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2010

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Essays on Competitive Strategy and Innovation Management

by

Richard Dick Wang

A dissertation submitted in partial satisfaction of the

requirements for the degree of

Doctor of Philosophy

in

Business Administration

in the

Graduate Division

of the

University of California, Berkeley

Committee in charge:

Professor Paul J. Gertler, Chair
Professor John Morgan
Professor Yingyi Qian

Fall 2010

Essays on Competitive Strategy and Innovation Management

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by

Richard Dick Wang

Abstract

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Doctor of Philosophy in Business Administration

University of California, Berkeley

Professor Paul J. Gertler, Chair

This dissertation examines product positioning and development strategies by firms. Product strategies not only determine a firm's performance, but they also influence the types of goods that are available in the market. I conduct empirical evaluations on how rivalries shape product decisions, and propose a framework that guides firms to devise incentive schemes to spur new ideas which are vital to the development of innovative products.

I begin by focusing on product differentiation strategy among rivals. I develop a theoretical model on programming choice by rival broadcasters in the media industry. The model predicts that the level of product differentiation is determined by the relative strengths of the rivals. I test this model using data from the Chinese satellite television industry. I analyze dynamic product positioning activities of 30 satellite television channels with respect to their dominant rival. Consistent with theory, the empirical evidence shows that weaker firms are more responsive when compared to the stronger ones to differentiate their products from the dominant rival.

In a second study, I focus on product imitation strategy among rivals. I empirically examine whether rivals imitate each other when they operate in uncertain market environments. Using data from the Chinese satellite television industry, I analyze product spatial distances between the satellite television channels before and after the commercialization of the dominant rival. I find that rivals cluster in product space when they are attacked by the dominant rival. Moreover, the level of clustering is most intense immediately following the industry shock, and less so as time progresses. I find mixed evidence on firms selectively cluster with rivals that are perceived to possess superior market information.

In the final essay, co-authored with John Morgan, we propose how firms may employ tournament incentive schemes to stimulate innovations which are essential to creating new products. Governments and foundations have successfully harnessed tournaments to generate innovative ideas. Yet this tool is not widely used by firms. We offer a framework for managers seeking to organize tournaments for ideas. We present the theoretical underpinnings of tournaments. We then connect the theory with three recent business concepts – the power of the network, the wisdom of crowds, and the leverage of intrinsic motivations – that boost the effectiveness of tournaments.

To my wife, Louise, and our daughters, Abigail and Alison.

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Chapter 1

Spatial Competition among Heterogeneous Rivals:
Evidence from the Chinese Satellite Television Industry

Abstract

This paper tests positioning theory between rivals in a media industry. Recent research in spatial economics predicts that distances between rivals are influenced by interactions of external market environment and heterogeneity between rivals. By exploiting a natural experiment involving a government policy change in the Chinese satellite television industry, I analyze dynamic product positioning activities of 30 provincial government-owned satellite television channels with respect to the resource-rich, central government-owned channel. Empirical evidence is consistent with theory predictions. Furthermore, the findings in this study suggest that modern state-owned enterprises behave strategically by responding to market environment as well as to rivalry.

1.1 Introduction

Spatial positioning with respect to rivals is a key strategic concern for organizations. Positioning close to rivals, on one hand, brings along benefits such as increasing legitimacy (DiMaggio and Powell, 1983), reducing information acquisition costs (Shaver et al. 1997), capturing spillovers (Baum and Haveman, 1997) and maintaining competitive parity (Garcia-Pont and Nohira, 2002). On the other hand, positioning close increases the likelihood of competition due to the lack of differentiation (Porter, 1991). More recently, researchers propose that managers should 'balance' the tradeoffs in positioning close to or far away from rivals (Deephouse, 1999; Semadeni, 2006). Considerable empirical research exists on positioning strategies. For example, studies have been conducted on geographic positioning (e.g. Baum and Haveman 1997; Greve 2000) as well as product positioning in segmented markets (e.g. Greve 1998; Thomas and Weigelt, 2000).

This study contributes to the literature on positioning strategy in two main areas. First, research on strategy focuses on heterogeneity in resources and capabilities between organizations to explain differences in choices and performances. Nevertheless, stemming from the seminal Hotelling (1929) model, research on spatial economics tends to assume firms as homogeneous entities. Spatial location decisions by firms have been accounted for by industry characteristics such as pricing (Shaked and Sutton, 1982), transportation costs (d'Aspremont et al. 1979), heterogeneity of customer demand (DePalma et al. 1985), and sequence of entry (Prescott and Visscher, 1977). The assumption of homogeneous players in the spatial economics literature is in contrast to the resource-based view of the strategy literature where differences in strategic choices and performance outcomes are caused by resource heterogeneity between organizations (Wernerfelt, 1984; Mahoney and Pandian, 1992). Recent advances in economics theory have incorporated firm heterogeneity in the analysis of spatial positioning. For example, Vogel (2008) theoretically examines spatial location decisions by players with different levels of productivity and finds that more productive firms are more isolated in space, *ceteris paribus*. This theory offers an empirically testable prediction that a less productive player is more likely to differentiate further away from her more productive rival than from a comparable rival. In this study I adapt the theory to the media industry and empirically test the key predictions in the Chinese satellite television industry.

Second, research on positioning has been focused on traditional firms – organizations with maximization of profits as their primary objective. But can the findings explain behaviors of organizations, such as state-owned enterprises (SOEs), where the assumption of profit-maximizing may not hold? Prior research has documented that governments influence the activities of SOEs and that these activities may not be consistent with profit maximizing. For example, governments have kept operating inefficient SOEs that should otherwise be shut down in order to avoid massive unemployment (Aghion and Blanchard, 1994). SOEs have found to be bureaucratically operated with less sensitivity to market and competitive environments compared to profit-maximizing firms (World Bank, 1995). Yet governments around the world, particularly those in emerging economies, have implemented reforms to their SOEs with the aim of improving operational efficiency and adaptability to market economy (Shirley, 1999). In a comparative study of Chinese businesses, Ralston *et al.* (2006) find that the organizational culture of Chinese SOEs has transformed from a bureaucratic mode to a configuration that

resembles those of privately-owned and foreign-controlled businesses. However, it has also been noted that under the reforms, SOEs are buffeted by often contradictory pressures from the government and from the market. Consequently, their behaviors are difficult to predict (*Economist*, 2009). This study aims to empirically investigate whether economic theories developed for firm strategic behaviors explain the actions of the modern SOEs.

I analyze programming lineups of 30 Chinese provincial government-owned satellite television channels with respect to the more resourceful, central government-owned television channel, CCTV1 over a twelve-month period spanning November 2002 to October 2003. I construct spatial distance measurements between the channels based on the air times of show genres. Applying a dyadic approach, I examine spatial distances between the satellite channels and CCTV1. I find that the satellite channels position themselves on average 12 to 15 percent further away from CCTV1 than from peers. To alleviate the concern of omitted variable bias, I exploit a natural experiment induced by a government policy change that led CCTV1 to shift its product location. By analyzing the dynamic relocation activities of the satellite channels, I find the satellite channels adjust their positions to differentiate from CCTV1. As predicted, evidence shows that the weakest satellite channels exhibit the greatest responsiveness to the CCTV1 programming change. Finally, I examine the effect of viewership characteristics on positioning strategy of satellite channels. I find that when market sizes between product segments are comparable, the satellite channels are more likely to differentiate from CCTV1. The overall findings suggest that these state-owned television channels behave strategically by responding to the actions of rival as well as to market environments.

The organization of the paper is as follows. First, I present a theory on spatial positioning with heterogeneous players in the context of the media broadcasting industry. Next I describe the institutional background of the Chinese satellite television industry and state the hypotheses. Afterwards I discuss the data and empirical methodology, followed by the results. The paper ends with concluding remarks.

1.2 Theory

Organizations face competitors with resources and capabilities that are different from their own. For example, new players compete with incumbents who have entrenched capabilities and complementary assets (Teece, 1986; Tripsas, 1997); *de novo* entrants compete with *de alio* entrants who have superior technical knowledge (Klepper and Simons, 2000); and single-unit businesses compete with business units who are connected to better networked and more resourceful corporate parents (Chang and Singh, 2000). The heterogeneities in organizations lead to systematic differences in performances such as productivity (Wernerfelt, 1984; Hoopes *et al.* 2003). While there exists considerable research on spatial economic theory following the seminal paper by Hotelling (1929), the models in these studies assume homogeneous players and rely on industry characteristic assumptions such as pricing decision, transportation cost, consumer demand heterogeneity, and sequence of entry to explain spatial locations of players (Prescott and Visscher, 1977; d'Aspremont et al. 1979; Shaked and Sutton, 1982; DePalma et al. 1985). It is not until recently when researchers begin to relax the assumption about homogeneity of players

(Aghion and Schankerman, 2004; Vogel, 2008). Vogel (2008) predicts that more productive players are more isolated in space than less productive players[1] – i.e. a less productive player should more likely to differentiate further away from her more productive rival than from a comparable rival.

In the context of the media industry, differences in the quality of resources possessed by media organizations – such as the talent of performing and creative artists, ability of managers and production crew, caliber of equipment and infrastructure, to name a few – will directly affect their productivity in program quality, which in turn generates consumer demand (Caves, 2000). To help empirically analyze the theory in the context of the television industry, consider the following parsimonious model based on Vogel (2008) and Brown (2008). Suppose two rival television channels possess similar types of resources but they are heterogeneous in terms of their degree of resource quality. The channels choose among two program genres and the level of investment in production quality. For simplicity, assume identical production cost functions for both genres. Suppose, per each dollar invested, the stronger channel produces a show of quality that is $\theta \geq 1$ times higher than the weaker channel's. Let the audience demand for shows to be proportional to the total quality of the shows produced for the genre but at a decreasing rate. Between the two genres, one is more popular with the audience and attracts $\beta \geq 1$ times the audience size than the other. Suppose the channels rely on advertising revenue as their sole source of income and the amount of advertising revenue generated by a show is proportional to its audience size. When both channels select the same genre (i.e. co-locate in product space), they split the total revenue according to the quality of their shows. Otherwise, each monopolizes the advertising revenue of their respective genres. To solve for the equilibrium strategies of the channels, functional forms for the audience demand and payoff need to be specified. An example with a set of simple demand and payoff functions is presented in Appendix A. The equilibrium strategies are illustrated in Figure 1.1.

Insert Figure 1.1 about here

In Figure 1.1, the horizontal axis θ represents the degree of heterogeneity between the two players while the vertical axis β represents the ratio of the market size between the two genres. The line running from the lower left to the upper right separates the equilibrium strategies of the players. In the region lying on the upper-left side of the line where heterogeneity between the players is small (i.e. the two rivals have comparable strengths) and the size ratio between the two market segments is large, the players will in equilibrium co-locate in the genre with the larger market size. Intuitively, two comparable rivals are more likely to compete head-to-head in the larger market segment rather than either one of them giving up the large market and monopolize the much smaller market segment. In the region lying on the lower-right side of the line where the heterogeneity between players is large and the market size ratio is close to unity (i.e. the two market segments have comparable sizes), the players will in equilibrium differentiate their show genres. Intuitively, rivals are less reluctant to each monopolize a market segment if the size difference between the segments is small, especially when the one player is

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[1] In Vogel (2008), the player with lower marginal cost of production is the more productive player.

much stronger than the other. To summarize, I state the predictions below. The hypotheses related to these predictions will be presented in the next section together with the empirical context.

> *Prediction 1. All else equal, the likelihood of a channel choosing the differentiation strategy increases with the strength of the rival channel.*

> *Prediction 2. All else equal, the likelihood of a channel choosing the differentiation strategy decreases with increasing market size ratio between program genre segments.*

1.3 Institutional Background

1.3.1 Industry Overview[2]

Television in China began in 1958 when the central government began broadcasting around the Beijing area on which is now known as the China Central Television, or CCTV. Nevertheless, it was not until the 1980's and more so in the 90's when the general public began to own television sets that the television industry took off. In 2005, 97.9 percent of urban Chinese households owned at least one television set. The television medium reaches over 95.3% of the Chinese population. In 2005, an average Chinese spend 174 minutes watching television per day. Primetime is between 7:00pm and 10:00pm with television audience ratings above 40%.

The Chinese television industry is comprised of three tiers of television stations.[3] The top tier is occupied by the China Central Television (CCTV) which is owned by the central government. The second tier consists of 31 provincial stations which are owned by the province-level governments. The third tier consists of the local stations owned by municipality, prefecture and county-level governments. Each television station operates one or more channels. For example, CCTV currently operates 20 channels (with CCTV1 being their flagship channel) and the Shanghai station operates 13. Literature on the Chinese media points out that the heterogeneity in terms of the resources available to CCTV and provincial stations is clearly distinct, as stated by Chan (2003, p.168), *"[CCTV] … enjoys unmatched privileges such as access to information at the national level and huge resources in terms of capital, equipment, and talent."*

1.3.2 Satellite Channels

In the late 1980's a number of television stations in China's mountainous southwestern provinces began using satellite communications technology to aid signal transmissions. Satellite broadcasts remained mostly limited to local provincial and regional levels until 2001 when the central government issued to each provincial television stations a national satellite channel

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[2] The information in this section, unless specified otherwise, is based on *China TV Rating Yearbook* from 2003 to 2006.

[3] Some researchers classify the channels into four tiers: central, provincial, metropolitan, and county (e.g. Harrison, 2002; Chan, 2003).

license. These thirty-one provincial satellite channels together with the CCTV channels form the national television industry.

Unlike in the U.S. and European countries where households install their own satellite dish, local cable companies aggregate the contents from the satellite channels together with those from CCTV and local stations and distribute the signals to households via cable. A typical household in urban China receives the CCTV channels, the satellite channels, the local provincial channels, and the local municipal channels. In 2002, the national broadcasters (i.e. CCTV and satellite channels) and local broadcasters (local province and municipal channels) split the audience shares almost evenly. Satellite channels take up approximately 16% of overall television viewership, or about one third of the national broadcast market share. Of all the national channels, CCTV1 alone takes up about 30 percent of the national market share.

The satellite channels are regulated by the State Administration of Radio, Film and Television (SARFT) which is under the State Council. SARFT reviews and approves the content of television programs. Channels have autonomy in selecting programs from the approved list for broadcast. Television programs are either produced in-house or are acquired from external producers.[4] Typically, programs that contain time-sensitive or regional specific contents (e.g. news reports and contemporary issues programs) are produced in-house while others (e.g. television drama and documentaries) are acquired externally. Every month the satellite channels are required to report to SARFT their programming lineups for the following month. There is only one program – the national evening news – which CCTV1 and all satellite channels (except Shanghai) are required to simulcast daily from 7pm to 7:30pm.

Financially, the satellite channels are receiving diminishing financial supports from the province-level governments and are increasingly relying on advertising revenues. The *New York Times* reports that "government support for Chinese television is dwindling, creating a burst of commercialism as stations compete for viewers and advertising dollars."[5] In 2005, satellite channels total advertising revenue reached CNY37.4 billion. In my interviews with television channel managers, they expressed that during the sample period the advertisers were more concerned about the size of the audience than the composition of the audience. This suggests that objective of the television channel is to maximize the overall ratings of their channels.[6]

1.3.3 CCTV1 Programming Shift

In May 2003, CCTV1 underwent a major overhaul of its programming lineup. The shift in CCTV1's programming strategy was a direct result of a central government policy change that

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[4] I reviewed several program television broadcast rights acquisition contracts and discussed the negotiation process with a with a program distributor. In addition to the financial terms, the terms related to the period of broadcast dates, the time of day to broadcast and the number of repeat broadcasts are commonly negotiated between the program rights holder and the broadcaster.
[5] "Upstart from Chinese Province Masters the Art of TV Titillation", *New York Times*, Nov 25, 2005.
[6] The author learned from a former manager at CNBC Beijing that CNBC attempted to pitch programming sales to Chinese television stations by emphasizing their wealthier audience profile. But at the time CNBC's approach received little interest from the television stations, which were more interested in maximizing raw ratings. This attitude has slowly changed in recent years as audience characteristics are receiving more attention from the television stations.

was intended to modernize the management of the television enterprise.[7] Traditionally, CCTV served as an important apparatus in disseminating government information to the public (Shambaugh 2007). The shift in government policy allowed CCTV to offer a more commercially-oriented programming lineup. With the overhaul, CCTV1 introduced a greater number of television drama and entertainment shows while retaining a portion of its original programming. Although CCTV1 announced the intention to revamp its programming in February 2003, details of the new lineup were kept secret until April 2003.[8]

1.3.4 Hypotheses

From the model, Prediction 1 states that weaker players are more likely to differentiate from stronger players. In the Chinese satellite television industry, CCTV1 is distinctly resource-rich as compared with the satellite channels (Chan, 2003). Therefore, I hypothesize that:

> *Hypothesis 1a. Satellite channels differentiate their programming genres from that of CCTV1.*

Resource heterogeneity exists among the satellite channels which influence the channels' competitive positions in different program genres. If resource heterogeneity is a significant determinant of a satellite channel's positioning strategy, then a weaker competitor to CCTV1 should be more influenced by CCTV1's programming decision compared to a stronger one. Formally stated:

> *Hypothesis 1b. Weaker satellite channels exhibit higher degree of differentiation from CCTV1 than stronger satellite channels.*

Prediction 2 relates market characteristics to spatial competition strategy. To test this prediction, I exploit the variations in audience characteristics across different times of the day. Recall that in the model, β represents the market size ratio between program genres. I argue that in the Chinese television industry context the value of β is greater in the evening than in daytime. The reasoning is as follows. Consider two program genres: a common denominator program (Beebe, 1977; Spence and Owen 1977) such as a game show which every member at home (say, the father, mother, child, grandfather and grandmother) will watch if their preferred substitute genres are not available; and a niche program (e.g. a Chinese opera) which is most preferred by only one member (the grandmother) but that the rest will not watch television at all. In this case, β is directly related to the number of persons at home at a given time. During the day, only the grandfather and the grandmother stay at home. If the television set is tuned into the game show, both grandparents will watch (2 persons watch the show). If the grandmother gets her way and watches the Chinese opera, then the grandfather takes a nap (only 1 person watches the show).

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[7] The policy, "Cultural Development and Restructuring," is detailed in Section VI of then Chinese President Jiang Zemin's report at the 16th Party Congress on November 8, 2002. A *New York Times* article describes CCTV as 'a model of how the Communist Party in China manages to keep state-owned companies profitable as it moves the nation toward a market economy with less government influence.' "Olympics are Ratings Bonanza for Chinese TV", *New York Times*, August 22, 2008.

[8] A May 2004 article by Guangdong TV station published on their official website indicates that the province-level channel did not learn about the specific details of CCTV1's new programming schedule until April 2003. (http://www.gdtv.cn/newpage/dabenying/wspd2/news.asp?NewsID=21811&page=46)

So the audience size ratio between the shows, β, is 2. In the evening when everyone is at home (5 persons), the audience ratio of the game show and the Chinese opera becomes 5 to 1, or a β value of 5. Therefore, $\beta_{evening}$ is greater than $\beta_{daytime}$. Prediction 2 argues that as β increases, all else equal, the likelihood of the channels adopting a differentiation strategy decreases. This leads to my second hypothesis:

> *Hypothesis 2. Satellite channels exhibit lesser degree of differentiation from CCTV1 in the evening than in the daytime.*

1.4 Data and Empirics

1.4.1 Data Sources

The main dataset contains complete daily programming lineups from 8 am to midnight for 30 satellite channels and CCTV1 from November 2002 to October 2003.[9] The CCTV1 programming shift took place at the seventh month of the sample period. The dataset includes the program title, the channel and date of broadcast, the start and end time of the show, and the category under which the show is classified. A sample lineup of primetime programming for CCTV1 and Shanghai satellite channel are presented in Tables 1.1a and 1.1b. Note that, unlike television programming in the US, Chinese television channels do not exactly follow hourly or half-hourly program slots. For instance, between 9 pm and 10 pm, CCTV1 airs a news program from 21:00 to 21:20 and a documentary from 21:24 to 21:53, while Shanghai satellite channel broadcasts a drama from 21:15 to 21:53 followed by a music video from 21:53 to 21:59.

Insert Tables 1.1a and 1.1b about here

The second dataset contains 15-minute timeslot monthly average ratings of the 30 satellite channels in all provincial capital cities (except Lhasa). The programming lineups and ratings datasets are collected by CSM Market Research (CSM) using peoplemeter panels.[10] The ratings data are generated through stratified sampling drawn proportionally to their incidence in the population. These proprietary programming lineups and ratings datasets are considered reliable and are widely used by Chinese television stations, advertisers and government regulators (Yuan and Webster 2006).

1.4.2 Constructing Spatial Distance Measurement

The dataset classifies each program into one of 87 categories, such as domestic drama, foreign movies, weather report, etc. I measure the spatial distance between two channels' programming as the angle between their portfolio vectors in orthogonal dimensions of product

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[9] This includes all province-level satellite channels except Tibet satellite channel. The data for Tibet was unavailable to the author.
[10] CSM Media Research (www.csm.com.cn) is subsidiary of the TNS Group (http://www.tnsglobal.com).

space.[11] Specifically, I calculate the spatial distance between channels *A* and *B* using vector dot product:

$$Spatial\ Distance\ = \cos^{-1} \frac{(Programming\ Vector\ A) \cdot (Programming\ Vector\ B)}{(Length\ of\ Programming\ Vector\ A)(Length\ of\ Programming\ Vector\ B)}$$

As a stylized example, assume there are only two categories of television programs – sports and drama. Say, in the 8:00 pm to 8:15 pm timeslot in January 2003 (a total of 31 days x 15 min/day x 60 sec/min = 27900 seconds of air time), *A* broadcasts 9300 seconds (5 minutes per day) of sports and 18600 seconds (10 minutes per day) of drama while *B* broadcasts 18600 seconds of sports and 9300 seconds of drama. The programming portfolio vectors for *A* and *B* will be [9300 18600] and [18600 9300], respectively. Using the vector dot product equation, I calculate the angle between the two channels' programming portfolio vectors. The angle ranges from zero to 1.5708, or π/2, radians. An angle of zero radians indicates that the two channels broadcast exactly the same categories of shows, while an angle of π/2 radians indicates the two channels broadcast shows of completely different categories. In this example, the angle between *A* and *B* is 0.6435 radians.

In terms of program repositioning, continuing with the above example, if *A* increases it sports content from 5 to 6 minutes per day (leaving only 9 minutes per day for drama) while *B*'s lineup remains unchanged, then the distance between *A* and *B* will decrease by 0.124 radians. Note that the conversion from minutes of program air time to radians in spatial distance is nonlinear. At the mean, with the distance between a satellite channel and CCTV1 at approximately 1.22 radians, a programming change of one minute per day in a 15-minute timeslot will result in a change in spatial distance by approximately 0.1 radians.[12]

1.4.3 Natural Experiment

To illustrate the natural experiment identification approach, consider the following two examples. First, Figure 1.2a plots the distance between Shanghai satellite channel and CCTV1 in the 1:30-1:45 pm timeslot from November 2002 to October 2003. Before the CCTV1 programming shift in May 2003, the distance between Shanghai channel and CCTV1 is fairly stable. In May 2003, CCTV1 replaces a news talk show with a television drama at the timeslot in which Shanghai channel at the time also broadcasts a drama. This increase in the overlap of programming genre is reflected by a drop in spatial distance between the two channels. Shanghai channel changes its programming over the next few months. In October 2003, Shanghai channel airs a home shopping show in this timeslot. The second example shows the case where CCTV1 moves away from a satellite channel. Figure 1.2b plots the spatial distance between Hainan satellite channel and CCTV1 in the 10:00-10:15am timeslot. At 10:00 am, the former channel broadcasts a 5-minute news program which overlaps with the latter's morning news program prior to the shift. In May 2003, CCTV1 cancels its morning news program and replaces it with a drama. This change in programming is reflected by an increase in spatial distance between the two channels. Note that Hainan channel does not reposition closer to CCTV1.

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[11] This method of spatial distance measure construction is similar in concept to Sweeting (2006) and Chisholm et al. (2006).
[12] This approximation is valid for a 2 program category space. For 3 and 4 program genre spaces, a programming change of one minute per day results in 0.11 and 0.13 radians change, respectively.

Insert Figures 1.2a and 1.2b about here

These two examples together illustrate a response pattern by satellite channels to CCTV1's programming shift. In the first example CCTV1 moves closer to a satellite channel in programming space (negative distance shock, or negative shock) and the satellite channel subsequently moves away from CCTV1 (positive distance repositioning, or positive reposition); in the second example CCTV1 moves away from a satellite channel (positive distance shock, or positive shock) and the satellite channel does not reposition itself to reduce the distance from CCTV1 (negative reposition). This pattern of asymmetric repositioning is consistent with the differentiation strategy but contradicts the staying close or maintaining distance strategies. If the satellite channels were staying close to CCTV1, then a positive shock should be followed by a negative repositioning, and a negative shock should result in no positive repositioning. Similarly, if the satellite channels were maintaining distances from CCTV1, then a positive (negative) shock should result in a negative (positive) repositioning.

1.4.4 Measures

To implement the identification approach described above, I organize the monthly channel programming observations according to four periods: November 2002 to January 2003 (*period p = -2*), February 2003 to April 2003 (*period p = -1*), May 2003 to July 2003 (*period p = 0*) and August 2003 to October 2004 (*period p = 1*). Mean values of observations are taken across the months within each period. Recall that the CCTV1 programming shift occurs in May 2003 (*period p = 0*).

Dependent variable. The unit of observation is channel-timeslot. The dependent variable is *Reposition$_{ij}$* which measures the change in spatial distance by channel *i* with respect to CCTV1 in timeslot *j* subsequent to the CCTV1 programming shift (i.e. between periods *p = 0* and *p = 1*.) A positive (negative) *Reposition$_{ij}$* value indicates an increase (decrease) in distance between channel *i* and CCTV1 in timeslot *j*.

Independent variables. The key independent variable is *Shock$_{ij}$* which measures the change in distance between channel *i* and CCTV1 in timeslot *j* between periods *p = -1* and *p = 0*. A positive (negative) *Shock$_{ij}$* value indicates an increase (decrease) in the distance between channel *i* and CCTV1 in timeslot *j*. As discussed in the previous subsection, the direction of *Shock* plays an essential role in the identification process. Therefore, I separate *Shock$_{ij}$* by *PositiveShock$_{ij}$* (when CCTV1 moves away from satellite channel *i* in timeslot *j*) and *NegativeShock$_{ij}$* (when CCTV1 moves towards satellite channel *i* in timeslot *j*). Next, to test Hypothesis 1b, I include interaction terms between *Shock$_{ij}$*, *PositiveShock$_{ij}$* and *NegativeShock$_{ij}$* with *Ratings$_{ij}$* which measures the audience ratings shares received by satellite channel *i* in timeslot *j* during period *p = -1*. Finally, to test Hypothesis 2, I include interaction terms between *Shock$_{ij}$*, *PositiveShock$_{ij}$* and *NegativeShock$_{ij}$* with *PrimeTime$_j$* which is a dummy variable with value of 1 if timeslot *j* falls between 7:30pm and 10:00pm, and zero otherwise.

Control variables. I include several control variables. *SpatialTrend$_{ij}$* is a control variable which captures distance trends prior to the CCTV1 programming shift. If a satellite channel has been executing a pre-existing spatial strategy towards CCTV1 prior to the shock, this control variable will help to capture this effect. Specifically, *SpatialTrend$_{ij}$* measures the change in distance between channel *i* and CCTV1 in timeslot *j* between periods *p = -2* and *p = -1*. In practice, television channels replace shows when they receive low ratings. *RatingsChange$_{ij}$* is a control variable that captures changes in ratings share received by channel *i* in timeslot *j* following the CCTV1 programming shift, i.e. between periods *p = -1* and *p = 0*. *RatingsTrend$_{ij}$* is a control variable that captures the trend in ratings share changes received by channel *i* in timeslot *j* between periods *p = -2* and *p = -1*. Finally, I include channel and timeslot fixed effects associated with satellite channel *i* and timeslot *j*, respectively. These fixed effects capture the time invariant unobservable characteristics of channels and the timeslots. Tables 1.2 and 1.3 present the summary statistics and correlations of the variables. Since SARFT requires that all satellite channels (except Shanghai) to simulcast the daily evening news report together with CCTV1 between 7:00 pm and 7:30 pm, the satellite channels have no autonomy in deciding their programming during this time. I therefore exclude these timeslots in my analysis. The number of observations is 1,860 channel-timeslot.[13]

Insert Tables 1.2 and 1.3 about here

1.4.5 Empirical Analyses

Panel analysis. Using the panel dataset on spatial distances between channels, I run the following regression to estimate the difference between CCTV1-satellite and satellite-satellite distances.

$$Distance_{ijm} = \alpha + \lambda_0 CCTV1_i + \gamma_0\, interaction_{ij} + \Phi FE_{jm} + \varepsilon_{ijm} \qquad (1)$$

The dependent variable is the average spatial distance (in radians) between channel *i* and all other satellite channels in timeslot *j* during year-month *m*. The dummy variable CCTV1 is equal to 1 when channel *i* is CCTV1 and is set to zero otherwise. The interaction term is between CCTV1 and *Primetime* which is a dummy variable of value 1 if timeslot j falls between 7:30 pm to 10:00 pm. The interaction term is used for estimating the effect of the evening primetime market on spatial distance. I include timeslot and year-month fixed effects.

The panel analysis is susceptible to bias due to potential unobserved factors. For example, if CCTV1 carries a political agenda while the satellite channels pursue commercial objectives, then the difference in spatial distance will reflect their difference in objectives rather than difference is abilities. To alleviate this issue, I turn to the natural experiment analysis.

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[13] 30 satellite channels x 16 hours per day x 4 timeslots per hour yields 1,920 channel-timeslot observations. Subtract the two timeslots between 7:00 pm and 7:30 pm for all satellite channels yields 1,860 channel-timeslot observations.

Natural experiment analysis. I employ an OLS model to test the spatial competition hypothesis (Hypothesis 1a):

$$Reposition_{ij} = \alpha + \lambda_1 Shock_{ij} + \Gamma Controls_{ij} + \Phi Fixed\ Effects_{ij} + \varepsilon_{ij} \qquad (2)$$

I expect the coefficient for *Shock* (λ_1) to be negative. However, a negative λ_1 is only a necessary but insufficient support of Hypothesis 1a, as it is also consistent with the strategy of maintaining distance. In order to pinpoint the spatial strategy, I modify Equation (2) by replacing *Shock* with *PositiveShock* and *NegativeShock*. A non-negative (or statistically insignificant) coefficient for *PositiveShock* coupled with a negative and statistically significant coefficient for *NegativeShock* will identify the differentiation strategy. To test Hypothesis 1b, I run the the following OLS model:

$$Reposition_{ij} = \alpha + \lambda_1 Shock_{ij} + \lambda_2 Shock_{ij}*Ratings_{ij} + \Gamma Controls_{ij}$$
$$+ \Phi Fixed\ Effects_{ij} + \varepsilon_{ij} \qquad (3)$$

Similar to testing Hypothesis 1a, I separate *Shock* into *PositiveShock* and *NegativeShock*. I proxy channel capability using the audience ratings share in the pre-CCTV1 program shift era (period *p=-1*). Theory predicts that, condition on the magnitude of *Shock*, satellite channel *i* will demonstrate smaller (greater) magnitude of repositioning if it receives strong (poor) ratings in a timeslot *j*. This prediction will be supported if λ_2 carries an opposite sign to the λ_1. Finally, to test Hypothesis H2, the specification I estimate is:

$$Reposition_{ij} = \alpha + \lambda_1 Shock_{ij} + \lambda_3 Shock_{ij}*PrimeTime_j + \Gamma Controls_{ij}$$
$$+ \Phi Fixed\ Effects_{ij} + \varepsilon_{ij} \qquad (4)$$

The empirical interpretation is analogous to that of Hypothesis 1b. Theory predicts that, conditioned on the magnitude of *Shock*, reposition activities will be smaller in evening timeslots. This prediction will be supported if the λ_3 carries an opposite sign to λ_1.

1.5 Results

1.5.1 Panel Analysis Results

Figure 1.3a plots the raw data that compares average spatial distances between CCTV1 and satellite channels. In every month the average CCTV1-satellite distance is greater than the average satellite-satellite distance. This difference is significant at the 95% level for all months except during the three-month period immediately after the CCTV1 programming change (May to July 2003). The results are similar when average distances from the nearest three channels are compared (Figure 1.3b).

Insert Figures 1.3a and 1.3b about here

I run equation (1) to estimate the difference between CCTV1-satellite and satellite-satellite distances. Table 1.4 shows the regression results. The dependent variable in panel A is the average spatial distance relative to all satellite channel neighbors. Column A1 shows that, when compared to their distance with peers, satellite channels distance themselves an additional 0.155 radians further from CCTV1, representing a difference of 14.6 percent (0.155/1.062=0.146). Column A2 includes year-month and timeslot fixed effects and the regression result changes to 11.6 percent (0.155/1.338=0.116). The result is consistent with Hypothesis 1a. Column A3 shows that the difference in distance drops significantly in primetime timeslots between 7:30 pm to 10:00 pm. This result is consistent with Hypothesis 2. The same set of regressions is repeated using average spatial distance relative to the nearest three satellite channel neighbors, and the results are presented in panel B. Again, the results are consistent with the hypotheses.

Insert Table 1.4 about here

1.5.2 Natural Experiment Analysis Results

Effect of organizational heterogeneity on positioning strategy. Table 1.5 presents results of the test of Hypothesis 1a using the natural experiment. The coefficient for *Shock* is negative, indicating that satellite channels relocate their spatial positions in the opposite direction in response to CCTV1. With no control variables and fixed effects, the coefficient is negative but not statistically significant. However, by including channel and timeslot fixed effects in column 2, both the coefficient's magnitude and statistical significance are increased. In columns 3 to 5, I include pre-policy spatial trends and ratings data as controls. The coefficient retains the negative sign and the statistical significance. The parameter estimate of *Shock* (-0.087) in column 5 reflects that when CCTV1 overlaps one more (less) minute of programming with a satellite channel per day in a 15-minute timeslot, the satellite channel will reposition itself to reduce (increase) the overlap by approximately 5.2 seconds. Table 1.6 presents the results of a robustness test that addresses any concerns about whether adjacent timeslots are independent. I subsample the data using only one quarter (15-minute timeslot) per hour. The coefficients for *Shock* retain the negative sign in all cases with statistical significance at the 5% level for the second and third quarter hour and at 10% level for the first and fourth quarter hour. The results remain robust.

Insert Table 1.5 and 1.6 about here

Recall that a negative coefficient for *Shock* is a necessary but insufficient identification of the differentiation strategy as it is also consistent with the maintaining distance strategy. To pinpoint the identification, I separate the variable *Shock* by *PositiveShock* and *NegativeShock*. When CCTV1 moves away (approaches) a satellite channel in the programming space, I consider it a positive (negative) shock. Table 1.7 presents the results. The results in column 1 show the signs

for *PositiveShock* and *NegativeShock* are positive and negative, respectively. This indicates that channels respond to positive (negative) shocks by subsequently repositioning closer to (away from) CCTV1, suggesting that satellite channels move away from CCTV1 regardless of the direction. However, when fixed effects and control variables are added to the regression model, the coefficient for *PositiveShock* loses statistical significance while the coefficient for *NegativeShock* gains both economic and statistical significance. This suggests that the satellite channels, rather than maintaining distances from CCTV1, differentiate from CCTV1. The parameter estimate of *NegativeShock* (-0.144) in column 5 implies that when CCTV1 increases program genre overlap with a satellite channel by one additional minute per day, the satellite channel will reposition itself to reduce the overlap by approximately 8.7 seconds.

Insert Table 1.7 about here

Table 1.8 presents results of the test of Hypothesis 1b. The key independent variable is the interaction between *Ratings* and *Shock*. For a given *Shock*, a satellite channel generating higher ratings in a timeslot is predicted by theory to demonstrate a lower level of response than a channel with a lower ratings share. Therefore, Hypothesis 1b predicts that the coefficient for the interaction term to have an opposite sign to the *Shock* coefficient. Columns 1-3 present the results with *Shock* while columns 4-6 present the results with *Shock* separated into *PositiveShock* and *NegativeShock*. From column 1, the coefficient of the key independent variable is found to be significant and of the predicted sign. However, it becomes insignificant when fixed effects and controls are included in columns 2 and 3. When *Shock* is separated into *PositiveShock* and *NegativeShock*, results presented in columns 4-6 show that the interaction term is significant with *NegativeShock* but not with *PositiveShock*. Moreover, the sign associated with the interaction term coefficient has the predicted sign. These results support Hypothesis 1b. The economic implication of the coefficient can be illustrated by the following example. A one minute increase in program overlap by CCTV1 will cause a satellite channel receiving the average rating share to reduce programming overlap by approximately 8.9 seconds. For the same shock, the overlap will only be approximately 6.9 seconds if the channel had received a ratings share of one standard deviation above the mean.

Insert Table 1.8 about here

Effect of market environment on positioning strategy. Table 1.9 presents results of the test of Hypothesis 2. The key independent variable is the interaction term between *Primetime* and *Shock*. Hypothesis 2 predicts that, for a given *Shock*, a lower level of differentiation response is expected during primetime. Therefore, I expect the coefficient for the interaction term to have an opposite sign to the *Shock* coefficient. The regression results support Hypothesis 2. Column 6 shows the full regression model result with separate *PositiveShock*, *NegativeShock*, and separate interaction terms with *Primetime*. The coefficients for *PositiveShock* and *Primetime* x *PositiviteShock* are statistically insignificant, while the coefficients for *NegativeShock* and *Primetime* x *NegativeShock* are statistically significant and carry the expected signs. The

economic implication of the coefficient can be illustrated by the following example. A one minute increase in program overlap by CCTV1 during non-primetime will cause a satellite channel receiving the average rating share to reduce programming overlap by approximately 10.4 seconds. If a shock of the same magnitude takes place in primetime, the overlap will only be approximately 0.54 seconds. The results are consistent with Hypothesis 2.

Insert Table 1.9 about here

1.6 Concluding Remarks

This study tests theory predictions on rival positioning strategy using data from the Chinese satellite television industry. I present a simple model of spatial positioning that predicts two rivals will be (1) more likely to differentiate their products when the difference between their resources is large, and (2) less likely to differentiate when the market size ratio between product segments is large. Based on a panel analysis and a natural experiment induced by a government policy change, I find the satellite channels position themselves on average 12 to 15 percent further away from CCTV1 than from peers. Moreover, I find the satellite channels dynamically adjust their positions to differentiate from CCTV1 with the weakest satellite channels exhibit greatest strategic responsiveness. Finally, I find the satellite channels locate closer to the CCTV1 in evening timeslots where the market size ratio between product segments is large. The evidence is consistent with theory predictions.

Moreover, this paper contributes to the literature by examining strategic behaviors of state-owned enterprises (SOEs). Governments around the world have been implementing reforms to their SOEs with the aim of improving efficiency and adapting to market economy. The degrees of success of these reforms are of interest to both policy makers and management researchers. For example, Ralston et al. (2006) has shown that the organizational culture of modern Chinese SOEs, after decades of reform, has transformed from a bureaucratic mode to a configuration that resembles those of privately-owned businesses. Building on existing literature, this paper directly examines the behaviors of China's SOEs and finds evidence suggesting that they behave strategically, just as firms in market economy do, by responding to market environment as well as to rivalry.

Several future research opportunities arise from the limitations of this study. First, the present study only focuses on pair-wise competitions between individual satellite channels and CCTV1. Since the satellite channels are likely to also take into consideration the actions of their peers, the process of determining the spatial positions of each player is anticipated to be more complex than the one modeled in this study. Future research can explore strategic interactions between the satellite channels. For example, the literature on imitation strategy argues that under uncertain environments, such as the circumstance facing the satellite channels when CCTV1 revamped its product portfolio, firms tend to imitate one another (e.g. Banerjee 1992). It will be interesting to test the imitation theory by examining whether the satellite channels, when differentiating from CCTV1, cluster among themselves in product spatial locations.

Second, in the advertiser-support media industry, broadcasters do not set prices to charge the audience (i.e. the price is zero). While exogenous determination of prices is not uncommon in regulated industries (e.g. taxicabs) and two-sided markets (e.g. internet search engines), future empirical research can include endogenous pricing in the analysis. When examining both the positioning and pricing decisions of heterogeneous firms, however, researchers need to exercise caution about selection issues as weaker players are less likely to participate in the market and therefore their product offering and prices are unobserved. For example, the study by Syverson (2007) on spatial competition in the cement industry finds that competition-driven selection on cost to be a significant underlying cause for his observed firm strategy.[14]

Third, similar to prior studies on positioning strategy (e.g. Baum and Haveman, 1997; Thomas and Weigelt, 2000; Semadeni, 2006), this study does not connect positioning strategy with organizational performance. A primary goal of management research is to understand how managerial strategic decisions influence firm performance. With both product locations and viewership ratings available in this study, one may be tempted to link positioning with performance outcomes. However, Hamilton and Nickerson (2003) point out that positioning decision by an organization is endogenous to the expected performance outcome. Therefore, even if correlations between satellite channels' positioning strategy and ratings performance are present, this study cannot conclude that the cause-and-effect between strategy and performance without conducting further econometric analysis.

In conclusion, spatial positioning has been a central and enduring topic for economists and management researchers. This study contributes to a richer understanding of spatial positioning strategy by integrating organizational heterogeneity and external market environment to examine conditions under which rivals exhibit various degree of differentiation.

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[14] Syverson (2007) uses census level data on cost, prices and geographical spatial location to analyze the ready-mixed concrete industry. He finds that equilibrium prices are lower in areas where players concentrate. If the players were assumed homogeneous, one might be tempted to conclude that competition leads to lower optimal mark ups. However, when Syverson includes cost data to reflect firm heterogeneity, he finds competition-driven selection on cost to be an underlying cause for the low equilibrium prices.

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APPENDIX A. A Simple Spatial Positioning Model with Heterogeneous Players

Suppose Channel 1, the stronger channel, produces $\theta \in (1, 2)$ units of quality per dollar spent while Channel 2 produces 1 unit of quality per dollar spent. One genre attracts a larger audience and generates revenue at $\beta\sqrt{q}$ where $\beta > 1$ is a scale multiplier and q represents the total quality of shows produced for this genre. The other genre attracts a smaller audience and corresponds to a scale multiplier of 1, all else equal. When both channels select the same genre , they split the total revenue according to $q_1/(q_1+q_2)$ and $q_2/(q_1+q_2)$. Otherwise, each monopolizes the revenue of their genres.

Given the payoff functions, in equilibrium, when both channels co-locate in the more attractive genre they earn $\pi_1 = \frac{3}{4}\beta^2\theta\frac{(2\theta-1)^2}{(\theta+1)^3}$, $\pi_2 = \frac{3}{4}\beta^2\theta\frac{(\theta-2)^2}{(\theta+1)^3}$; and when they enjoy a monopoly in the genre with scaling factor β, they earn $\pi_1' = \frac{\theta\beta^2}{4}$, $\pi_2' = \frac{\beta^2}{4}$.

Proposition *There exist three equilibria under the following conditions:*

Condition (1): Suppose $\beta^2 \geq \frac{1}{3}\frac{(\theta+1)^3}{\theta(\theta-2)^2}$, then the unique equilibrium is for both channels to co-locate in the genre with the larger audience.

Condition (2): Suppose $\frac{1}{3}\frac{(\theta+1)^3}{(2\theta-1)^2} < \beta^2 < \frac{1}{3}\frac{(\theta+1)^3}{\theta(\theta-2)^2}$, then the unique equilibrium is where the more able channel selects the genre with the larger audience and the less able channel selects the genre with the smaller audience.

Condition (3): Suppose $\beta^2 \leq \frac{1}{3}\frac{(\theta+1)^3}{(2\theta-1)^2}$, then the channels never co-locate in equilibrium. Moreover, either channel may select the genre with the larger audience.

Proof *Condition (1): Suppose $\beta^2 \geq \frac{1}{3}\frac{(\theta+1)^3}{\theta(\theta-2)^2}$* , for channels to co-locate in the more attractive genre requires that $\frac{3}{4}\beta^2\theta\frac{(2\theta-1)^2}{(\theta+1)^3} \geq \frac{\theta}{4}$ and $\frac{3}{4}\beta^2\theta\frac{(\theta-2)^2}{(\theta+1)^3} \geq \frac{1}{4}$, which yields the set of conditions $\beta^2 \geq \frac{1}{3}\frac{(\theta+1)^3}{(2\theta-1)^2}$ and $\beta^2 \geq \frac{1}{3}\frac{(\theta+1)^3}{\theta(\theta-2)^2}$. It is readily verified that $1 < \frac{1}{3}\frac{(\theta+1)^3}{(2\theta-1)^2} < \frac{1}{3}\frac{(\theta+1)^3}{\theta(\theta-2)^2}$ for $\theta \in (1, 2)$. Thus, if $\beta^2 \geq \frac{1}{3}\frac{(\theta+1)^3}{\theta(\theta-2)^2}$, neither channel can profitably deviate by differentiating from the more attractive genre. To see that this is the unique equilibrium, notice that if the channels did not co-locate, the channel broadcasting the less attractive genre could profitably switch to the more attractive genre. Finally, if channels co-locate in the less attractive genre, then either channel could profitably deviate to become the monopolist in the more attractive genre.

Condition (2): Suppose $\frac{1}{3}\frac{(\theta+1)^3}{(2\theta-1)^2} < \beta^2 < \frac{1}{3}\frac{(\theta+1)^3}{\theta(\theta-2)^2}$, co-location in either market is not an equilibrium since the weaker channel can profitably deviate to the unoccupied genre. To see that the weaker channel cannot monopolize the more attractive genre, notice that the stronger channel could profitably deviate by co-locating there since $\frac{1}{3}\frac{(\theta+1)^3}{(2\theta-1)^2} < \beta^2$. Thus, the only equilibrium is that identified in the proposition.

Condition (3): Suppose $\beta^2 \le \frac{1}{3}\frac{(\theta+1)^3}{(2\theta-1)^2}$, since $\beta^2 \le \frac{1}{3}\frac{(\theta+1)^3}{(2\theta-1)^2}$, neither channel finds it profitable to co-locate in a genre. To see that the weaker channel can monopolize the more attractive genre, notice that the stronger channel cannot profitably deviate from the less attractive genre to co-locate with the weaker channel. At the same time, the weaker channel cannot profitably deviate to the less attractive genre. The proof is similar for the case where the stronger channel monopolizes the more attractive genre. ∎

Table 1.1a and 1.1b Sample Primetime Programming Lineup

Wednesday January 15 2003 7:00pm – 11:00pm

<table>
<tr><th colspan="4">Table 1.1a CCTV1</th></tr>
<tr><th>Title</th><th>Start</th><th>End</th><th>Category</th></tr>
<tr><td>National News</td><td>19:00:00</td><td>19:30:00</td><td>General News</td></tr>
<tr><td>Commercials</td><td>19:30:00</td><td>19:31:05</td><td>Commercials</td></tr>
<tr><td>Weather Forecast</td><td>19:31:05</td><td>19:35:20</td><td>Weather Forecast</td></tr>
<tr><td>Commercials</td><td>19:35:20</td><td>19:38:50</td><td>Commercials</td></tr>
<tr><td>*Jiaodian* Interview</td><td>19:38:50</td><td>19:50:50</td><td>News Commentary</td></tr>
<tr><td>Commercials</td><td>19:50:50</td><td>19:57:40</td><td>Commercials</td></tr>
<tr><td>Technology Expo</td><td>19:57:40</td><td>20:02:10</td><td>General Science</td></tr>
<tr><td>Commercials</td><td>20:02:10</td><td>20:04:00</td><td>Commercials</td></tr>
<tr><td>*Da Shi*</td><td>20:04:00</td><td>20:54:02</td><td>Domestic Drama</td></tr>
<tr><td>Commercials</td><td>20:54:02</td><td>21:00:05</td><td>Commercials</td></tr>
<tr><td>*Xianzaibobao*</td><td>21:00:05</td><td>21:20:00</td><td>General News</td></tr>
<tr><td>Commercials</td><td>21:20:00</td><td>21:22:45</td><td>Commercials</td></tr>
<tr><td>Program Guide</td><td>21:22:45</td><td>21:23:45</td><td>Program Guide</td></tr>
<tr><td>Commercials</td><td>21:23:45</td><td>21:24:20</td><td>Commercials</td></tr>
<tr><td>Around the World</td><td>21:24:20</td><td>21:53:45</td><td>Documentary Others</td></tr>
<tr><td>Program Guide</td><td>21:53:45</td><td>21:54:45</td><td>Program Guide</td></tr>
<tr><td>Commercials</td><td>21:54:45</td><td>22:00:00</td><td>Commercials</td></tr>
<tr><td>World Report</td><td>22:00:00</td><td>22:17:00</td><td>General News</td></tr>
<tr><td>Commercials</td><td>22:17:00</td><td>22:20:00</td><td>Commercials</td></tr>
<tr><td>Nightly News</td><td>22:20:00</td><td>22:30:00</td><td>General News</td></tr>
<tr><td>Commercials</td><td>22:30:00</td><td>22:32:00</td><td>Commercials</td></tr>
<tr><td>Sports News</td><td>22:32:00</td><td>22:42:00</td><td>Sports News</td></tr>
<tr><td>Commercials</td><td>22:42:00</td><td>22:47:00</td><td>Commercials</td></tr>
<tr><td>Weather Forecast</td><td>22:47:00</td><td>22:52:00</td><td>Weather Forecast</td></tr>
<tr><td>Commercials</td><td>22:52:00</td><td>22:56:00</td><td>Commercials</td></tr>
<tr><td>Program Guide</td><td>22:56:00</td><td>22:57:00</td><td>Program Guide</td></tr>
</table>

<table>
<tr><th colspan="4">Table 1.1b Shanghai</th></tr>
<tr><th>Title</th><th>Start</th><th>End</th><th>Category</th></tr>
<tr><td>Nightly Sports News</td><td>19:00:00</td><td>19:30:00</td><td>Sports News</td></tr>
<tr><td>Commercials</td><td>19:30:00</td><td>19:33:00</td><td>Commercials</td></tr>
<tr><td>Renzai Shanghai</td><td>19:33:00</td><td>19:57:00</td><td>Documentary</td></tr>
<tr><td>Commercials</td><td>19:57:00</td><td>20:00:00</td><td>Commercials</td></tr>
<tr><td>Shanghai Satellite Channel News</td><td>20:00:00</td><td>20:27:50</td><td>General News</td></tr>
<tr><td>Commercials</td><td>20:27:50</td><td>20:28:20</td><td>Commercials</td></tr>
<tr><td>Weather Forecast</td><td>20:28:20</td><td>20:30:00</td><td>Weather Forecast</td></tr>
<tr><td>Commercials</td><td>20:30:00</td><td>20:34:25</td><td>Commercials</td></tr>
<tr><td>Dafuqingzhai</td><td>20:34:25</td><td>21:13:10</td><td>Domestic Drama</td></tr>
<tr><td>Commercials</td><td>21:13:10</td><td>21:15:45</td><td>Commercials</td></tr>
<tr><td>Dafuqingzhai</td><td>21:15:45</td><td>21:53:45</td><td>Domestic Drama</td></tr>
<tr><td>Song of the Week</td><td>21:53:45</td><td>21:59:00</td><td>Music Others</td></tr>
<tr><td>News At Ten</td><td>21:59:00</td><td>22:23:02</td><td>Foreign Language News</td></tr>
<tr><td>Commercials</td><td>22:23:02</td><td>22:26:01</td><td>Commercials</td></tr>
<tr><td>Weather Forecast</td><td>22:26:01</td><td>22:27:00</td><td>Weather Forecast</td></tr>
<tr><td>Commercials</td><td>22:27:00</td><td>22:30:00</td><td>Commercials</td></tr>
<tr><td>Nightline News</td><td>22:30:00</td><td>23:09:27</td><td>General News</td></tr>
</table>

Note: The original dataset contains title and category data in Chinese

Table 1.2 Summary Statistics

Variable	Definition	Obs	Mean	Std. Dev.	Min	Max
$Reposition_{ij}$	Change in spatial distance between channel i and CCTV1 in timeslot j between periods $p = 0$ and $p = 1$	1860	0.04	0.20	-1.49	1.10
$Shock_{ij}$	Change in distance between channel i and CCTV1 in timeslot j between periods $p = -1$ and $p = 0$	1860	-0.15	0.42	-1.42	1.30
$PositiveShock_{ij}$	Equals $Shock_{ij}$ if $Shock_{ij} > 0$, zero otherwise	1860	0.07	0.14	0	1.30
$NegativeShock_{ij}$	Equals $Shock_{ij}$ if $Shock_{ij} < 0$, zero otherwise	1860	-0.22	0.36	-1.42	0
$Ratings_{ij}$	Ratings share received by channel i in timeslot j during $p = -1$	1860	0.65	0.85	0.01	11.02
$SpatialTrend_{ij}$	Change in distance between channel i and CCTV1 in timeslot j between periods $p = -2$ and $p = -1$	1860	0.02	0.18	-0.92	1.23
$RatingsChange_{ij}$	Change in ratings share received by channel i in timeslot j between periods $p = -1$ and $p = 0$	1860	0.02	0.44	-5.52	1.91
$RatingsTrend_{ij}$	Change in ratings share received by channel i in timeslot j between periods $p = -2$ and $p = -1$	1860	0.02	0.54	-1.78	7.97

Periods: $p = -2$ covers Nov 2002 – Jan 2003; $p = -1$ covers Feb 2003 – Apr 2003; $p = 0$ covers May 2003 – Jul 2003; $p = 1$ covers Aug 2003 – Oct 2003

Table 1.3 Correlations Matrix

	Reposition	Shock	Positive Shock	Negative Shock	Ratings	Spatial Trend	Ratings Change	Ratings Trend
Reposition	1							
Shock	-0.04	1						
PositiveShock	0.02	0.57*	1					
NegativeShock	-0.05*	0.95*	0.29*	1				
Ratings	0.06*	-0.10*	-0.03	-0.11*	1			
SpatialTrend	-0.07*	-0.20*	-0.17*	-0.17*	-0.01	1		
RatingsChange	0.07*	-0.01	0.00	-0.02	-0.32*	-0.01	1	
RatingsTrend	-0.03	-0.01	-0.02	-0.00	0.61*	0.00	-0.61*	1

*p<.05

Table 1.4 Panel Analysis Results

Satellite channels distance themselves further from CCTV1 compared to their peers

Panel A. Dep. Var. = Average spatial distance between channel *i* and *all* satellite channel neighbors in timeslot *j* in year-month *m*.

Panel B. Dep. Var. = Average spatial distance between channel *i* and the *nearest three* satellite channel neighbors in timeslot *j* in year-month *m*.

| | Panel A | | | Panel B | | |
	(A1)	(A2)	(A3)	(B1)	(B2)	(B3)
CCTV1	0.16	0.16	0.18	0.18	0.18	0.21
	(0.01)***	(0.01)***	(0.01)***	(0.02)***	(0.01)***	(0.02)***
CCTV1*PrimeTime			-0.15			-0.18
			(0.03)***			(0.03)***
PrimeTime	No	No	Absorbed	No	No	Absorbed
YearMonth Fixed Effect	No	Yes	Yes	No	Yes	Yes
Timeslot Fixed Effect	No	Yes	Yes	No	Yes	Yes
Constant	1.06	1.34	1.34	0.59	0.78	0.78
	(0.00)***	(0.01)***	(0.01)***	(0.00)***	(0.03)***	(0.03)***
Observations	23808	23808	23808	23808	23808	23808
R-squared	0.01	0.53	0.53	0.01	0.16	0.16

Robust standard errors in parentheses
*** $p < .01$

Table 1.5 Test of Hypothesis 1a

Satellite channels differentiate from CCTV1

Dependent Variable: Spatial distance repositioning by Satellite Channels with respect to CCTV1

	(1)	(2)	(3)	(4)	(5)
Shock	-0.02	-0.08	-0.08	-0.09	-0.09
	(0.01)	(0.03)**	(0.03)**	(0.03)**	(0.03)**
Channel Fixed Effect	No	Yes	Yes	Yes	Yes
Timeslot Fixed Effect	No	Yes	Yes	Yes	Yes
RatingsChange	No	No	Yes	Yes	Yes
SpatialTrend	No	No	No	Yes	Yes
RatingsTrend	No	No	No	No	Yes
Observations	1860	1860	1860	1860	1860
R-squared	0.00	0.30	0.30	0.30	0.30
No. of SE Clusters	-	30	30	30	30

Robust standard errors in parentheses; SE clustered by channels in (2)-(5)
** $p < .05$

Table 1.6 Robustness Test of Hypothesis 1a

Dependent Variable: Spatial distance repositioning by Satellite Channels with respect to CCTV1

	(1) 1st quarter of each hour	(2) 2nd quarter of each hour	(3) 3rd quarter of each hour	(4) 4th quarter of each hour
Shock	-0.08	-0.13	-0.08	-0.07
	(0.04)*	(0.05)**	(0.04)**	(0.04)*
Channel Fixed Effect	Yes	Yes	Yes	Yes
Timeslot Fixed Effect	Yes	Yes	Yes	Yes
RatingsChange	Yes	Yes	Yes	Yes
SpatialTrend	Yes	Yes	Yes	Yes
RatingsTrend	Yes	Yes	Yes	Yes
Observations	450	450	480	480
R-squared	0.29	0.36	0.35	0.35
No. of SE Clusters	30	30	30	30

Robust standard errors in parentheses; SE clustered by channels
*$p < .10$; ** $p < .05$

Table 1.7 Test of Hypothesis 1a with Positive and Negative Shocks

Dependent Variable: Spatial distance repositioning by Satellite Channels with respect to CCTV1

	(1)	(2)	(3)	(4)	(5)
PositiveShock	0.05	0.10	0.10	0.08	0.08
	(0.03)	(0.07)	(0.07)	(0.06)	(0.06)
NegativeShock	-0.03	-0.14	-0.14	-0.14	-0.14
	(0.02)**	(0.04)***	(0.04)***	(0.04)***	(0.04)***
Channel Fixed Effect	No	Yes	Yes	Yes	Yes
Timeslot Fixed Effect	No	Yes	Yes	Yes	Yes
RatingsChange	No	No	Yes	Yes	Yes
SpatialTrend	No	No	No	Yes	Yes
RatingsTrend	No	No	No	No	Yes
Observations	1860	1860	1860	1860	1860
R-squared	0.00	0.31	0.31	0.31	0.31
No. of SE Clusters	-	30	30	30	30

Robust standard errors in parentheses; SE clustered by channels in (2)-(5)
*** p < .05; *** p < .01*

Table 1.8 Test of Hypothesis 1b

Stronger satellite channels less likely to differentiate from CCTV1

Dependent Variable: Spatial distance repositioning by Satellite Channels with respect to CCTV1

	(1)	(2)	(3)	(4)	(5)	(6)
Shock	-0.03	-0.09	-0.10			
	(0.01)*	(0.04)**	(0.04)**			
Ratings x Shock	0.09	0.12	0.09			
	(0.03)***	(0.07)	(0.07)			
PositiveShock				0.02	0.10	0.10
				(0.04)	(0.07)	(0.07)
Ratings x PositiveShock				0.05	0.01	-0.03
				(0.04)	(0.06)	(0.06)
NegativeShock				-0.06	-0.16	-0.17
				(0.02)***	(0.04)***	(0.04)***
Ratings x NegativeShock				0.04	0.03	0.04
				(0.02)**	(0.02)*	(0.02)**
Ratings	Yes	Yes	Yes	Yes	Yes	Yes
Channel Fixed Effects	No	Yes	Yes	No	Yes	Yes
Timeslot Fixed Effects	No	Yes	Yes	No	Yes	Yes
RatingsChange	No	No	Yes	No	No	Yes
SpatialTrend	No	No	Yes	No	No	Yes
RatingsTrend	No	No	Yes	No	No	Yes
Observations	1860	1860	1860	1860	1860	1860
R-squared	0.01	0.30	0.31	0.01	0.31	0.32
No. of SE Clusters	-	30	30	-	30	30

Robust standard errors in parentheses; SE clustered by channels in (2),(3),(5),(6)
  * $p < .10$
 ** $p < .05$
*** $p < .01$

Table 1.9 Test of Hypothesis 2

Satellite channels less likely to differentiate from CCTV1 in evening timeslots

Dependent Variable: Spatial distance repositioning by Satellite Channels with respect to CCTV1

	(1)	(2)	(3)	(4)	(5)	(6)
Shock	-0.03	-0.10	-0.11			
	(0.02)*	(0.04)**	(0.04)**			
Primetime x Shock	0.04	0.11	0.10			
	(0.03)	(0.05)**	(0.05)*			
PositiveShock				0.07	0.11	0.08
				(0.04)**	(0.07)	(0.06)
Primetime x PositiveShock				-0.08	-0.09	-0.07
				(0.09)	(0.16)	(0.16)
NegativeShock				-0.06	-0.18	-0.17
				(0.02)***	(0.05)***	(0.06)***
Primetime x NegativeShock				0.06	0.19	0.16
				(0.03)**	(0.08)**	(0.08)**
Primetime	Yes	absorbed	absorbed	Yes	absorbed	absorbed
Channel Fixed Effects	No	Yes	Yes	No	Yes	Yes
Timeslot Fixed Effects	No	Yes	Yes	No	Yes	Yes
RatingsChange	No	No	Yes	No	No	Yes
SpatialTrend	No	No	Yes	No	No	Yes
RatingsTrend	No	No	Yes	No	No	Yes
Observations	1860	1860	1860	1860	1860	1860
R-squared	0.01	0.30	0.31	0.01	0.31	0.32
No. of SE Clusters	-	30	30	-	30	30

Robust standard errors in parentheses; SE clustered by channels in (2),(3),(5),(6)

 * $p < .10$
 ** $p < .05$
*** $p < .01$

Notes :
1. PrimeTime = 1 if timeslot j falls between 7:30pm and 10:00pm. Otherwise PrimeTime = 0.
2. Observations excluded if timeslot j falls between 7:00pm and 7:30pm during the simulcast of the national news.

Figure 1.1 Spatial Strategy Equilibria

Market
Segment Size
Ratio, β

Co-location

Differentiation

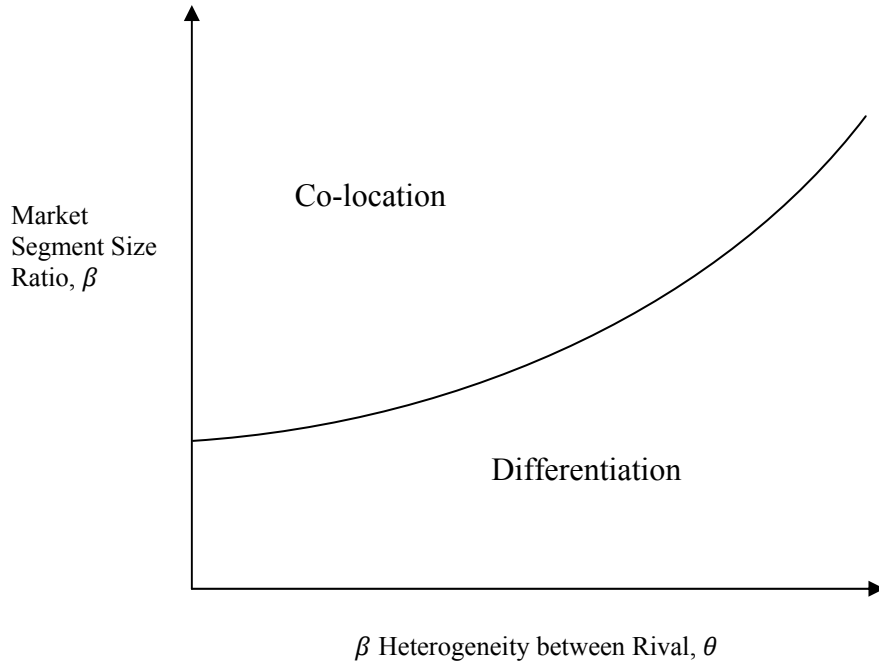β Heterogeneity between Rival, θ

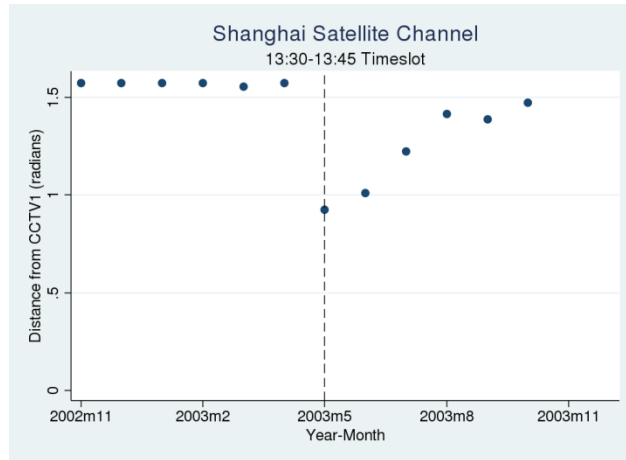**Figure 1.2a CCTV1 Shock on Shanghai Satellite Channel**

Figure 1.2b CCTV1 Shock on Hainan Satellite Channel
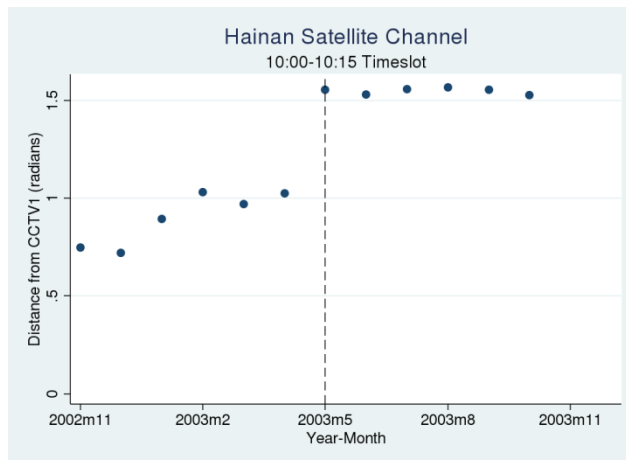
Figure 1.3a Product Spatial Distance: All Channels
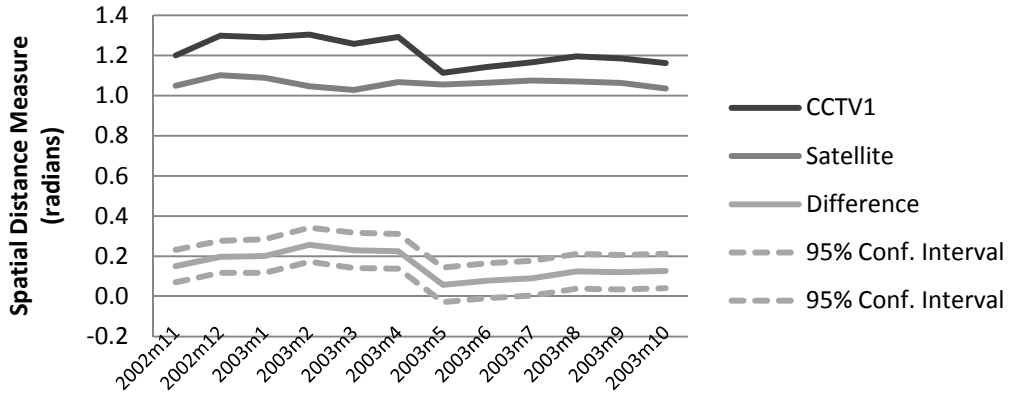
Figure 1.3b Product Spatial Distance: Nearest Three Channels
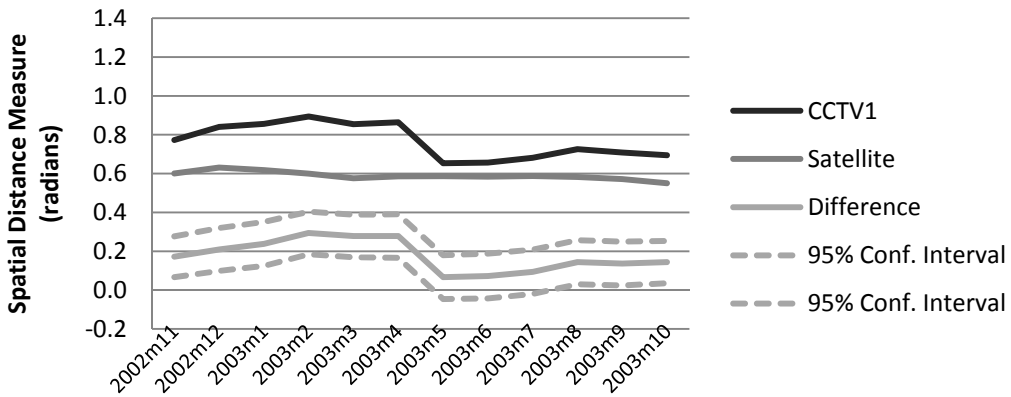
Chapter 2

Mimetic Spatial Positioning Response to Rival Entry

Abstract

This paper studies strategic responses by incumbents facing market uncertainty caused by the entry of a dominant rival. Based on imitation theory, I hypothesize that (1) incumbents are more likely to cluster in product space when facing uncertain market conditions; (2) they cluster more tightly when market uncertainty is high and less tightly as the market uncertainty clears; and (3) they cluster around their stronger peers. I analyze product spatial distances between 30 Chinese satellite television channels before and after the time of commercialization of a government-owned dominant rival. Empirical results are generally consistent with the hypotheses. I also address potential alternative explanations of the clustering patterns.

2.1 Introduction

Firms formulate and adapt their strategies to changing market environments based on imperfect market information. For example, when Walmart enters a neighborhood, retailers nearby will face changes in the competitive market environment. In response they may adjust their prices and product offerings. Yet they may be uncertain about by how much to change the prices and in what ways to change the product offerings since they lack information about the new competitive landscape. The question of how decisions are made under imperfect information has intrigued economists, sociologists, and management scholars. Commonly they refer to the imitation theory – players mimic the decisions of others in environments characterized by uncertainty. Lieberman and Asaba (2006) review the multiple strands of imitation theory and organize them into information-based theories, where players follow others that they believe to possess superior information (e.g. DiMaggio and Powell, 1983; Sharfstein and Stein, 1990; Banerjee, 1992; Bikhchandani et al. 1992), and rivalry-based theories, where players take similar actions to maintain competitive parity or limit rivalry (e.g. Klemperer, 1992).

Empirical studies on imitation have examined a broad setting of decision making under uncertainty, such as R&D and product innovations (e.g. Cockburn and Henderson, 1994; Kennedy, 2002), adoption of managerial practices and strategies (e.g. Davis, 1991; Greve, 1996), market entries (e.g. Baum and Haveman, 1997; Henisz and Delios, 2001), and investment decisions (e.g. Gilbert and Lieberman, 1987; Grinblatt et al. 1995). Despite considerable research on imitation, two key areas remain unexplored. First, researchers have yet to empirically explore imitation theory in a setting where incumbents respond to entry of a rival. Second, there is little understanding of how the patterns of imitation change over time – will firms imitate each other when market uncertainty is high, and differentiate as the uncertainty clears? And, if players imitate, with whom are they more likely to follow?

This study aims to contribute to the literature by analyzing imitation strategy in uncertain market environments over time. In particular, I focus on the dynamics of clustering of product portfolio strategy in response to the entry of a dominant rival. I begin by examining whether firms cluster subsequent to rival entry. I then study how clustering intensity changes as the market progresses through the uncertain period, and with which players do the clusters form around. I address these questions by analyzing product spatial positioning of 30 Chinese satellite television channels before and after the commercialization of a dominant rival, the central government-owned CCTV1. Traditionally, CCTV1 served as an important apparatus in disseminating government information to the public while the satellite channels were more commercially oriented (Chan, 2003; Shambaugh, 2007). In 2003, a shift in government policy allowed CCTV1 to offer a more commercially-oriented programming lineup. With the overhaul, CCTV1 introduced a greater number of television drama and entertainment shows while retaining a portion of its original programming. The entry into the commercial television market by CCTV1 imposed different degrees of uncertainty to the satellite channels in different timeslots – some satellite channels were directly attacked by CCTV1, thus experienced greater uncertainty, while others were not attacked by CCTV1. The analysis shows that (1) the satellite channels are more likely to cluster in product space when facing uncertain market conditions; (2) they cluster more tightly immediately after CCTV1 commercialized, and less tightly as time progresses; and (3) there is some evidence suggesting that they cluster with their stronger peers.

The organization of the paper is as follows. First, I discuss the conceptual framework and state my hypotheses. Next I present the competitive framework of the Chinese satellite television industry and the commercialization of CCTV1 that triggered the market uncertainty. Then, I describe the data and methodology, followed by the results. The paper ends with discussions and concluding remarks.

2.2 Conceptual Framework

In this section, I present an overview of the literature on imitation theory and strategic response to rival entry, followed by the hypotheses.

2.2.1 Imitation Theory

In environments characterized by uncertainty, imitation theory predicts that managers mimic the decisions made by others. Lieberman and Asaba (2006) present a comprehensive review of imitation theory from the economics, sociology and strategic management literature. They organize the various strands of imitation theory into two broad categories: information-based theories and rivalry-based theories.

Information-based theories – A strand of the information-base theories comes from the economics literature (Banerjee, 1992; Bikhchandani et al., 1992). It argues that actions by early players reveal their private information about the nature of the state to the followers. As early players' information accumulates, it may be rational for later players to ignore their own private information and repeat their predecessors' decisions. A second strand of the information-base theory stems from principal-agent theory (Scharfstein and Stein, 1990). Agents may ignore their private information and imitate others in order to avoid negative perceptions by the principals. Consider the following scenario. If an agent chooses to follow her own private information and not imitate, she risks revealing that she is of the low ability type should her decision leads to an unfavorable outcome. In contrast, the principal cannot rely solely on the outcome to identify the agent's ability if the agent herds with her peers. A third strand of the information-based theories comes from the concept of mimetic isomorphism in the organizational sociology literature (Dimaggio and Powell, 1983). It explains that imitation behavior is rational because by mimicking others, players economize on search costs as they navigate in uncertain environments.

Rivalry-based theories – This branch of imitation theory proposes that firms pursue imitation strategy in order to mitigate rivalry, maintain competitive parity, and reduce risks. For example, Klemperer (1992) shows that when two crosstown rival retail outlets offer similar products and prices, consumers will only shop at the one nearest to them. The rivals can sustain higher prices and preserve profits. Knickerbocker (1973) and Motta (1994) point out that the reason behind the "follow-the-leader" strategy in foreign direct investment decisions is the desire to ensure no one rival is relatively better or worse off. In winner-takes-all settings, such as patent races, firms may behave similarly in order to prevent others to reduce the risk of losing (Reinganum, 1989).

Lieberman and Asada (2006) offer a guideline on distinguishing between information-based and rivalry-based imitation. These two categories are not mutually exclusive. Yet imitation behavior is more likely to be rivalry-based if firms compete in the same market, they have similar size and resources, and the environment uncertainty is moderate. In contrast, when the firms are in the same market and have different sizes or resources, information-based imitation is more likely to be the case.

2.2.2 Strategic Responses to Rival Entry

The seminal work by Bain (1956) sets the framework for the economics literature on strategic response to rival entry which covers mechanisms such as price (Milgrom and Roberts, 1982), investment in capacity (Spence, 1977; Dixit, 1980), and advertising (Bagwell and Ramey, 1988). Incumbents also consider product strategy when anticipating or responding to rival entry. This literature, based on the Hotelling (1929) spatial competition model, argues that firms choose their locations in product space to deter or accommodate entries. To deter entry, incumbents strategically occupy product spaces which leave non-positive expected profits for potential entrants (Prescott and Visscher, 1977; Eaton and Lipsey, 1979). If the incumbents accommodate new entries, they reposition to a new location that, in equilibrium, maximizes their profits in the post-entry competitive landscape (Noam, 1987). The literature on product spatial response to entries, however, assumes that the market environment is known and unaffected by the new player. This may not be realistic particularly when the entrant is a dominant firm.

In management literature, Milliken (1987) summarizes three types of uncertainties facing firms – environmental, organizational and decision response. At the firm level, Wernerfelt and Karnani (1987) present a theoretical discussion on how firms should balance the trade-off between focusing and spreading their resources to best cope with uncertainties. At the product level, Miller and Shamsie (1999) empirically study how firms organize their product lines to manage these uncertainties. They find that Hollywood studios diverse their products to cope with environmental uncertainties but they simplify their products to cope with organizational and decision response uncertainties. Yet entries by dominant rivals will likely cause uncertainties along all three dimensions. Hence how mangers should adjust their product portfolio in response to rival entry is unclear.

Recent empirical studies addressing incumbent product spatial strategy in response to dominant rival entries has generated diverse results. George and Waldfogel (2006) find that local newspapers increase their local news coverage and reduce their national news content in response to the market penetration of the *New York Times*. Ailawadi et al. (2010) analyze price, promotion and product responses by local incumbent retailers to new Walmart stores. While they find significant sales decline among the incumbents, surprisingly, they find that many incumbents show little reaction, if any, to Walmart's entry. Moreover, they find substantial variations in the performance outcomes according to the incumbents' store characteristics, retail formats, product categories, as well as their strategic choices. They comment that the incumbents perhaps "feel incapable of effectively reacting to a behemoth like Walmart." Alternatively, their results may suggest that the best response strategy is not obvious to the incumbents. In a related analysis on the Chinese television industry, Wang (2010) finds that satellite television channels relocate in product space to differentiate from the central government-owned dominant channel.

The study, however, does not identify whether the satellite channels relocate in clusters or in dispersed patterns. In situations where relocation in product space is hampered by technical barriers or patent protections, researchers may observe firms exiting the market instead of relocating in product space. The study by de Figueiredo and Silverman (2007) on the laser printer industry shows that small incumbents exit the product market when attacked by Hewlett-Packard, the dominant firm in the industry.

2.2.3 Hypotheses

The empirical literature suggests that the best strategic response to rival entry may not be clear to the incumbents. Under uncertainty, incumbents may choose to imitate others. For the manger, imitating helps avoid sending a negative signal about his ability to the top executives in case his decision leads to a poor outcome. At a firm level, imitating will help maintain competitive parity among the incumbents. If firms imitate each other, they will display clustering patterns in the strategy space. Therefore, I hypothesize that:

> *Hypothesis 1: Firms cluster when under attack by a dominant rival.*

Market uncertainty will be the highest immediately following the entry by the dominant rival. Incumbents that are under direct attack by the dominant rival need to reformulate their strategy to adapt to the new competitive landscape. As time progresses, incumbents will be able to gather and analyze information about how the market has changed, and the uncertainty diminishes. With lower uncertainty about the environment there is less need for the incumbents to imitate each other. This leads to my second hypothesis:

> *Hypothesis 2: Firms cluster more intensely immediately following an attack by a dominant rival, and the intensity of clustering decreases over time.*

When firms cluster with their peers, they intend to choose a strategy that, in expectation, will lead to the best outcome. Under the information-based imitation argument, firms anticipate that their strongest peers are more able to accurately detect the market signals. When the strongest players act on their private information and execute their strategy, they create positive externalities to others by revealing their private signals. Other players benefit from this externality by imitating the strategy of their stronger peers (Shaver and Flyer, 2000). Therefore, I hypothesize that:

> *Hypothesis 3: Firms cluster with their stronger counterparts when under attack by a dominant rival.*

2.3 Competitive Framework

2.3.1 Overview of the Chinese Television Industry

Wang (2010) offers a detail description of the television industry in China. In essence, the industry is comprised of three tiers of television stations.[15] The top tier is occupied by the China Central Television (CCTV) which is owned by the central government. The second tier consists of 31 provincial stations which are owned by the province-level governments. The third tier consists of the local stations owned by municipality, prefecture and county-level governments. Each television station operates one or more channels. For example, CCTV currently operates 20 channels (with CCTV1 being their flagship channel) and the Shanghai station operates 13. Literature on the Chinese media points out that the heterogeneity in terms of the resources available to CCTV and provincial stations is clearly distinct, as stated by Chan (2003, p.168), *"[CCTV] … enjoys unmatched privileges such as access to information at the national level and huge resources in terms of capital, equipment, and talent."* Altogether, these thirty-one provincial satellite channels together with the CCTV channels form the national television industry. The satellite channels combined take up about one third of the national broadcast market share while CCTV1 alone occupies approximately 30 percent.

The satellite channels are regulated by the State Administration of Radio, Film and Television (SARFT) which is under the State Council. SARFT reviews and approves the content of television programs. Channels have autonomy in selecting programs from the approved list for broadcast. Television programs are either produced in-house or are acquired from external producers.[16] Typically, programs that contain time-sensitive or regional specific contents (e.g. news reports and contemporary issues programs) are produced in-house while others (e.g. television drama and documentaries) are acquired externally. Every month the satellite channels are required to report to SARFT their programming lineups for the following month. There is only one program – the national evening news – which CCTV1 and all satellite channels (except Shanghai) are required to simulcast daily from 7pm to 7:30pm.

Financially, the satellite channels are receiving diminishing financial supports from the province-level governments and are increasingly relying on advertising revenues. The *New York Times* reports that "government support for Chinese television is dwindling, creating a burst of commercialism as stations compete for viewers and advertising dollars."[17] In 2005, satellite channels total advertising revenue reached CNY37.4 billion. In my interviews with television channel managers, they expressed that during the sample period the advertisers were more

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[15] Some researchers classify the channels into four tiers: central, provincial, metropolitan, and county (e.g. Chan, 2003).

[16] I reviewed several program television broadcast rights acquisition contracts and discussed the negotiation process with a with a program distributor. In addition to the financial terms, the terms related to the period of broadcast dates, the time of day to broadcast and the number of repeat broadcasts are commonly negotiated between the program rights holder and the broadcaster.

[17] "Upstart from Chinese Province Masters the Art of TV Titillation", *New York Times*, Nov 25, 2005.

concerned about the size of the audience than the composition of the audience. This suggests that objective of the television channel is to maximize the overall ratings of their channels.[18]

2.3.2 CCTV1 Commercial Market Entry

In May 2003, CCTV1 underwent a major overhaul of its programming lineup. The shift in CCTV1's programming strategy was a direct result of a central government policy change that was intended to modernize the management of the television enterprise.[19] Traditionally, CCTV served as an important apparatus in disseminating government information to the public (Shambaugh 2007). The shift in government policy allowed CCTV to offer a more commercially-oriented programming lineup. With the overhaul, CCTV1 introduced a greater number of television drama and entertainment shows while retaining a portion of its original programming. Although CCTV1 announced the intention to revamp its programming in February 2003, details of the new lineup were kept secret until April 2003.[20] Wang (2010) finds that satellite channels, in response to attacks by CCTV1, reposition themselves to differentiate from CCTV1. However, Wang (2010) does not identify whether the satellite channels move in clusters or in dispersed patterns.

2.4 Data and Methodology

2.4.1 Data Sources

This study employs the same datasets as the Wang (2010) analysis. The main dataset contains complete daily programming lineups from 8 am to midnight for 30 satellite channels and CCTV1 from November 2002 to October 2003.[21] The CCTV1 programming shift took place at the seventh month of the sample period. The dataset includes the program title, the channel and date of broadcast, the start and end time of the show, and the category under which the show is classified.

The second dataset contains 15-minute timeslot monthly average ratings of the 30 satellite channels in all provincial capital cities (except Lhasa). The programming lineups and

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[18] The author learned from a former manager at CNBC Beijing that CNBC attempted to pitch programming sales to Chinese television stations by emphasizing their wealthier audience profile. But at the time CNBC's approach received little interest from the television stations, which were more interested in maximizing raw ratings. This attitude has slowly changed in recent years as audience characteristics are receiving more attention from the television stations.

[19] The policy, "Cultural Development and Restructuring," is detailed in Section VI of then Chinese President Jiang Zemin's report at the 16th Party Congress on November 8, 2002. A *New York Times* article describes CCTV as 'a model of how the Communist Party in China manages to keep state-owned companies profitable as it moves the nation toward a market economy with less government influence.' "Olympics are Ratings Bonanza for Chinese TV", *New York Times*, August 22, 2008.

[20] A May 2004 article by Guangdong TV station published on their official website indicates that the province-level channel did not learn about the specific details of CCTV1's new programming schedule until April 2003. (http://www.gdtv.cn/newpage/dabenying/wspd2/news.asp?NewsID=21811&page=46)

[21] This includes all province-level satellite channels except Tibet satellite channel. The data for Tibet was unavailable to the author.

ratings datasets are collected by CSM Market Research (CSM) using peoplemeter panels.[22] The ratings data are generated through stratified sampling drawn proportionally to their incidence in the population. These proprietary programming lineups and ratings datasets are considered reliable and are widely used by Chinese television stations, advertisers and government regulators (Yuan and Webster 2006).

2.4.2 Constructing Spatial Distance Measurement

The dataset classifies each program into one of 87 categories, such as domestic drama, foreign movies, weather report, etc. I measure the spatial distance between two channels' programming as the angle between their portfolio vectors in orthogonal dimensions of product space.[23] Using the method described in Wang (2010), I calculate the spatial distance between channels *A* and *B* using Equation (1):

$$Spatial\ Distance\ = \cos^{-1} \frac{(Programming\ Vector\ A) \cdot (Programming\ Vector\ B)}{(Length\ of\ Programming\ Vector\ A)(Length\ of\ Programming\ Vector\ B)} \qquad \text{Eq. (1)}$$

The spatial distance ranges from zero to 1.5708, or $\pi/2$, radians. An angle of zero radians indicates that the two channels broadcast exactly the same categories of shows, while an angle of $\pi/2$ radians indicates the two channels broadcast shows of completely different categories.

2.4.3 Dyadic Analysis

Prior research has employed dyadic analysis to examine rival competitions (e.g. Chen, 1996; Semadeni, 2006). Using Equation (1), I construct distance measurements between all satellite channels in each 15-minute timeslot for every month over the sample period. Figure 2.1a shows a kernel density plot of within dyad distances before (solid line) and after (dash line) CCTV1 commercialized. The plot shows a bi-modal distribution of spatial distance, suggesting channels cluster in product space. Figure 2.1b shows the kernel density plot of the channel dyads that were under attack by CCTV1 (the treatment group). Figure 2.1c shows the kernel density plot of those that were not attacked (the control group). Compared to the pre-commercial era, the channels in the treatment group in the post-commercial era have greater number of close neighbors. This contrast is more apparent when the treatment group is compared to the control group. Figure 2.1d shows the kernel density plot for the treatment subgroup that contains strong rival players. The pattern of clustering is even more apparent.

Insert Figures 2.1a, 2.1b, 2.1c, 2.1d about here

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[22] CSM Media Research (www.csm.com.cn) is subsidiary of the TNS Group (http://www.tnsglobal.com).
[23] This method of spatial distance measure construction is similar in concept to Sweeting (2006) and Chisholm et al. (2006).

2.4.4 Regression Framework

The goal of the empirical analysis is to identify clustering of satellite television channels strategy in the treatment group subsequent to the commercialization of CCTV1. Since the satellite channels under CCTV1 attack will be in a greater state of uncertainty than those that are not, I hypothesize that the dyads in the treatment group are more likely to cluster. Hence the within dyad distances should decrease for the treatment group. The regression equation to test this hypothesis has the following form:

$$Distance_{ijkm} = \alpha + \beta_1 Commercial\_Era_m + \beta_2 Attacked_{ijk} +$$
$$\beta_3 (Commercial\_Era_m \times Attacked_{ijk}) +$$
$$\gamma_1 Channel\_FE_i + \gamma_2 Timeslot\_FE_k + \gamma_3 Yearmonth\_FE_m + \varepsilon_{ijkm} \qquad \text{Eq.(2)}$$

Equation (2) is a differences-in-differences (DD) estimation on the effect of CCTV1 attack on the distance between channels. In this equation, i indexes focal channels, j indexes rival channels, k indexes timeslots, m indicates year-month. The dependent variable is the distance between channels i and j in timeslot k in year-month m. On the right hand side of the equation, *Commercial_Era$_m$* is a dummy that marks the post-commercialization period (1 if month m is on or after May 2003, 0 otherwise), *Attacked$_{ijk}$* is a dummy for the treatment group – dyads that were attacked by CCTV1 (1 if both channels i and j were attacked by CCTV1 in timeslot k, 0 otherwise). The variable of interest is the interaction *Commercial_Era$_m$* and *Attacked$_{ijk}$* which captures the variation in distances specific to the treatment group in the post-commercialization era. I expect β_3 in Equation (2) to be negative and statistically significant. Finally, I include focal channel fixed effect, timeslot fixed effect and year-month fixed effect.

In order to test for transitional response by satellite channels (Hypothesis 2), I modify Equations (2) by separating the *Commercial_Era$_m$* into *Transition_Era$_m$* (1 if m falls in May to July 2003, 0 otherwise) and *PostTransition$_m$* (1 if m falls in August to October 2003, 0 otherwise) era. Variations in transitional responses and subsequent strategy adjustments will be reflected by the differences between the *Transition_Era$_m$* and *PostTransition$_m$* coefficients.

Strong players are more likely than others to judge correctly the actual market conditions. Therefore, in uncertain market environments, channels are more likely to cluster with their stronger peers (Hypothesis 3). The regression equation to test this hypothesis has the following form:

$$Distance_{ijkm} = \alpha + \beta_1 Commercial\_Era_m + \beta_2 Attacked_{ijk} + \beta_3 Top5_{jk} +$$
$$\beta_4 (Commercial\_Era_m \times Attacked_{ijk}) + \beta_5 (Commercial\_Era_m \times Top5_{jk}) +$$
$$\beta_6 (Top5_{jk} \times Attacked_{ijk}) + \beta_7 (Commercial\_Era_m \times Top5_{jk} \times Attacked_{ijk}) +$$
$$\gamma_1 Channel\_FE_i + \gamma_2 Timeslot\_FE_k + \gamma_3 Yearmonth\_FE_m + \varepsilon_{ijkm} \qquad \text{Eq.(3)}$$

Equation (3) is a differences-in-differences-in-differences (DDD) estimation that builds on Equation (2). An additional independent dummy variable, *Top5$_{jk}$* (1 if channel j in timeslot k ranks among the top five in viewership ratings during the three months prior to the commercialization of CCTV1, 0 otherwise), and its corresponding interaction terms are introduced. The variable of interest in Equation (3) is the third-level interaction (β_7) which

captures the variation in distances specific to the dyad pairs with a strong rival among the treatment group after CCTV1 commercialized. If players herd with their stronger peers, I expect β_7 in to be negative and statistically significant. Again, I augment Equation 3 by separating the *Commercial_Era$_m$* into *Transition_Era$_m$* and *PostTransition$_m$* era.

Table 2.1 presents the key variables used in the regression analyses.

Insert Table 2.1 about here

2.5 Results

Tables 2.2 and 2.3 present the summary statistics and correlation matrix. Since SARFT requires all satellite channels (except Shanghai) to simulcast the daily evening news report together with CCTV1 between 7:00 pm and 7:30 pm, the satellite channels have no autonomy in choosing their programming in these timeslots. I therefore exclude them in the analysis. Altogether there are 647,280 channel-pair-timeslot-month observations.[24]

Insert Tables 2.2 and 2.3 about here

Table 2.4 presents the regression results for the differences-in-differences model. I focus my discussion on Columns IV and V. In Column IV, the interaction coefficient is -0.103 (se = 0.011). This indicates the distance decreases by 0.103 radians for the treatment group and it is statistically significant at the 1 percent level. The result is consistent with Hypothesis 1. Column V reveals further details on the within dyad distance change for the treatment group. In the transition era immediately following the shock, the distance decreases by 0.112 radians for the treatment group. In the post-transition period, the decrease in distance diminishes to 0.095 radians. A Wald test shows that these two coefficients are statistically different at the 10% level ($F(1, 29) = 3.01$). The results from Model V suggest that the intensity of clustering is greater immediately after the attack, and as time progresses the pattern of clustering lessens. This result is consistent with Hypothesis 2.

Insert Table 2.4 about here

Table 2.5 presents the regression results for the DDD regression. The purpose is to test Hypothesis 3 which states that players choose to cluster with stronger peers. In Column I, the third-level interaction coefficient is -0.002 (se = 0.008). The result is not statistically significant.

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[24] 30 focal channels x 29 rival channels x 62 timeslots x 12 months = 647,280 observations.

The results are more interesting in Column II where the *Commercial_Era* is separated into the *Transition_Era* and *Post_Transition* periods. The coefficient for the third-level interaction coefficient in the *Transition_Era* is positive and significant at the 5 percent level ($\beta = 0.015$, se = 0.007). This indicates that, relative to the control group, the within dyad distances in the treatment group increase during the transition period. In the post transition period, however, the third-level interaction coefficient is negative and significant at the 10 percent level ($\beta = -0.019$, se = 0.011). This indicates the channels cluster with strong players some time after CCTV1 commercialized. The results are mixed for Hypothesis 3.

Insert Table 2.5 about here

2.6 Discussion: Clustering for Non-Imitation Reasons

Clustering may be a result of non-imitation reasons. In this section I address three potential alternative explanations: (1) constraints in programming supply, (2) limited variety of viewer preferences, and (3) cost minimization.

Constraints in the supply of programming contents – When under attack, satellite channels differentiate from CCTV1. If the supply of programming is very limited, then channels will have few program genres to choose from. This may force them to cluster in a genre space despite that they have no intention to imitate each other. Should the channels decide to produce their own shows, the production time may cause a delay in achieving optimal distance with their peers. This could lead to the time-varying clustering patterns consistent with Hypothesis 2. To investigate the supply-side explanation, future research should examine the availability of programming in the market around the time of CCTV1 commercialization. One direction will be to collect and analyze data from SARFT, the government regulatory body of television in China, which maintains a list of approved programs. At first glance, the restriction of programming supply appears unlikely. In early to mid-2000, SARFT approves on approximately 800-1000 television program titles per year in the drama category alone. Furthermore, my interviews with television managers in China reveal that, while individual channels can purchase exclusive broadcast rights for particular program titles, it is very difficult to monopolize an entire program genre and exclude other players. Therefore, channels do not appear to face limitation in supply of program contents in various genres.

Limited variety of viewer preferences – If viewers collectively have a narrow band of preferences over program genres, the satellite channels may face difficulty in finding profitable spatial locations to reposition to. This will lead to clustering without any intention by the channels to imitate each other. I argue that this is unlikely to be the case. In the difference-in-difference analysis, satellite channels that were not directly attacked by CCTV1 actually dispersed in space (in column IV of Table 4, the coefficient for *Commercial_Era* is positive and significant.) This suggests that the satellite channels are not under tight constrains by viewer preferences. Future research can explore in which locations the channels actually form the

clusters. If the channels cluster in different locations of the product space, this will strengthen the argument against this alternative explanation.

Cost minimization strategy – In highly uncertain environments, risk-averse managers may choose to minimize the cost of programming until the uncertainty is cleared. Programs such as music videos and documentaries cost much less than live sports and first-run dramas. Risk-averse managers may cluster in the low cost programming space without intending to imitate each other. To explore the cost minimization explanation, future research should examine whether the channels disproportionately cluster around the low cost genre space.

2.7 Concluding Remarks

This paper examines product spatial strategies of firms in uncertain market environments. Based on imitation theory, I analyze the dynamics of cluster intensities and with whom firms choose to cluster in product space before and after the entry of a dominant rival. I hypothesize that (1) firms are more likely to cluster when facing uncertain market conditions; (2) firms cluster more tightly under greater market uncertainty, and less tightly as the market uncertainty clears; and (3) firms cluster with stronger peers. The empirical testing of the hypotheses in the Chinese satellite television industry generated results that are consistent with the first two hypotheses but show mixed support for the last hypothesis.

I conclude by discussing two future steps for this study. First, I raise three alternative explanations that might lead the satellite channels to cluster without intending to imitate each other. While initial explorations suggest that these alternative theories are unlikely motivators for the clustering patterns, further research is needed in order to rule them out definitively. Second, a potential extension to the current study is to distinguish between information-based and rivalry-based imitation. Lieberman and Asaba (2006) offer a guide on how to distinguish between the two. Hypothesis 3 in this study is a first step in this direction to test whether the clustering pattern is due to information-based imitation. To test rivalry-based imitation theory, I need to collect additional data on the satellite channels to identify specific rival groups among the 30 players.

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Table 2.1 Definitions of Key Variables

Variable	Definition
$Distance_{ijkm}$	Distance in radians between focal player (i) and rival player (j) in timeslot (k) in year-month (m)
$Commercial\_Era_m$	Year-month (m) from May 2003 onward = 1; otherwise = 0
$Transition\_Era_m$	Year-month (m) between May and July 2003 = 1; otherwise = 0
$Post\_Transition_m$	Year-month (m) between August and October 2003 = 1; otherwise = 0
$Top5_{jk}$	Rival player (j) in top5 viewership ranking in timeslot (k) = 1; otherwise = 0
$Attacked_{ijk}$	Both Focal (i) and Rival (j) players in a dyad were attacked in timeslot (k) = 1; otherwise = 0

Table 2.2 Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
$Distance_{ijkm}$	647280	1.131	0.491	0.000	1.571
$Commercial\_Era_m$	647280	0.500	0.500	0.000	1.000
$Transition\_Era_m$	647280	0.250	0.433	0.000	1.000
$Post\_Transition_m$	647280	0.250	0.433	0.000	1.000
$Top5_{ik}$	647280	0.167	0.373	0.000	1.000
$Attacked_{ijk}$	647280	0.340	0.474	0.000	1.000

Table 2.3 Correlation Matrix

		(1)	(2)	(3)	(4)	(5)	(6)
(1)	$Distance_{ijkm}$	1.000					
(2)	$Commercial\_Era_m$	-0.003*	1.000				
(3)	$Transition\_Era_m$	0.004*	0.577*	1.000			
(4)	$Post\_Transition_m$	-0.007*	0.577*	-0.333*	1.000		
(5)	$Top5_{ik}$	-0.079*	0.000	0.000	0.000	1.000	
(6)	$Attacked_{ijk}$	-0.306*	0.000	0.000	0.000	0.051*	1.000

* indicates significance at 5%

Table 2.4 Differences-in-Differences Regression Results

Dependent Variable: $Distance_{ijtm}$

	(I)	(II)	(III)	(IV)	(V)
Commercial_Era	-0.003**	0.015	0.015	0.050***	
	(0.001)	(0.009)	(0.009)	(0.009)	
Attacked			-0.357***	-0.305***	-0.305***
			(0.011)	(0.011)	(0.011)
Attacked × Commercial_Era				-0.103***	
				(0.011)	
Transition_Era					0.053***
					(0.010)
Post_Transition					0.048***
					(0.009)
Attacked × Transition_Era					-0.112***
					(0.010)
Attacked × Post_Transition					-0.095***
					(0.014)
Focal Channel FE	N	Y	Y	Y	Y
Timeslot FE	N	Y	Y	Y	Y
Year-month FE	N	Y	Y	Y	Y
Constant	1.132***	1.277***	1.309***	1.291***	1.291***
	(0.001)	(0.024)	(0.023)	(0.022)	(0.022)
Observations	647280	647280	647280	647280	647280
R-squared	0.000	0.182	0.256	0.259	0.259

Robust standard errors in parentheses; SE cluster by focal channel except (1)
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 2.5 DDD Regression Results

Dependent Variable: $Distance_{ijtm}$

	(I)	(II)
Commercial_Era	0.052***	
	(0.009)	
Attacked	-0.292***	-0.292***
	(0.011)	(0.011)
Top5	-0.059***	-0.059***
	(0.011)	(0.011)
Top5 × Attacked	-0.048***	-0.048***
	(0.009)	(0.009)
Top5 × Commercial_Era	-0.011**	
	(0.005)	
Attacked × Commercial_Era	-0.103***	
	(0.010)	
Top5 × Attacked × Commercial_Era	-0.002	
	(0.008)	
Transition_Era		0.055***
		(0.009)
Post_Transition		0.050***
		(0.009)
Top5 × Transition_Era		-0.007
		(0.005)
Attacked × Transition_Era		-0.114***
		(0.009)
Top5 × Attacked × Transition_Era		0.015**
		(0.007)
Top5 × Post_Transition		-0.015***
		(0.005)
Attacked × Post_Transition		-0.091***
		(0.012)
Top5 × Attacked × Post_Transition		-0.019*
		(0.011)
Focal Channel FE	Y	Y
Timeslot FE	Y	Y
Year-month FE	Y	Y
Constant	1.299***	1.299***
	(0.023)	(0.023)
Observations	647280	647280
R-squared	0.263	0.263

Robust standard errors in parentheses; SE cluster by focal channel
* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 2.1a Kernel Density Plot of Dyadic Distances: All Samples
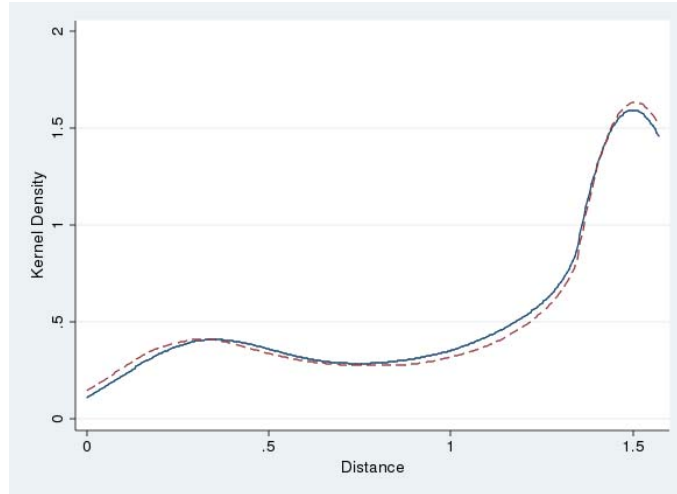

Figure 2.1b Kernel Density Plot of Dyadic Distances: Treatment Group
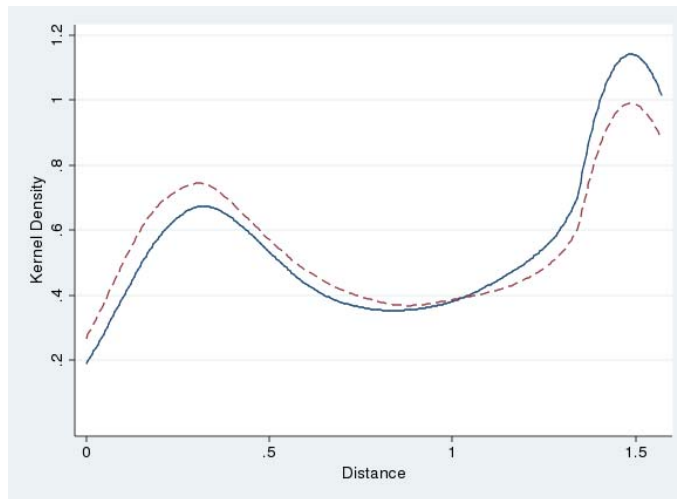
Figure 2.1c Kernel Density Plot of Dyadic Distances: Control Group
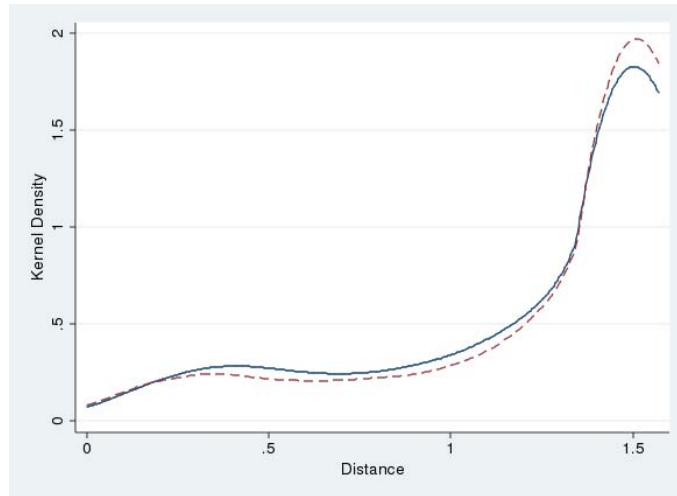
Figure 2.1d Kernel Density Plot of Dyadic Distances: Treatment Subgroup
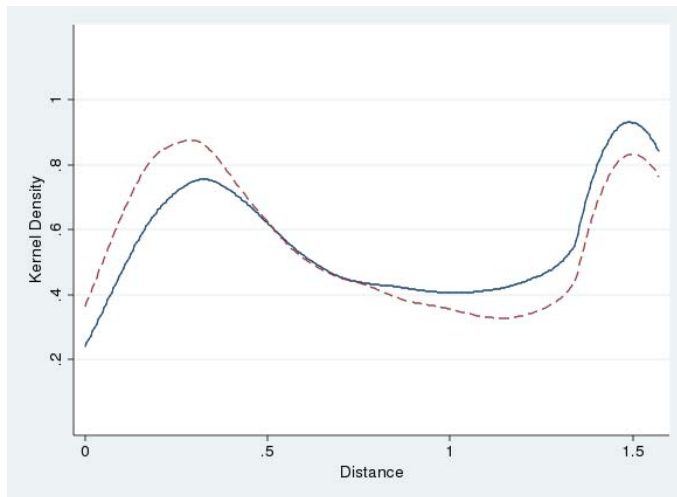
Chapter 3

Tournaments for Ideas

Abstract

Governments and foundations have successfully harnessed tournaments to spur innovation. Yet this tool is not widely used by firms. We offer a framework for managers seeking to organize tournaments for ideas. We present the theoretical underpinnings of tournaments. We then connect the theory with three recent innovations—the power of the network, the wisdom of crowds, and the power of love—that boost the effectiveness of tournaments. Short cases and academic studies are used to illustrate our framework.

3.1 Introduction

During the Age of Discovery in Europe, innovations in navigation technology were of great importance in conquering the seas. In particular, a method for accurately determining the longitude of a ship's location was needed. Sea-faring empires created Longitude Prizes to attract inventors. In 1714 the British Parliament held a tournament and offered a grand prize of £20,000 (roughly £6 million in today's term) to the inventor who arrived at the best solution.

Over the next decades, two competing concepts emerged as most promising. In one camp, intellectual giants such as Isaac Newton and Gottfried Leibniz supported the lunar distance method; in the other, inventors like Larcum Kendall and John Harrison chased after marine chronometers. The lunar distance method required only simple measurement tools but involved complex calculations. The marine chronometer, while easy to read, was initially expensive with the cost equaling one third of a ship's. Subsequent design breakthroughs made the marine chronometer more affordable and accurate, thus winning the hearts of ship captains. The Longitude Prize not just led to the invention of a piece of sophisticated equipment, it essentially gave the British Empire a competitive advantage in dominating the seas.[i]

The Longitude Prize is a classic example of a *tournament for ideas*—a contest designed to produce important innovations. Typically, these tournaments are proposed either by governments or non-profit foundations, such as the X Prize Foundation, and for grand innovations like space travel. But innovation need not be grand to be important and contests need not be sponsored by governments or foundations to be successful. In this paper, we argue tournaments for ideas offer a powerful vehicle for firms looking to spur innovation.

3.2 Using Tournaments to Unlock the Power of Ideas

The idea of using a contest to create incentives is a familiar one in business. Firms regularly organize tournaments based on sales performance. Even CEO compensation is sometimes tied to firm performance against industry benchmarks—effectively a tournament against rivals in the same industry. Tournaments work well in cases where measuring relative performance is easier than measuring absolutes. Indeed, economic theory tells us that, in these circumstances, tournaments are often the incentive strategy.[ii] Tournaments systems are also used in setting career milestones. For instance, GE's famous 70-20-10 employee performance evaluation system is recognizably a tournament. Likewise partnerships with "up or out" systems such as law firms, consulting firms, and academia may be thought of as tournaments.

Ideas are similarly difficult to measure on an absolute scale. While one can perhaps distinguish between better and worse ideas, delineating a bright line standard for a "good" idea is often difficult. Idea generation is at least as critical to long-term firm success as sales or promoting the right people. Yet despite this, it is still uncommon for firms to use tournaments when seeking to innovate.

This article explains how (and why) firms can use tournaments to power innovation. We start with the theory of tournaments, including their strengths and weaknesses. We then connect

the theory with three recent innovations—the power of the network, the wisdom of the crowd, and the power of love—the boost the effectiveness of tournaments. Throughout, we use short cases and academic studies to illustrate our framework. We close with a how-to guide for managers seeking to apply the ideas in the article.

3.2.1 Tournaments as Incentive Mechanisms

Tournaments are reward structures where compensation is based on relative rank as opposed to absolute levels of output.[iii] Economists have developed theoretical models to examine the performance of tournaments compared to other compensation schemes. These models show that an appropriately structured tournament does at least as well as traditional contracts based on piece-rate outputs.[iv] Tournaments are especially effective in situations where (1) efforts are difficult to monitor; (2) performances are observable but difficult to judge in absolute terms; and (3) performances are subjected to common underlying and unobservable shocks.[v]

To see why, it is useful to visit Staten Island on a cold November morning for the start of the New York City Marathon. While a runner's performance (i.e. the time it takes to complete 26.22 miles) is easily measured, the ingredients leading to this performance—the strain and effort undertaken in the race, the countless hours of training leading up to the event—are not. But it is these latter ingredients that make the race such a compelling event. Moreover, even when we have perfect measurement of the finishing time we might still wonder if the runner's performance is the best it could be. For example, a runner finishing in two hours and eight minutes claimed the first place finish in the 2008 New York City Marathon. However, the same duration of two hours and eight minutes is only good enough for a second place finish at the Boston Marathon in the same year.[vi] Furthermore, all the runners in a race are subjected to the same factors, such as the route and weather conditions, that could affect performance. The tournament filters out the common underlying uncertainties to reward the best athlete. At the same time, contestants are still motivated to put in their best efforts regardless of the elements.

But what does this have to do with generating ideas? The three features where tournaments have the advantage in theory are all strongly present in incentivizing ideas and innovation. To start with, the "effort" input is extremely difficult to monitor—it is difficult to distinguish someone staring out the window while thinking about the next great idea from someone staring out the window while daydreaming. Judging on the basis of idea output is likewise difficult or impractical. Unlike the finishing time in a marathon, the ultimate value of an idea, like the marine chronometer, is often not known until years later. Similarly, common shocks apply to ideas generation as well as marathon running. For instance, advances in computer technology have transformed "impossible" to solve mathematical problems, like the four-color theorem, into easy problems. These features all point to the appeal of tournaments as a means of incentivizing innovation.

3.2.2 Designing Tournaments for Ideas

Tournaments come in many formats with variations in prize structures, number of rounds, handicapping systems and entry restrictions, to name a few. These features help us to fine tune the incentive structure in order to accommodate for different scenarios. In the following we focus

on a few common situations and discuss how we could make use of these tournament design features.

3.2.3 Adapting to the Nature of Ideas

Depending on the nature of the problems to be solved, we can customize tournaments to better incent efforts from the contestants. There are times when we look for revolutionary ideas, say we want to design a green car that achieves a hundred miles per gallon, or evolutionary ideas, such as raising the fuel efficiency of an existing car model by ten percent. To arrive at a revolutionary idea, it may require the contestants to formulate new paradigms which entail intensive R&D and integration efforts. The probability of arriving at a revolutionary idea therefore hinges on the peak level of efforts by the contestants. Evolutionary ideas, such as enhancing fuel efficiency through improving aerodynamics and reducing vehicle weight, are more often diversified, modular and involve moderate level of efforts by each contestant. Successful evolutionary ideas are therefore more dependent on aggregating a large pool of contestant idea contributions and efforts.

Economic theory tells us that, when seeking revolutionary ideas, we should employ high powered incentives in order to motivate intensive efforts from our agents. Besides offering greater prize money, there are other ways to sharpen incentives. Theory suggests that *limiting* competition is often an effective strategy. By restricting entry, each contestant perceives a higher chance of winning the contest and raises effort accordingly. While the total "bandwidth" devoted to the problem may be lower, peak bandwidth is higher and hence truly revolutionary ideas are more likely to be generated.

For generating evolutionary innovations, maximizing total bandwidth devoted to the problem is crucial. Here, theory suggests the opposite approach, making the tournament open to all comers is the appropriate. [vii]

The prize structure is another key lever. The two most common prize structures are winner-take-all and multiple prizes. The right prize structure depends on the type of innovation and the variance in the ability of the contestants. In winner-take-all tournaments, only contestants who believe they have the absolute best idea will participate. This deters entry by potential contestants who are not completely confident about their ideas. Awarding multiple prizes invites participation from contestants who believe they have workable ideas even though they see their ideas might not be the absolute best but at the cost of reducing incentives for the very best ideas. The latter approach could help increase the quantity of ideas received which is more suitable for generating evolutionary ideas.

3.2.4 Motivating Contestants with Different Level of Abilities

Incentive problems arise when contestants of various abilities compete in a tournament. Weak contestants are unlikely to contribute much to the tournament outcomes but they dilute the probability of talented contestants winning the tournament. This in turn lowers peak efforts from the strong contestants. At the same time, when weaker contestants find out that they are competing with a stronger contestant, they would perceive their chance of winning the prize

vastly diminished and therefore become discouraged to put in efforts. For example, it has been found that professional golfers score nearly one stroke higher (worse) than they normally do when competing in tournaments which Tiger Woods (a superstar in the game of golf) is present.[viii]

There are several ways to mitigate this type of incentive problem. Besides restricting entry, the host can organize multiple-rounds tournaments with each subsequent round offering a larger prize. Multiple-rounds tournaments eliminate weaker contestants in earlier rounds and save larger prizes for the final rounds to keep talented contestants motivated. Tournament organizers sometimes institute handicapping systems or group their contestants by talent levels (e.g. junior category, amateur category, professional category, etc.) to level out the playing field. Under these arrangements, greater total effort could be achieved but they are unlikely to raise peak efforts.[ix]

3.2.5 Understanding When Not to Use Tournaments

To be sure, there are situations in which tournaments do not work well. In some cases, tournaments undercut workers' incentives to cooperate. For example, a survey of over 800 employees in Australian firms reveals that they are less likely to work cooperatively – such as sharing of production tools – under tournament incentive systems.[x] In other cases, tournaments could tempt contestants to collude, such as in competitive bidding process. Generally speaking, tournaments do not work well in situations where the participants' performances are interdependent.

Insert Figure 3.1 about here

3.3 Integrating New Concepts to Tournaments for Ideas

In the following we present how organizations are integrating tournaments for ideas with three emerging business concepts – hosting tournaments for ideas on platforms, leveraging social acceptance as a non-pecuniary motivator and democratizing the idea generation process.

3.3.1 Platforms as Ecosystems for Ideas

When you have a question and know who has the answer, you would probably go straight to the person and ask. Similarly, traditional tournaments organizers have some ideas on whom and where the experts are and therefore would promote the tournaments in the corresponding channels. In the past when search and promotion costs are high, this unidirectional questioner-seeking-expert approach might have been an efficient way to organize tournaments. Information technology has markedly reduced these costs and with it we want to revisit, or perhaps even improve, the way tournament organizers interact with target experts. In this section we focus on how tournaments for ideas, when coupled with platforms and network effects, have created a market ecosystem that fosters the generation and exchange of ideas.

Platform and Network Concepts

In markets for ideas there are two parties: the questioner and the answerer. While in many markets the two parties can trade directly, Economics Nobel Laureate Kenneth Arrow has pointed out that this may not be the case in market for ideas. The reason, now commonly referred to as the information paradox, is that the questioner does not know the true value of the idea *ex ante* unless answerer reveals the idea. But once the idea is revealed, the questioner could behave opportunistically and pay little, if any at all, to the answerer.[xi] An intermediary agent such as a platform can alleviate this type of market failure caused by the information paradox.

Platforms exist to serve multi-sided markets with two or more distinct groups of customers who value each other's participation. Examples of platforms include credit cards, advertiser-support media, video game consoles, shopping malls, and e-business portals such as Amazon.com. While the primary purpose of a platform is to connect customers from both sides, in market for ideas, a platform not only connects questioners and answerers but also take on the responsibility of protecting the ownership as well as verifying the validity of the idea. Yet for any platform to become truly effective, the key to success hinges on what economists refer to as network effects.

Raised to prominence by UC Berkeley professors Michael Katz and Karl Shapiro, the theory of network effects describes how a product, such as a telephone, has little value when existing in isolation but the value grows exponentially as it becomes one of many connected in a network.[xii] Similarly, a platform is worthless when few customers join in. However, as more customers join in, the value for the next potential customer to join the platform increases. Next we will look at how Innocentive, by hosting a tournament for ideas on a platform and leveraging on network effects, enhanced the probability of matching questions with answers.

Case: Innocentive Challenges

Originally founded as an e-business venture of Eli Lilly in 2001, Innocentive is now operating independently as a neutral online marketplace for ideas. Organizations with difficult to tackle questions can register as seekers with Innocentive which posts the questions online as "challenges". The challenges fall into four categories – Ideation, Theoretical, Reduction to Practice (RTP) and Request for Proposals (eRFP). In Ideation, seekers invite solvers to brainstorm for ideas and submit them in writing that are typically under two pages in length. Winners of Ideations grant seekers non-exclusive license to use the ideas. Theoretical challenges require solvers to submit thorough solutions and, if chosen by the seekers, solvers will formally transfer the intellectual property rights. RTP takes the requirement one step further than Theoretical challenges by requesting the solvers to present, in addition to detail description of the ideas, physical evidences demonstrating their ideas are the best among all submissions. The fourth type of challenge, eRFP, permits greater interactions between seekers and solvers. In eRFP, solvers are not asked to reveal confidential details about their ideas in their initial submissions. Instead, seekers can selectively get in touch with solvers to negotiate specific contracts. Some recent challenges are presented in Table 3.1.

The tournament format is ideal for Innocentive. Tournament reward schemes eliminate the need for seekers to monitor efforts of solvers. Moreover, seekers can evaluate the ideas by simply benchmarking them against one another without needing to worry about environmental uncertainties. The winner-take-all prize structure offers solvers high powered incentives to take on difficult challenges. The amounts of prize money, ranging from five thousand to a million dollars, usually commensurate with expected effort levels – prizes offered for RTP are typically greatest since these types of challenges requires most efforts, while prizes for Ideation challenges are usually smallest as seekers requests for early stage ideas (see Table 3.1). Nevertheless, Ideation usually generates large participations despite of small prizes because the effort needed to produce a two-page report is comparatively little. Ideation therefore offers seekers an economical way to collect vast numbers of ideas. Finally, while challenges in the Ideation, Theoretical and RTP categories are open to all solvers, the eRTP format provides seekers with flexibilities in screening solver participations.

Answers from Out of Left Field

With 160,000 solvers registered with Innocentive, seekers frequently receive solutions from half way around the world. For example, in a typical challenge you can find a Russian scientist, a retired head of Hoechst R&D, a Chief Research Officer from Northern Ireland, and a head of an Indian research institute competing for a $25,000 prize in finding a synthetic strategy for a chemical compound.[xiii]

More interestingly, it is quite common to have winning solutions generated by solvers whose expertise lies outside of the seekers' domain. The *New York Times* reported a story on John Davis, an Innocentive solver and chemist from Illinois who had some experience pouring concrete. Davis won $20,000 from the Oil Spill Recovery Institute (OSRI) of Cordova in Alaska by offering a solution to keep oil from freezing. The idea was simple and widely known within the cement industry – concrete will not set if it is kept vibrated. Scott Pegau, the research manager at OSRI, was impressed by Davis' solution. "The oil-flow problem was solved by an outsider," said Pegau. "If it could easily have been solved by people within the industry, it would have been," he added.[xiv] The story of John Davis underscores a fundamental problem with the top-down, unidirectional expert search associated with traditional tournament for ideas – the organizers don't know who has the best answer to their questions. By reaching only to experts whom they think might possess answers, tournament organizers are limiting their chance of finding the best solutions.

Researchers at Harvard have investigated into the expert search problem. After examining all cases from Innocentive between 2001 and 2004, Professor Karim Lakhani finds that many problems that were unable to be solved by experienced corporate researchers were cracked by outsiders. In particular, Lakhani concludes that a more diverse problem-solving population will lead to greater likeliness that the problem will be solved.[xv] Here, the platform technology frees up tournament organizers and enables them to economically tap into idea

sources from beyond their traditional domains. Outside experts could then arbitrage their specialized knowledge developed for other purposes to solve the problems. But to be sure, reducing information dissemination cost for tournament organizers is only half the story. From the outside experts' point of view, those who are confident that their ideas are valuable and want to find questions to match them with can now do so on the Internet.

Look Who's Searching – Experts Hunting for Questions

Ed Melcarek from Ontario is a case in point. Melcarek has a Ph.D. in Engineering Science and years of design experience ranging from conventional heating vents for buildings to spray-paint robots to working in a world-class particle accelerator laboratory. But Melcarek had a hard time landing on a corporate R&D job. "Too diverse a set of skills and experience" was the most common rejection answer he got at interviews. Then one day Melcarek came across Innocentive and saw a problem posted by Colgate-Palmolive. The question was about injecting fluoride powder into a toothpaste tube without dispersing into surrounding air. "It was really a very simple solution," commented Melcarek. He used his particle accelerator experience and submitted an answer. The $25,000 prize money he won, as Melcarek recalled, not only saved him from the welfare office but also "re-affirmed his confidence in himself". Now a six-time Innocentive challenge winner, Melcarek continues to look for challenges where he can turn his ideas into paychecks.[xvi]

Leveraging on Network Effects

With the emergence of companies such as Innocentive as well as a new breed of experts like Ed Melcarek, the Internet has created platforms for ideas where both questioners and experts actively search for one another.[xvii] By transforming the unidirectional search mode in traditional tournaments to a two-way matching process, the platform for ideas model has improved both the problem solving rates as well as the caliber of the solutions generated. This is consistent with network economic theory predictions – as more experts succeed in solving problems posted on the platform, seekers become more inclined to post their problems, which in turn attracts greater number of experts and hence raise the probability of successful problem-solution matching. Network effects are fueling the growth of the platform.

Professor Lakhani and Jill Panetta, a co-founder and former chief science officer at Innocentive, offer an assessment on how the platform model is living up to the reputation: On average, a problem posted on the Innocentive platforms receives detail attention from more than 200 potential solvers, from which about ten will submit solutions. These statistics constitute to Innocentive's remarkable achievement of thirty percent problem solving rate.[xviii]

Concerns over Secrecy

Platforms like Innocentive are not the right forum for all types of innovations. In particular, the information paradox is a problem not just vertically—between questioner and answerer—but horizontally as well. In some industries, it may be enough to know the question posed by a rival, even if the answer is kept from view, to gain a competitive advantage. For instance, a pharmaceutical company posting a question detailing an intravenous delivery method of a

pediatric protein-based drug for FDA clinical trial could potentially disclose strategic information to its closest competitors. While there are ways to mitigate this information leakage, this possibility suggests the need for some care on the part of managers in determining whether the platform approach offers the right fit. For larger organizations, one alternative is to reinvent the platform in-house—away from the prying eyes of the competition.

The Platform Ecosystem

While traditional tournaments for ideas use a top-down approach—a question or challenge is posed upstream seeking answers downstream—the network economics of platforms are capable of transforming the process to a bi-directional, questioner and answerer side-by-side process. With this transformation, synergistic use of existing ideas becomes possible and hidden expertise can be unlocked.

3.3.2 Optimal Prize Structure: The Importance of Social Motivators

Economics Nobel Laureate John Harsanyi once said "*People's behavior can largely be explained in terms of two dominant interests: economic gain and social acceptance.*"[xix] Simply put, most of our actions are motivated by love and money. While tournaments such as the Longitude Prize and the ones taking place at Innocentive are driven by pecuniary motives, tournaments powered by love can be an attractive alternative. In this section, we will first look at a study on how a form of social acceptance – reciprocity – can unlock hidden value. Next we turn to Flickr, the largest photo image hosting site on the Internet, to see how they leverage social forces to power a large-scale tournament.

Measuring the Returns to "Love"

Reciprocity is one of the most common forms of expressing social acceptance. Reciprocity happens all around us: We tip more generously in restaurants when served by smiling waiters. Free samples often lead to purchases in supermarkets. In short, we repay kindness with kindness.[xx] But how powerful is the force of reciprocity in economic life? To try to quantify the returns to kindness, we turn to controlled laboratory experiments.

To examine this question, some Swiss researchers asked the simple question: do employers benefit by offering above-market wages? In other words, do employees pay back the "gifts" of their employers with additional effort? Is this enough to make such gifts profitable in the first place?[xxi]

In the experiment, "employers" were asked to offer salaries and state their desired level of efforts to "employees." The suggested effort is non-binding—employees are free to work as much or as little as they like while still receiving the contracted wage. The profits to "employers" depends on the (costly) effort of their "employees." If employees were solely motivated by pecuniary considerations, all wage offers would lead to the outcome—employees would choose the lowest possible effort level. Anticipating this, employers would optimally offer the lowest possible wage and the returns to kindness would be negative. If reciprocity is an important

consideration, however, smart employers could benefit by offering generous wage packets knowing that these would be repaid with employee effort.

Insert Figures 3.2 and 3.3 about here

Even in the stark and impersonal laboratory setting, the researchers found strong evidence of reciprocity. The results are presented in Figures 3.2 and 3.3. Figure 3.2 illustrates that "employees" reciprocate to "employers" generous salary offers. Employees receiving only the minimum salary gave zero effort back to their employers. Increasing the wage offer produced systematically more effort. Figure 3.3 illustrates the profitability of this strategy. A 33% increase in wages at the lowest salary brackets produced 20% higher profits. ROI becomes even more favorable at higher brackets. Between the top second and third salary brackets, an increase of 16% in salary boosted "employer" profits by 22%. Nevertheless, the researchers noted that there are limits to the power of love. Figure 3.4 recasts the "employer" profits in terms of percentage increase. While percentage increases in profits are positive for most wage brackets, the returns to offering the highest wage bracket turn negative. In other words, the law of diminishing returns applies also to "love" as the additional income gained by "employee" efforts is insufficient to compensate for the higher wage outlays.

Insert Figure 3.4 about here

Economists and businesses are increasingly recognizing the power of non-pecuiary incentives in motivating employees. This is especially true when it comes to generating ideas. For instance, Wikipedia owes its success almost entirely to the power of these incentives. But what happens when we harness non-pecuniary incentives in a tournament-like structure. To examine this, we turn to the case of Flickr.

Case: Powering Tournaments with "Love" at Flickr

Consistently ranked as a top ten Web 2.0 site, Flickr receives over 20 million unique visitors each month. By November 2008, over 3 billion photos were posted to the site.[xxii] While Flickr is useful for organizing personal photos, so are many of its rivals. Instead, Flickr owes its success to the social nature of its site. Many users post there to share their "best shots" with the broader online community. In fact, over 80 percent of the photos are available for public viewing.[xxiii] The high quality of many Flickr photos has led firms to look there, rather than at traditional stock photo repositories, for images to be used in promotional material and elsewhere.

Flickr started as a digital photo storage and sharing company in 2004 and was acquired by Yahoo for an estimated $35 million a year later. When asked why they became interested in Flickr, then Yahoo executive Bradley Horowitz explained:

"With less than 10 people on the payroll, they had millions of users generating content, millions of users organizing that content for them, tens of thousands of users distributing that across the Internet, and thousands of people not on the payroll actually building the thing. That's a neat trick. If we could do that same thing with Yahoo, and take our half-billion user base and achieve the same kind of effect, we knew we were on to something."[xxiv]

Flickr is, in effect, a platform for ideas, only here the ideas are the photos. Searchers visit Flickr to see high quality photos while photographers post their works on Flickr to gain appreciation, recognition, and, in some cases, money. As with Innocentive, network effects play an important role—the platform becomes more valuable to both parties as it scales up. But rival sites have the potential for the same network effects. What makes Flickr stand out?

Flickr provides no direct monetary rewards to photographers posting there. Indeed, the opposite is true, those who want to post more than a few images must pay Flickr for the privilege. Likewise, Flickr does not charge browsers to visit the site. In many cases, browsers do not even have to pay to download photos posted by Flickr users. Instead, Flickr owes its success to its tournament for ideas fueled by social acceptance.

The tournament, in this case, is Flickr's Explore page. Multiple times per day, Flickr combs through the billions of photographs on its and selects the 500 it considers to be the best. These are displayed prominently and receive disproportionately many views from browsers. Essentially, Explore is continuously running photo contest. For photographers, having a photo featured in Explore is an important recognition of excellence—one that generates wide recognition and occasionally commercial opportunities.

But how does Flickr select the best photos? While the exact algorithm is proprietary, Flickr acknowledges that the social recognition of other users plays a key role. Specifically, photos posted to Flickr can receive comments from other users. The more positive comments a photo receives the higher the photo will be ranked. Often, these comments come from Flickr groups, which are powered by reciprocity—those posting to a group are expected to offer comments to other worthy photos.

The 11,000-member Flickr group, "All You Need is Love", is a case in point.[xxv] The group has voluntarily established a reciprocity rule that requests members to express "love" to three fellow members' photos whenever they post a photo of their own. In the words of the group administrator, the reason behind this social institution is because "[t]here's an awful lot of negativity among Flickrites. It's time we build one another up instead of tear one another down." This type of "pay it forward" reciprocity, analogous to "employers" offering generous salaries to "employees" in the reciprocity experiment, generates abundant circulation of "love" within Flickr. "Love" is quite probably what makes Flickr's world go 'round.

Reciprocity works locally as well. Flickr users can connect to each other through a contact system. Photos of user's contacts are displayed prominently on the page and contacts often comment on each other's photos—again the power of reciprocity.

With an ever expanding portfolio, the task of organizing and evaluating photos has become enormous for Flickr. On one of Flickr's lead webpages they state, "Flickr labs have been hard at work creating a way to show you some of the most awesome content on Flickr."[xxvi] Indeed, Flickr is pioneering a way to discern photo qualities with the help of user participation – a tournament for ideas powered by social acceptance.

Harnessing the Power of Social Acceptance

While Flickr demonstrates the possibility of using social incentives to power tournaments, the practical lesson for managers is not to neglect non-pecuniary motives in contest design. Creating avenues for "peer review" of ideas in the form of social acceptance, creating opportunities for "answerers" to gain recognition beyond simply cash payments, and making the pecuniary component "generous" (but not necessarily unprofitable) are all ways to build more powerful and cost-effective tournaments for ideas.

3.3.3 The Democratization of Ideas

Both Innocentive and Flickr benefit from participation by millions of non-experts. Flickr posters are, for the most part, enthusiastic amateur photographers rather than seasoned professionals. Answerers on Innocentive come from a wide array of fields and often have no particular connection or expertise with the industry of the seeking firm. This inspires to our next question: When you look for a solution to a problem, would you rather seek help from an expert, or from a large group of ordinary people?

An ancient Chinese proverb says: "*Three smelly leather shoemakers put together can be counted as a Zhuge Liang.*" A statesman and military strategist from the Three Kingdoms period of China (AD 220-280), Zhuge Liang is widely recognized by the Chinese as a mastermind with the wisdom exceeds that of the wisest person. In recent years, this old wisdom of Chinese proverb is being embraced by business strategists. For example, perhaps learning the "neat trick" from Flickr, Yahoo decided to tap into the crowds when they set up the Yahoo Answers platform in 2005.

Case: Yahoo Answers

An online platform where askers post their questions, Yahoo Answers is organized as a tournament where volunteer answerers compete to offer solutions to be voted upon by users. The best answers chosen are displayed prominently and the winning answerers are awarded recognition points. A vast number of questions have been answered by the online community using this tournament system. Within a half year, Yahoo Answers became the second most popular Internet reference site after Wikipedia. And by their first birthday, Yahoo Answers surpassed 60 million users and 160 million answers.[xxvii]

Launched three years before Yahoo Answers, Google Answers had a substantial head start in the online knowledge market. The conventional wisdom suggests that this head-start, combined with Google's proven business acumen, should have proved an insurmountable barrier

for Yahoo. While both Answers platforms share similarities, such as taking advantage of the Internet to lower communication and administration costs, Google decided to pursue the expert route – at one time, over 500 experts were selected by Google to answer questions. With hundreds of selected experts available, one would expect better quality answers from Google than Yahoo. Surprisingly, Google Answers succumbed to the competition from Yahoo. In December 2006, Google shutdown the service, citing the Answers community's limited size as a reason for pulling the plug.

Democratization of Ideas

Google Answers was built on the conventional wisdom that expert answers are the only valid ones. Google was not alone about their belief in experts. Governments in the past had doubts in giving democracy to ordinary citizens – they were concerned that decisions by commoners might be inferior to those made by elite aristocrats.

For example, at the turn of the 20th century, British scientist Sir Francis Galton was skeptical about the wisdom of ordinary citizens. To prove his point, Galton visited a county fair in 1906 where a weight-judging competition was underway. In hope of winning the prize money, participants paid an entry fee of six pennies to submit guesses on the weight of an ox. Galton compared the competition to democratic voting since many of the fairgoers lacked expertise with livestock and meat processing just as most voters lacked knowledge on government policies. Eager to show that the "average voter" was incapable of making good decisions, Galton borrowed the entire lot of entries from the organizer after the competition. Of the 787 valid guesses, Galton found none has gotten the exact correct answer of 1,198 pounds. But to his surprise, the median value of all guesses came out to be 1,207 pound, which was off by less than 0.8 percent of the true weight! "This result is, I think, more creditable to the trustworthiness of a democratic judgment than might have been expected," concluded Galton.[xxviii]

Galton's experiment has been credited as the first mathematical demonstration of the "wisdom of crowds."[xxix] Popularized by James Suroweicki's 2004 bestseller of the same title, the wisdom of crowds proposes that ideas gathered from many ordinary people are at least as good as or even better than those proposed by the experts.[xxx] Yahoo Answers is a modern day demonstration of the concept. By scaling up the collection of wits from three cobblers to include millions of minds from around the world, Yahoo Answers operates on the likelihood that someone somewhere possesses the exact solution to the question, or by accumulating bits of ideas from a vast pool of people, the final answer will approach the best.

Harnessing the Wisdom of Crowds: Is it Compatible with Tournaments for Ideas?

While the wisdom of crowds potentially adds an appealing element to traditional tournament of ideas, we need to be aware of the compatibility between the two concepts. Note that the key to achieving the wisdom of crowds is by statistically processing information from many people, each offering a bit of knowledge, albeit incomplete, of the solution. Though it can seem magical, the wisdom of crowds can only extract information when there is information from the crowds to be extracted. For example, in Galton's weight-judging competition, the participants were motivated to contribute in their honest best guess because they each paid an entry fee and aimed

to win the tournament prize. As the number of participants grew, on one hand, the probability of learning the true answer improved, but on the other, the chance of any one contestant winning the tournament prize decreased. Recognizing that their chance of winning was diminishing, contestants might casually throw in their guesses instead of diligently making good effort answers. Random guesses from the crowd, each containing virtually no useful information, could cripple the wisdom of crowds.

To avoid stalling the wisdom of crowds, Yahoo Answers turns to another Flickr "neat trick" – using non-pecuniary rewards to motivate contestants. Yahoo leverages on what cognitive psychologists call intrinsic motivation of activities – that every activity has a motivation of its own. This is evident in the way Yahoo brands the platform as "a whole new kind of volunteerism" and persuading the users with phrases such as "You make someone's day each time you reply" and "You share your intelligence for a good cause" to boost the intrinsic motivation of the tournament.[xxxi] As intrinsic motivations are independent of pecuniary rewards, the incentive level of the tournament is preserved even when the number of participants expands. The advantage of using intrinsic motivation goes beyond economizing the prize money. Most importantly, Yahoo has the answer to uniting the wisdom of crowds and tournaments for ideas.

Fusing the Wisdom of Crowds and Tournaments for Ideas

Since the publication of Surowiecki's book, the idea of "crowd-sourcing" has gained much currency among managers. However, indiscriminate application of this idea is unlikely to produce useful results. The lessons from Yahoo Answers and the tournament theory suggest three key lessons. First, crowdsourcing works when what matters is the collection of answers rather than the single best answer; that is, when small bits of information can be combined together in a useful way. For evolutionary innovations, this is often the case. For those seeking revolutionary innovations, it rarely is. Second, crowd-sourcing works best when there is a competition. Market surveys, which may be thought of as an early version of crowd-sourcing, are capable or producing great results or disastrous ones (e.g., New Coke). Pairing the crowd-sourcing model in a tournament setting is much more likely to produce incentives for useful answers. Finally, users are drawn to crowd-sourcing models under a variety of motives. Some are motivated by money; some by recognition; some simply want to "make a difference." Tournaments should be designed to offer rewards for these varied incentives.

3.4 A Framework for Organizing Tournaments for Ideas

We close by offering a framework for managers seeking to incorporate the concepts presented here into their own tournaments for ideas. Figure 3.5 presents a flowchart illustrating the key decision milestones.

Several key features are worth noting. First, it is critical to understand what type of innovation is to be sought. Typically many inputs can be combined in producing evolutionary innovations. The tournament structure should reflect this. It should be open, take advantage of scale economies of the network, and harness non-pecuniary as well as pecuniary incentives.

Revolutionary innovations, however, rely on what statisticians refer to as the "order statistic"—the quality of the best idea. Here, the appropriate framework may be closed and high-powered.

Ability differences among participants are another important dimension to consider. In a closed tournament, these ability differences can undermine the incentives to produce great ideas. The correct solution is to "level the playing field." This can be done by combining weaker individuals into teams or separating individuals into different tiers by ability level.

Secrecy and the information paradox play an important role. Creating safeguards so that sensitive information is not disclosed in the questions themselves, and so that answerers do not feel at risk of being expropriated are obviously critical to the success of the tournament.

Last, it is important to recognize the many motives of individuals to contribute their ideas. Creativity is a fundamental human attribute. While money is one motive to induce the creation of ideas, there are many others including fame, self-satisfaction, love of competition, curiosity-seeking, recognition from peers, and so on. Tapping these varied motives is crucial in designing a successful tournament for ideas.

Table 3.1. Examples of Innocentive Challenges

Title	Challenge Type	Number of Participation	Prize
Improving Banking Processes in the Developing World	Ideation	641	$7,500
Extending Shelf Life of a Microbiological Product	Theoretical	427	$20,000
Plastic with Property of Glass	RTP	81	$50,000
Corrosion Resistant Nylon	eRTP	54	Varies

Examples of Seeker Questions and Prizes on Innocentive Marketplace[xxxii]

Figure 3.1 A Decision Tree for Designing Tournaments for Ideas

Are the contestants' performances interdependent?

No → Does the problem require a revolutionary idea?

Yes → Do potential contestants' ability vary by much?

Yes → **Tournaments**
- Offer High Powered Incentives
- Charge Entry Fee
- Establish Entry Criteria
- Organize Multiple Rounds

No → **Tournaments**
- Offer High Powered Incentives
- Winner-take-all Prize

No → Do potential contestants' ability vary by much?

Yes → **Tournaments**
- Offer Flattened Incentive Structure
- Set up Handicapping Systems
- Group contestants by categories

No → **Tournaments**
- Offer Flattened Incentive Structure
- Open Entry

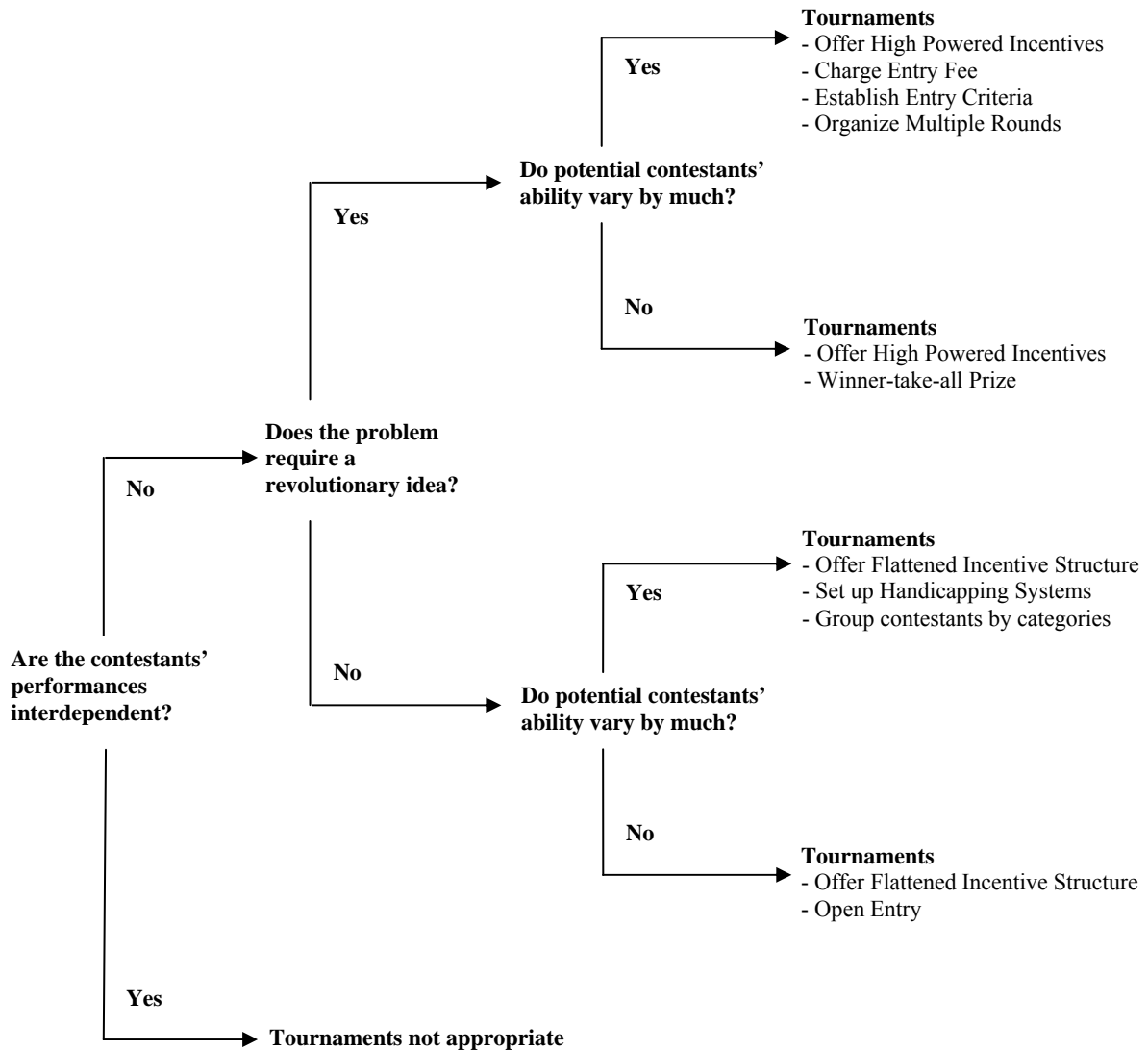Yes → **Tournaments not appropriate**

Figure 3.2 Effects of Wage Offer on Employee Effort Level

Figure 3.3 Effects of Wage Offer on Employer Profit

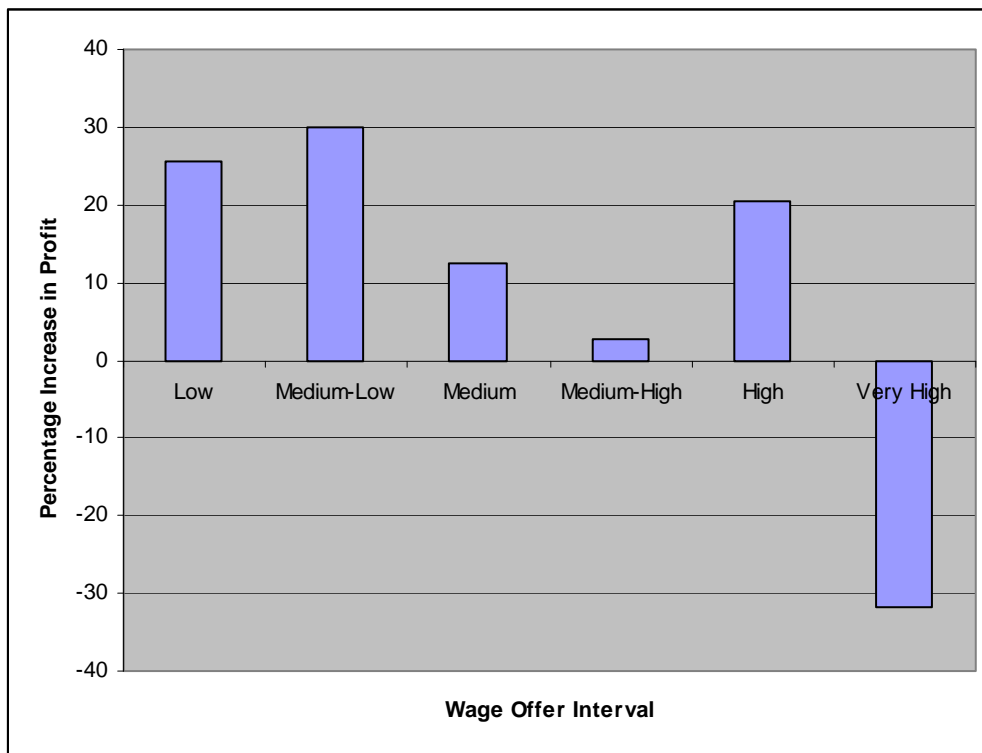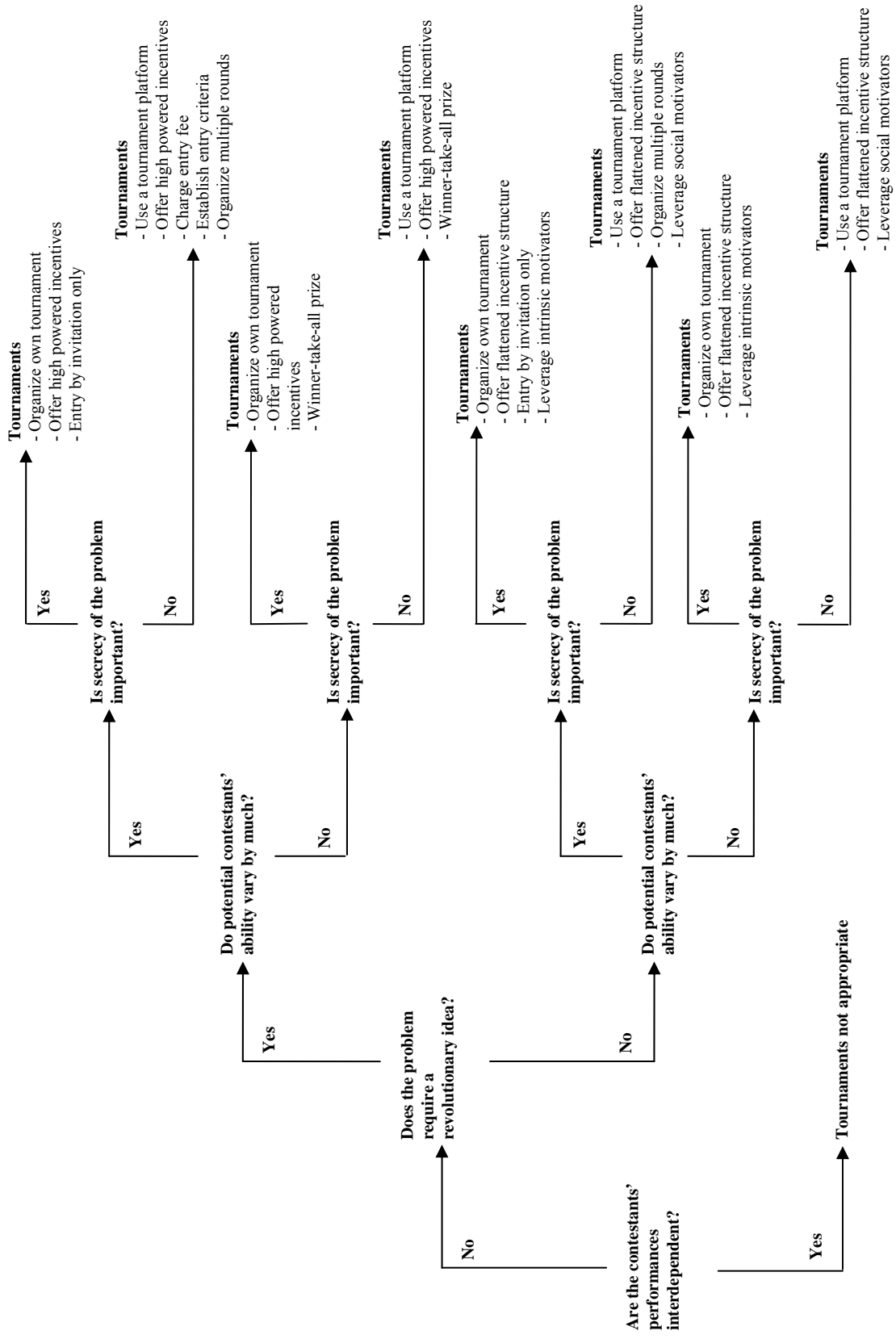**Figure 3.4 Percentage Increase in Profits with Wage Offer** [xxxiii]

Figure 3.5 A Decision Tree for Designing Tournaments for Ideas in the Internet Era

Are the contestants' performances interdependent?

No →

Does the problem require a revolutionary idea?

Yes →

Do potential contestants' ability vary by much?

Yes →

Is secrecy of the problem important?

Yes →
Tournaments
- Organize own tournament
- Offer high powered incentives
- Entry by invitation only

No →
Tournaments
- Use a tournament platform
- Offer high powered incentives
- Charge entry fee
- Establish entry criteria
- Organize multiple rounds

No →

Is secrecy of the problem important?

Yes →
Tournaments
- Organize own tournament
- Offer high powered incentives
- Winner-take-all prize

No →
Tournaments
- Use a tournament platform
- Offer high powered incentives
- Winner-take-all prize

No →

Do potential contestants' ability vary by much?

Yes →

Is secrecy of the problem important?

Yes →
Tournaments
- Organize own tournament
- Offer flattened incentive structure
- Entry by invitation only
- Leverage intrinsic motivators

No →
Tournaments
- Use a tournament platform
- Offer flattened incentive structure
- Organize multiple rounds
- Leverage social motivators

No →

Is secrecy of the problem important?

Yes →
Tournaments
- Organize own tournament
- Offer flattened incentive structure
- Leverage intrinsic motivators

No →
Tournaments
- Use a tournament platform
- Offer flattened incentive structure
- Leverage social motivators

Yes → **Tournaments not appropriate**

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Notes

[i] For background of the British Longitude Prize, see D. Sobel, *Longitude: the true story of a lone genius who solved the greatest scientific problem of his time* (New York: Penguin Group, 1996) and N. Kollerstrom, *Newton's Forgotten Lunar Theory, His Contribution to the Quest for Longitude* (Santa Fe, New Mexico: Green Lion Press, 2000).

[ii] See, for example, E. Lazear and S. Rosen (1981) "Rank-Order Tournaments as Optimum Labor Contracts" *Journal of Political Economy*, 89(5): pp. 841-864.

[iii] This definition is also used by J. Green and N. Stokey (1983) "A comparison of tournaments and contracts" *Journal of Political Economy*, 91(3): pp. 349-364.

[iv] Lazear and Rosen (1981), op. cit.

[v] Green and Stokey (1983), op. cit.

[vi] Marilson Gomes Dos Santos of Brazil was the winner for the 2008 New York Marathon, completing the race in 2:08:43. Robert K. Cheruiyot of Kenya won the 2008 Boston Marathon with a time of 2:07:46 while Abderrahime Bouramdane of Morocco held the second place finish with a time of 2:09:04.

[vii] K. Konrad (2009) *Strategyand Dynamics in Contests* Oxford University Press: Oxford

[viii] J. Brown (2009) "Quitters Never Win: The (Adverse) Incentive Effect of Competing with Superstars" *Northwestern University Working Paper*.

[ix] For the theoretical details, refer to M. O'Keefe, W.K. Viscusi and R. Zeckhauser (1984) "Economic Contests: Comparative Reward Schemes" *Journal of Labor Economics*, 2(1): pp. 27-56.

[x] Robert Drago and Gerald T. Garvey, "Incentives for Helping on the Job: Theory and Evidence," *Journal of Labor Economics*, Vol. 16, No. 1., (1998): pp. 1-25.

[xi] Kenneth Arrow (1959) Economic Welfare and the Allocation of Resources for Invention, Rand Corporation P-1856-RC. "[T]here is a fundamental paradox in the determination of demand for information; its value for the purchaser is not known until he has the information, but then he has in effect acquired it without cost. Of course, if the seller can retain property rights in the use of the information, this would be no problem, but given incomplete appropriability, the potential buyer will base his decision to purchase information on less than optimal criteria. He may act, for example, on the average value of information in that class as revealed by past experience. If any particular item of information has differing values for different economic agents, this procedure will lead both to a nonoptimal purchase of information at any given price and also to a nonoptimal allocation of the information purchased."

[xii] M. Katz and C. Shapiro (1994) "Systems Competition and Network Effects" *Journal of Economic Perspectives*, 8(2): pp.93-115.

[xiii] Solver statistics from Innocentive company website < http://www.innocentive.com/crowd-sourcing-news/faq/ >, accessed December 12, 2008. Innocentive Case 3109, presented on March 3, 2005 at MIT by Innocentive Chairman of the Board and Founding CEO Darren J. Carroll, posted at <http://ocw.mit.edu/NR/rdonlyres/Sloan-School-of-Management/15-352Spring-2005/2F3996A5-1852-419E-8EB8-6C4354266BA2/0/mit_mar07_2005.pdf>, accessed December 12, 2008.

[xiv] C. Dean, "If you have a problem, Ask Everyone," *New York Times*, July 22, 2008, posted at < http://www.nytimes.com/2008/07/22/science/22inno.html?_r=2&oref=slogin&oref=slogin>, accessed December 12, 2008.

[xv] Karim Lakhani and Lars Bo Jeppesen, Getting Unusual Suspects to Solve R&D Puzzles, Harvard Business Review, May 2007, pp. 30-32.

[xvi] Ed Melcarek's Bio from Innocentive website, posted at < http://blog.innocentive.com/2008/08/20/ed-melcarek/ >, accessed December 12, 2008 and J. Howe, "The Rise of Crowdsourcing," Wired Magazine, Issue 14.06, June 2006, posted at <http://www.wired.com/wired/archive/14.06/crowds.html?pg=3&topic=crowds&topic_set=; http://blog.innocentive.com/2008/08/20/ed-melcarek/#more-88>, accessed December 12, 2008.

[xvii] Besides Innocentive, yet2.com, Nine Sigma, and YourEncore are examples of online markets for ideas, which are also referred to as "ideagoras". See D. Tapscott and A.D. Williams, " Ideagora, a Marketplace for Minds," *BusinessWeek*, Feb 15 2007, posted at < http://www.businessweek.com/innovate/content/feb2007/id20070215_251519.htm>, accessed December 12, 2008.

[xviii] Lakhani and Jeppesen Op cit.; Karim Lakhani and Jill Panetta, The Principles of Distributed Innovation, Innovations: Technology, Governance, Globalization 2(3) summer 2007, pp. 97-112.

[xix] J.C. Harsanyi, "Rational choice models of behavior versus functionalist and conformist theories," *World Politics*, 21/4 (1969): 513-538. The quote was taken from page 524.

[xx] Examples taken from K.L. Tidd and J.S. Lochard, "Monetary significance of the affirmative smile: a case for reciprocal altruism," Bull. Psychonom. Soc. (1978) 11, 344-346, and R. Cialdini, *Influence – The Psychology of Persuasion*, New York: Quill William Morrow, 1993.

[xxi] For details of the experiment, see E. Fehr and A. Falk, "Wage Rigidity in a Competitive Incomplete Market," *Journal of Political Economy*, 107/1 (1999): 106-134, and E. Fehr and A. Falk, "Psychological Foundations of Incentives," *European Economic Review*, 46/4-5 (2002): 687-724.

[xxii] http://blog.flickr.net/en/2008/11/03/3-billion/

[xxiii] For traffic statistics on Flickr, see <http://siteanalytics.compete.com/flickr.com/>, <http://www.quantcast.com/flickr.com>, <http://www.alexa.com/data/details/traffic_details/flickr.com?q=flickr.com>, <http://www.ebizmba.com/articles/user-generated-content>, <http://www.techcrunch.com/2007/11/13/2-billion-photos-on-flickr/>, accessed in October 2008. "Plain Text: Photo for the Masses," *Newsweek Web Exclusive*, March 11, 2005, posted at <http://www.newsweek.com/id/48941/page/2>, accessed December 12, 2008.

[xxiv] S. Levy and B. Stone, "The New Wisdom of the Web," *Newsweek*, April 3, 2006, posted at <http://www.newsweek.com/id/45976/page/1>, accessed December 12, 2008.

[xxv] Other examples of Flickr social groups with some form of reciprocity rules include Flickr Hearts, Hearts Award, and Flickr My Winners.

[xxvi] From Flickr website, <http://www.flickr.com/explore/>, accessed December 12, 2008.

[xxvii] See Yahoo press release, December 13, 2006, posted at <http://www.bloomberg.com/apps/news?pid=conewsstory&refer=conews&tkr=YHOO:US&sid=aTFpqCnKcfrM>, accessed December 12, 2008. S. Hamner, "The Secret to Yahoo Answers Success," *Business 2.0 Magazine*, October 2, 2006, posted at <http://money.cnn.com/magazines/business2/business2_archive/2006/09/01/8384345/>, accessed December 12, 2008.

[xxviii] F. Galton, "Vox Populi," *Nature*, 75 (1907):450-451 and F. Galton, *Memories of my life*, (London: Methuen & Co., 1908).

[xxix] "Wisdom of the Crowds," NOVA scienceNow, aired June 25 2008, posted at <http://www.pbs.org/wgbh/nova/sciencenow/0301/04.html>, accessed December 12, 2008.

[xxx] J. Surowiecki, *The Wisdom of Crowds: Why the many are smarter than the few*, (New York: Doubleday, 2004).

[xxxi] Retrieved from Yahoo Answers website, <http://answers.yahoo.com/info/welcome;_ylt=AnTFskYGp9TOrI2PpAfWpenpy6IX;_ylv=3>. accessed December 12, 2008.

[xxxii] These examples are drawn in April 2009. The Innocentive project numbers for the projects are: 8135922, 8110538, 8219824 and 8197987, respectively.

[xxxiii] Graph generated based on data from Fehr and Falk (1999), op. cit. Figures 5 and 6.