensing fees to secure PPC content from movie studios and TV stations (Montlake 2012). Furthermore, much of this content could not be purchased on an exclusive basis, unless fees were increased dramatically. This led to sites being distinctly undifferentiated as they offer highly similar content from site to site (Epstein, 2010). Together with Chinese audiences' unwillingness to pay for content, the video firms were in a bind as to figuring out ways to alleviate competitive pressure while staving off depleting cash.

It became clear that firms needed to find a way to beat back the pressure while distinguishing themselves from the pack. Around 2009, certain firms started transitioning from being pure repositories of licensed video content to producing the content.<sup>5</sup> While they continued to license popular content from studios, they started investing in production capabilities and sponsoring artistes to develop content that they owned exclusive license to. This was done for two main reasons. First, it gave Internet video firms a potential way to distinguish themselves from the pack, as the self-produced content by construct will be exclusive. Second, it also gave them a plausible means to not only reduce content acquisition costs by also to earn additional revenue as being the copyright holders; they can then license the content out to other firms should it prove popular. The content produced was popularly referred to as *Self Created Content (SCC)*, to distinguish it from normal PPC.

Finding the creative talents to produce the content is not immediately straightforward. However, UGC sites with their existing user base – which have been uploading content previously – may be able to leverage the amateur film makers as content producers as the firms switch towards producing content. In other words, users

could serve as complementary assets in the production of self-created content. As recalled by the VP of operations at a major UGC site:

*We suddenly found ourselves with access to users who may have ability to create content, many [of whom] are part of the artistic young... we started engaging them to help us produce professional content that we can license.*

Nevertheless venturing into the world of content *production* also carries with it significant risk as the content needs to conform to SARFT rulings and regulations.<sup>6</sup> UGC sites however, should have had significance experience (and expertise) in dealing with SARFT. The potential availability of users as content creators and the experience of dealing with censors, could serve as accidental yet unforeseen assets to enhance delivery of their new business model as producers of content. These potential capabilities and complementary assets, which derive from supporting and engaging users, lead one to hypothesize that entrants who successfully transitioned from a UGC to a PPC model will outperform those that offered only PPC – and so neither invested in users nor benefited from their value as assets.

In sum: the exaptive process of repurposing assets (here, connections with users) for a new scenario (here, offering SCC) may explain the superior performance of initially UGC firms as they pivot to offering PPC.

## **5 The role of exaptation: Quantitative data analysis**

To supplement the preceding qualitative review and propositions, we now undertake a range of empirical analyses that relate the choice of a business model to later firm

performance. The story presented here is a long and rich one that includes several industry shifts and changes. The focus in this paper is on understanding the effect of strategic change on the firm's subsequent performance. Toward that end, we perform regressions in the contexts of firms that ultimately failed (by testing for across-firm variation in outcomes) and of firms' interim performance as measured by number of visits (within-firm variation over time).

## 5.1 Variables

For our main explanatory variables, we coded the content offered by each firm. The content type we coded corresponded to what was offered in the quarter for which that type was observed in the cached webpage. Thus, quarter by quarter, firms offering content sourced exclusively from users (YouTube's original model) were coded as "UGC" while firms offering content licensed from TV studios and other professional content providers (Hulu's original model) were as "PPC".<sup>7</sup>

When analyzing firm performance, we examined both interim performance and firm survival. For our *firm survival* analysis, the primary outcome variable was coded from measures of failure. Going off-line for six or more consecutive months was coded as a *Fail* (i.e., not surviving). Websites that came back online after an extended period of dormancy were few in number: among all sites that went off-line for at least six months, less than 15% were eventually restored. Our results are robust to the exclusion of these sites.

For our analysis of the *interim performance* of Internet-based start-ups, traditional financial measures (profitability, liquidity, cash flow, net worth, etc.) are usually not

available. So instead of using a more typical measure of financial performance (e.g., stock market returns), we use search volume for the focal website as measured by Baidu.com. Search volume and other related measures of public interest have been used extensively as a proxy for users' behavior, which ultimately determines firm performance (e.g. Carrière-Swallow & Labbé, 2013); our analysis uses the natural logarithm of the public interest index recorded by Baidu.com. Additional website metrics we collected from iResearch, which include the average time a viewer spends watching each video, will help in our robustness checks.

Our models include controls for both initial conditions and subsequent competition between the websites. Regarding initial conditions, we exploited the unusually rich institutional environment of China to control for the ownership type of websites. Ownership type is acknowledged to be a key institutional factor because it indicates the avenues through which a government can exercise control, thus affecting the firm's choice of competitive position and subsequent performance (Tan, Li & Xia 2007). Much like other sectors in China, the online video industry features ownership structures ranging from pure private start-ups to state-owned ventures. We use the *State* indicator variable to mark firms owned by the Chinese government.

For firm characteristics we collected a list of venture capital (VC) investment events, which are publicly reported via China-specific investment media. In this way we created an indicator variable, *Invest*, that signifies whether or not the focal firm has any VC investors. Because most of these firms are private, additional firm-level data (e.g., employment count) were not publicly available. Finally, we also used our estimations to model competitive dynamics. Doing so required that we control for the number of active

websites in each time period – a measure of population density, which has been shown to correlate with firm failure (Carroll & Hannan 1989). This number is our *Number of active firms* variable.

## 5.2 Estimation strategy

We first estimate a discrete-time survival model for change in the post-regulatory period.<sup>8</sup> First, we define an indicator variable,  $UGC\_initially_i$ , to mark all firms that started with the UGC model. Finally, we use the indicator variable  $PPC_{i,t}$  to signify an offering of professionally produced content by firm  $i$  in quarter  $t$ ; this variable is set to 1 if the firm offers PPC during that quarter of observation (and set to 0 otherwise). Our main variable of interest is the interaction between  $UGC\_initially_i$  and  $PPC_{i,t}$ . In other words, we seek to measure how firms offering PPC in the new competitive environment differ as a function of their initial strategy.

Formally, we specify:

$$\ln[p_{i,t}/(1 - p_{i,t})] = \alpha + \beta_1(UGC\_initially_i) + \beta_2(PPC_{i,t}) + \beta_3(UGC\_initially_i)(PPC_{i,t}) + \gamma(X_{i,t}).$$

We repeat the same analysis for our interim performance measures. Because we use firm-level fixed effects in our specifications, time-invariant factors such as  $UGC\_initially_i$  are absorbed. Formally, we specify:

$$Y_{i,t} = \alpha + \beta_1(PPC_{i,t}) + \beta_2(UGC\_initially_i)(PPC_{i,t}) + X_{i,t} + \Omega_i + \varepsilon_{i,t}.$$



Yet the choice of a business model, like any strategic decision, is generally endogenous; that characteristic makes it difficult to establish the direction of causality between performance and strategic choices. Although the dramatic shift in regulatory environment lends more confidence than usual to the supposition that strategic choices affect performance (and not vice versa), there remain justifiable concerns about the possibility of significant imbalances among the different groups of firms. To allay these concerns, we performed a “coarsened exact match” (CEM) procedure (Iacus, King & Porro 2012) to identify a control for each “treated” firm. In our setup, the treatment group consists of sites that started with a pure-UGC strategy but later (after the new regulations) adapted by offering PPC; the control group is made up of sites that started with a PPC strategy. We identified controls based on the following set of covariates: quarter of the firm’s entry, its ownership type, and the number of visits during the four quarters *preceding* the regulatory change in January 2008. We then coarsened the joint distributions of these covariates by deciles, a process that involved grouping firms in terms of their performance under the old regime (i.e., prior to the new regulations). Thus we were able to match 18 of the 22 treated firms.

Following this exercise, our analysis focused on determining whether firms that retained features from their original, pure-UGC business model exhibited performance superior to firms that abandoned UGC upon offering PPC. In evaluating that hypothesis, we employ much the same specifications in performing regressions on subsamples of the data set. The results of these regressions will yield insight into the exaptive processes motivating this study.

All our variables are listed and described in Panel A of Table 1. Descriptive statistics of the variables – and the correlations among them – are given in Panel B.

**[[ INSERT Table 1 about Here ]]**

### **5.3 Regression results**

We start by looking at firms that began with the pure-UGC model and switched by adopting PPC. We wish to explore how this strategic adaptation is related to subsequent firm performance. First, we examine descriptive statistics of the strategic change by firms.

**[[ INSERT Table 2 about Here ]]**

Table 2 shows the morphology of firms after the regulatory change in 2008. In line with our expectations about the new environment, nearly 40% of all firms that started with a pure-UGC business model began to offer PPC after the regulatory change. In Table 3 we present discrete-time regression results concerning the strategic shifts in business models and how they relate to business failure.

**[[ INSERT Table 3 about Here ]]**

The results are interesting. Column (3) of the table shows that, on average, firms that began as pure-UGC sites yet later offered PPC were *less* likely to fail. In other

words: sites whose pure-UGC model became disadvantaged by the new regulations were, if they subsequently offered PPC, more successful than other sites. In column (4) we now consider the period after the regulatory change. In column (4) we repeat the analysis but only for firms that entered the industry prior to the regulatory change; the results are similar, although we lose some statistical significance.

In column (5) of Table 3 we now change our baseline firms to perform a stricter test. We drop firms which stayed as pure UGC sites throughout from the sample. In other words, the baseline firms are now those that both began and continued as PPC sites. This refinement is important as it helps us isolate the performance effect of the strategic transition, since these firms – targeted by the regulatory change – are expected to fail and hence may cause our results to be biased upwards.<sup>9</sup> As expected the magnitude on our coefficient of interest is smaller, yet it remains statistically significant. In other words, sites which transition to offer PPC were *more* successful than sites that never offered anything but PPC.

Finally in column (6), we repeat our analysis but now with the CEM sample. Despite considerable statistical power being lost because of the smaller sample, the data trends are similar to those observed previously. Firms that started with an initial UGC strategy – when matched in terms of entry timing, ownership, and previous quarters' *Interest* levels – still fail at a substantially lower rate than do firms that started with an initial PPC strategy. According to our results, firms that began by using the subsequently disadvantaged UGC business model but that switched to offering PPC were associated with significant performance gains in comparison with firms that were not required to switch their business model.

**[[ INSERT Table 4 about Here ]]**

We now turn to analyzing firms' interim performance. The results of our firm fixed effects regressions, shown in Table 4, are in line with our earlier survival analysis. In column (2) of the table we see that, among PPC sites after the new regulations, those that began as pure-UGC sites and transitioned to also offering PPC enjoyed a 30% increase in (log) *Interest* relative to baseline sites; this result is significant at the 5% level. In column (3) we repeat the analysis but only for firms that entered the industry prior to the 2008 regulatory change; the results we obtain are similar. In column (4) the analysis was conducted using a conditional fixed-effects negative binomial regression on the non-logged *Index*. The results exhibit a consistent pattern: the coefficient for the  $UGC\_initially \times PPC$  interaction term remains consistently positive and significant. Column (5) repeats this analysis by dropping sites which stayed as pure UGC sites; Column (6) uses the CEM matched sample of firms. Just as with survival analysis, the same trends continue to hold.

Overall, these regression results confirm what might seem to be a surprising phenomenon: firms that did not start with the PPC model end up outperforming firms that always offered PPC only. So in spite of being disadvantaged by regulatory changes, firms that adapted and changed their business model to the eventual dominant one do better than firms that never used anything but the dominant model. The analysis to follow will explicate the mechanisms driving this phenomenon.

#### 5.4 Exaptation processes

The results presented so far suggest that the successful evolution of certain firms – in offering PPC – was key to their performance gain. However, we should like to examine this case further to see if there were performance effects associated with exaptation processes. In other words, we wonder whether or not firms benefited from the capabilities derived from their initial foray into the ultimately disadvantaged UGC model. For this we distinguish between traditional PPC and self-created content (SCC). As discussed earlier in Section 4, the latter is content produced by amateur filmmakers and licensed by the firm for distribution. This content can be in the form of short films, drama series, or movies.<sup>10</sup>

If the users carried over from developing a UGC platform are indeed complementary assets, then they should provide their associated firms with a competitive edge – by facilitating the development of SCC – over pure-PPC firms with no experience in developing and establishing access to a user community. We therefore coded for another binary indicator variable: *SCC*, which is set equal to 1 or 0 according as whether or not the focal firm produced licensed content through partnership with amateur filmmakers. We then examined the incidence of SCC via a linear probability specification while using as explanatory variables the firms' strategic profiles (i.e., *UGC\_initially or not*). We also provide alternative non-linear specifications using a logit. Results are given in Table 5.

**[[ INSERT Table 5 about Here ]]**

The results agree with our supposition. The coefficient for *UGC\_initially* is both positive and significant, which suggests that firms that started off with engagement of users through offering of UGC are more likely to develop SCC than pure-PPC firms. These results hold also for the CEM sample, which is further evidence that – from the firm’s perspective – its UGC platform users are indeed complementary assets in the firms’ transition to producers of content.

We repeat the same analysis for our interim performance measures, introducing SCC as a moderator variable. For this exercise, in the interest of parsimony we consider only firms after pivoting to offering PPC after 2008 (together with those which had stayed in PPC mode). Formally, we specify:

$$Y_{i,t} = \alpha + \beta_1(SCC_{i,t}) + \beta_2(UGC\_initially_i)(SCC_{i,t}) + X_{i,t} + \Omega_i + \varepsilon_{i,t}.$$

**[[ INSERT Table 6 about Here ]]**

The results of our firm fixed effects regressions, shown in Table 6, exhibit a consistent pattern: the coefficient for the *UGC\_initially* × *SCC* interaction term remains consistently positive and significant. Column (2) repeats this analysis using the matched sample of firms. The results in essence suggest that SCC is associated with superior performance, and firms that started with UGC seem to be benefitting more than those that had not. Overall it lends support for our supposition that exaptive features left over from firms’ initial foray into the UGC world, had lent them capabilities and complementary

assets – users in this case – they could exploit in their transition towards producing content.

Overall, the various regression results confirm what might seem to be a surprising phenomenon: firms that did not start with the PPC model end up outperforming firms that always offered PPC only. So in spite of being disadvantaged by regulatory changes, firms that adapted and changed their business model to the eventual dominant one do better than firms that never used anything but the dominant model. Further we present evidence that suggest that exaptive mechanisms drove the process.

## **5.5 Robustness checks**

As a first robust check, we performed analysis using such alternative measures of performance as *Number of pages viewed* and *Percentage share of total visits* obtained from iResearch. The results remain similar for all models. Second, we had performed all analyses on only a subsample of the earliest entrants – those that entered before 2008. The main advantage of focusing on the earliest entrants is that doing so eliminates any concerns about the endogeneity of entry timing.

Another possible challenge to our findings is if these sites were fundamentally different from each other and catered to different sets of viewers. That being the case would vitiate our empirical premise of a common entrepreneurial opportunity. Because analyzing just such a scenario is one of the paper's key motivations, it is critical to establish that the websites in our data set attracted a common set of viewers – and thus can be viewed as having exploited a common entrepreneurial opportunity.

For this purpose we obtained data from iResearch on the *Average time spent on*

*a video*. Chinese websites are tracked by iResearch using a representative sample group of consumers and their video consumption behavior, and the “average time spent” metric is measured in seconds. We use this metric as an alternative outcome variable in our regressions. An argument challenging our assumption would predict that the average time spent on a video is correlated with firms’ differing strategic profiles. The intuition behind that prediction is that the time spent on each video should differ if the video websites are, in fact, catering to different groups of viewers. In other words, the websites in question must be offering different kinds of videos. The time spent viewing videos is widely regarded as a reasonable (albeit imperfect) measure of the type of videos viewed (Artero 2010; Kumar & Tomkins 2010). We fitted a fixed-effects ordinary least-squares (OLS) specification in this part of our analysis, the results of which are shown in Table 7.

**[[ INSERT Table 7 about Here ]]**

Column (1) of the table shows that the coefficient for *UGC\_only* is insignificant, which indicates a lack of statistical evidence for arguing that the user profile for these sites differs from that for pure-PPC sites. The same trend prevails even when the sample is broken down in terms of the enacted regulatory changes (the *Post2008* variable), as revealed in column (2). This finding lends weight to our empirical claim that the websites in question were all pursuing a common entrepreneurial opportunity when they entered the nascent industry. Thus these competing sites were likely using the same kind of content, which legitimizes our presumption of a common entrepreneurial opportunity.



## 6 Discussion

Leveraging a newly assembled data set of all entrants to the Chinese Internet video industry between 2006 and 2011, we present both quantitative and qualitative evidence indicating that strong firm performance is more characteristic of entrants that *switched to* the eventual dominant strategy than of entrants that *started with* the dominant strategy. As a possible explanation of this puzzling empirical result, our evidence further suggests that a firm's engagement with the user community prior to the occurrence of a regulatory shock (a quasi-exogenous shock) plays a unique and accidental role in their strategic switch – an *exaptive* process. We document how engagement of the user community by certain Internet video sites allowed them to build a sustainable performance advantage sufficient even to overcome the *disadvantages* entailed by a quasi-exogenous shock to the industry's regulatory environment.

The empirical observations on which our analysis is based accord with extant literature addressing the importance of complementary assets that underlie a technology's commercialization (Teece, 1986). Scholars have emphasized the role of complementary assets and how their interaction with an environment's "appropriability" affects the firm's strategic choices (see e.g. Gans & Stern, 2003). The availability and consideration of these firm-level assets cohere with traditional explanations of industry evolutionary dynamics, yet they also enable a more dynamic approach to the entrepreneurial strategy process. When making core strategic commitments, a firm is normally most sensitive to the commercial environment. Nonetheless, its very next concern is typically how best to become adaptive in that environment by identifying and building (or modifying) the

firm's unique and tailored capabilities, resources, and market positions that make its chosen strategy sustainable.

Our paper also resonates with the increasing body of knowledge on effectuation theory as it relates to entrepreneurial decision-making. In a fast-moving world that defines most nascent entrepreneurial environments, effectuation theory predicts that entrepreneurs are more likely to start with the means they have and assess for possible goals (see e.g. Sarasvathy, 2009). Our results cohere with this line of thinking as the Internet video firm entrepreneurs adjust and switch in business models, arriving at an eventual winning model that is radically different from their original goals.

The main limitation of this paper is the endogeneity of strategic choice, which means that the reported results should be interpreted cautiously. Even so, our work offers a methodological advancement beyond current literature by controlling for the underlying entrepreneurial opportunity and then using matched sets of firms to run a quasi-experiment that helps clarify the effects of strategic adaptation. Our results point to the dynamic role of entrepreneurial strategy making. Some threads of the literature depict each firm as a largely unconnected and nonadaptive entity in that they focus either on initial strategies and products of firms (in their depictions of industry evolution) or on the entry and selective replacement of organizations. However, the results reported here suggest instead that entrepreneurial strategy must focus on how firms and managers can best respond to and then exploit environmental signals.

The results of this paper have implications also for new directions of research that can take advantage of similar institutional barriers impeding the exploitation of original entrepreneurial ideas. This phenomenon is especially common in the digital age, where

business models can be rapidly copied and modified while leveraging the same technological platform. There exist clones of collective buying sites (Groupon clones such as Coupang.com), of social media websites (Twitter clones such as Weibo.com), and of social networking sites (Facebook clones such as RenRen.com). China is an especially rich setting for such study owing to the combination of enforced institutional barriers (e.g., the country's Internet firewall) and "softer" barriers (e.g., its culture and language). Studying the development of clones of original ideas spawned elsewhere relieves the researcher from having to account for the confounding factors encountered in most traditional studies that seek to link strategy and performance (e.g., technological and founder effects). Hence our identification powers are increased, making it easier to isolate the causal effect of strategic variates.

Like any study, ours has certain limitations. First, it offers evidence for exaptive processes yet examines just one industry context. As such, this paper is more of an instructive industry case study than a strong test of our theories. Second, the data do not provide a full picture of the firms' time-variant organizational capabilities and resources – a consequence of the limitations inherent to this industry setting. Future work could devise clearer measures of technical capabilities and resources. Nevertheless, as one of the first studies in exaptation that have departed from the realms of technology towards a more generalized entrepreneurial setting, we see this as a necessary compromise to establish a new research agenda of exaptation in entrepreneurship, with hope that future research might advance it further.

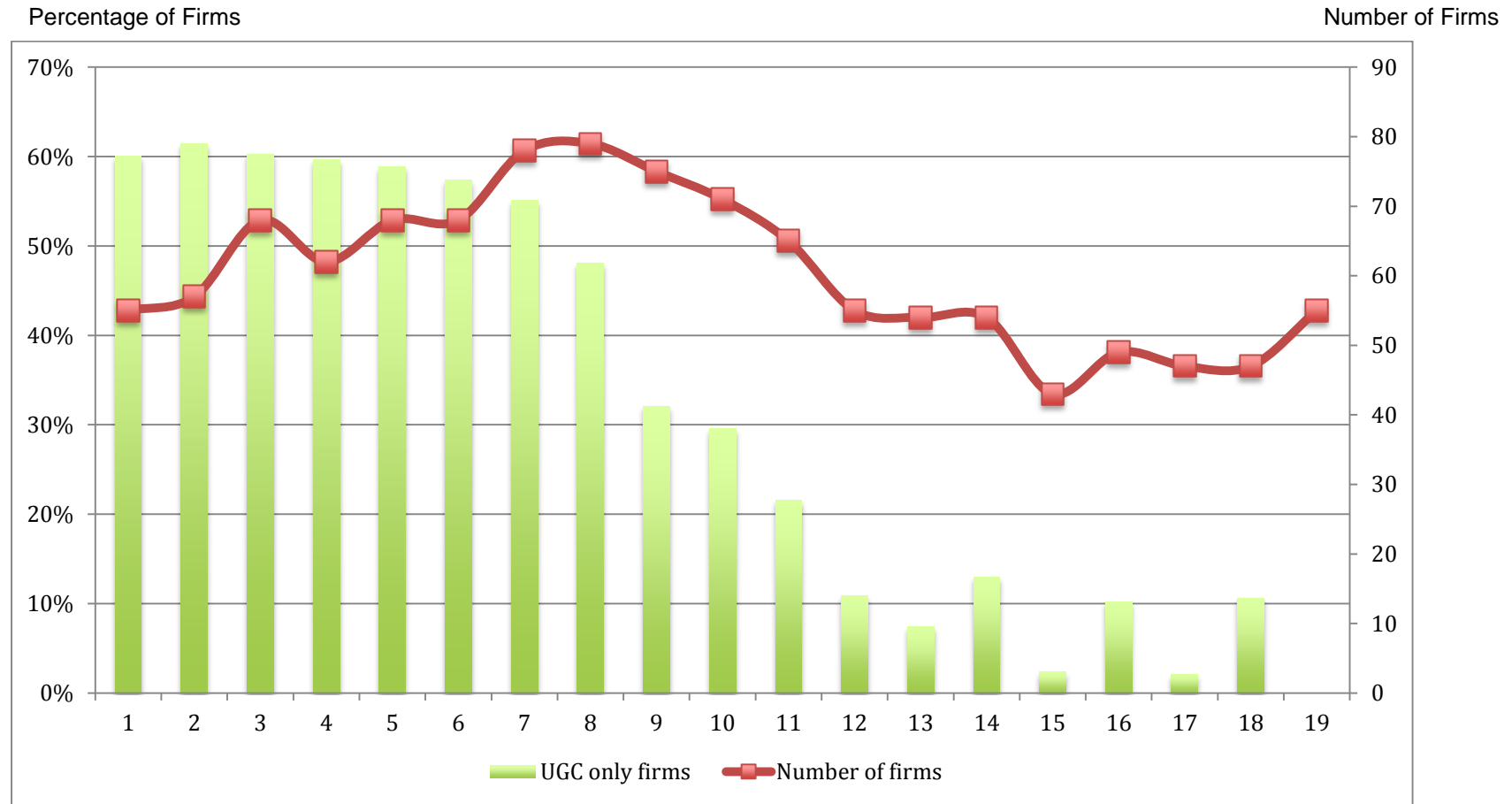
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**Figure 1 Chinese Internet video firms: Strategy density (percentage using a particular business model) – and patterns of entry and exit – during 19 consecutive quarters beginning July 2006**



**Table 1 Definition and descriptive statistics of the variables, and their correlation****Panel A Definition of variables**

<b>Variable</b>	<b>Definition</b>	<b>Source</b>
<b><i>Strategic variables</i></b>		
<i>UGC_only</i>	Dummy variable set to 1 if the firm offers UGC only (set to 0 otherwise)	Internet Wayback Machine
<i>PPC_only</i>	Dummy variable set to 1 if the firm offers PPC only	Internet Wayback Machine
<i>Mixed</i>	Dummy variable set to 1 if the firm offers both UGC and PPC	Internet Wayback Machine
<i>PPC</i>	Dummy variable set to 1 if the firm offers PPC	
<i>UGC_initially</i>	Dummy variable set to 1 if the firm started operations with a pure-UGC business model	Internet Wayback Machine
<b><i>Firm characteristics</i></b>		
<i>Post2008</i>	Dummy variable set to 1 if the firm is operating subsequent to the regulatory change in 2008	Internet Wayback Machine
<i>State</i>	Dummy variable set to 1 if the firm is owned by either state or provincial government	SARFT, Internet Wayback Machine
<i>Invest</i>	Dummy variable set to 1 if either a venture capital or private equity company invested in the firm	Investment news sites
<i>Age</i>	Number of quarters the firm has been active since its founding	Internet Wayback Machine
<i>Quarter of entry</i>	Quarter in which the firm first entered industry	Internet Wayback Machine
<b><i>Other controls</i></b>		
<i>Number of active firms</i>	Number of firms active in the industry during the focal quarter	Internet Wayback Machine
<i>Quarter of observation</i>	Quarter in which the firm is observed	Internet Wayback Machine
<b><i>Performance variables</i></b>		
<i>Fail</i>	Dummy variable set to 1 if the firm goes off-line for more than six consecutive months	Internet Wayback Machine



*Interest*  
*SCC*

Public Interest index recorded by Baidu Index  
Dummy variable set to 1 if the firm offers SCC

Baidu Index  
Internet Wayback Machine

**Panel B Descriptive statistics and correlation matrix**

<b>Variable</b>	<b>Obs.</b>	<b>Mean</b>	<b>SD</b>	<b>Minimum</b>	<b>Maximum</b>
PPC	752	0.78	0.42	0	1
UGC_initially	752	0.42	0.49	0	1
State	752	0.11	0.31	0	1
Invest	752	0.18	0.38	0	1
Age (L)	752	1.95	0.77	0	2.94
Number of active firms (L)	752	4.41	0.15	4.11	4.57
Quarter of observation	752	12.34	3.80	7	19
Quarter of entry	752	4.64	4.57	1	19
Fail	752	0.24	0.43	0	1
Interest	752	1.73	0.78	0.62	4.57
SCC	752	0.082	0.27	0	1

	PPC	UGC_initially	State	Invest	Age (L)	Number of active firms (L)	Quarter of observation	Quarter of entry	Fail	Interest (L)	SCC
<b>PPC</b>	1										
<b>UGC_initially</b>	0.32	1									
<b>State</b>	0.14	-0.20	1								
<b>Invest</b>	0.10	0.24	-0.16	1							
<b>Age (L)</b>	0.06	0.24	0.09	0.21	1						
<b>Number of active firms (L)</b>	-0.26	-0.00	-0.07	-0.17	-0.03	1					
<b>Quarter of observation</b>	0.40	-0.05	0.06	0.16	0.29	-0.49	1				
<b>Quarter of entry</b>	0.21	-0.31	-0.07	-0.13	-0.53	-0.11	0.34	1			
<b>Fail</b>	-0.39	0.13	-0.05	-0.19	0.05	0.05	-0.07	-0.11	1		
<b>Interest (L)</b>	0.11	-0.01	-0.05	0.11	0.00	-0.02	0.01	0.01	-0.18	1	
<b>SCC</b>	0.11	0.24	0.00	0.15	0.25	-0.28	0.37	-0.07	-0.08	0.12	1

**Table 2 Pattern of strategic adaptation after regulatory change  
as a function of the firm's initial strategy choice**

<b>Post-2008 business plan</b>	<b>Initial business plan</b>	
	<b>UGC</b>	<b>PPC</b>
Offer PPC	39.6%	100%
Offer only UGC	60.4%	0%

*Note:* The key statistic in this table is that, among firms starting with a pure-UGC strategy and still operating after the January 2008 regulatory changes, nearly four in ten eventually adapted by offering PPC.

**Table 3 Discrete-time estimation results for strategic adaptation and failure of Chinese Internet video firms**

Variable				Pre-2008	Drop	CEM
	(1)	(2)	(3)	entry	UGC-only	sample
	(1)	(2)	(3)	(4)	(5)	(6)
<i>UGC_initially</i>		-1.475** (0.476)	0.575 (0.576)	0.490 (0.630)	-0.311 (0.614)	1.189 (0.829)
<i>PPC</i>		-3.366*** (0.534)	-1.353** (0.539)	-1.431** (0.591)	-1.176* (0.526)	-1.073** (0.549)
<i>UGC_initially X PPC</i>			-2.420** (0.795)	-2.455** (0.849)	-1.512* (0.838)	-1.622* (0.981)
<b>Control Variables</b>						
<i>State</i>	-0.887* (0.373)	-0.604 (0.394)	-0.650 (0.398)	-0.377 (0.450)	-0.377 (0.450)	-0.406 (0.541)
<i>Invest</i>	-1.930*** (0.466)	-1.540*** (0.454)	-1.527*** (0.454)	-1.490*** (0.495)	-1.132** (0.466)	-0.553 (0.510)
<i>Number of firms (L)</i>	0.117 (0.830)	0.189 (0.791)	0.0790 (0.796)	0.814 (0.893)	0.0221 (0.973)	0.175 (0.239)
<i>Age (L)</i>	-0.0831 (0.395)	0.134 (0.433)	0.0930 (0.418)	0.0151 (0.494)	0.257 (0.587)	-0.175 (0.669)
<i>Quarter of observation</i>	0.0239 (0.0636)	0.141** (0.0627)	0.149** (0.0638)	0.199*** (0.0755)	0.0929 (0.0841)	0.0721 (0.111)
<i>Quarter of entry</i>	-0.104 (0.0777)	-0.0660 (0.0773)	-0.0757 (0.0764)	-0.0128 (0.0926)	0.0146 (0.103)	-0.131 (0.120)
<i>Interest (L)</i>	-0.565*** (0.172)	-0.449*** (0.172)	-0.471*** (0.175)	-0.377*** (0.170)	-0.573** (0.219)	-0.882*** (0.265)
Constant	-0.141 (3.903)	0.262 (3.863)	-1.171 (3.928)	-5.100 (4.469)	-0.867 (4.891)	9.184 (6.930)
Observations	752	752	752	653	566	408
$X^2$ [df]	45.7 [7]	79.2 [9]	80.1[10]	78.9 [10]	46.2[10]	44.03 [10]
Log-likelihood	-372.1	-321.3	-318.4	-347.1	-233.9	-172.0

Notes: Robust standard errors (in parentheses) are clustered by firm. CEM = coarsened exact match; (L) = logged.

\* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

**Table 4 Firm fixed-effects estimation results for the strategic adaptation of Chinese Internet video firms subsequent to regulatory change**

Variable	Model:	Dependent variable					
		Interest (L)	Interest (L)	Interest (L)	Interest (L)	Interest (L)	
			[pre-2008 entry]	[pre-2008 entry]	[pre-2008 entry, drop UGC-only sites]	[pre-2008 entry, CEM sample]	
		OLS (1)	OLS (2)	OLS (3)	N.B. (4)	OLS (5)	OLS (6)
<i>PPC</i>			0.0821 (0.0707)	0.0901 (0.0760)	1.0931 (0.204)	0.0885 (0.0760)	0.186 (0.229)
<i>UGC_initially</i> $\times$ <i>PPC</i>			0.348** (0.116)	0.337** (0.120)	1.739** (0.369)	0.331** (0.124)	0.114* (0.0572)
<b>Control variables</b>							
<i>State</i>		0.128* (0.0699)	0.0113 (0.0773)	0.0128 (0.0796)	1.530 (20.846)	0.0384 (0.0861)	-0.176 (0.311)
<i>Invest</i>		0.297*** (0.0792)	0.280*** (0.0848)	0.297*** (0.0857)	1.434** (0.230)	0.299*** (0.0879)	0.0355 (0.0330)
<i>Number of firms (L)</i>		1.458** (0.483)	1.441** (0.535)	1.334** (0.0593)	4.041* (2.458)	1.298** (0.648)	0.0161 (0.125)
<i>Age (L)</i>		-0.0846 (0.103)	-0.0524 (0.0989)	-0.0851 (0.0890)	0.864 (0.0790)	-0.109 (0.0936)	-0.00517 (0.0553)

Constant	-4.520** (2.142)	-4.501* (2.373)	-4.004 (2.642)	0.0337 (0.0910)	-3.830 (0.229)	0.483 (0.578)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	752	752	653	639	566	408
Number of firms	137	137	100	86	72	56
Adjusted R-square	0.01	0.02	0.05	N.A.	0.033	0.05

*Notes:* Robust standard errors (in parentheses) are clustered by firm; IRR reported for column (4); CEM = coarsened exact match; (L) = logged; N.A. = not applicable; N.B. = negative binomial.

\* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

**Table 5 Incidence of self-created content (SCC) in firms' strategic profiles**

<b>Variable</b>	<b>Model</b>	<b>OLS (1)</b>	<b>OLS (2)</b>	<b>Logit (3)</b>	<b>Logit (4)</b>
<i>UGC_initially</i>		0.129*** (0.0338)	0.117** (0.0421)	2.627*** (1.007)	2.200** (0.806)
Controls		Yes	Yes	Yes	Yes
Time fixed effects		Yes	Yes	Yes	Yes
Observations		566	408	343	274
Number of firms		72	56	61	52
Adjusted R-square		0.40	0.25	NA	NA

*Notes:* The dependent variable is *SCC*, and the reference group consists of firms that started as pure PPC. Robust standard errors (given in parentheses) are clustered by firm. Column (2) and (4) are based on the CEM sample.

\*\* $p < 0.05$ , \*\*\* $p < 0.01$

**Table 6 Firm fixed-effects estimation results for the performance of firms post regulatory change and pivot**

<b>Variable</b>	<b>(1)</b>	<b>(2)</b>
<i>SCC</i>	0.102 (0.137)	-0.0508 (0.0830)
<i>UGC_initially x SCC</i>	0.273* (0.150)	0.204** (0.0826)
Controls	Yes	Yes
Firm fixed effects	Yes	Yes
Time fixed effects	Yes	Yes
Observations	491	372
Number of firms	68	56
Adjusted R-square	0.03	0.07

*Notes:* The dependent variable is *Interest (logged)*, and the reference group consists of firms that started as pure PPC. Robust standard errors (given in parentheses) are clustered by firm. Column (2) is based on the CEM sample.

\* $p < 0.1$ , \*\* $p < 0.05$



**Table 7** Fixed effects estimation results of Time Spent on Videos segmented by business models

	(1)	(2) [Post 2008]
<i>UGC_only</i>	-0.278 (0.227)	-0.0563 (0.215)
Controls	Yes	Yes
Firm fixed effects	Yes	Yes
Observations	1128	752
Number of firms	146	137
Adjusted R <sup>2</sup>	0.04	0.06

*Notes:* Dependent variable is *Average time spent per video (logged)*;  
Robust standard errors clustered by firm in parenthesis.  
\*p<0.1, \*\*p<0.05, \*\*\*p<0.01.

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<sup>1</sup> China's Internet censorship policy is extensive and spans a wide variety of laws and administrative regulations. Scholars have estimated that at least 18,000 websites are blocked from within mainland China and the number is always growing (Edelman & Zittrain 2005). The government of the People's Republic of China (PRC) defends this censoring by claiming that, within its own borders, the country has the right to govern the Internet according to its own rules. (Bristow, 2010).

<sup>2</sup> See, for example, "Chinese Borrowing," *The Economist*, 7 May 2009.

<sup>3</sup> In this paper, "UGC" and "PPC" are used with reference both to the business model and to the type of content; clarification will be provided where confusion might otherwise ensue.

<sup>4</sup> Both business models in that period utilized the same Adobe Flash technological platform. Alternative technological platforms have emerged since the period that we analyze, in particular the growth of HTML5 (and, to a much lesser degree, of QuickTime).

<sup>5</sup> Similar dynamics have also been observed in the US market. YouTube runs a fairly similar program called YouTube Partners where they sponsor selected YouTube users to produce content that they own copyrights to. Other examples include Netflix and Amazon (Prime), which all produce content now after previously existing as mere replay sites.

<sup>6</sup> There are numerous anecdotes on self-produced content running afoul of the regulators. For example, the short TV drama *Love Finally* produced by Ku6.com was reportedly cited by the authorities for portrayal of adult sexuality while being self-classified as a "youth drama".

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<sup>7</sup> Further details on the coding are documented in Appendix A (available online).

<sup>8</sup> We acknowledge that these firms may be regarded as multi-sided platforms (as in Boudreau, 2010) especially those of the UGC type. Although this paper does not debate the merits of particular platform-related strategies, our estimation approach is similar to that used by many current studies on such strategies. One notable difference is that, in the baseline regressions, we do not directly model network effects in terms of user growth dynamics (Boudreau, 2012). Yet this difference should not present any problems because our procedure, in effect, matches treated firms with a set of control firms that are nearly balanced in terms of performance (number of users). Hence in our estimations all treated firms have about the same number of users before the regulatory change, which eliminates most noise arising from specific network effects.

<sup>9</sup> Our initial set of analyses presents a detailed look at the failure rates of firms that persisted in using a pure-UGC model. In the interest of parsimony, we do not present these results in the main paper but instead collect them in Appendix B (available online). The results confirm that firms retaining their pure-UGC model after the regulatory change are associated with performance declines; this finding supports our assumption that, as a business model, UGC was indeed disadvantaged by the new regulations.

<sup>10</sup> We have observed similar dynamics in the US and international markets recently. YouTube, Vimeo and other Internet video firms have been engaging users to create professional, licensed content.