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**The missing links between regulatory resources and risk concerns:
Evidence from the case of food safety in China**

Running title: Regulatory resources and food safety concerns in China

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Abstract

Do resources available to regulatory agencies matter for public perceptions of social risks? In this paper we use the case of food safety in China to empirically examine the relationship between regulatory resources and risk concerns. The multilevel model estimates suggest that neither regulatory revenue nor personnel is significantly related to public concerns over food safety. There is no significant interaction effect between regulatory resources and food scandals either. Despite the fact that sufficient fiscal revenue and manpower are the prerequisites of effective food safety regulation, they do not bring about more favorable public perceptions. These are the two missing links leading to the insignificant effects of regulatory resource inputs. First, ineffective distribution and deployment of resources and the lack of external participation retard the growth of regulatory capacity. Second, underinvestment in risk communication and the amplification effect of risks undermine regulatory legitimacy. We also discuss the theoretical and policy implications of the results, and conclude with research limitations and suggestions for future research.

Keywords: Food safety; regulation; citizen perception; multilevel model; China

Introduction

Natural disasters (e.g., fire, flood, and hurricane) and man-made emergencies (e.g., terrorism, food poisoning, and pollution) occur unexpectedly, making the public highly obsessed with deep worry (Boin & Lodge, 2016). Given the rising and complicating risks in society, citizens around the world have been increasingly concerned about their safety. Public perceptions of and concerns about risks may be amplified by media exposure and interpersonal exchange (Frewer, Miles, & Marsh, 2002), which can generate profound social and political impacts. Individuals are usually vulnerable to risks and crises, and it is largely the responsibility of governments to shelter their constituencies from threats and casualties. Apart from personal predispositions and media exposure, government performance in reducing risks and handling crises is one of the key determinants of public perceptions. Governance capacity and legitimacy are the two pillars of crisis management performance (Christensen, et al., 2016). The successful regulation of risk requires affluent resources and strong capacity. It is thus both theoretically imperative and practically important to examine the implications of regulatory resources and capacity for public perceptions of risks.

More resources generate higher capacity and legitimacy, which in turn lower public concerns about social risks. Supported by theories like the resource-dependent theory, this conventional proposition is commonly advocated by politicians, but has been rarely tested empirically. In cases of eye-catching crises, governments are under strong public pressures to respond effectively. Regulatory agencies are usually bestowed with more financial, personnel, and technological resources, and citizens' expectations are raised

by politicians' hyping commitments to address social risks. The influx of various resources, however, may not be well distributed and deployed, which undermines the mechanisms through which public risk perceptions are successfully addressed. While the importance of regulatory agencies to regulatory compliance is well established, its relevance to citizen perceptions of risk regulation has not been systematically examined. The existing literature predominantly focuses on the issues of environmental protection and pollution control (Gray & Shimshack, 2011), while food safety regulation has not been studied. Therefore, the complicated linkage between regulatory resources and public risk perceptions is worth more in-depth exploration.

In this paper, we examine the effects of regulatory resources on citizens' risk perceptions using the case of food safety in China. As a high-profile public issue concerned by most citizens, China's food safety provides a perfect case to examine the abovementioned proposition. The hypothesis is tested quantitatively with archival and survey data from multiple sources across 30 Chinese municipalities, followed by qualitative interviews with officials and consumers. The hypothesized negative relationship between regulatory resources and risk perceptions is not supported by the quantitative evidence. Regulatory resources are pivotal to food safety governance, but the results suggest that some other variables are more pronounced in shaping risk concerns. The results shed light on the theory of risk state-building in developing countries, especially the application of effective risk communication strategies to strengthen the legitimacy of risk regulation and governance in the state-building process. We suggest that government officials should pay more attentions to resource allocation,

capacity-building, and legitimacy, particularly the role of risk communication in food safety regulation. We discuss the theoretical and policy implications of the findings and also suggest a few directions for future research in this field, particularly how to make consumers less concerned about food safety risks by remodeling regulatory capacity and streamlining risk communication.

Theoretical Framework and Propositions

Regulatory Resources and Risk Control

The past two decades have witnessed a burgeoning stream of literature highlighting the role of management in regulatory capacity and public service improvement (O'Toole & Meier, 2015). The effectiveness of regulatory agencies depends by and large on their capacity to acquire and manage essential resources. As OECD (1995) recommended, regulatory quality as the outcome of regulatory capacity can be defined as a combination of the building of regulatory agency, the usage of regulatory tool, and the implementation of regulatory policy. Regulatory agencies are among the most prominent players in risk control, although other actors and their relationships also play important roles. It is local regulatory agencies that implement laws, and regulatory compliance is significantly shaped by their willingness and capacity (Lo, et al., 2006). Regulatory resources are pivotal to tax collection and drug approval (Carpenter et al., 2003), and regulatory agencies can strengthen their deterrence effects by sanction and reputation (Shimshack & Ward, 2005).

The effectiveness of market regulation is largely shaped by the resources available

to regulatory agencies (Carpenter, et al., 2003). Empirical studies show that sufficient budgetary resource, professional manpower resource, and strong administrative support are important to foster a stronger regulatory capacity (Lo, et al., 2006). Food control is a highly professional task requiring sophisticated detective technologies and equipment as well as skilled staff. Generally speaking, more regulatory resources can bring about a stronger regulatory capacity, which can improve citizens' satisfaction with regulatory effectiveness. Regional disparities in food safety risk can be partially attributed to the varying regulatory resources and capacities at local levels (Liu, 2010).

The resources available to regulatory agencies can help to boost citizen confidence in food safety in at least two ways. First, affluent budgetary and personnel resources can help regulatory agencies to implement stringent food safety standards, frequently detect food samples, and identify food safety risks as soon as possible, which minimize food-related risks and retain citizens' confidence in food safety. Second, regulatory agencies that are rich in resources are more prepared to respond to food safety accidents and scandals, making citizens more confident in their capacity to mitigate negative consequences.

Citizens are more likely to be confident in food safety if the regulatory sectors are rich in fiscal and human resources. Citizens tend to trust in governments with strong resources and capacities, which can be used to protect them from food safety risks. This proposition has been tested in several sectors such as environmental regulation (Rothstein, et al., 2006) and pharmaceutical regulation (Carpenter, 2010). In this regard, we expect that citizens residing in regions with more budgetary revenue and human

resource in food safety regulation are more likely to be confident in food safety. We predict that the amounts of fiscal and personnel resources devoted to food safety regulation are negatively related to public concerns.

The (Mis)Match between Risk Severity and Regulatory Resources

The quality of law enforcement is conditional on several variables. For instance, regulatory stringency is by and large a function of local politics and citizens' demands (Becker & Stigler, 1974). The effects of management on public service performance are to a large extent contingent on organizational environment and the political and socioeconomic context at large (Meier, et al., 2015). Organizational configuration theory argues that management aligned with organizational context is most effective (Andrews & Boyne, 2011). The effects of fiscal and personnel resources on public concerns over food safety may also be moderated by other contextual variables, especially the severity and complexities of food safety regulation (Christensen, et al., 2016).

The resources of the regulatory agencies should be understood as a relative concept terms by taking the severity of policy issues into account. If many food safety scandals are reported in a region, the resources available to regulatory agencies may not be equivalently effective in safeguarding the residents from risks compared to another region with fewer scandals but similar amount of resources. Regions with rampant food scandals desiderate extra resources to regulate food industries, and the relationship between regulatory resources and citizen perceptions would be stronger. In contrast, the

demand for resources in regions with few food scandals is low, and the resources-concerns relationship would be attenuated. Frequent reports of food safety scandals not only increase the regulatory agencies' demands for resources, but also intensify citizens' concerns about food safety. In other words, the relationship between regulatory resources and citizen concerns is positively moderated by the number of food scandals. We expect the severity of food safety risk to moderate the relationship between regulatory resources and public concerns, which is predicted to be stronger when there are more food scandals.

Regulatory Capacity and Legitimacy

Though named differently in different domains (e.g., administrative, management, governance, or regulatory capacity), resources are highly synonymous albeit conceptually incommensurable with capacity. Capacity, unlike resources, is intangible processes, skills and capacities. "Administrative capacity refers to the ability to manage efficiently the human and physical resources required for delivering the outputs of government." (Painter & Pierre, 2005, p. 2). Policy capacity is a complex and multidimensional construct that is difficult to conceptualize and measure (Wu, et al., 2015). Wu, et al. (2015) argue that policy capacity is comprised of two key components, competencies and capabilities. Policy competences refer to analytical, operational and political skills important to policy success, while policy capabilities are essential for policy-making at individual, organizational and system resource levels. Christensen, et al. (2016) suggest that governance capacity can be assessed in coordination, regulative,

analytical, and deliberating aspects.

Management capacity and quality are found to be pivotal in improving public service performance (Andrews & Boyne, 2011). The effectiveness of regulatory agencies depends largely on their capacity to acquire and manage essential resources. Bureaucracy has a strong impulse to maximize its budget and personnel, which causes government size to increase dramatically (Light, 1999). Money and manpower available to the regulatory agencies are usually regarded as the key prerequisites of a strong regulatory regime, but they may not automatically transform into regulatory capacity and legitimacy, which are the key ingredients to public perceptions of risks (Christensen, et al., 2016).

Resources may be transformed into capacity, but resources can also be misused and abused without contributing to capacity-building. Administrative capacity can be measured by “effective resource management” (Painter & Pierre, 2005), which is not equivalent to the magnitude of resources available. If the resource inputs are not efficiently and effectively utilized in food safety regulation, then public risk perceptions cannot be improved accordingly. Apart from governance capacity, governance legitimacy is equivalently crucial in crisis management performance (Christensen, et al., 2016). It is expected that plenty of regulatory capacity input can foster a more effective regulatory regime, which in turn produces a safer physical food safety situation. If the regulator can convey this information to consumers smoothly and consumers have sufficient rational knowledge about food safety risk, a safer physical food safety situation can lead to citizens’ higher satisfaction and lower concern with

food safety. In the meantime, however, fiscal and personnel resources mobilized by the bureaucracy to deal with public crises may also create high public expectations that are difficult to fulfill in the short term.

The influx of regulatory resources may create a division in public perceptions of social risks. Rationale citizens may consider more resources helpful in safeguarding their food safety, and thus better than nothing (Christensen, et al., 2016). High expectations raised by government commitment, legislation, and investment, however, may in turn lower citizen satisfaction in relative terms (Wu et al., 2017). Citizens prefer small government and are cynical about the increment of regulatory resources, which can compromise market freedom. Furthermore, more resources themselves may implicitly imply there are big problems in risk regulation, otherwise there is no need to add resources. More resources imply that the government is incapable of handling the problems, and regulatory agencies have to claim more resources to cover up their incapability and ineffectiveness (Liu & Ma, 2016). Given the high expectations and cynicism raised by resource inputs, citizens' concerns may not be adequately addressed through the increment of resources. Public risk perceptions, however, may even deteriorate as a result of the abovementioned psychological and cognitive mechanisms.

The Context of Food Safety Regulation in China

Food Scandals and Public Discontent

As far as food safety is concerned, within a decade from 2003 to 2013, there have been a total of 9,279 food poisoning accidents, which caused more than 2,700 deaths in China.

The outbreak of rampant food safety scandals over the past decade, particularly the notorious case of toxic Sanlu Milk Powder in 2008, has substantially undermined the credibility of the food industry and severely damaged public confidence in food safety (Liu, et al., 2013). Although Beijing's official regulatory data have shown that its food safety situation has been improved significantly since 2008, public opinion surveys have repeatedly revealed the increasing concerns of Chinese consumers over food safety. The longitudinal surveys by the Pew Research Center show that the share of respondents considering food safety as "a very big problem" has nearly tripled since 2008.¹ In line with the rising public concern, the media reported food scandals archived by the ZCCW website have also soared. There were few news reports on food scandals before 2005, but the situation changed remarkably from then on, with an average of over 350 cases reported from 2005 to 2013.²

The cross-regional flow of foods exposes almost everyone to the risk of unsafe food. The risk and citizens' perceptions of food safety, however, vary remarkably across regions in China (Holtkamp, et al., 2014). It is interesting and meaningful to examine the driving forces of the regional disparities in food safety risk and citizen perceptions, since it is still unclear what factors matter for people's food safety perceptions and its implications for food safety governance in China (Liu & Ma, 2016).

¹ The public concern data are from the Pew Research Center, and we aggregate the percentage of respondents who thought safety of food is "a very big problem" and "a moderately big problem."

² The media report data are from ZCCW (<http://www.zccw.info/index>), last updated 2015-07-09. The disproportional decrease of media coverage from 2014 may be partially attributed to the withdrawal of Mr Wu from the operation of ZCCW in 2013. Although the website is still maintained by volunteers, the news reports are updated sparsely.

Government Responses and Escalating Public Expectations

The authoritarian Chinese government is as responsive to public grievances as its Western democratic counterparts (Distelhorst & Hou, 2016), primarily to retain regime resistance and governing legitimacy. Given the lingering concerns of the public about food safety, the government has implemented multiple policies to address citizens' discontent (Wu et al., 2017). The past two decades have witnessed the creation of China Food and Drug Administration (CFDA) as the watchdog of national food safety and the re-decentralization of regulatory authorities from central to local governments. Currently regional food safety regulation is primarily the responsibility of local governments at various levels, and CFDA's branches at local levels are in charge of food safety in their jurisdictions (Liu & McGuire, 2014). Called the "strictest law," *the National Food Safety Law* (NFSL) was adopted in 2009 and amended in 2015 to empower CFDA to heavily punish illegal food producers and suppliers.

The CFDA leaders recognizes that food safety regulatory agencies without sufficient financial and personnel resources are toothless tigers to the food industry out of control (Jia & Jukes, 2013). As such, the CFDA has been forcefully claiming more resources by resorting to NFSL, which states that local governments shall arrange budgetary expenditure and strengthen supervision and administration capability to secure food safety. National leaders such as the Chinese President Xi Jinping are very concerned about political repercussions of food safety risks, and consider this issue a great challenge and test of the ruling Chinese Communist Party (CCP)'s governance capacity.

The fiscal resources and manpower of regulatory agencies have been steadily increasing over the past decade. For example, the food and drug administration system employed 67 and 45 thousand persons in its administrative agencies and public service units respectively in 2013, which were raised to 136 and 67 thousand in 2014 and 266 and 80 thousand in 2015 respectively, partially due to agency amalgamation at local levels. Although regulatory personnel have increased, about 150 thousand employees are specifically responsible for food safety.³ The US FDA employs about 16 thousand at federal level, and there are about 100 thousand employees in state and local agencies.⁴ Given that the US population size is about one quarter of China's, the workforce of food safety in China is really affluent.

Despite the increment of budget and personnel of CFDA agencies, the past decade has witnessed the deterioration of food safety in China. Budget and manpower resources in CFDA agencies have steadily increased over the past years, but have not resulted in less food-safety scandals or lower public concern. The public is still skeptical about government capacity to enforce this "strictest law." The question, then, is why more resources did not bring about higher public confidence? What explains the puzzles in the resource-perception linkage?

Methods

We use the mixed-method approach to examine the link between regulatory resources and public perceptions in the case of food safety in China. The quantitative analysis

³ The data are from the annual reports of CFDA.

⁴ Personal interview with FDA officials.

employs multilevel regressions to study the effect of provincial and city-level regulatory resources on citizens' concerns about food safety. The data are from multiple sources as detailed below. The qualitative analysis consists of in-depth interviews with regulatory officials and consumers, which are helpful in clarifying the missing links between regulatory resources and public perceptions. Drawing conclusions from both quantitative and qualitative evidences, this study helps to deepen our understanding of social ramifications of regulatory regime.

Sample and Data Sources

The sample used in this study is composed of 30 municipalities in Mainland China, including four municipalities (e.g., Beijing), 22 provincial capital cities (e.g., Guangzhou), and capital cities of the four autonomous regions (e.g., Urumqi). Lhasa, the capital of Tibet, has to be dropped from the analysis as the survey data are unavailable. Usually categorized as the tier-one and tier-two cities in China, these cities are regional hubs with relatively vibrant economies and large populations. These cities are also homes of a large number of food consumers and suffer from rampant food scandals. Hence, it is meaningful to examine their residents' concerns over food risks.

We use archival and survey data from multiple sources to investigate the relationship between regulatory capacity and perceived food safety risks. The data on food safety perceptions and other demographics are from a face-to-face survey of local residents in 30 provincial capital cities in January 2013. The survey adopted a multi-stage stratified random sampling strategy to recruit respondents. For cities with total population size

above 10 million, from 5 to 10 million, from 2 to 5 million, and less than 2 million, the quota sample size is 300, 250, 200, and 150 respectively. The survey first proportionally sampled the administrative districts in each city by the shares of total population. Each administrative district was then divided into five subdistricts, from which the families and specific persons to be interviewed were randomly sampled by the KISH method (i.e., a family member with the last birthday was recruited). People aged between 18 and 60 and residing at least one year in the sampled city were recruited. In sum, the survey data were collected from 6,259 respondents, with a response rate of 8.85 percent.

To understand and interpret the findings from the quantitative analyses, we also conducted in-depth interviews with local food safety regulatory officials in Beijing (the capital city), Shanghai (a coastal municipality), Guangdong (a southern province), and Guizhou (a southwestern inland province). A semi-structured interview method was used, and the interviewees were asked a handful of questions on regulation resource allocation and deployment, structural change and functional arrangement, public outreach and communication, and so forth. We also interviewed food consumers about their risk perceptions and opinions toward regulatory measures.

Dependent Variables

The dependent variable is measured by the respondents' answers to the question "do you often feel concerned about food safety in your ordinary life?" The answers are captured on a five-point Likert scale ranging from 1 ("Never concerned") to 5 ("Very concerned"), with higher values indicating greater concerns. While the item may not

perfectly capture the respondents' perceived food safety risk in their locality *per se*, it is nevertheless a good proxy. To verify its validity, we include a Baidu index from the dominant search engine (<http://index.baidu.com>) in China, which is similar to the Google index. We use "food safety" (*shipin anquan*) as the keyword, and yearly average of Baidu index in 2013 is used to gauge citizens' concerns with food safety in the sampled cities. Our item is positively albeit insignificantly related to the Baidu index ($r=0.183$, $p>0.1$), meaning that the measure is acceptable, though not perfect. There is also a relevant item in the survey, which can be used to check the validity of our measure: "Did you complain about food and drug safety to local governments or officials over the past year?" We find that it is highly related to our dependent variable ($r=0.148$, $p<0.01$), again supporting the validity of our measure. We acknowledge the limitation of using single-item measurement, as citizens' concerns differ across various types of food risks (e.g., pesticides, additives, foodborne diseases). While it is relevant to examine citizens' overall concerns, we hope future research can dig into perceived risks in different categories.

Independent Variables

We use per capita budgetary revenue of municipal FDAs as the proxy of financial resources, which is highly correlated with FDA's budgetary revenue as share of GDP ($r=0.889$, $p<0.05$). We also use per capita budgetary expenditure of FDAs as an alternative measure, which is also highly correlated with FDA's budgetary expenditure as share of GDP ($r=0.994$, $p<0.05$). To measure personnel capacity, we use the total

number of employees working in municipal FDAs, standardized by the size of urban population. While it may be more appropriate to use the percentage of FDA employees with qualifications and degrees to measure the professionalism of the workforce, this information is unfortunately unavailable.

The respondents' food safety perceptions may be influenced by fiscal and personnel resources of provincial FDAs, and we run robustness tests to check this proposition. The per capita budgetary expenditures of provincial and municipal FDAs are highly correlated with budgetary expenditure as a share of GDP ($r=0.912$, $p<0.05$). All those fiscal data are collected from the official websites of provincial and municipal FDAs, and we divide the budgetary expenditure by the total population to get per capital budgetary expenditure for FDAs.

We use media reported food safety scandals in each province to measure food safety risk, which has been validated by a recent study (Holtkamp et al., 2014). The data on food scandals are from Wu Heng's "Throw out the window" (*Zhichu Chuangwai* or ZCCW, www.zccw.info/), an independent and nonprofit website archiving online news reports on food safety in Chinese provinces. The incidents are uniquely identified by ZCCW, and we can treat the data as media-based event counts of food scandals instead of media focus or media attention. Although there are other datasets archiving Chinese newspapers, the specific locations of food scandals are usually unspecified or unstandardized in the archival. News reports can be either positive or negative, which brings noises to the measurement. Furthermore, food scandals are often repeatedly reported by multiple sources, which may overestimate the

actual amount of cases. We find the number of news reports archived by Baidu, for instance, is positively related to the ZCCW indicator ($r=0.210$), indicating that the measure is valid to a fare extent.

Media-based event count data may be biased due to political censorship, commercial competition, media coverage, and other contextual factors, but they can be used as reliable sources of data (Woolley, 2000). Even though large-scale nationwide food safety scandals such as melamine infant formula can be politically sensitive, most of the regional scandals with relatively small impacts are considered “safe” enough and able to survive the Chinese media censorship. In addition, most negative messages collected in ZCCW are reported in non-local media, which are difficult to be censored by the propaganda agencies in their original localities. Therefore, the news report information included in this dataset is reliable to reflect the distribution of food scandals in various cities (Liu & Ma, 2016). Finally, the data on food safety incidents exposed by the media have been validated and are found to be highly correlated with officially reported incidents (Holtkamp et al., 2014). Although the actual number of food scandals may be underreported by the media, it is exactly the media reported cases that trigger and amplify public concerns with food risks.

The citizen survey was conducted in January 2013, and we use media reported data in previous years to estimate their effects on public concerns. To mitigate yearly volatility, we use the three-year moving average number of accidents from 2010 to 2012 to measure media reported food scandals in each province. The weights for the three years are $1/6$, $2/6$, and $3/6$ respectively, with later years having higher weights. The

logarithm of the variable is used to ensure its normal distribution.

Control Variables

We control for individual-level demographic and socioeconomic variables that may affect citizens' risk perceptions in the model. The respondents were asked to specify the channels by which they used to obtain news on six three-point scale items. The news channels include online sources (online news portals, online forums and blogs, micro blogs), mass media (newspapers and magazines, television), and social network (chats with friends and colleagues). The extent to use these channels includes "almost never," "occasionally," and "almost every day," and they are coded by 0, 1, and 2 respectively. We develop the media exposure index by aggregating the above six items. We expect respondents exposed to more and diverse news channels to be more receptive to media coverage of food scandals.

We use total monthly household income to measure the affluence of the respondents. The variable is ordinal, ranging from 0 (without regular income) to 16 (more than RMB 40,000 Yuan).

The education level is measured by an ordinal variable with five categories in ascending order, including: middle school and below (0), high school and equivalent educations (1), college (2), university (3), and graduate (4).

We asked whether the respondents have children aged from 6 to 16, and create a dummy to denote the existence of underage children in the family. As children aged below 6 and those aged between 16 and 18 are excluded from this measure, the effect

is actually underestimated in the analysis.

We also control for other individual demographics that may affect food risk perceptions (Dosman, et al., 2001), which include gender, age, and household registration type (see Table 1 for more details).

Apart from individual-level variables, we control for city-level variables that may affect food risk perceptions.⁵ The social amplification effect of food risk may be more prominent among low-educated population, and it is thus reasonable to include residents' average education level in the sampled cities. We use the percentage of residents with higher education to gauge the average level of education at the city-level. The relevant data are from the 2010 census.

Food consumption varies across ethnicities and religions, which may affect consumers' perceptions of food safety. Muslims and some ethnic minorities consume halal food, which is less prone to safety risk due to stringent religious monitoring and industrial standards. Since the respondents' ethnicity and religion were not covered in the survey, we instead include a city dummy that takes value 1 if the share of ethnic minorities in local resident population is larger than 10 percent (e.g., Urumqi), and 0 otherwise. We expect this variable to be negatively associated with risk concerns.

Model Specifications

A multilevel model is used to estimate the effect of provincial level regulatory capacity on citizen-level perceptions of food safety, while controlling for other demographic and

⁵ We thank an anonymous reviewer for suggesting us including these two controls.

socioeconomic variables. The data used in this study are of a typically nested structure, with individuals nested in cities. The individuals are not independent from each other, which violates the independence assumption of ordinary least square (OLS) model. In such cases, a multilevel model or hierarchical linear model is more appropriate (Hohl & Gaskell, 2008).

Similarly, we use a multilevel model to estimate the effect of city- and provincial level regulatory revenue and personnel (Level 2) on individual-level citizen perceptions of food safety (Level 1), controlling for other individual-level demographic and socioeconomic variables. We center the Level 1 independent variables by their mean within each city while the Level 2 variable is centered by its grand mean (Aguinis, et al., 2013).

Quantitative Analytic Results from Multilevel Model Estimates

The descriptive statistics of key variables are reported in Table 1, and we can find substantial variations in risk perceptions among the respondents. Contrary to our expectations, regulatory resources and food risk perceptions are positively correlated, although the strength of the correlation is not significant for both revenue ($r=0.186$, $p>0.05$) and personnel ($r=0.0627$, $p>0.05$) resources.

Insert Table 1 about here.

The null model reports an intraclass correlation (ICC) of 0.1331, suggesting that

roughly 13.31 percent of the total variance in food risk perceptions can be attributed to the Level 2 variables. Although the variance explained by city- or provincial level variables is not as large as individual-level variables, the choice to use multilevel model is justified by the LR test ($\chi^2 = 589.74, p < 0.01$). We then estimate the random intercept and fixed slope models to identify the direct and joint effects of Level 2 variables on the variance of citizen perceptions.

In Model 1 (the baseline model) we enter all L1 and L2 control variables (see Table 2), and most of the signs are in line with the results in prior studies on China and other countries (Lee, et al., 2012; Liu et al., 2013; Parra, et al., 2014; Zhllima, et al., 2015). The results suggest that residents with more media exposure are more concerned about food risk. Residents with higher levels of family income are less concerned about food risk, partially due to their higher level of purchasing power to afford healthier and more expensive foods. Residents with higher education levels are more concerned about food risk. Residents who have young children are more concerned about food risk. Female respondents are more concerned than males about food risk. Elder residents are more concerned about food risk than young ones. In terms of household, local urban residents are more concerned about food risk than nonlocal rural households. Average education at the city level is positively albeit insignificantly related to citizen concerns. The dummy of ethnic minorities is negatively associated with risk perceptions, suggesting religious scrutiny helps to deter food safety risks.

Insert Table 2 about here.

We then include all Level 1 variables together with our key independent variables at Level 2 (Model 2-4). Contrary to our expectations, the two regulatory resource measures are both positively related to public concerns over food safety. Interestingly, personnel resource is significantly related to the degree of citizens' concerns (Model 3), suggesting more regulatory manpower in fact generates higher risk perceptions. The relationship between food scandals and citizen perceptions is insignificant, although the coefficient is positive.

The interaction terms between regulatory resources and food scandals are in opposite directions (Model 5-7). The interaction effect of fiscal resource and food scandals is positive (Model 5), while the interaction term between personnel resource and food scandals is negative (Model 6). The findings generate interesting patterns of regulatory resources, as food scandals strengthen (attenuate) the perceptual effect of fiscal (personnel) resource. When the two interaction terms are simultaneously included in Model 7, however, they are both insignificant.

Qualitative Insights from Interviews

Despite the fact that the importance of regulatory resources has been highlighted in the literature, their effects on citizens' perceptions of food safety are not well supported by the results of our empirical tests. To make things even more puzzling, we find that residents in localities with denser regulatory personnel are more concerned about food safety risks. Why do not regulatory resources attenuate public perceptions of food

safety risks? What are the missing links between regulatory resources and risk concerns?

Our qualitative evidences from field interviews shed light on the unexpected effects of regulatory resources and allow us to attribute the unexpected findings to the following four reasons. The theoretical link between regulatory resources and risk perceptions needs to be analyzed using a fine-grained theoretical framework.

First, our measures of regulatory capacity are primarily pertinent to fiscal and personnel resources of regulatory agencies, which may not be transformed into regulatory capacity. Agency budgetary revenues and human resources are usually distributed in proportion to the size of local economy and population rather than the severity of policy issues. Due to the large influx of rural migrant workers, the number of formal posts (*bianzhi*), which are based on the number of registered households (*hukou*) instead of resident population, often lags behind (Ang, 2012). The mismatch between regulatory resources and targeted regulatees makes the situation even worse, and regulatory agencies are becoming increasingly incompetent in meeting the escalating regulatory needs.

Local regulatory officials acknowledged that the amount of resources available was not equivalent to that actually utilized by CFDA in performing regulatory tasks. For instance, although local CFDA imported expensive technologies and equipment for food testing and inspection, few professional employees can effectively utilize these devices. Provincial and municipal CFDA are affluent in regulatory resources, whereas county CFDA that are at the frontline of food safety regulations are in serious shortage of manpower. One regulatory officer from a township CFDA office in Guizhou

province expressed his great pressure in meeting regulatory demands:

“In our township regulatory office, we have a total of three civil servants and five provisional public employees. However, we have to cover over 500 regulatees such as food manufacturers, retailers, and restaurants in 12 villages. Even if we give up other regulatory tasks and inspect one regulatee every day without any break, we cannot manage to oversight all of them within one year.”⁶

On the other hand, localities that have adopted “the unified model” are facing the new challenge that employees in charge of food safety regulatory enforcement are undertrained. The unified regulatory model advocates merging various regulatory agencies including industrial and commerce administration, quality and technology supervision administration and CFDA into one mega-department with the aims of reducing regulatory costs, simplifying regulatory process and improving regulatory coordination (Liu & McGuire, 2014). Most staff members transferred from other agencies were previously on irrelevant jobs, and they have not received sufficient professional training on food safety regulation, which hinders their abilities to effectively fulfill their missions. One regulatory officer from a prefecture-level CFDA in Tianjin complained:

“More than two-thirds of our regulatory officers are in charge of market competition fairness, elevator safety, and copyright protection regulation, and they are not quite familiar with food safety laws and standards. Up to now they haven’t received any professional training and are confused about food law enforcement.”⁷

⁶ Interview note (20160429-01-02).

⁷ Interview note (20160108-01-03).

Even if more manpower is to be deployed at the grass-root levels in those regions, there is still a serious shortage in professional staff that are proficient with food safety regulation. In addition, due to the inertia of budgetary regulations, the resources may not be fully used in regulatory tasks. Unlike the affluence of regulatory resources, their distribution may matter much more to alleviating food safety concerns. Regulatory capacity reinforcement may be useful in reducing physical food safety risks, but it may not be very effective in alleviating consumers' anxiousness. It may also be that the government has overspent on regulatory processes but neglected risk communication and public relations with media and the public at large.

Second, although both central and local authorities have input huge resources on food risk assessment and management, there has been insufficient attention on risk communication and media response. We find an interesting gap between official input data and subjective perception surveys in food safety. Public perceptions of food safety are subtle and shaped by multiple factors. Although it is highly recommended by FAO and WHO (2006) to conduct risk analysis, management, assessment and communication in food regulation, practically the function of risk communication has been neglected for a long period of time. Despite the establishment of a special agency for risk communication, the China National Center for Food Safety Assessment (CFSA) in October 2011, there is no independent institution in charge of risk communication. CFSA fulfills the duty of risk communication through expert panel discussion, professional training for journalists from mass media, and knowledge education for consumers, among others. However, risk communication at the local level is still a new

function largely neglected by the regulators. Our interviews suggest that few local CFDA's assign professional staff to take responsibility of risk communication. This can partially explain the poor response of CFDA's and the prevalence of food rumors under the condition of large-scale accidents and scandals. As one interviewee acknowledged:

*“In the organizational design of regulatory agency in our province, the duty of risk communication on food safety is generally allocated to the division of information or general office. Generally, the working staff who is in charge of risk communication affairs is responsible for other related jobs such as information releasing and policy research. No professional staff is equipped in our agency, and everyone takes risk communication as a part-time job.”*⁸

Besides, from the perspective of policy performance evaluation, subjective indicators such as consumers' concerns about or satisfaction with food safety have not been taken seriously in CFDA's performance evaluation. Through our interviews we collected the annual performance evaluation measurement systems from some sub-provincial authorities. An interesting feature shared by all of them is that most indicators are gauged by objective data such as annual food poisoning accidents, food-borne diseases, passing rate of annual food safety inspection, while subjective data like consumer concern/satisfaction has not carried much weight. The highest weight of consumer satisfaction is about 15 percent of the total evaluation grade in Shanghai, while the lowest is only 5 percent in Guizhou. In addition, there is no good practice and professional procedure on data collection to ensure the accuracy of subjective data.

⁸ Interview note (20150903-01-02).

Third, food safety control is not the responsibility of the regulatory agencies alone, but involves many other agencies and actors as well. Risk regulation regimes vary in terms of control components (e.g., information gathering, standard setting, and behavior modification), regulatory contexts (type of risk, public preferences and attitudes, and organized interests), and regulatory contents (regulatory size, structure, and style (Hood, et al., 2001). The state is among the core regulatory institutions, but other actors also play indispensable roles in the process. The regulators could be the state, the market, and/or the civil society, and their hybrid relationships and interactions contribute to various forms of regulatory regimes (Levi-Faur, 2011). Regulation has been increasingly “decentred” and fragmented, and it is diffuse across diverse societal actors instead of exclusively or predominantly controlled by the state (Black, 2002). Governance institutions suffering capability deficits may pursue orchestration, a soft and indirect mechanism to mobilize the intermediaries to achieve their goals, which differs from hard and direct governance techniques such as hierarchy and delegation (Abbott, et al., 2015). In other words, the involvement of and coordination among these non-state players may matter more than the resources and capacity of regulatory agencies in boosting citizens’ confidence in food safety, which can in part explain why the effects of regulatory resources are nonsignificant and even in the opposite direction.

The weakening effect of decentered regulation on citizen’s trust is evidenced by our interviews in various localities. A recent typical case is the withdrawal of live fish products in Beijing’ supermarkets in November 2016. Beijing’s local media reported that most supermarkets had suddenly withdrawn all live fish products in their selling

racks because the surrounding water might have had been heavily polluted. The CFDA officials shortly made a public explanation that the Beijing CFDA informed all the supermarkets to prepare for an inspection of live fish products, which worried sellers about fine for illegal chemical additive. However, Beijing CFDA announced that there was no information leakage during this process, which almost denied the CFDA's explanation. Both central and local regulators have made timely clarifications on this case, but their information are paradoxical and inconsistent, which made most consumers confused. An ordinary Beijing consumer in our interview expressed her distrust as follows.

“I don't know whose information is correct since both are government agencies. Actually no matter who is lying, I am sure there must be some problems in the live fish products. I won't buy fish for eating. I'll never be confident about whatever the government says about food safety.”

Finally, the amplification and spill-over effects of food safety risks in China's regulatory context are very remarkable due to limited scientific knowledge on the part of the consumers about food safety. The amplification and spill-over effects of food safety risks are well documented in the existing literature (Frewer, et al., 2002), and promote unreasonable exaggerations among the population nationwide (Liu & Ma, 2016). This effect is vividly illuminated by our on-site interview in Guizhou province as well.

“Although I can't read many news reports on local scandals, I am still less confident about food safety here. The main reason is that most negative messages in food safety

may be hidden by local media censorship. Therefore, when I read negative food safety news in central and other non-local media in Beijing, Shanghai and Guangdong, it brings me a psychological hint that similar problems happen probably in my locality since most problematic foods flow across the country.”

This interview vividly shows the important role of psychological hints in shaping food safety concerns. Psychological hints mean consumers are inclined to associate non-local food safety scandals with local situations, even though they are not exposed to such risks in reality. Ordinary citizens can easily imagine that similar food safety scandals may occur in their localities as well, which elicits them to relate more investment in regulatory resources to just the remedy of riskier situations. Consumers may exaggerate environmental and food safety risks in their perceptions (Frewer, et al., 2002; Kim, et al., 2015), and this sweeping social problem has been found even severer in the Chinese context, according to several empirical studies (Ho, et al., 2006; Wu, et al., 2013). It is found that “[c]hinese consumers have a high awareness of safe food but limited knowledge about the concept of safe food, low recognition of the relevant labels and limited ability to identify safe food”, which elicits them to overestimate food safety risks (Liu, et al., 2013).

This phenomenon can be interpreted from two perspectives. On the one hand, in contrast with the dominant technological risks in most developed countries, the top risks in China’s food safety accidents are food adulteration and malicious crimes, which have fostered pathologies of trust deficit on food safety among Chinese consumers (Chen, 2013; Huang & Peng, 2015). On the other hand, over a long period of time Chinese

consumers have been more concerned about food supply and nutrition for survival rather than food safety. China has to feed one quarter of the world population with scarce farmland and fertility, and its history is full of drought, food shortage, and famine, with the latest Great Leap Famine in 1958-1961 claiming at least 30 million deaths, the largest in human history (Yang, 1996). Therefore, scientific knowledge on food safety is not included in its national education system all along, which makes most of Chinese consumers incapable of distinguishing fake news and result in high public panic more easily.

Discussions

Theoretical Contributions

The resources and capacities of regulatory agencies play a pivotal role in shaping public risk perceptions, but such claims have not been empirically tested. In this paper, we examine the relationship between regulatory resources and risk perceptions using the case of China's food safety regulation and a mixed-method approach. Our study reveals that resources invested inappropriately and deployed ineffectively may not increase government capacity and legitimacy, which are the underpinning mechanisms through which public perceptions are addressed. Despite the fact that sufficient regulatory expenditure and manpower are the prerequisites of effective food safety regulation, our results do not support this resource-based view. Instead, public concerns over food safety are primarily driven by individual-level demographics and socioeconomic factors.

Resources are argued to be key ingredients of regulatory capacity and legitimacy in prior studies (Carpenter, et al., 2003; Lo, et al., 2006; Rothstein, et al., 2006), but our findings show that this common sense should be reexamined with caveat, particularly for wicked problems in complicated contexts. Rampant crises (e.g., food scandals) and media amplification of social risks trigger public discontent and concerns, which elicit government responses by investing more resources in regulatory agencies. Resource input without capacity-building, however, cannot strengthen regulatory capacity in detecting and preventing risks. Government underinvestment and ineffectiveness in risk communication may generate legitimacy deficit, which deteriorates public confidence in regulatory capacity. Regulatory agencies are weak in cross-sector collaboration, which undermines the effectiveness of risk regulation. Lingering government attentions and actions also escalate public expectations, and it becomes more difficult to satisfy cynical citizens. These missing links identified in this study help to uncover the relationships between regulatory resources and risk perceptions, and contributes to the literature on regulatory regime and agency administration.

Regulatory capacity is well documented in prior literature (Painter & Pierre, 2005; Wu, et al., 2015), but its differences from and missing links with resources have not been examined. We distinguish regulatory resources from capacity and legitimacy (Christensen, et al., 2016), which are the missing links in explaining risk concerns. An important theoretical implication of this study is that we need to expand the notion of regulatory capacity from the input of regulatory resource to its allocation and deployment, especially resource utilization, efficiency improvement, and staff

professionalism. Risk communication, media response, and cross-sector collaboration should be regarded as “soft” regulatory capacities instead of traditional hard capacity. Furthermore, regulatory legitimacy also matters for risk perceptions (Christensen, et al., 2016), which is directly linked to resource allocation and capacity-building. These theoretical propositions generated from qualitative analyses enrich the literature on regulatory governance, and can be tested and extended in future studies.

Our results reveal a vicious cycle in risk regulation in contexts characterized by fragile regime legitimacy repeatedly attacked by notorious scandals (Wu et al., 2017). Government responses by more resource inputs lead to more expectations among citizens, while mismatched allocation and ineffective deployment fail in controlling risks. More investment in resources do not generate higher public satisfactions, but rather lead to higher expectation and more discontent. More resources breed consumers to have unreasonably high expectations for food safety governance, which cannot be controlled effectively via efficient risk communication. It is thus crucial to escape the vicious cycle to a virtuous cycle by strengthening regulatory capacity and streamlining risk communication, which are not well documented in existing studies.

We do not find a significant interaction effect between regulatory resources and risk severity on risk perceptions, suggesting other variables may matter. While a case study of food safety may not reveal the contingency factors affecting the resource-perception nexus in risk regulation, our findings suggest it is meaningful to reexamine it in similar cases. In other words, the effect of regulatory resources on risk perceptions is contingent on other factors, and our theoretical framework can be used to identify these variables.

For instance, citizen trust in government is of particular importance in aligning government inputs and public dispositions (Chen, 2013; Huang & Peng, 2015). Risk communication is also relevant in interpreting the missing link between regulatory resources and perceived risks (Wallace & Oria, 2010).

The findings reveal the missing links between regulatory resources and risk concerns, which helps explain the managerial dilemma of food safety regulation in China and other countries, especially in some developing countries. This theoretical framework can be used to explain why an increase in the input of regulatory resources does not always raise consumers' satisfaction in many countries. This study is one of the first to empirically examine the missing links between regulatory resources and risk perceptions, and our results help to fill the gap in the literature. The theoretical framework can be applied and extended to other policy domains and countries, whereby it helps to understand similar regulatory dilemmas between regulatory resources and risk perceptions.

Policy Implications

The findings generate helpful policy implications for regulatory sectors. First, it suggests that the focus of regulatory agencies should be shifted from resource input to resource allocation and deployment, which are more important to foster regulatory capacity. In addition to the input of financial and manpower resources, resource utilization, efficiency improvement, and staff professionalism should be the new foci to be included in the notion of regulatory capacity to promote regulatory quality.

Second, more political attentions should be paid to risk communication to forge risk consensus among regulators, regulatees, the mass media, and consumers. More resources should be allocated for risk communication to strengthen food risk transparency and media interaction, which helps to bridge the gap between objective risks and subjective judgments (Wallace & Oria, 2010). We suggest establishing an independent risk communication system at central and local levels to routinize risk explanation, which can effectively retain government legitimacy in risk regulation.

Third, it is important to impart adequate knowledge about food safety on consumers so that the irrational amplification and spill-over effects can be minimized. Among the many complicated reasons for the trust deficit on consumers' part in food safety, insufficient consumer education and lack of scientific knowledge stand out. The consumer education program may not be able to alleviate trust deficiency among consumers immediately, but it can help them perceive food safety risks more objectively and rationally, which helps to create a friendlier environment for food safety regulators to foster better trust among consumers in the long run.

Finally, we suggest that more weights should be placed on consumers' satisfactions with and perceptions of food safety in the government's performance evaluation system, which encourages local authorities to take consumers' perceptions more seriously. Public opinion survey should be included in local food regulatory performance measurement, so that more resources can be appropriately allocated and effectively utilized.

Limitations and Future Research Directions

We identify four limitations in our study, which call for future research in this field. First, the theoretical framework of the current research can be applied and extended to various policy domains (e.g., environmental pollution) and contexts (e.g., Western democracies and other developing countries). Given the contingency effects of risk perceptions, our findings may be different in other situations. For instance, provincial capital cities included in this study are substantially different from small and medium sized cities, let alone the rural areas. We hope future research could replicate and extend our findings in other contexts, which help enrich the theoretical models.

Second, the measures used in the study can be improved in future studies. The single item used to gauge citizens' overall concerns may not be the best measure. Food safety risks of different categories and domains may be the results of different factors, and it is relevant to examine public perceptions of various food safety risks. It is also helpful to use multiple-item measurements to gauge food safety risk, and behavioral indicators such as food consumption patterns can also be included in future studies. Our measures of regulatory resources can also be revisited in future research, particularly fine-grained and discerning indicators capturing specific categories of financial arrangements and manpower types. The data of media-reported food scandals may be underreported due to media censorship or misreporting, and its triangulation with administrative archives and other sources could be pursued in future studies.

Third, the data used in this study are cross-sectional and the causal relationships among variables cannot be tested. We lagged the independent variables by one year

from the dependent variables, but still the findings are of correlational instead of causal. We encourage future studies to collect longitudinal data to investigate causal effects of regulatory resources and capacities on risk perceptions. Experimental design, either quasi- or natural, for instance, can be introduced.

The results do not support the moderating effects of food scandals in the relationship between regulatory resource and food safety concerns, and it is helpful to identify other contextual variables that may matter for food safety regulation. Local food culture, for instance, may impact regulatory foci, resource allocation, and capacity-building. The finding that citizens in localities with high proportions of ethnic minority populations are much less concerned about food safety risks suggests that it is a promising direction in future studies.

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TABLES AND FIGURES

Table 1. The descriptive statistics of key variables

Variable	N	Mean	SD	Min	Max
<i>Individual level variable</i>					
Food safety concern	6248	4.255	0.956	1	5
Media exposure	6257	6.147	2.714	0	12
Family income	5869	7.044	2.537	0	16
Highest education	6231	2.323	1.043	0	4
Children	6246	0.247	0.431	0	1
Gender (Male=1)	6257	0.492	0.500	0	1
Age	6257	2.865	2.213	0	7
<i>Household (Reference=Nonlocal rural)</i>					
Local urban	6209	0.792	0.406	0	1
Local rural	6209	0.049	0.216	0	1
Nonlocal urban	6209	0.057	0.231	0	1
<i>City-level variables</i>					
Budgetary revenue per capita	23	12.765	13.675	1.628	61.488
Manpower per capita	21	0.141	0.077	0.035	0.348
Average education	30	0.098	0.032	0.04	0.2
Ethnic minorities	30	0.233	0.430	0	1
<i>Provincial level variable</i>					
Budgetary expenditure per capita	25	7.396	8.504	0.803	38.979
Manpower per capita	29	0.040	0.037	0.009	0.154
Media reported food scandals	30	13.911	16.567	0.667	72

Table 2. The multilevel model estimates of food safety concern

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Revenue (log)		0.042 (0.080)		0.153 (0.107)	0.017 (0.076)		0.062 (0.116)
Manpower (log)			0.426* (0.220)	0.466* (0.279)		0.473** (0.205)	0.646** (0.306)
Food scandals		-0.063 (0.072)	0.042 (0.088)	0.045 (0.093)	-0.079 (0.068)	0.046 (0.081)	0.037 (0.087)
Revenue× scandal					0.151* (0.082)		0.128 (0.107)
Manpower× scandal						-0.301* (0.156)	-0.267 (0.266)
Average education	2.919 (1.803)	1.838 (2.306)	-0.335 (2.468)	-3.111 (3.500)	0.254 (2.313)	0.186 (2.292)	-3.274 (3.271)
Ethnic minorities	-0.374*** (0.137)	-0.655*** (0.230)	-0.578** (0.231)	-0.706*** (0.258)	-0.688*** (0.216)	-0.723*** (0.226)	-0.767*** (0.243)
Media exposure	0.031*** (0.005)	0.034*** (0.005)	0.019*** (0.006)	0.021*** (0.007)	0.034*** (0.005)	0.019*** (0.006)	0.021*** (0.007)
Family income	-0.008 (0.005)	-0.010* (0.006)	-0.011* (0.006)	-0.016** (0.007)	-0.010* (0.006)	-0.011* (0.006)	-0.016** (0.007)
Highest education	0.041*** (0.014)	0.038** (0.016)	0.050*** (0.017)	0.064*** (0.019)	0.038** (0.016)	0.050*** (0.017)	0.064*** (0.019)
Children	0.061** (0.027)	0.046 (0.030)	0.069** (0.032)	0.062* (0.034)	0.046 (0.030)	0.069** (0.032)	0.063* (0.034)
Gender (Male=1)	-0.101*** (0.023)	-0.111*** (0.026)	-0.097*** (0.028)	-0.101*** (0.030)	-0.111*** (0.026)	-0.097*** (0.028)	-0.101*** (0.030)
Age	0.044*** (0.007)	0.042*** (0.007)	0.036*** (0.008)	0.039*** (0.008)	0.042*** (0.007)	0.036*** (0.008)	0.039*** (0.008)
Local urban	0.082* (0.044)	0.103** (0.047)	0.136*** (0.049)	0.122** (0.051)	0.104** (0.047)	0.136*** (0.049)	0.123** (0.051)
Local rural	0.034 (0.068)	0.046 (0.075)	0.078 (0.076)	0.079 (0.083)	0.046 (0.075)	0.079 (0.076)	0.079 (0.083)
Nonlocal urban	0.086 (0.064)	0.086 (0.069)	0.104 (0.075)	0.096 (0.079)	0.086 (0.069)	0.104 (0.075)	0.096 (0.079)
Constant	4.254*** (0.056)	4.197*** (0.068)	4.217*** (0.070)	4.182*** (0.083)	4.145*** (0.070)	4.136*** (0.077)	4.112*** (0.087)
Wald χ^2	81.47	81.47	81.47	81.47	81.47	81.47	81.47
L1 <i>N</i>	5,804	4,767	4,255	3,679	4,767	4,255	3,679
L2 <i>N</i> of groups	30	23	21	17	23	21	17

Note: L1 = Level 1; L2 = Level 2. Values in parentheses are standard errors. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The base category of household registration is nonlocal rural.