Lying is Contagious:

Spatial-Temporal Diffusion of Launching Agricultural "Satellites" in China's Great Leap Forward Movement

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Abstract

The Great Leap Forward (GLF) was a massive campaign launched by the Communist Party of China that mobilized the entire country to adopt radical socioeconomic policies from 1958 to 1961. As a hallmark of the GLF, many regions launched agricultural "satellites" - wildly exaggerating grain yields. The resulting delusion of a big harvest led the top political leaders to require excessive compulsory procurement which was one of the causes of the great famine that took away 16.5 to 30 million human lives. This study attempts to understand how lying about agricultural output became contagious across China. Two complementary hypotheses, peer competition and peer learning, are proposed to explain the spatial-temporal diffusion of launching agricultural "satellites". Historical archive data will be drawn to geocode the location and mark the timestamp of each "satellite". An event history analytical framework will be invoked to model the spatial-temporal evolution of these "satellites".

Introduction

The Great Leap Forward (GLF) was a massive campaign launched by the Communist Party of China (CPC) that mobilized the entire country to adopt radical economic and social policies from 1958 to 1961. The goal of the GLF was to rapidly transform China from a predominantly agrarian society to an industrialized socialist economy through a Soviet-style, high investment in heavy industry, supported by agricultural collectivization. Unfortunately, this frenzied campaign turned into an unprecedented calamity that claimed millions of people's lives.

The "wind of exaggeration" – falsely reporting ever higher yields of firstly agricultural (e.g. rice and wheat) and then industrial products (e.g. iron and steel), respectively, was one of the key elements of the GLF. Epitomizing the "wind of exaggeration", local cadres began to launch high-yield agricultural "satellites"[1] in June 1958, that is, fictitiously report a grain output of thousands or even ten thousands of catties per *mu*[2] (Bernstein, 1984), a fantasy that was only partially achieved four decades later, to the *People's Daily*, the CPC's official newspaper (Kung & Chen, 2011). The grain production was reported to be 375 million metric tons (MMT) in the end of 1958, roughly doubled from that in 1957; however, verification in 1961 yielded a nearly half reduction to 200 MMT (Bernstein, 1984; C.-M. Li, 1962).

Wild exaggerations of the growth in grain yield gave rise to a deception of the large harvest in 1958, which convinced the top political leaders that China was now confronted by a problem of storing and processing surplus grain rather than a problem of food shortage (Bernstein, 1984; Yang, 1996). This false vision of the agricultural production led the top political leaders to require excessive compulsory procurement (Ashton, Hill, Piazza, & Zeitz, 1984; Bernstein, 1984). The total grain procurement in the 1958 grain year (April 1958 – March

[1] The term was inspired by the Soviet Union's Sputnik satellite launched in 1957.
[2] One catty equals 1/2 kilogram, and one *mu* equals 1/6 acre.

1959) was 22.3 percent more than that in 1957 (Yang, 1996, p. 43). In addition, new policies were implemented to divert labor and resources from agriculture to fruitless projects such as the so-called backyard furnace movement in later 1958[3] and to reduce sown acreage in 1959 (Ashton et al., 1984). These movements together resulted in a sharp decline in grain production, and rural villages suffered from severe food shortage after forced grain requisitioning to support urban and industrial growth. Coupled with other manmade and natural devastating factors[4], the resulting great famine of 1958-1961 caused a total number of excess deaths that ranges from 16.5 to 30 million, depending on the data sources, underlying assumptions, and methods of estimation employed (Ashton et al., 1984; Banister, 1987; Coale, 1981; Peng, 1987; Yao, 1999).

Previous studies of the GLF are mainly focused on its social, economic, and political origins (Goldstein, 1991; MacFarquhar, 1974), and its catastrophic consequences to China's population and society (Chang & Wen, 1997; Kung & Lin, 2003; Lin, 1990; Yang, 1996). Despite the consensus on regional variations in provincial radicalism, the severity of the wild exaggeration of grain output, and the resulting excessive death toll in the subsequent great famine, few have attempted to systematically examine the spatial-temporal dynamics of wild lying – launching agricultural "satellites" at local administrative levels. Was there any spatial pattern of wild lying about grain yield? Did launching a "satellite" in one prefecture or county affect the probability for its neighbors to follow up? If so, why would such bodacious lies be spatially contagious? While we strongly suspect that launching agricultural "satellites" were not isolated but spatially contagious events, no one has addressed the problem with relevant data.

[3] The backyard furnace movement was characterized by melting any steel objects available, including pots and pans in the blast furnaces in the backyard of the people's communes. Most of the iron produced was of low quality and hence no value at all.

[4] Examples of other factors contributing to the great famine include weakened work incentives due to the formation of the people's communes (Perkins & Yusuf, 1984); large amount of food waste due to free dining in communal kitchens (Chang & Wen, 1997; Yang, 1996); and disastrous weather conditions (Kueh, 1995).

Building on the literature about career mobility and political incentive in authoritarian states (Edin, 2003; Goldstein, 1991; Kung & Chen, 2011; Walder, 1995; Yang, 1996), this study proposes two theories, peer competition and peer learning, to explain the spatial-temporal diffusion process of local cadres' blatant lies in a hierarchical polity. Drawing data from multiple sources, this study tests these theories during the surging period of agricultural "satellites" from June to September 1958. By unveiling the spatial-temporal cascades of launching agricultural "satellites" at local states, this study contribute to a better understanding of local radicalism in adopting new socioeconomic policies, and more important, its contagious nature in contemporary China and other transition societies. By uncovering the important role of geographic location and proximity in shaping the decision-making processes and the resulting spatial diffusion of political and economic lies, this study also contributes to the ongoing research on social diffusion (Wejnert, 2002) and the emerging research attention to spatial thinking in social science research (Logan, 2012).

Historical Background

By 1949, China's socioeconomic and population growth had been severely traumatized after decades of political upheavals, civil wars, and foreign invasions. After taking over the control of the mainland China, the CPC launched a series of social and economic development initiatives. In particular, the CPC embarked on the First Five-Year Plan, characterized by centralized economic planning, gradual collectivization in the agricultural sector, state monopoly in the industrial section, and emphasis on heavy industry at the expense of agriculture from 1953 to 1957. These development initiatives were overall effective in reviving China's economics in that agricultural and industrial output grew steadily at an average annual rate of 3.8 and 19 percent,

respectively, and more than doubled their pre-1949 levels by the end of the First Five-Year Plan (Fairbank & Goldman, 1998).

The successful economic recovery within a relatively short time period translated into a Chairman Mao Zedong's over-optimistic view about the Second Five-Year Plan starting in 1958. The success of the First Five-Year Plan also reinforced Mao's reliance on mass mobilization as an effective means for accomplishing mission impossible, a strong belief accumulated from his past wartime experience. Combined with an ever-growing desire to accelerate economic growth, Mao convinced his top leaders to launch a new Five-Year Plan characterized by aggressive expansion of heavy industrialization and agricultural collectivization. As a cue to the central state's activism, the *Peoples' Daily* published an editorial on November 13, 1957, calling for – and hence dubbed the term – a "Great Leap Forward" in production once the agricultural collectivization was accomplished. Inspired by the Russian leaders' plan to surpass the U.S. in industrial output in 15 years at the 40th anniversary ceremony of the October Revolution in Moscow, Mao unveiled his ambition to overtake the U.K. in steel output in 15 years. Echoing Mao's call, On January 1, 1958, the *Peoples' Daily* published its New Year's editorial, proclaiming that China would surpass the U.K. in fifteen years and catch up with the U.S. in twenty to thirty years, marking the start of the GLF movement.

The entire country, from the central state down to villages, was soon set into a motion of frequently revising targets for steel, grain, cotton, and other products upward in an attempt to fulfill the GLF movement's spirit of "doing things with greater and faster results" (Yang, 1996, p. 34). For example, the goal for grain yield was originally set at 500 MMT, a wild target in itself that was more than doubled from 1957; this goal was raised up to 700 MMT in three months later. Accordingly, local governments, led by loyal and enthusiastic cadres, began to modify

their plans by either exaggerating their targeted figures by 50 percent or more, or cutting down the planned work period for the original target by half, or both. The timetable for catching up with the U.K. was repeatedly shortened from 15 to 7, 5, and eventually down to 2 years as Mao proclaimed in June 1958.

Wild exaggeration of agricultural plans turned into high-yield agricultural "satellites" when the summer harvest season began. The first "satellite" was launched on June 8, 1958, when the front-page headline of the *People's Daily* reported that a People's Commune in Suiping County of Henan Province achieved a significant breakthrough in an average wheat yield of 2,105 catties per *mu*, a barefaced lie that marked the beginning of the agricultural "satellite" season. This lie was soon topped on the next day by another "satellite" as the *People's Daily* reported that another commune in Hubei Province harvested an average of 2,357 catties of wheat per *mu*. Picking up the high-profile cue from these reports by the *People's Daily*, other regions throughout the country exploded into a frantic race to launch more "satellites" to a higher altitude through bolder exaggeration. From June to September, more than 800 false reports of abnormally high grain yield were covered by the *People's Daily*. Among them, the greatest "satellites", or the wildest lies, were reported to reach to 8,586 and 130,435 catties per mu for wheat and rice, respectively. The fever of launching "satellites" gradually faded away by September as the grain harvest season came to an end.

Theoretical Framework

Spatial diffusion is not an uncommon phenomenon in human society. In addition to transmission of infectious diseases, scholars have examined a variety of spatial diffusion processes of social epidemics, ranging from changes in reproductive (Montgomery & Casterline, 1993; Tolnay,

1995) and consumer (Allaway, Black, Richard, & Mason, 1994) behaviors at micro-level, to adoption of new technologies and products (Feldman & Florida, 1994; Hägerstrand, 1967), health (Shannon, Bashshur, & Metzner, 1971) and family planning (Berry, Hall, Hernandez-Guerrero, & Martin, 2000) programs at meso-level, and to spread of political protests (Rasler, 1996) and democratization of the world (O'Loughlin et al., 1998; Wejnert, 2005) at macro-level. Hinged on China's hierarchically structured party-state system and the hyperpolitical atmosphere surrounding the GLF movement, two complementary theories, peer competition and peer learning, are proposed to explain the spatial-temporal diffusion of launching agricultural "satellites" in this study.

Peer Competition for Radicalism

The first theory is derived from the long-standing peer competitions among local officials, especially those from nearby administrative areas, rooted in China's hierarchically ordered realm. Ever since the Qin Dynasty (221-206 BC), lower-level officials have been designated by the central state rather than elected by local voters, although these officials hold certain local accountability in addition to their accountability to superiors (Xie & Brown, 2011). When it came to power in 1949, the CPC transformed China into a single-party state and imposed an even stronger top-down accountability system to supervise subordinate cadres (Kung, Cai, & Sun, 2009), despite enduring informal accountability provided by local solidary groups (Tsai, 2007). This party-state unity consists of five layers of administration: the central state, provinces (and five ethnic minority autonomous regions and three centrally administered municipalities of equal rank), prefectures, counties, and townships. This structure is paralleled by a hierarchy of party committee, extending downward from the CPC's Central Committee, which exercises the

ultimate control over personnel appointments, removals, and transfers two levels down the hierarchy (Burns, 1987; Hongbin Li & Zhou, 2005; Manion, 1985). The election of party committee members itself was screened and approved by a superordinate committee (Goldstein, 1991). In fact, the state authority has been so hierarchically concentrated in the hands of superordinate leaders that even after the introduction of village elections in the late 1980s, upper-level governments retain the power to remove 'disqualified' cadres from office without local villagers' consent (Kung et al., 2009).

In such a hierarchically ordered regime, local cadres' career incentives played a central role in delusional "innovations" such as launching agricultural "satellites" to demonstrate their loyalty to the top leaders, especially Mao[5], through their enthusiastic endorsement of the GLF movement. Political loyalty was rewarded with career advancement and the associated increases in salary, occupation prestige, authority, and privileged access to bureaucratically controlled goods. These material benefits and non-monetary perquisites were decisive incentives in a time of austerity when no alternative socioeconomic resources existed outside of the party-state polity and the planned economy (Goldstein, 1991; Walder, 1995). Career advancement ensued shortly after expressing endorsement to the central state's ambitious policies. At the provincial level, for example, seven party secretaries were promoted to be members of the CPC's Central Committee for their early support of the GLF movement (Goldstein, 1991). Similarly, a recent study found that compared to the provincial cadres of higher party ranks in the CPC's Central Committee, those who were of lower rank retained a stronger incentive to signal their loyalty in order to move up the career ladder, thereby adopting more radical policy measures such as excessive grain procurement (Kung & Chen, 2011).

[5] Mao earned enormous power and prestige among his colleagues and the people for his successful leadership in war and in peace, and became the ultimate political leader in China's party-state system (Teiwes, 1988).

By the same token, local cadres at prefecture or lower levels would be equally, if not more, enthusiastic about demonstrating their revolutionary zeal to appeal to the central state's urge to an accelerated increase in agricultural productivity. Adopting extremely radical measures could attract direct attention from the top leaders beyond provincial level. For example, thanks to the extraordinary activism of Zhang Guozhong, its first party secretary, *Xishui*, a remote and impoverished county in Hebei Province, earned Mao's political endorsement through his in-person visit in August, 1958, thereby rising to be a star of the GLF movement, and so was the secretary Zhang.

In addition, lower-level cadres were motivated by not only their career incentives in terms of promotion but also the intense pressures from their superordinate cadres. Throughout the GLF movement, activism and the associated political pressure was conveyed and magnified in a top-down fashion. Typically, Mao and his comrades at the top of the political unity would send out a formal or informal cue, which was picked up by provincial leaders who in turn developed compliant policy guidelines. Under these guidelines, prefecture cadres would design concrete measures, with specific task targets assigned, for county officials to carry out (Lu, 2008). A new dual system of competitive target-setting arose from this top-down process of policy deployment. Each level of the governments, from central to county, prepared two sets of production plans, one publicized minimum and the other larger expected one. The latter was set to be the publicized minimum for the level below (Ashton et al., 1984), cascading into an increasingly ambitious plan that would cast even greater pressures down the hierarchy. Failure to comply with superordinate authorities could lead to demotion or even political persecution.

To the extent that their future prospects mainly depended on the evaluation by their powerful superiors, and that performance was evaluated more as an indication of political

commitment and loyalty rather than that of administrative competence, local cadres tended to "hop on the political bandwagon" (Goldstein, 1991) by exaggerating grain yield, in compliance with the superordinate leaders' call for radicalism (i.e. "lead forward"), than the true figures that could be labeled as "rightists", a form of political disobedience, or even anti-revolutionary. In essence, launching agricultural "satellites" became a way for local cadres to earn extra political credential that signaled "the willingness of individuals to commit themselves to a greater degree of political scrutiny and responsibility vis-à-vis the ruling party's organization in exchange for career advancement (Walder, 1995, p. 313)." In fact, under the hyperpolitical atmosphere surrounding the GLF movement, wild exaggeration of grain output might be the one of the necessary strategies for local cadres to ensure their survival and promote their career advancement.

Within such a career incentive structure, local cadres were exposed to competitive pressures which eventually translated into competitive radicalization in the GLF movement. The tightly multi-layer-multi-regional hierarchical structure of the political system implies that promotions and sanctions, and hence competitions, were most often sought among peer cadres who were of the same rank and who shared the same next-level superordinate authority (i.e. horizontal competition for survival or reward under the same superior). Among those of the same level of administrative authority, the competition was likely to be most intense between neighboring areas bounded within the same regional line, because geographical affinity reflects similarities in terrain, demographics, agricultural productivity, economic structure and development, social and cultural characteristics, and history. These shared features among two adjacent areas would make one a natural yardstick for the other to be evaluated and ranked by the superordinate authority (Qian & Xu, 1993). For example, Anhui and Henan, two

neighboring provinces, were led by their first party secretaries to competing with each other to excel in radical GLF projects (Yang, 1996, p. 81). When prefecture cadres, under the influence of provincial leaders, pressured village cadres to exaggerate grain yield, it was common to initiate a rivalry with other nearby production units (Yang, 1996, p. 8). Similarly, when the provincial leader of Sichuan continued to push forward aggressive GLF-style agricultural policies despite the emerging famine, leaders in Yunnan and Guizhou, two neighboring provinces in the southwest region, were compelled to keep up with the frenzy in Sichuan (Yang & Su, 1998).

In sum, peer competition for upward career mobility or avoidance of being stripped of their posts in a hierarchically ordered realm stimulated local cadres to outdo their peers in terms of signaling loyalty and activism. Such a competition was more sensitive and could escalate to a greater scale among neighboring administrative units who happened to be natural yardsticks for each other to be assessed by their superordinate authorities. When one triggered a competition by launching an agricultural "satellite", the nearby units were likely to respond by launching more and larger "satellites".

Peer Learning about How to Lie

Besides a strong career incentive to compete with peers in the arena of launching agricultural "satellites", local cadres were still confronted by a challenge of how to lie about grain yield. After all, most agricultural "satellites" were subject to field inspection by superordinate cadres from two or more levels above. Typically, the claimed high-yield grains were harvested and weighed in the field in presence of county and prefecture officials. Occasionally, photos of local harvest were taken by journalists from the *People's Daily* as auxiliary evidence for successfully

launched a "satellite". Therefore, the challenge of passing the external inspection by superordinate cadres and journalists made exaggerating grain yield an innovative task. Those who were eager to launch a "satellite" but not creative enough to do so had to either give up or learn from others, among whom a neighboring peer in close spatial proximity would be a good role model.

Previous research on diffusion of innovations has shown that spatial proximity promotes the spread of innovative ideas and imitative behaviors by potential adopters (Hägerstrand, 1967; Montgomery & Casterline, 1993; Rasler, 1996; Rogers, 2003; Wejnert, 2005). It plays an important role in facilitating peer learning since closer proximity helps not only increase the awareness of innovations that occur in adjacent areas, but also reduce the costs of communication and transportation incurred during the learning process. In face of an ambiguous situation in which an innovation is too novel to assess its consequence, a neighbor's successful adoption of the innovation reduces the uncertainty in one's decision making process and stimulates potential followers.

So far there is little quantitative evidence supporting peer learning from neighboring areas about how to manufacture a false harvest without being exposed. However, some historical case studies are suggestive in this regard. For example, Li (2009) provided a detailed account of a steep learning curve experienced by the cadres of Qin village in Dongtai County, Jiangsu Province. The cadres of Qin village were skeptical about the "satellites" launched in other provinces that claimed a harvest of 7,000 catties of wheat per *mu* as opposed to only 200 to 300 catties per *mu* in their own village. They soon learned that two "satellites" were launched in two neighboring counties within the same prefecture, claiming high yields of 9,328 catties of wheat per *mu* and 12,000 catties of rice per *mu*, respectively. Under the pressure to catch up

with their neighbors from the county leaders, Qin villagers experimented with the three commonly reported means to achieve high grain yields, namely, deep plowing, intensive seeding, and heavy fertilizing. Of course, none of these techniques succeeded in producing a yield as high as any "satellite" reported in the newspaper. Fortunately, by the time their superordinate leaders came to examine their experiment, the cadres of Qin village had learned from the trick from the satellite launchers in nearby areas: cutting the crop from other fields and secretly moving it to the experiment field in the night to inflate its yield.

This type of peer learning was not an isolated case. Instead, local cadres were urged to emulate their counterparts in Xiyang County of Shanxi Province, home to the famous Dazhai production brigade, an agricultural role model endorsed by Mao (Yang, 1996, p. 95). In fact, spatially informed peer learning did not fade away after the GLF movement, but remained evident during the economic reform in the 1980s in that successful reform policies or development strategies such as the experiments of the township and village enterprises in one region were quickly imitated by adjacent regions; and in the same vein, modern technologies diffused from coastal to inland areas (Qian & Xu, 1993).

In sum, an agricultural "satellite" was essentially a lie that was subject to external (newspaper reporters) and particularly superior (county, prefecture, province, and even central state officials) inspection, and not every local cadre was creative enough to invent independently a unique way to pass the scrutiny. Learning from neighboring peers who had succeeded in launching agricultural "satellites" turned out to be an effective and yet low-cost solution to this challenge.

Research Hypotheses

The essence of the diffusion process of launching agricultural "satellites" is that lying about grain output in one area stimulates further lying in nearby areas, resulting in a spatial-temporally autoregressive behavior (Montgomery & Casterline, 1993) or social contagion (Erbring & Young, 1979) of falsified reporting. From the theoretical background discussed above, several research hypotheses about this dynamic can be formulated and tested in this study.

Given the strictly hierarchical nature of China's party-state system, peer competition is more likely to occur among subordinate administrative units clustered within the same superordinate unit. Moreover, peer competition can be a repeated game in the sense that every strike can cause a counterstrike in a recursive fashion. That is, for the sake of outperforming the peers, a prefecture or county that launched the first "satellite" within the province was likely to launch another one, had the neighbors within the same province emulated its first "satellite", and so on and so forth. However, such a competition would be less likely to be triggered if a "satellite" was launched in a neighboring prefecture or county located in the adjacent province, because career mobility was sought within the same branch of the hierarchy.

In contrast, peer learning was not necessarily restricted to nearby units within the same superordinate geographic boundary. It was as convenient for cadres to visit and learn from an adjacent prefecture or county in a different province as from a unit within the same province. In fact, several avant-garde counties and people's communes were designated as the GLF stars by Mao who encouraged cadres across the country to visit and learn from these prominent examples. Furthermore, peer learning is more or less a one-time game in that once a cadre had learned from neighboring peers about how to lie and pass the field inspection by his/her superiors, there would be no need to learn again. Therefore, three hypotheses can be formulated as follows:

Hypothesis 1: The peer competition and learning theories together predict that the probability of launching an agricultural "satellite" would increase after neighboring units have launched one or more "satellites".

Hypothesis 2: The peer competition theory predicts that in an arena of repeated competition, the probability of launching a second "satellite" would increase if one's neighboring units within the same branch of the hierarchy (i.e. the same province) have launched one or more "satellites".

Hypothesis 3: The peer learning theory predicts that the probability of launching an agricultural "satellite" would increase if one's neighboring units that are located in a different branch of the hierarchy (i.e. a different province) have launched one or more "satellites".

Analytical Plan

Data

The main data source of this study comes from the news reports published by the People's Daily from June to September 1958, the main period of launching agricultural "satellites". Every "satellite" will be extracted and geocoded to its location on a prefecture-level map of 1953 China, available from the China Data Center at the Interuniversity Consortium for Political and Social Research (ICPSR), University of Michigan. The date of each "satellite" will also be recorded to establish the correct temporal order. Control variables such as areal demographics and agricultural productions will be drawn from historical government statistics.

Measures

The event of interest is launching an agricultural "satellite" by a prefecture – wild exaggeration of grain yield reported by the *People's Daily*. The exposure of risk began on June 8, 1958, the date when agricultural "satellites" were invented, for an area that had not launched a "satellite" yet; or the next day after an area launched its last "satellite". Right censoring occurred had no "satellite" been launched by September 30, 1958 when the fever gradually faded away.

The key predictor is the number of agricultural "satellites" launched by neighboring prefectures to date. Neighboring prefectures are defined to be those which shared a boundary with the focal prefecture. To disentangle the test of peer competition from that of peer learning, a further distinction will be made between neighboring prefectures within the same province versus across a provincial boundary.

Other confounding variables that may affect the risk of launching a "satellite" will be controlled, such as type of terrain (plain, pasture, and mountain), population density in 1953, being an old revolutionary base area, being a remote area, and proportion of agricultural population and grain yield per *mu* in 1980. Despite being measured in about twenty years later, the last two variables may still capture the relative ranks of different regions with respect to agricultural development in 1958 given China's stagnant economic growth in the 1960s and 1970s.

Event History Analysis

Following previous research on diffusion (Allaway et al., 1994; Strang & Tuma, 1993), an event history analysis framework will be adopted to model the spatial-temporal evolution of launching agricultural "satellites" across China. This framework treats the space and time path of launching an agricultural "satellite" as a dynamic, parametric or semi-parametric, probabilistic

process influenced by time-varying and time-constant factors (Allaway et al., 1994). An event history model allows for the fact that some areas only lied once, others lied repeatedly, and still others never lied.

Specifically, a conditional frailty model (CFM) will be employed as follows (Box-Steffensmeier & De Boef, 2006; Box-Steffensmeier, De Boef, & Joyce, 2007):

$$\lambda_{ik}(t) = \lambda_{0k}(t_k - t_{k-1})e^{X_{ik}\beta+\omega_i}$$

where k denotes event number (launching the first, second, …, "satellite"); $\lambda_{0k}(t_k\text{-}t_{k-1})$ is the baseline hazard rate, which is stratified by event number to control for event dependence; $(t_k\text{-}t_{k-1})$ incorporates the conditional gap time structure so that the hazard gives the risk for event k since the (k-1)th event; X is a vector of covariates (time-constant and/or time-varying), and β denotes the effect parameters. For prefectures with multiple events, launching a "satellite" could be determined by unobserved characteristics that make them more or less prone to repeat over time. This unobserved heterogeneity is controlled via a random effect, denoted by ω_i, which is shared across a prefecture's repeated events. In this way, the CFM produces more efficient and less biased model estimations than conventional variance-corrected and frailty models.

To further explore the unobserved spatial variation in the risk of launching agricultural "satellites", we will further extend a CFM by adding a spatially structured random effects term as follows:

$$\lambda_{ik}(t) = \lambda_{0k}(t_k - t_{k-1})e^{X_{ik}\beta+\omega_i+s_i}$$

where s_i can take a non-parametric form such as the well-known intrinsic conditional autoregressive (CAR) model (Besag, York, & Mollié, 1991), or a parametric form that involves a distance-decay correlation function (Xu, Forthcoming). Such a spatial CFM has the potential to uncover the underlying unobserved spatial process of launching agricultural "satellites" and avoid biased statistical inference compared to a non-spatial CFM.

REFERENCES

Allaway, A. W., Black, W. C., Richard, M. D., & Mason, J. B. (1994). Evolution of a Retail Market Area: An Event-History Model of Spatial Diffusion. *Economic Geography, 70*(1), 23-40. doi: 10.2307/143576

Ashton, B., Hill, K., Piazza, A., & Zeitz, R. (1984). Famine in China, 1958-61. *Population and Development Review, 10*(4), 613-645. doi: 10.2307/1973284

Banister, J. (1987). *China's changing population*. Stanford, CA: Stanford University Press.

Bernstein, T. (1984). Stalinism, famine, and Chinese peasants. *Theory and Society, 13*(3), 339-377. doi: 10.1007/bf00213230

Berry, B. J. L., Hall, L. S., Hernandez-Guerrero, R., & Martin, P. H. (2000). México's Demographic Transition: Public Policy and Spatial Process. *Population and Environment, 21*(4), 363-383. doi: 10.2307/27503713

Besag, J., York, J., & Mollié, A. (1991). Bayesian image restoration, with two applications in spatial statistics. *Annals of the Institute of Statistical Mathematics, 43*(1), 1-20.

Box-Steffensmeier, J. M., & De Boef, S. (2006). Repeated Events Survival Models: The Conditional Frailty Model. *Statistics in Medicine, 25*(20), 3518-3522.

Box-Steffensmeier, J. M., De Boef, S., & Joyce, K. A. (2007). Event dependence and heterogeneity in duration models: the conditional frailty model. *Political Analysis, 15*(3), 237-256.

Burns, J. P. (1987). China's nomenklatura system. *Problems of Communism, 36*(5), 36-51.

Chang, Gene H., & Wen, Guanzhong J. (1997). Communal Dining and the Chinese Famine of 1958–1961. *Economic Development and Cultural Change, 46*(1), 1-34. doi: 10.1086/452319

Coale, A. J. (1981). Population Trends, Population Policy, and Population Studies in China. *Population and Development Review, 7*(1), 85-97. doi: 10.2307/1972766

Edin, M. (2003). State Capacity and Local Agent Control in China: CCP Cadre Management from a Township Perspective. *The China Quarterly, 173*, 35-52. doi: doi:10.1017/S0009443903000044

Erbring, L., & Young, A. A. (1979). Individuals and Social Structure: Contextual Effects as Endogenous Feedback. *Sociological Methods & Research, 7*(4), 396-430. doi: 10.1177/004912417900700404

Fairbank, J. K., & Goldman, M. (1998). *China: a new history*. Cambridge, Mass.: Belknap Press of Harvard University Press.

Feldman, M. P., & Florida, R. (1994). The Geographic Sources of Innovation: Technological Infrastructure and Product Innovation in the United States. *Annals of the Association of American Geographers, 84*(2), 210-229. doi: 10.2307/2563394

Goldstein, A. (1991). *From bandwagon to balance-of-power politics: structural constraints and politics in China, 1949-1978*. Stanford, CA: Stanford University Press.

Hägerstrand, T. (1967). *Innovation diffusion as a spatial process*. Chicago: University of Chicago Press.

Kueh, Y. Y. (1995). *Agricultural instability in China, 1931-1991: weather, technology, and institutions*. Oxford : New York: Clarendon Press ; Oxford University Press.

Kung, J. K.-s., Cai, Y., & Sun, X. (2009). Rural Cadres and Governance in China: Incentive, Institution and Accountability. *The China Journal*(62), 61-77. doi: 10.2307/20648114

Kung, J. K.-s., & Chen, S. (2011). The Tragedy of the Nomenklatura: Career Incentives and Political Radicalism during China's Great Leap Famine. *American Political Science Review, 105*(1), 27-45.

Kung, J. K.-s., & Lin, Justin Y. (2003). The Causes of China's Great Leap Famine, 1959–1961. *Economic Development and Cultural Change, 52*(1), 51-73. doi: 10.1086/380584

Li, C.-M. (1962). *The statistical system of Communist China*. Berkeley: University of California Press.

Li, H. (2009). *Village China under Socialism and Reform: A Micro History, 1948-2008*. Stanford, CA: Stanford University Press.

Li, H., & Zhou, L.-A. (2005). Political turnover and economic performance: the incentive role of personnel control in China. *Journal of Public Economics, 89*(9–10), 1743-1762. doi: http://dx.doi.org/10.1016/j.jpubeco.2004.06.009

Lin, J. Y. (1990). Collectivization and China's Agricultural Crisis in 1959-1961. *Journal of Political Economy, 98*(6), 1228-1252. doi: 10.2307/2937756

Logan, J. R. (2012). Making a Place for Space: Spatial Thinking in Social Science. *Annual Review of Sociology, 38*, 507-524. doi: 10.1146/annurev-soc-071811-145531

Lu, H. (2008). How "Satellites" Were Launched: Grass-Roots Cadres in Rural China and the Great Leap Forward. *Open Times, 5*, 116-126.

MacFarquhar, R. (1974). *The Origins of the Cultural Revolution. Vol. 2: The Great Leap Forward, 1958-1960*. New York: Columbia University Press.

Manion, M. (1985). The Cadre Management System, Post-Mao: The Appointment, Promotion, Transfer and Removal of Party and State Leaders. *The China Quarterly, 102*, 203-233. doi: doi:10.1017/S030574100002991X

Montgomery, M. R., & Casterline, J. B. (1993). The Diffusion of Fertility Control in Taiwan: Evidence from Pooled Cross- Section Time-Series Models. *population Studies, 47*(3), 457-479. doi: 10.2307/2175128

O'Loughlin, J., Ward, M. D., Lofdahl, C. L., Cohen, J. S., Brown, D. S., Reilly, D., . . . Shin, M. (1998). The Diffusion of Democracy, 1946-1994. *Annals of the Association of American Geographers, 88*(4), 545-574. doi: 10.2307/2564092

Peng, X. (1987). Demographic Consequences of the Great Leap Forward in China's Provinces. *Population and Development Review, 13*(4), 639-670. doi: 10.2307/1973026

Perkins, D. H., & Yusuf, S. (1984). *Rural development in China*. Baltimore, MD: Published for the World Bank [by] Johns Hopkins University Press.

Qian, Y., & Xu, C. (1993). Why China's economic reforms differ: the M-form hierarchy and entry/expansion of the non-state sector. *Economics of Transition, 1*(2), 135-170. doi: 10.1111/j.1468-0351.1993.tb00077.x

Rasler, K. (1996). Concessions, Repression, and Political Protest in the Iranian Revolution. *American Sociological Review, 61*(1), 132-152. doi: 10.2307/2096410

Rogers, E. M. (2003). *Diffusion of innovations* (5 ed.). New York: Free Press.

Shannon, G. W., Bashshur, R. L., & Metzner, C. A. (1971). The Spatial Diffusion of an Innovative Health Care Plan. *Journal of Health and Social Behavior, 12*(3), 216-226. doi: 10.2307/2948557

Strang, D., & Tuma, N. B. (1993). Spatial and Temporal Heterogeneity in Diffusion. *American Journal of Sociology, 99*(3), 614-639. doi: 10.2307/2781285

Teiwes, F. C. (1988). Mao and His Lieutenants. *The Australian Journal of Chinese Affairs*(19/20), 1-80. doi: 10.2307/2158541

Tolnay, S. E. (1995). The Spatial Diffusion of Fertility: A Cross-Sectional Analysis of Counties in the American South, 1940. *American Sociological Review, 60*(2), 299-308. doi: 10.2307/2096388

Tsai, L. L. (2007). Solidary groups, informal accountability, and local public goods provision in rural China. *American Political Science Review, 101*(2), 355.

Walder, A. G. (1995). Career Mobility and the Communist Political Order. *American Sociological Review, 60*(3), 309-328. doi: 10.2307/2096416

Wejnert, B. (2002). Integrating Models of Diffusion of Innovations: A Conceptual Framework. *Annual Review of Sociology, 28*(1), 297-326. doi: doi:10.1146/annurev.soc.28.110601.141051

Wejnert, B. (2005). Diffusion, Development, and Democracy, 1800-1999. *American Sociological Review, 70*(1), 53-81. doi: 10.2307/4145350

Xie, Y., & Brown, M. (2011). Between Heaven and Earch: Dual Accountability of East Han Chinese Bureaucrats. *Chinese Journal of Sociology, 31*(4), 1-28.

Xu, H. (Forthcoming). Comparing Spatial and Multilevel Regression Models for Binary Outcomes in Neighborhood Studies. *Sociological Methodology*. doi: 10.1177/0081175013490188

Yang, D. L. (1996). *Calamity and reform in China: state, rural society, and institutional change since the great leap famine*. Stanford, CA: Stanford University Press.

Yang, D. L., & Su, F. (1998). The politics of famine and reform in rural China. *China Economic Review, 9*(2), 141-155. doi: http://dx.doi.org/10.1016/S1043-951X(99)80011-X

Yao, S. (1999). A Note on the Causal Factors of China's Famine in 1959–1961. *Journal of Political Economy, 107*(6), 1365-1369. doi: 10.1086/250100