The Politics of Food Safety: Detection and Perceptions of Food Safety Problems in China

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Dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Political Science in the Graduate School of Duke University

2017
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Abstract

Advances in science and technology have laid the foundation for unparalleled economic prosperity but such breakthroughs have also precipitated the proliferation of unprecedented societal risks. Though the threat of nuclear war and climate change represent the most globally catastrophic of these risks, arguably no other risk has had as intimate and as direct an effect on the lives of most ordinary people than risks to their food safety.

However, despite concerted political will, governments tasked with securing food safety face many challenges in doing so. Authoritarian governments in particular, often touted for their ability to spur economic development precisely because they ignore societal risks like food safety, face unique challenges in building the necessary regulatory regime to ensure it. Meanwhile, though public furor provides the fuel for regulatory reform, the ability of the public to translate that furor into effective regulation is stymied by existing political structures and their own cognitive biases. I investigate these issues with a special focus on China, where food safety problems have run rampant since the early 2000’s.

In so doing, I argue that the inherent challenge in ensuring food safety stems from its extreme opacity. Although people have long known that consuming unsafe food can lead to negative health outcomes, the detection of which items are unfit for consumption is generally neither easy nor self-evident without substantial expertise, resources and time. Meanwhile even if outside institutions, such as the government
or the media, step in to fill this gap, the necessity of such intermediation means that the populace’s evaluation of food safety is also necessarily filtered by what these institutions choose to reveal on the one hand and public perceptions of these institutions on the other hand.

Building on this premise, I push forward our understanding of the general correlation between greater economic development and increasing risks to food safety by theorizing and testing a relationship between urban biased policies and food safety problems. In so doing, I argue that policies designed to increase food production may lead to the proliferation of food safety problems out of ignorance or indifference (Chapter 2). Meanwhile, I investigate the extent to which the politicization of food safety problems is sensitive to the existing political environment. To that end, I find that the extent to which people express grievances in response to food safety crises in authoritarian regimes is tempered by fears of potentially negative political repercussions (Chapter 3). Given the importance of ensuring food safety to political legitimacy, authoritarian leaders have every incentive to address the problem. However, enforcing food safety regulation is the responsibility of local government officials, not those in the central government. While I find that local officials are responsive to both bottom-up grievances and top-down monitoring, competing economic incentives seem to exercise far more sway over their governance decisions (Chapter 4). Finally, food safety regulatory tools that manage to sidestep this central-local government conflict may still face challenges to ensuring food safety. That is, I find evidence to suggest that public trust in regulatory institutions forms an important component of regulatory buy-in and thus regulatory success (Chapter 5).

I test my hypotheses using a range of evidence and methodological strategies. I assess the argument that urban biased policies can increase risks to food safety using a panel dataset of agricultural inputs and food safety metrics. Meanwhile, I test whether the political environment affects how grievances over food safety are
expressed using originally collected data of Weibo posts and newspaper articles about food safety at the Chinese sub-provincial level. I also use this dataset to investigate the types of incentives the local government respond to with regards to food safety regulatory enforcement. Finally, I evaluate the extent to which trust in regulatory institutions affects regulatory buy-in using original Chinese survey data.
For my parents, Marian and Peter Cheng.
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Introduction

Advances in science and technology have laid the foundation for unparalleled economic prosperity but such breakthroughs have also precipitated the proliferation of unprecedented societal risks (Beck, 1992). To that end, modern manufactured risks like climate change and nuclear war have come to rival natural disasters, which have historically held the monopoly on catastrophe, in terms of apocalyptic potential. But across the spectrum of natural and manufactured risks, few can challenge food safety hazards in their ability to threaten ordinary people’s lives on such intimate and direct terms. This has held true even as such hazards have expanded from the realm of natural risk, when maintaining food safety was largely a matter of ascertaining which plants and animals were naturally toxic and what forms of home food preparation and hygiene would reduce the incidence of food borne disease (Griffith, 2006), toward the domain of manufactured risk. In this modern iteration, ensuring food safety has come to further include safeguarding food against contamination by harmful man-made chemical adulterants and against foodborne hazards that increasingly occur outside the home and across a growing chain of food producers, manufacturers and distributors.
The expansion of food safety risks from the natural to manufactured also mirrors its increasing prevalence in the world today, especially in developing countries. To that end, food safety scares in China are perhaps the most well known, with the 2008 baby milk scandal receiving the most international prominence. As the scandal unraveled, melamine poisoning of baby milk powder was linked to at least 300,000 sick babies and 6 dead ones. In the process, the scandal injected new political furor in governmental efforts to build a food safety regulatory regime with the capacity to address the growing number food safety problems in the China more broadly. Indeed while the scope of 2008 baby milk scandal was singular, its occurrence was no mere isolated incident. Since at least the early 2000’s, food safety in China has been under continuous assault. Thousands of food safety incidents across a wide range of food and over every corner of China have occurred after the 2008 scandal, despite the efforts of the central government to control it.

Developing countries more broadly are also experiencing similar travails as they pursue the path of economic development. India’s equivalent of China’s baby milk scandal erupted in 2015 when unhealthy levels of lead was detected in Nestle’s Maggi noodles, leading to public outrage and an outright ban of Maggi noodles.1 Meanwhile, in that same year in Egypt, it was discovered that a number of vendors had sold unknowing customers donkey and dog meat, sparking a food scandal in the country.2 Though often overshadowed in the international media by coverage of China’s food safety problems, Taiwan has also experienced a spate of food safety problems in recent years — in the form of adulterated cooking oil, processed meat, starch, beverages and


bread — to broad popular outrage. Meanwhile adulteration of milk products is a phenomenon that unfortunately is not limited to China, but has been widely reported in many developing countries including Pakistan, Brazil and India (Handford et al., 2016), to the great consternation of its respective citizens and much hand-wringing by those in positions of power.

Indeed the global progression towards increased economic growth and integration has greatly increased the potential for food safety problems to occur. While economic development has transformed how people live in an untold number of ways, arguably the most revolutionary are the changes it has wrought on how people eat. Whereas once the vast majority of people literally relied on the fruits of their own labor to feed themselves, for an increasing number of people, access to food is now mediated by a small army of food producers, processors, marketers and distributors. Moreover, a host of new technologies have been developed to make this transition possible, from new pesticides and fertilizers which increase productivity yields to the development of chemical additives and preservatives which make the transportation and distribution of both processed and primary foods possible. This has significant consequences for food safety as the more intermediary stages that food must pass through to get from farm to table, the greater the potential to pick up imperceptible but potentially deadly adulterants.

1.1 Challenges in Regulating Food Safety

While the rise of food safety problems due to manufactured risks certainly underpins an increasing proportion of the food safety travails occurring in the world, the framing of different types of food safety risks (both natural and manufactured) as more or

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less bifurcated by modern science belies the socially constructed nature of risk itself. The history of food safety risks cannot be divorced from the history of the underlying science and knowledge which has made awareness of potential food safety problems possible in the first place. Like the sound that the proverbial tree makes as it falls down down in the forest when no one is around, the question of whether risks in general exist if no one is aware of them is a deeply philosophical one. From a purely social perspective however, risks are both revealed and constructed at the same time (Adam and Van Loon, 2000). Ignorance about risks does not render them fictive. Such ignorance, however, does mean that socially, risks will not be recognized as such and correspondingly, political and social institutions will not be organized to respond to them.

For instance, the Roman upper classes used lead extensively in wine and as preservatives for fruit and historical evidence suggests that as a result, lead poisoning was widespread among that social strata. Though Romans were aware of the existence of lead poisoning, they were unaware that it could be transmitted through food. Indeed the problem was so serious that modern-day scholars have argued that lead poisoning could explain why Roman elites experienced poor health and infertility at higher rates than the general population (Waldron, 1973), with some going as far to argue that this was a contributing factor in the decline of the Roman Empire (Gilfillan, 1965; Nriagu, 1983). All this is to say that lead certainly does not take into consideration whether its potential as a food poison is incorporated into human knowledge before wreaking havoc on human bodies.

To speak about food safety risks then is to speak about food safety risks that society is aware of. Yet awareness of a risk tells only one half of the story. While the inability to directly observe such risks is what underpins the ignorance about them, this inability also means that any subsequent awareness is necessarily mediated by others and thus subject to interpretation (Adam and Van Loon, 2000). This gives
those in the position to provide such mediation, often the government or the media, key positions of power to shape or legitimate risks.

Meanwhile even when there is an agreed social definition of risk, this of course does not mean that people or institutions consequently automatically possess the necessary understanding or capacity to deal with it. To stretch the analogy, hearing the sound of a tree falling only tells you that it fell — it does not tell you what kind of tree it was or why it fell, much less what to do to keep other trees from falling. Similarly, awareness about food safety problems is not immediately counterbalanced by the ability to build a functioning regulatory regime to address them.

This dissertation is about the politics of building a food safety regulatory regime in the context of societies that are becoming alive to them. It is specifically concerned with understanding and explaining the challenges that authoritarian governments face in securing food safety in the context of increased economic development, and the role the populace plays in both fueling and hindering these efforts, with a particular emphasis on China. As part of this research, I draw on a range of different materials, including panel data on food contaminants, an original dataset of Chinese food safety incidents and grievances, original Chinese survey data and field interviews.

Permeating each chapter of the dissertation is the contention that, at its roots, the inherent challenge in ensuring food safety stems from its extreme opacity. Although people have long known that consuming bad food can lead to negative health outcomes, the identification of which items are unfit for consumption is often neither easy or self-evident. Even when there might be general knowledge about what is and what is not safe to consume, mapping this general knowledge onto a specific food product is typically far from straightforward, requiring instead considerable time, expertise and resources. To put it plainly, one of the main challenges of ensuring food safety is simply being able to detect food safety problems.

Conversely, the difficulty in detecting food safety problems means that, for the
mass majority of people, their understanding of food safety is often filtered through other third parties, for example the media or regulatory institutions. Popular understanding of food safety problems can be as much a function of its real risk as it is its perceived risk. How food safety problems are perceived then, can pose substantial challenges to any subsequent efforts to regulate them. In what follows, I further elaborate on the problems of detection and perception as they pertain to food safety risks.

1.1.1 The problem of food safety detection

Food safety is difficult to regulate in large part because it is difficult to detect. Technological advances have helped both resolve and reinforce these challenges. Indeed pre-industrial governments employed no shortage of strategies to try deter food adulteration, from fines, to flogging, banishment, the pillory, and even death.\(^4\) However limitations in technology and knowledge meant that the enforcement of such policies were of questionable efficacy with regards to safeguarding the public health.

For example, the first British law to regulate food safety, the Assize of Bread and Ale of 1266, attempted to regulate the price, weight and quality of manufactured bread and beer. Though officials had the technology to devise objective measurements for mass and weight, quality could only be evaluated subjectively using appearance, aroma and taste. One common heuristic was to pour the ale onto a wooden bench or stool, which the inspector would then sit on. If the ale stuck to the inspector’s leather breeches, it was considered good quality.\(^5\) Clearly the scientific

\(^4\) In 200 B.C.E. the Zhou dynasty for example had “had agents whose duty it was to prohibit the making of spurious products and the defrauding of purchasers” while 800 years later under the Tang dynasty, the legal code stated that, “when dried or fresh meats cause men to become ill...the violator will be flogged 90 strokes.” Turkey however, stands out for having a particularly gruesome punishment on the books — in the 18th century bakers caught giving false weight or adulterating their bread were said to have their ears nailed to their doors (Hart, 1952).

knowledge available at the time was wanting.

The world had to wait until Frederick Accum, a German chemist working in London, brought modern science into the evaluation of food safety. Accum’s *Treatise on Adulterations of Food and Culinary Poisons*, published in 1820, was the first book to show how to detect adulterants scientifically using easy to implement tests. The book was wildly popular, selling out the first month with a thousand copies; publications in the US and Germany followed shortly. Building on this work, Thomas Wakely, surgeon, member of parliament (MP) and editor of *The Lancet*, took up the task of exposing adulterated food and drugs thirty years later. As editor of *The Lancet*, Wakely was instrumental in publicizing Arthur Hill Hassell’s work which analyzed some 2500 samples of food and drink between 1851 and 1854. Hassell’s work established and publicized the widespread adulteration of foodstuffs in England at the time and helped push forward the first legislative action of its kind to combat it.

Almost around the same time in 1861, in France, Louis Pasteur was doing groundbreaking work illuminating the link between microorganisms, food spoilage and disease. Pasteur showed that spoilage was caused by micro-organisms and developed a process to eliminate them through heat, which came to be known as pasteurization (Uemura and Bari, 2015). Building on his work, future microbiologists discovered the existence of such food-borne pathogens like *salmonella, e. coli* in the Golden Age of Food Microbiology that ran from the late 1800’s to early 1900’s (Griffith, 2006).

But while these advancements made the detection of food safety problems possible, they also allowed adulteration methods themselves to become more sophisticated.

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6 Each sample was treated to a detailed analysis along with the names and addresses of the vendors as well as the date of purchase.

cated. As detection methods become better, so have attempts to get around them, in a sort of food adulteration arms race between ‘scientists and fraudsters’, according to Evershed and Temple (2016).

The 2008 baby milk scandal is illustrative of this problem. In a joint workshop between US and Chinese experts, Chinese researchers reported that what happened was no mere adulteration of milk, but ‘nothing short of a wholesale re-engineering of milk’ (Xin and Stone, 2008). Indeed, melamine is not water soluble and must be mixed with formaldehyde or another chemical before it will dissolve in milk, something which poor farmers would likely not known to do on their own. They concluded that the perpetrators must have developed a premix of melamine and other chemicals. One dean of food sciences estimated that such a concoction would take a university team three months to develop. As the same premix was used by multiple milk collecting stations, it seems safe to conclude that these stations were reliant on yet unknown perpetrator(s) for their technical skill in order to successfully execute the adulteration (Xin and Stone, 2008).

Perhaps more importantly then, while the ability to test for food safety problems is a vital part of keeping food safe, a food safety regime solely based on end stage testing is neither practical nor effective. For one, given the many possible kinds of adulterants out there, it is impossible to test for every single one. As Martin Rees notes, ‘absence of evidence is not evidence of absence’ (Oliver and Billingham, 1971). For another, significant subsamples of a food must be tested to ensure representativeness, which again points to the inadequacy of relying solely on end stage testing.8


9 The severity of this problem is a function of the base hazard level. Larger subsamples must be drawn the smaller the base hazard level. See: Beach, Coral. ‘Expert survey says: You can’t test your way to food safety.’ Food Safety News. 29 February 2016. Accessed February 2017: http://www.foodsafetynews.com/2016/02/expert-survey-says-you-cant-test-your-way-to-food-safety/#.WJW4-jKZOP0
Meanwhile current testing methods are not yet sophisticated enough to accurately assess the safety of various foodstuffs in a cost effective or timely manner (Ropkins and Beck, 2000). Finally, end stage testing is a reactive measure which focuses only on a particular part of the food processing system, quality assurance and control, and can only uncover food safety problems if they occur, rather than minimizing their occurrence (Ropkins and Beck, 2000).

As such, the paradigm of an effective food safety regime has moved increasingly away from a probabilistic model of detecting food safety problems after the fact to a process-oriented system of preventing food safety problems from occurring in the first place.\textsuperscript{10} Developing countries, however, face numerous particular challenges in building such a system, including a relative lack of well-educated or trained personnel, a lack of necessary facilities and equipment, and a relative dearth of necessary basic information to develop reliable baseline hazard assessments (Jirathana, 1998; Bai et al., 2007; Baş et al., 2007).

1.1.2 The problem of food safety perceptions

Separate from the challenge of developing the tools to detect food safety problems, is the challenge of addressing public perceptions of food safety. The opacity of food safety problems means the perceived quality of food can have an important influence on food safety policy. Even under near-famine conditions in early 20th century China for example, consumers were highly sensitive to perceived differences in the quality of rice aid. Such distinctions often conflated the perceived nutritional value of different types of rice with issues of gustation and economic class (Lee, 2011). In the bread

\textsuperscript{10} Foremost among food safety systems which promote this process-oriented approach is the Hazard analysis and critical points (HACCP) system. Under this system, food safety is maximized by 1) analyzing production processes 2) identifying potential hazards 3) identifying critical points where hazards may be introduced 4) establish critical limits for hazards 5) adopt strategies for correcting deviations from those limits 6) establish record keeping procedures to document the HACCP plan and 7) establish procedures for verifying the HACCP plan. See (Hulebak and Schlosser, 2002) for more information.
riots in England during the 18th century, commoners likened darker bread as being more amenable to concealing ‘noxious additives, including alum, chalk, slaked lead and ‘even sacks of old ground bones’; white bread by contrast was seen as being purer and of higher nutritional value (Thompson, 1971).

Considerations of popular sentiment have continued to have significant weight in the creation of a modern food safety regulatory regime. As Henson and Caswell (1999) note, in addition to objective food safety risks, “governments may also be driven by political considerations such as the need to protect ‘consumer confidence’ or to be seen to take action.” Lynch and Vogel (2001) argue, for example, that American regulatory policy-making more generally is often sensitive to public opinion, to such an extent that ‘especially between the mid 1960s through the mid 1980s, [American regulatory policy] was characterized by the triumph of ‘passion’ over ‘sound science.” Similarly, public fears can be understood as driving the precautionary principal toward GMOs in Europe, rather than any actual scientific evidence of negative health effects caused by the consumption of GMOs.

Meanwhile today’s consumers tend to rate pesticide and chemical contamination as a much higher threat to food safety when biological contamination is often a much more serious problem, especially in developing countries (Grace, 2015). Indeed, in the United States, an estimated 48 million people a year, or 1 in 6 Americans, become sick as a result of food borne disease.\textsuperscript{11} Although it is impossible to quantify exactly how many people suffer from food adulteration (Johnson, 2014), the problem is very likely to be several orders of magnitude smaller (Evershed and Temple, 2016). A similar pattern is true in China, but on a much larger scale. In 2011, researchers estimated that 94 million Chinese residents fell ill because of bacterial foodborne diseases alone, that is discounting the viral and microbial foodborne diseases which

went into calculating the US estimates. Like in the US and indeed in the rest of the world, while adulterated food in China is the most politically salient, the public health consequences from food borne diseases is far greater (Alcorn and Ouyang, 2012).

The risk literature has investigated the reasons behind this misalignment between the priorities identified by public health experts and those held by the public at large. Psychological factors such as whether a risk is perceived to be involuntary or voluntary, known or unknown have been found to play an important role in explaining these discrepancies (Slovic, 1987; Vassie et al., 2005). Under this paradigm, adulterated food may be more likely to be seen to be motivated by unscrupulous producers (voluntary) while biologically contaminated food is more likely to be viewed as accidental (involuntary), leading people to associate greater risk with the former. Social amplification of fears and rational ignorance may serve to further compound these biases (Kasperson et al., 1988; Frewer et al., 2002; Verbeke et al., 2007). Risk communication, that is, how food safety is communicated then, forms an important part of food safety regulation.

1.1.3 Building a modern food safety regime

In building a modern food safety regulatory regime then, governments must wrest with the challenges of detecting and preventing food safety problems as well as managing public perceptions of them. While the former requires complex policy trade-offs and large investments in human capital and technical resources, the latter is driven by a public that demands swift psychological reassurance. Meanwhile, how food safety events are reported and thus subsequently perceived by the public plays an important role in shaping public perception of food safety risks and correspondingly, plays an important role in conditioning government response. The confluence between government trade-offs, public perceptions and media influence affects both the
development and efficacy of any subsequent food safety regime and presents unique challenges to governments looking to build one. Understanding the motives and incentives that governments, media and the public have toward safeguarding food safety is thus important to understanding the politics around food safety, which I elaborate on more fully below.

**Government Incentives to Regulate Food Safety**

Undergirding most political decisions is the goal of political survival and government incentive to safeguard food safety is no exception in this regard. However, before safeguarding food safety becomes a political priority, it first must be put on the political radar. To that end, the less capacity there is to detect food safety problems, the easier it is to sweep them under the rug, or at least, put such concerns aside in favor of other, often economic, interests. In other words, the goal of political survival is not always in line with the public interest.

From the very beginning, competing political and economic forces have long stymied efforts to regulate food safety problems, as Accum’s rapid fall from grace hints at. In April 1821, Accum was indicted by the Royal Institution for mutilating books, specifically for tearing pages out of books at the Royal Institution and taking them home, though the details of scandal are sufficiently murky to suggest a conspiracy of powerful interests were behind it. However, the fact remains that as a result of this episode his reputation was tarnished. Rather than face trial, Accum fled to Germany, leaving food safety problems to run unfettered until Wakely and Hassell revisited the issue. In the intervening thirty years, food safety problems continued to run amok and unfettered (Wilson, 2008).\(^{12}\)

Meanwhile, in one of the earliest instances of government involvement in the

investigation of the health effects of food additives, in 1902, the US Department of Agriculture set up its infamous ‘Poison Squad’ led by its chief chemist, Dr. Harvard Washington Wiley. This was a team of ‘twelve young clerks, vigorous and voracious’\(^\text{13}\) who agreed to serve as human guinea pigs for common food additives in order to evaluate their effects on human health. While the Poison Squad discovered that many of the most common food additives at the time, including borax, sulfuric acid, saltpeter, formaldehyde and copper sulfate, had negative consequences for human health, it was impeded in its efforts to do much about it by a powerful food lobby. Indeed, the Secretary of Agriculture himself suppressed many of the reports that the Poison Squad produced.\(^\text{14}\)

As developing countries like China build their food regulatory regime, they will deal with similar pressures. The history of China’s State Drug Administration (SDA) provides an illuminating example. While its immediate goal was to address the problem of regulatory fragmentation in China’s pharmaceutical industry, its larger purpose was to build a regulatory environment that would increase the sophistication and competitiveness of the Chinese drug market and build public trust in China’s regulatory regime.

As such, the head of the SDA sought to introduce national drug standards, a necessary first step in building a unified national regulatory regime. However, pharmaceutical companies whose drugs would have failed to meet these higher national standards but whose business was important to the local economy lobbied hard against them. Eventually, the SDA responded by lowering standards. The process for registering new drugs was similarly fraught, with many companies submitting fraudulent data and bribes in order to receive regulatory approval they otherwise


Conflicts between what political survival means for those who set the regulatory agenda and those who enforce them then, can often create obstacles toward effective regulation. In authoritarian regimes, these roles are often played by the central government and local governments respectively.

**Media Coverage of Food Safety**

Political survival and public interest come into greater alignment the more the public becomes aware of food safety risks. To that end, the media plays an important role in providing the public with this information and pushing the government to take action. It is worth noting that prior to the 1906 passage of the US Pure Food and Drug Act, over 200 proposals to regulate food and drugs in the United States were considered and ultimately rejected between 1879 and 1906 (Barkan, 1985). While it would be naive to discount the considerable benefits that the Pure Food and Drug Act provided food companies looking to reduce competition in the food industry, the role of muckraking journalists and a public increasingly well informed about the degree to which it was consuming adulterated food was instrumental for explaining the timing of the landmark legislation (Barkan, 1985; Law and Libecap, 2004). Meanwhile more recently in China’s 2008 baby milk scandal, though some of the main culprits of the melamine poisoning and local government officials were aware of the adulteration problems, government action took place only after media shined a light onto the problem.

At the same time, media coverage of food safety problems is neither necessarily unfiltered nor purely public-spirited. Media outlets have their own incentive to garner as much traffic to their platforms as possible. For individual media outlets, this can

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15 Indeed a whole cottage industry sprung up around providing services to pharmaceutical companies to circumvent the process.
shape both the content that they write and for the media industry as a whole, this can shape the overall volume of coverage, both of which can have a substantial influence on public perceptions of food safety.

These issues are further complicated in authoritarian regimes because most authoritarian governments possess at least a partial ability to control media coverage. That is, whether and how stories get reported is often to some extent a function of government approval, even if the approval needed is only tacit. Though this does not change the influence that the media can have over public opinion, it does change responsibility for it. At least partial government responsibility for media content invites an important shift in the relationship between the public and the media in that complete censorship is always an option in authoritarian regimes. At the same time, complete censorship is not necessarily the best option for political survival as, conditional on public knowledge of food safety problems, it precludes the possibility of central government monitoring of local government enforcement of food safety.

The upshot of how media coverage of food safety problems in authoritarian regimes affects subsequent food safety regulation is that it invites greater political manipulation of coverage. More concretely, this means there is greater political manipulation of how the public views food safety hazards and of whether those tasked with enforcing food safety feel the incentive to do so.

*Public Perceptions of Food Safety*

As food safety becomes increasingly compromised and perhaps more importantly, publicized as such, popular opinion has expanded the purview of responsible governance to include food safety. This is perhaps a function of the fact that as food production becomes increasingly modernized and globalized, food safety problems also become increasingly democratized as they travel from the private to public sphere. If government was once deemed necessary to prevent people in the state of nature
from killing each other with stones, modern states are now increasingly tasked with
the responsibility of stopping people from killing each other through unsafe food.
Such deaths moreover can take on a much more diverse set of characteristics, both
physical and psychological, chronic and acute. Yet ensuring food safety becomes no
less difficult once the government assumes overt responsibility for it. In a sense, the
government itself becomes just another intermediary and the degree to which it acts
as an effective backstop depends at least in part on its ability and incentive to do
so. Public opinion provides governments such an incentive but can equally pose a
challenge in doing so.

To that end, as developing countries increasingly start building food safety regimes
that focus on control and prevention of food safety problems as opposed to detection
and punishment after the fact, public attitudes toward such measures can also play
an important role in determining their efficacy. Under regimes focused on preven-
tion, traceability of food sources and certification of food production practices are
playing an increasingly important role. Yet while numerous studies have investigated
customer willingness to pay for traceable or certified goods (Loureiro and Umberger,
2007; Cicia and Colantuoni, 2010; Ortega et al., 2011b), less work has explicitly
explored the degree to which such efforts are seen as credible and how consumer
perceptions can influence such decisions.

Finally much of what we know about the role of the public in shaping food safety
policy has focused on how governments have done this in times long past. While
in many ways food safety problems in the United States and the United Kingdom
in the late 19th and early 20th century mirrors those that developing countries are
experiencing today, the political, social and technological contexts in which such
problems arose were very different. Among the many differences, the means of rapid
communication enabled by the internet and social media that are now woven deeply
into the fabric of daily life were previously unfathomable, new eating patterns have
emerged\textsuperscript{16} and finally previously marginalized groups have made meaningful strides toward greater political and social empowerment, especially women.\textsuperscript{17} Meanwhile, though numerous studies have investigated how public opinion shapes food safety regulation in developed countries today (Frewer et al., 1994; De Jonge et al., 2004; Grunert, 2005), we know little about the effect of public opinion pressures when they arise in the context of a food safety regulatory framework that is still in the process of being created and molded, as is true of many developing countries today.

1.2 Why Authoritarian Regimes and Why China?

Examining food safety risk in authoritarian regimes may be especially compelling because risk and authoritarianism speak the same language of uncertainty. For most people, risks to their food safety is analogous to Schroedinger’s cat. Information about whether an item of food is safe to eat is shrouded in a black box which may or may not be masking disease or serious adulteration. Meanwhile the sources of risk, should there be any, are similarly murky with compromises to food safety possible anywhere in the process of producing, distributing and consuming food.

Risks to food safety then eerily echo the political dynamics in authoritarian regimes, where boundaries between safe and dangerous political behavior can be unclear and as such, where political accountability of government officials can be tortuous at best or subject to personal repercussions at worst. While being in a democratic regime in no way guarantees that one will have a functioning regula-

\textsuperscript{16} People are much more likely to eat fresh produce, eat pre-processed goods or eat out more, all of which are behaviors likely to increase the incidence of food safety problems (Altekruse et al., 1997).

\textsuperscript{17} While gender equality is still far from being reached, over the last 100 years, women have been, if haltingly, accruing greater economic and political power, including in developing countries. Economic development, and in particular industrialization, has been found to be linked toward greater economic independence and subsequently political independence for women (Ross, 2008; Przeworski, 2009). At the same time, women are still more likely to be responsible for household food preparation and have correspondingly been found to exhibit more concerns about food safety (Dosman et al., 2001).
tory regime, citizens in a truly democratic society have access to formal institutions through which they are empowered, both legally and in practice, to hold their elected officials to account in the face of food safety problems. Whereas food safety problems in a democratic regime may be emblematic of problems in the regulatory bureaucracy, in authoritarian regimes they can further serve as edible metaphors for the state of authoritarian governance more broadly.

Perhaps nowhere today are these issues more pertinent than in China. For the past decade innumerable food safety scandals have plagued the country, ranging from wheat buns whitened by sulfur dioxide and pigs dosed with clenbuterol to cooking oil salvaged from the sewers, all to much popular outrage. Such food safety scandals are a direct result of China’s unprecedented economic expansion as the swiftness of its growth has far outstripped the Chinese state’s ability to build an adequate regulatory regime to safeguard the safety of the subsequent food supply. Indeed, since 2004, at least 5900 food safety scandals have occurred in China (see Figure 1.1). Twenty years after Lester Brown provocatively asked, ‘Who will feed China?’ the more pertinent question has become, ‘What is being fed to China?’ Any country that seeks to emulate China’s economic rise will necessarily contend with the same questions.

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18 Data comes from information scraped from the ‘Throw it Out the Window’ website, an online database which tracks food safety incidents in China. See Chapter 3 for more details.

To that end how China’s authoritarian government has dealt with food safety scandals provides a unique counterpart to how democracies like United States and the United Kingdom have previously dealt with them. A better understanding of the challenges that the Chinese government faces in regulating food safety would also provide an important case study of authoritarian governance. While most of the literature on authoritarian regimes focus on how they might gain power and ward off subsequent threats to their power, far less work has investigated what political and economic pressures might influence authoritarian regimes’ ability to govern once they have power.

country with 1.3 billion people, gaining a better understanding of the challenges that the Chinese government faces in addressing food safety problems is of high intrinsic importance. Given that China is also an exporter of 56.36 billion USD of agricultural goods, it is also a matter of great global relevance. These risks have already moved from the realm of the hypothetical to the real as evidenced by the scandal around melamine adulteration of Chinese-exported US pet food in 2007.20 Furthermore, in 2012, Chinese-exported frozen strawberries to Germany led to at least 11,000 cases of norovirus, the largest recorded foodborne illness outbreak in German history.21

In examining the challenges that China faces in managing food safety, what this dissertation does not do is investigate in depth the nuts and bolts of its food safety regulatory structure. This is clearly an important topic of research and one that researchers have been investigating and will continue to do so as China’s food safety regime evolves (Tao and Yang, 2008; Balzano, 2012; Jia and Jukes, 2013b; Yasuda, 2015). Yet while scholars have investigated how China’s legal and regulatory framework can affect food safety efficacy, consideration of how the people most affected by food safety problems can also affect food safety policy has been relatively neglected. Indeed, public perception plays an important role in food safety politics regardless of the form of a country’s overall regulatory structure. Though developed countries have comparatively well-functioning and well-established food safety regimes, the formation of their food safety policies are hardly immune from public pressure influence. By examining this gap, this dissertation seeks to shed light on how political


context can shape how public grievances about food safety problems are expressed and how such grievances can have real consequences for the efficacy of food safety regulation.

1.3 Plan of Dissertation

Food safety problems not only expose the tension between how people integrate food safety in their daily lives and what the food itself is made of, but turns this tension into outright conflict. The intimate nature of the relationship between people and food means that such conflict is played out not only in the public sphere but on people’s bodies. All people are swept by the tides of political-economy, but generally such tides stop short of becoming literally incorporated into one’s corporeal being. Understanding why food safety problems might arise and how they might persist is thus of critical importance to human health and human life.

As part of understanding the challenges in ensuring food safety, the questions guiding this research agenda include the following: Why do food safety issues arise? What informs the politicization of food safety problems? Under what circumstances does the political will to address food safety problems fail to translate into political action? When might concerted regulation of food safety fail to translate into actual improvement of food safety? The chapters of the dissertation have been formulated to provide answers to each of these questions. A brief outline of each of them is as follows:

Chapter 2: Urban bias and food safety: Cheaper food but at what cost? A self-evident prerequisite for safe-guarding food safety is a basic awareness that risks to food safety might exist as a problem. However, government policies which can affect food safety have often lacked this awareness, likely because of ignorance or indifference. Prominent among such policies are urban biased policies. I argue that urban-biased
policies have negatively affected food safety levels by encouraging the overuse of chemical agricultural inputs to boost agricultural production. In so doing, I seek to make the larger point that economic policies which emphasize agricultural production often do so at the expense of food safety and to the detriment of food security more broadly.

I support these arguments by analyzing the effect of urban bias on pesticide use and fertilizer use. I then examine whether countries with more urban biased policies subsequently further lead to greater chemical food contamination.

Chapter 3: Unraveling Food Safety Crises: The Role of Signaling  
Awareness of a problem is not the same as being able to concretely identify it, much less resolve it. Using an original dataset of Chinese newspaper articles on food safety, I show that social grievances expressed on Sina Weibo, China’s version of Twitter, are at least in part a function of the degree to which users feel safe to do so. That is, I find evidence to suggest that 1) people are more likely to temper their grievances about food safety for fear of potential political repercussions 2) people’s willingness to express grievances about food safety is sensitive to tacit government sanction of the reporting of some food safety scares over others. More broadly, I seek to show that the existing political environment can substantially affect whether and how food safety scares unravel.

To conduct this analysis, I built a database for newspaper articles on food safety by a) identifying and cleaning appropriate search terms for food safety incidents from an existing, though circumscribed database on food safety b) scraping a Chinese newspaper repository, WiseSearch, for newspaper articles on food safety using the search terms from part a) and c) refining the subsequent database by building supervised learning machines to automate text classification. I applied the same methodology for building a database on grievances over food safety, using a repository of weibo texts maintained by the Hong Kong University’s Weiboscope project.
as the foundation.

Chapter 4: Authoritarian Responsiveness: A Case Study in Chinese Food Safety  Food safety is one of many competing areas of governance that governments must grapple with. Using subnational data from China, I show that the decision to implement food safety regulation is conditioned by, on the one hand, the extent to which government officials face economic incentives to ignore food safety problems, and on the other hand the degree to which consumers express grievances over poor food safety, particularly if such push back displays collective action potential. In this chapter then, I investigate the degree to which authoritarian regimes can be driven by the internal priorities of those who govern as opposed to the public will of those being governed.

To substantiate the above arguments, I evaluate how food safety grievances, media coverage, and tax revenues from the food industry as a percentage of total revenues can affect the regulatory enforcement of food safety using a Bayesian multilevel model. My findings suggest that i) the greater the number of food safety grievances with collective action potential, the lower the food industry’s profits and ii) the more media reports on food safety the lower the food industry’s profits and iii) the greater the percentage of revenues from the food industry as a percentage of total provincial government revenues, the higher the food industry’s profits. Though in this chapter I show that public fear of food safety problems can provide the political will to regulate food, the results from this chapter also suggest that it is ill-equipped to effectively resolve them. The implication of this research is that the reactionary nature of public opinion can only be a complement, not a substitute for a functioning regulatory body.
Chapter 5: The Role of Perceptions in Food Safety Regulation in China  Effective food safety depends not only on technical and bureaucratic capacity, but also on trust. If consumers cannot evaluate for themselves whether food is safe, neither can they evaluate the authenticity of claims that a particular food is safe. Whether consumers view food as safe then is as much a function of its real safety as it is the credibility of the institution that avows for it. In explore how trust affects consumer buy-in of food safety regulation in China, I seek to show that trust in regulatory regimes more generally can play an important role in regulatory efficacy.

Using an original willingness to pay (WTP) and willingness to accept (WTA) survey experiment, I explore how perceptions of trust in different regulatory players can affect the success of regulatory actions. My results are based off of a telephone survey of 1000 respondents from 10 Chinese cities (100 respondents in each city). My findings show that trust is an important factor in consumers’ willingness to pay for certified pork and to a lesser extent their willingness to accept un-certified pork as well. They also show that levels of trust for a particular regulatory institution affects a consumer’s subsequent evaluation of his or her own food safety.
Urban Bias and Food Safety

2.1 Introduction

The World Health Organization (WHO) estimates that in 2010 alone, there were 600 million cases of foodborne illnesses and 425,000 deaths caused by 31 foodborne hazards (WHO, 2015).\(^1\) In fact, it is likely that these estimates greatly discount the number of foodborne illnesses that occur each year as they are based exclusively on the extent to which 31 foodborne hazards led to 32 diseases, a mere fraction of the more than 200 diseases that are spread through food.\(^2\) Such threats to public health have economic consequences as well, though these are equally difficult to gauge. For instance, though foodborne illness is estimated to cost the US economy around USD 15.5 billion a year, this appraisal is based solely on the 9.4 million cases of foodborne illness that can be traced to an identifiable pathogen. However, around 80 percent of the 48 million cases (38.4 million cases) of foodborne diseases which occur in the

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\(^1\) These hazards include ‘11 diarrhoeal \[sic\] disease agents (1 virus, 7 bacteria, 3 protozoa), 7 invasive infectious disease agents (1 virus, 5 bacteria, 1 protozoan), 10 helminths and 3 chemicals’ (WHO, 2015).

United States each year are due to an unknown cause. Suffice it to say then, the full cost of foodborne disease to the US economy is doubtless higher, to say nothing of the cost to the global economy (Hoffmann et al., 2015).

However, despite the impact that it has on both public health and consequently the economy, food safety is often missing from leading initiatives to improve food security. Indeed, the fact that 2010 was the first year that the WHO measured the global burden of foodborne disease at all is reflective of the relative neglect that food safety has suffered as both a public health issue and political economy issue.

Instead, food quantity has enjoyed primacy of place. As part of its Millennium Development Goal for instance, the UN seeks to eradicate extreme hunger and poverty. In particular it has set the goal of halving the proportion of people who suffer from hunger between 1990 and 2015, but without any further qualification as to the safety of the food consumed. Meanwhile, Oxfam, the foremost NGO dealing with food and nutrition developing world, was founded on the mission of relieving famine through food provision. Though it has now expanded its focus to include strategies to combat the causes of famine, food safety is not mentioned in its agenda.

Moreover to the extent that social scientists engage with the issue, existing research has also tended to center on exploring the political and economic determinants of food production and agricultural growth (Boserup, 1965; Lipton, 1977; Bates, 1981; Bezemer and Headey, 2008) on the one side and agricultural disaster and famine on the other side (Sen, 1981; Yang, 1996; Howe and Devereux, 2004; Gráda, 2009). By contrast, little scholarly work has systematically explored the relationship between

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3 According to the definition articulated at the 1996 World Food Summit and later adopted by the Food and Agriculture Organization (FAO): ‘Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.’

4 Meanwhile, the fact that these estimates were only published in 2015 is reflective of the relative difficulty in estimating the incidence of foodborne disease.

5 Oxfam’s current agenda is rooted in addressing the structural causes of poverty: “Our Purpose and Beliefs.” Oxfam International. Accessed December 2015: http://oxf.am/2Lj
agricultural production, economic development and food safety issues.

Pointing out that experts and policy-makers have often neglected to acknowledge the importance of food safety in their initiatives to bolster food security is not to set them up as straw men; clearly governments and transnational organizations are not so naïve as to think that addressing domestic food insecurity or more ambitiously, ending world hunger can be achieved without considerations of safety and quality. Meanwhile, experts and policymakers are justified in focusing on food and agriculture’s relationship with economic development — no country has been able to successfully develop and industrialize without substantially transforming its agricultural sector.

Rather, the failure to address food safety problems in initiatives to increase agricultural production or reduce hunger suggests that policymakers assume that the subsequent food produced will be safe for human consumption. As the WHO estimates show, such an assumption would be grossly unfounded. Moreover by giving undue focus to the food quantity component of food security, one is in danger of making the further assumption that food security as a whole is merely an economies of scale problem. In fact, issues of regulation, monitoring and transparency of food safety must be given equal consideration.

At the same time, scholars who have looked specifically at the causes and consequences of food safety note a positive correlation between increased economic development, urbanization and food safety problems (Delgado et al., 2001; Steinfeld et al., 2006; Grace, 2015). However such studies fall short of illustrating a plausible mechanism between specific policies that seek to promote economic development and their potential consequences for food safety. Meanwhile, there is good reason to suspect that government intervention of the price and quantity of food in the name of economic growth may also affect the subsequent quality of the food. Under poli-
cies that encourage agricultural production above all else for example, there may be substantial pressure to lower the quality and more seriously, safety, of the subsequent product.

In many ways, urban bias policy is representative of such a policy. In a bid to increase economic growth, governments who adopt an urban bias policy institute a variety of trade or price controls which keep food prices low for some consumers while subsidizing agricultural inputs for some food producers. Squeezed by below-market food prices but supported by government subsidies for agricultural inputs, agricultural producers can arguably exercise one of two options: i) increase production volume to balance the negative effect below-market agricultural prices have on profits ii) exit the agricultural market in search of better economic opportunities in urban locales (Barrett et al., 2001; Deininger and Olinto, 2001). Both of these options have the potential to increase the risk to food safety, by encouraging the overuse of agricultural inputs that are harmful to food safety, a contention that I will explore further in this chapter. While in principle, considerations of safety and quality should already be incorporated into the price of a good, this is only true in markets where there is perfect information; food safety problems arise precisely because of imperfect information.

Meanwhile the pervasiveness of urban bias policy makes it suitable for cross-national analysis. Though such policies gained particular traction in the immediate post World War II era, they are still very much in practice in many parts of the developed world today (Denning et al., 2009; Sanchez et al., 2009; Bezemer and Headey, 2008). Finally, despite a copious literature which has investigated the degree to which urban bias policy has affected agricultural growth and other economic phenomena, no research has yet been conducted to investigate the degree to which it may have affected food safety.

This chapter takes up this charge by examining the relationship between urban-
biased policies and food safety and argues that such policies can have a substantial negative impact on food safety. In what follows, I will first provide background information about how the various strategies designed to promote food production can also compromise food safety before fleshing out the logic for how urban biased policies exacerbate these problems. I then test these arguments by first exploring how urban bias and urbanization can affect fertilizer use, pesticide use and chemical food contamination. In the course of constructing this data, I also develop a new multiple imputation strategy to impute multilevel data, adapted from Hoff (2007). To preview, I find evidence to suggest that contrary to my initial hypotheses, the more governments pursue urban bias policies the less likely they are to use fertilizers. As such, such countries are less likely to experience food safety problems than governments which do not pursue such policies. However, these results still need to be validated against pesticide use and food contamination data, which for various empirical reasons discussed in greater detail later in the paper, cannot yet be confidently estimated.

Assuming that these findings were validated, however, against pesticide use and food contamination, they would suggest that contrary to the hypotheses laid out here, the more countries pursue rural bias policies, the greater the risk to their food safety. Ultimately then, the overarching positive relationship between policies designed to increase food production and increased risk to food safety generally hold, though the mechanisms laid out here would need to be substantially reevaluated.

2.2 Food Safety and Increased Agricultural Production

Before delving into the logic of how urban biased policies might negatively affect food safety through increasing the incidence of chemical and biological contamination of foodstuffs, it is perhaps useful to provide some background information on how new production and distribution practices that have helped increase food production more
Table 2.1: Sources of growth in crop production (percentage), 1961-1999

<table>
<thead>
<tr>
<th></th>
<th>(1) Yield Increases</th>
<th>(2) Increases in cropping intensity</th>
<th>(3) Arable land expansion</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>78</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>All Developing countries</td>
<td>71</td>
<td>6</td>
<td>23</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>34</td>
<td>31</td>
<td>35</td>
</tr>
<tr>
<td>Near East/North Africa</td>
<td>72</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Latin America and the Caribbean</td>
<td>55</td>
<td>21</td>
<td>46</td>
</tr>
<tr>
<td>South Asia</td>
<td>80</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>East Asia</td>
<td>79</td>
<td>-5</td>
<td>26</td>
</tr>
</tbody>
</table>


generally can put food safety at risk. In the what follows, I detail the ways in which increasing crop production can lead to adverse food safety effects before giving an overview of the mechanisms through which increased meat production can do the same.

2.2.1 Food safety and increased crop production

Broadly speaking, crop production has increased by leaps and bounds in the post-WWII era via a number of pathways: 1) increasing agricultural yield, 2) increasing cropping intensities (i.e. multiple cropping and shorter fallow periods) or 3) increasing land expansion. The degree to which different regions of the world have pursued each of these policies from 1961-1999 is summarized in Table 2.1. From this table we can see that generally, increasing crop yields has been the most common method to increase agricultural production, followed by arable land expansion and increasing crop intensity.

The statistics in Table 2.1 beg the following question: what is driving these increases? While a variety of factors can be pointed to, since the advent of the
Green Revolution, significant increases in crop yield and cropping intensification has virtually always been accompanied by the increased use of chemical pesticides and fertilizers. Though arable land expansion has not been as reliant on the use of chemical inputs, neither has it been completely free of them. In what follows, I outline the degree to which the use of chemical inputs is relied on in each of the different ways to increase agricultural output and how it may negatively impact food safety.

Food safety and increasing crop yield

Ushered in by the technological advances of the Green Revolution, a combination of modern crop breeds, chemical fertilizers and pesticides have been used to increase crop yields since the mid-20th century, often to dramatic effect. Indeed, crop production in developing countries increased around 21 percent in the 1960’s and 1970’s and 40 percent in the 1980’s and 1990’s (Evenson and Gollin, 2003; Pinstrup-Andersen and Hazell, 1985).

With time, however, the use of many chemical agricultural inputs has been found to pose considerable risks food safety. Indeed, many pesticides that were previously thought to have had negligible effects on human health are now banned in developed countries (e.g. DDT, HCH, lindane). Unfortunately, many of these pesticides are also highly environmentally persistent — for example, most people in the United States have detectable amounts of DDT in their system despite its ban in 1972 (Gilden et al., 2010). Moreover, in developing countries where agricultural production still forms a significant share of total economic growth, many farmers continue to make use of such contaminants because of their cheap cost (Carvalho, 2006). Overexposure to pesticides in general has been linked to a variety of negative health outcomes, including an increased risk of cancer, worsening neurological outcomes, and greater...
risk of negative effects for reproduction and fertility (Gilden et al., 2010).\textsuperscript{67}

Meanwhile heavy metal contamination from fertilizer overuse can also pose a major threat to food safety. Heavy metal contamination is difficult to remove and this is problematic because crops growing in polluted soil can also become contaminated, thereby compromising the safety of subsequent crops for consumption. Most comes from the consumption of fruits and vegetables (Chang et al., 2014; Chen et al., 2014), though absorption through rice and grain crops can also be high (Dong et al., 2001).\textsuperscript{9}

Finally modern breeds of corn, soy and wheat crops have made monocropping an attractive strategy to boost production. However, monocropping, that is the growing of only one type of crop on a large piece of land, also requires increased pesticide and fertilizer use. Monocropping also makes the crop in question more vulnerable to insects, weeds, fungi and other types of pests which further exacerbates the potential for pesticide and fertilizer overuse.\textsuperscript{10}

\textit{Food safety and increasing cropping intensities}

Farmers have also sought to increase agricultural productivity through increasing cropping intensity. This entails multiple plantings of crops a year and reducing the number of fallow years between plantings. However, increased cropping intensity


\textsuperscript{7} In China for example, agricultural production has grown on average 2 percent every year for the last thirty years in part because pesticide use has concurrently grown 6 percent every year. As a result, food safety in China has become increasingly compromised due to pesticide overuse (Lu et al., 2015).\textsuperscript{8}

\textsuperscript{9} Of the heavy metals that can contaminate the food supply through fertilizer overuse, arsenic, cadmium, mercury and selenium are among the most harmful (McLaughlin et al., 1999), and can lead to a number of negative health consequences, including increased risk of cancer, kidney and liver damage. Cadmium in particular is the most common of the heavy metals included in fertilizers. Cadmium intake is very slow to excrete so that accumulation can take on excessive limits over a long period of time and affects human health primarily through kidney and liver damage (McLaughlin et al., 1999), among other health problems (Lu et al., 2015).

can pose a risk to food safety to the extent that it goes hand in hand with increased use of agricultural inputs for the same reasons as outlined above, which has often occurred result of the changes brought by the Green Revolution.

For one, whereas the crop-bearing capacity of land was previously tied to organic recycling practices, the advent of the Green Revolution brought about the application of chemical fertilizers to crop varieties that could be planted more intensively (Parr et al., 1986). The development of fertilizers and high-yielding crops has thus replaced the need for traditional soil quality management and farmers now have greater liberty to plant crops using chemical-intensive methods in many developing countries. For another, the development of chemical pesticides and high yielding crop breeds have encouraged more intensive cropping practices, to the detriment of crop rotation (FAO, 2011).

Crop intensification can also affect food safety in its own right, albeit by more indirect means. Many negative externalities are associated with crop intensification including land degradation, salinization of irrigated areas, over-extraction of groundwater, buildup of pest resistance and the erosion of biodiversity. These negative externalities limit the stock of arable land and increase pressure to produce more crops on less arable land (FAO, 2011). The extent to which this pressures food producers to further increase use of chemical inputs as a means to increase production puts food safety further at risk.

*Food safety and land expansion*

Finally, food producers can also choose to increase crop yield through land expansion. For example, with regards to land subsidies, the governments of Nigeria, Sudan, Kenya and Ghana pursued policies that lowered the price of land in the 1970’s (Bates, 1981). At the further extreme, many governments in the post-World War II era pursued land reform policies which, in addition to transferring vast land tracts
from the hands of the landed to the landless,\textsuperscript{11} also introduced previously unused land at substantially subsidized terms to market (Anderson and Valenzuela, 2008; Wade, 1990).\textsuperscript{12}

While the direct effect of land expansion on food safety is generally more tempered than the effect of increasing agricultural yield or crop intensity, government policies to promote land expansion have often gone hand in hand with encouraging the adoption of modern agricultural techniques, as was the case in many African countries (Bates, 1981).\textsuperscript{13}

To briefly summarize, the potential to overuse chemical inputs is likely to be realized when agricultural production is increased through either increasing crop yields or increasing cropping intensity and to a lesser extent expanding land use. Empirically this has been borne out in the past 40 years. Most of the increase in agricultural production has been a result of either increasing crop yields or increasing cropping intensity and the overuse of chemical agricultural inputs now poses a serious problem to food safety (Foley et al., 2005).

\subsection{2.2.2 Food safety and increased livestock production}

Meanwhile, increasing livestock production can entail substantial transformations to livestock production processes, often at substantial risk to food safety. In particular, to meet growing demand for meat, producers confronting dwindling grazing resources

\textsuperscript{11} Note in many cases, such transfers also amounted to an increase in the amount of land being farmed as some large landowners were not actively growing crops on their land.


\textsuperscript{13} Meanwhile in Brazil, public investments in infrastructure, credit subsidies and Green Revolution technologies spurred the conversion of forests and natural vegetation of the Cerrado region toward use in capital-intensive, large-scale agriculture (Klink and Moreira, 2002).
have increasingly turned to intensified agricultural production (IFAP) (Delgado et al., 2001; Steinfeld et al., 2006).\textsuperscript{14} IFAP is characterized by the dense confinement of animals to allow economies of scale in animal husbandry. However, producing meat in this way also poses risks to food safety to the extent that it increases i) transmission of biological contaminants ii) the overuse of antibiotics in livestock production which can lead to antimicrobial resistance in people and iii) food contamination through livestock waste.

The potential threats to food safety that increasing livestock production poses is especially concerning given that growth in the livestock sector has already outstripped growth in all other agricultural sectors in most countries. Indeed, meat production more than tripled in developing countries between 1980 and 2004, with 77 percent of the increase coming from pork and poultry production. In the early 2000’s, more than half of poultry and pork was produced using industrial agriculture worldwide. In the developing world, though the production of ruminants is largely still in the hands of smallholders, more than a quarter of poultry and pork was produced using industrial agriculture; this percentage has undoubtedly increased since then (Steinfeld et al., 2006). To that end, China and Brazil have played a starring role in the livestock revolution,\textsuperscript{15} though India and Latin American countries have also significantly increased their meat and diary consumption. In what follows, how IFAP can increase risks to the safety of the meat subsequently produced is further elaborated.

\textsuperscript{14} Monogastric species like pigs, chickens and dairy cattle are more amenable to grain feeding as opposed to ruminants like beef cattle, sheep and goats (Steinfeld et al., 2006).

\textsuperscript{15} China, Brazil and India in particular account for almost two thirds of total meat and half of milk production in developing countries (Steinfeld et al., 2006).
IFAP and transmission of biological contaminants

First, the high density populations of livestock with low genetic diversity characteristic of IFAP threatens food safety to the extent that it increases the transmission biological contaminants (Jones et al., 2013), including *vibrio vulnificus*, *listeria monocytogenes*, *Staphylococcus aureus*, *Enterococci*, *Shigella* (Altekruse et al., 1997; Newell et al., 2010). The most common of these pathogens are *Salmonella*\(^{16}\), *Campylobacter*\(^{17}\) and *E. coli* (Hall et al., 2004; Newell et al., 2010).

IFAP and antibiotics

Second, to reduce the risk of disease transmission, IFAP producers have turned to administering antibiotics to their livestock. However, such practices also poses risks to food safety to the extent that it increases the risk antibiotic overuse in livestock production. Such overuse is problematic because it can lead to human antimicrobial resistance (Silbergeld et al., 2008; Newell et al., 2010).\(^{18}\) Consequences for people who consume the subsequently produced meat include increased severity of infections and failures in treatment, including prolonged illness duration, increased hospitalization and increased mortality. Antimicrobial-resistant infections now account for many of

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\(^{16}\) *Salmonella* serotype *Enteritis* (SE) can colonize a wide range of hosts, including all the major livestock species (poultry, cattle and pigs). It has proved to be remarkably adaptable; as one strain of SE is addressed, new strains develop to the continued threat of food safety (Newell et al., 2010) and the production of new strains has coincided with the increasing centralization of livestock production (Altekruse et al., 1997).

\(^{17}\) Though SE gets the most media attention, *campylobacter* has been found to be the cause of most bacterial foodborne disease in the EU (“Campylobacter.” European Food Safety Authority. Accessed December 2015: http://www.efsa.europa.eu/en/topics/topic/campylobacter). Contamination of CAFO produced poultry and pork is considered a major source of *Campylobacter*. With regards to poultry, flock size, the number of houses, use of untreated water and disposal of poultry wastes all increase the risk of *Campylobacter*; such practices have also been linked to the spread of avian influenza (Graham et al., 2008).

\(^{18}\) Although antimicrobial resistance in response to antimicrobial agents is an inevitable result of evolutionary adaption, the use of antimicrobials to livestock production accelerates and spreads this adaption. Because bacteria share resistance genes, antimicrobial agents applied to one animal in an IFAP facility can also quickly spread to other animals. Moreover, resistance may continue even if antimicrobials are no longer present (Silbergeld et al., 2008).
the emerging infectious diseases worldwide and in some pathogens, the selection for resistance also results in increased virulence (Silbergeld et al., 2008).

Though people still have a higher risk of contracting resistant infections while hospitalized, current evidence suggests that consumption of CAFO-produced meat may lead the population at large to contract a greater number of resistant infections because of the relative infrequency of hospitalization compared to the consumption of CAFO-produced meat at the population level (Silbergeld et al., 2008). Such evidence is in line with other estimates which estimate the prophylactic use of antibiotics to treat disease in livestock to be larger than the proportion of antibiotic use for active treatment of human disease (Gorbach, 2001; Silbergeld et al., 2008).

**IFAP and food contamination through livestock waste**

Finally, another consequence of amassing large number of animals in a highly confined space is that it also leads to the production of huge amounts of animal waste which can contain a range of pathogens harmful to human health. Indeed, the FAO estimates that 140 million metric tons of poultry waste and 460 million metric tons of swine waste were produced in 2003 (Graham et al., 2008). Such waste is often untreated and can and often does contaminate food crops when it is disposed of improperly (Silbergeld et al., 2008; Altekruse et al., 1997).

19 For example, there is direct evidence that antimicrobial use in livestock selects for antimicrobial-resistance non-typhoid Salmonella serotypes which can be transmitted to people via food or direct contact with animals. In the United States, patients with anti-microbial resistant infections are more likely to require hospitalization and to be hospitalized for longer periods of time (Altekruse et al., 1997). Similarly, the development of *Campylobacter*’s resistance to fluoroquinolones has been linked to the introduction of its use in animal production (Silbergeld et al., 2008; Newell et al., 2010). Fluoroquinolones are antibiotics which play an important role in the treatment of serious bacterial infections and are frequently prescribed for diarrheal illness, including travel diarrhea (Smith et al., 1999). They are also often included the treatment of pneumonia, genitourinary infections and sickle-cell patients (“Quinolone.” Wikipedia. Accessed December 2015: https://en.wikipedia.org/wiki/Quinolone). Meanwhile, multidrug-resistant *E. coli* has been found to be significantly more prevalent in animals that were supplied antimicrobials as compared to those that came from organic farms. Conventionally produced meats, that is livestock treated with antimicrobials, have been found to be more likely to carry resistant bacteria in general (Silbergeld et al., 2008).
Fresh produce is thus compromised to the extent that it is cross contaminated with pathogenic animal fecal matter.  

There is still much that is unknown about the extent to which IFAP production threatens food safety and human health. Currently, most of our data comes from developed countries. However, food safety problems are likely much more serious in developing countries where government have even less regulatory capacity to deal with them (Silbergeld et al., 2008; Grace, 2015). Perhaps even less investigated is the role that government policy may play in encouraging these trends, which I seek to address in the next section.

2.3 How Urban Bias Affects Food Safety

Urban bias policies may lead to negative food safety outcomes through at least one of two pathways. First, such policies may lead to perverse agricultural production incentives which may increase the likelihood that food producers make production decisions that are harmful to the subsequent safety of the food. Second, urban bias policies may also encourage greater urbanization, leading to both a smaller agricultural workforce on the production side and encouraging dietary habits that are more susceptible to food safety issues on the consumption side. I provide more detail about the logic of these potential pathways in what follows below.

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20 Many of the most common pathogens, like *Salmonella*, *Campylobacter* *jejuni*, *E. coli* are intestinal pathogens, and indeed all pathogens that cause food poisoning originate from animals (Freston, Kathy. “E. Coli, Salmonella and Other Deadly Bacteria and Pathogens in Food: Factory Farms are the Reason.” Huffington Post. 2010 August 03. Accessed December 2015: [http://www.huffingtonpost.com/kathy-freston/e-coli-salmonella-and-oth_b_415240.html](http://www.huffingtonpost.com/kathy-freston/e-coli-salmonella-and-oth_b_415240.html)).

21 For example, early outbreaks of *E. Coli* were linked to contaminated beef meat and today, almost any food in contact with ruminant feces is a potential source of infection (including fresh fruits and vegetables) (Newell et al., 2010). In one study, surface and ground water found down-gradient from CAFOs were found to have 4-33 times greater concentrations of antibiotic resistant enterocci, fecal coliforms and *E. Coli* (Sapkota et al., 2007). In other study, crops deliberately grown with contaminated waste were found to have higher incidence and persistence of *E.Coli* than crops that were uncontaminated (Islam et al., 2004).
2.3.1 Perverse agricultural production incentives and the overuse of agricultural inputs

Urban-biased policies may negatively affect food safety through increasing the likelihood of the chemical and biological contamination of foodstuffs. Under the logic of urban bias, urban residents are able to make more demands on the central government because, relative to rural residents, they are both better able to overcome the collective action problem and are spatially closer to centers of power. Significantly, lower food prices often constitute one of their primary demands. While policymakers could address these demands by raising urban wages, the government itself is usually a large employer of urban workers and moreover also faces resistance from other urban employers against raising wages. As such, lowering food prices through raising wages is often both economically and politically unattractive (Bates, 1981). In the face of such pressures, many governments opt to tax agricultural producers in order to provide low food prices for urban residents (Lipton, 1977; Bates, 1981; Bezemer and Headey, 2008).

Although the agricultural sector as a whole generally fares worse relative to the urban sector under urban-biased policies, some in the agriculture sector do receive support. That is, while the government seeks to subsidize urban food prices by taxing agriculture, it also seeks to increase agricultural production as much as possible so that it may extract the agricultural surplus to invest in the industrial sector. To that end, governments also provide subsidies to agricultural producers to increase agricultural yield, often in the form of subsidies to agricultural inputs like chemical fertilizers and pesticides. Thus, under urban biased policies, the agricultural sector is often simultaneously taxed and subsidized.\footnote{Indeed, many developing countries have and continue to seek to increase crop yield by subsidizing chemical pesticides and fertilizers while at the same time taxing agricultural outputs. For example, from the 1950’s to 1970’s, the Korean government both intervened in agricultural markets to keep crop prices low for urban workers and subsidized fertilizer and pesticide costs to promote production}
These competing policies can threaten food safety to the extent that they encourage the overuse of agricultural inputs that are harmful to food safety. One mechanism through which this may plausibly occur is as follows: policies which keep crop prices below market should encourage at least some agricultural producers who decide to remain in the market to increase production volume to make up for their subsequent smaller profit margin. Meanwhile, because these policies are joined by other policies which subsidize agricultural inputs, agricultural producers who do seek to increase volume should be incentivized to do so by increasing the use of subsidized inputs. Under such a policy framework, the pressure to increase production could very easily lead to the overuse of subsidized agricultural inputs.

On an anecdotal level, such policies can be plausibly linked to increased risk to food safety in many countries. In Taiwan for example, overvaluation of the domestic currency, land taxes and a compulsory procurement scheme of rice at below-market prices all functioned as a tax on agricultural good in the 1950’s and 60’s. At the same time, the government relied on agricultural subsidies and technology policies to stimulate agricultural production (Wade, 1990)[pg. 76-77]. These subsidies continued in earnest in the 1970’s (Anderson et al., 2008). As a result, fertilizer use increased three-fold between 1952 and 1980. Taiwan also became among the top pesticide users in the world in the 1990’s and residual pesticides as a result of pesticide overuse has been traced to larger and larger numbers of food poisoning cases there (Chi, 1994). Meanwhile, also consider that the countries that have been the

to counteract the low prices they imposed for rice and barley (Kihl and Bark, 1981; Anderson and Valenzuela, 2008). From 1961 to 1978, food production in Korea increased from 6 million tons to 10 million tons although land area harvested decreased from 2 million to 1.8 million — the increase in production was a result of increasing agricultural yield from 31 to 57 thousand hectograms per ha (FAO, 2015). Meanwhile, for farmers in Latin America, the burden of high agricultural taxes was partially offset by fertilizer subsidies. Though many governments abandoned urban biased policies due to their untenable cost and mixed efficacy in promoting agricultural production during the 70’s and 80’s, in the wake of the 2008-2009 global food price shocks, African governments in particular have been revisiting these policies anew (Denning et al., 2009; Dorward, 2009).
most successful in encouraging high food production in the past 50 years are generally the countries where risks to food safety are the most alarming. China, India, Mexico, and Brazil are all countries that have experienced unprecedented increases in food production in the developing world. They have also all intervened heavily in their agricultural markets, instituting policies that tax agricultural profits while subsiding its inputs. Meanwhile many of these very same countries were named in the top 10 list of countries with the most food safety violations in 2013. This list was led by India followed by China, Mexico, France, the US, Vietnam, Brazil, the Dominican Republic, Turkey and Spain.\textsuperscript{23} Such examples are merely suggestive of a negative relationship between urban biased policy and food safety of course. To adequately test this argument requires a more rigorous statistical analysis which the empirical section of the paper takes up. To that end, I test the following hypothesis:

\textbf{H1: Countries which pursue more urban biased policies are likely to experience increased risk to their food safety compared to other countries because food producers have greater incentives to overuse agricultural inputs that are harmful to food safety.}

\subsection*{2.3.2 Food safety and exits from the agricultural production economy}

Urban-biased policies can affect food safety not only through perverse incentives in the agricultural sector but through encouraging urbanization as well. Recall, as laid out in the previous section, that the necessity of addressing the concerns of the urban population informs a prominent piece of the logic of urban bias (Lipton, 1977; Bates, 1981; Bezemer and Headey, 2008). As Wallace (2013a) argues however, while urban-biased policies may address short-term threats to the government, they may encourage even greater urbanization in the long run. Indeed, for some food

producers, taxes to agriculture may be too high and subsidies to agricultural inputs too low, especially relative to the real wages that urban workers may enjoy. In the face of such policies, people may choose to exit the agricultural market and migrate to the urban center, thus increasing the threat that collective action may pose to a regime.

While Wallace (2013a) explores the implications that greater urbanization may bring to bear for autocratic survival, greater urbanization also has significant implications for food safety. Indeed, increased urbanization implies a greater base of food consumers and a smaller base of food producers. As the production of food shifts away from subsistence farming, the distance between food producers and food consumers necessarily expands, creating opportunities for food contamination. For one, as the social distance between food producers and food consumers increases, the more anonymized food distribution becomes, loosening the any ethical or social constraint producers may feel to act responsibly (Roos et al., 2007). For another, the longer the logistical chain between producer and consumer, the more the opportunities for unsafe food conditions to arise, due to improper storage and transport, unhygienic processing practices and other types of contamination (Grace, 2015). As food chains become more dispersed and more globalized, the risk of food safety problems expand as well (Elmi, 2008).

A second pathway through which increased urban-bias may lead to greater food safety risks is by encouraging different dietary habits. It is well documented that as people move from rural to urban areas and income levels increase, eating habits tend to shift toward greater meat and dairy consumption (dubbed the ‘livestock revolution’) and greater consumption of fresh fruits and vegetables. Indeed, the consumption of meat increased by 70 million tons in the developing world from the 1970’s to mid 1990’s, almost the triple the increase of developed countries (Delgado et al., 2001)
However, such changing food habits are also associated with increases in risk to food safety. For one, increased meat demand necessitates shifting to production practices like IFAP. Pressure to meet this demand can lead to increased livestock density, overuse of antibiotics, and fecal runoff which as previously documented can all increase risk to food safety. For another, increased meat and dairy consumption can further increase the likelihood of chemical food contamination to the extent that it places even greater pressure on increasing crop production. Meat and dairy production are both highly grain intensive, requiring on average 7 kg of grain to produce 1 kg of beef, 5 kg of grain to produce 1 kg of pork and 2 kg of grain to produce 1 kg of poultry (White, 2000). As demand for meat increases then, it puts greater pressure on feed crops and threatens food safety to the extent greater food production is achieved by the increased use of chemical inputs.

Meanwhile greater consumption of perishable fruits and vegetables can also increase food safety problems. As Grace (2015)[pg. 2] notes, most foodborne disease is a ‘result of [the] consumption of fresh, perishable foods sold in informal markets,’ that is outdoor, wet markets. In countries that are seeking to increase economic growth, such informal markets tend to be the norm.24 The extent that urban biased policies subsidize food costs for urban workers then, such policies should further encourage urban workers to adopt these new food habits.

It would be difficult to parse out the degree to which greater urban-bias induced urbanization threatens food safety due to i) the greater pressure that increased urbanization places on the remaining workers in the agricultural sector to increase production or ii) the higher proportion of urban residents whose dietary habits are more susceptible to food safety problems. However regardless of the exact pathway,  

24 While supermarkets are increasingly common in developing countries, the march toward a ‘supermarket revolution’ has been uneven (Humphrey, 2007). While in most developing countries wet markets continue to be prominent (Goldman et al., 1999), some are making the transition to supermarkets faster than others (Gorton et al., 2011).
the combination of urban biased policies and urbanization likely places a strain on maintaining food safety. This leads to my second hypothesis.

**H2:** Conditional on the degree to which its population is urbanized, food producers in countries that pursue more urban biased policies are more likely to overuse agricultural inputs and are subsequently likely to experience more food safety problems compared to countries that do not pursue such policies.

### 2.4 Data

#### 2.4.1 Outcome variables

I test my hypothesis vis-à-vis three different outcome variables: pesticide use, fertilizer use and incidence of food contamination. More details about how these data are measured and the sources of these data is detailed below:

**Fertilizer Use**

Data on fertilizer use in tonnes is available via FAOSTAT from 1961 to 2013, though not continuously. Starting in 2002, the FAO has used a revised methodology in reporting fertilizer use\textsuperscript{25} such that “the two sets [data from 1961-2002 and data from 2002-2013] should be used separately and not combined in order to create longer time series.” In the subsequent analyses I examine the relationship between urban bias and fertilizer use in tonnes from 1961-2002.

\textsuperscript{25} Such changes include: “the move to the use of calendar rather than a mixture of calendar and fertilizer year; revised classification of the fertilizer items; the addition of the non-fertilizer use parameter in the fertilizer balance and the use of new data sources for some data (e.g. UN COMTRADE).” Inputs —> Fertilizers. *FAOSTAT.* Accessed April 2016: http://faostat3.fao.org/download/RF/*/E
**Pesticide Use**

Data on pesticide use in tonnes is available from the FAO Corporate Statistical Database (FAOSTAT) from 1991 to 2013. Here, pesticide use is measured in terms of yearly percentage change in pesticide use. While it would be ideal to measure the overall level of pesticide use, it is not possible to do so using the data available from the FAOSTAT database. Moreover to my knowledge, no other database exists which provides data on cross-national time-series pesticide use that is as complete as the FAOSTAT database. For more information on how the pesticide use is constructed in the FAOSTAT database and transformed for this paper, please see Appendix A.1.

**Incidence of Food Contamination**

The Global Environment Monitoring System - Food Contamination Monitoring and Assessment Programme (GEMS/Food) has been tracking global trends in food contamination levels since 1976. As part of this endeavor, various collaborating centers and recognized national institutions submit the results of their food contamination assays to GEMS/Food. The GEMS/Foods Programme then organizes the data and makes it publicly accessible.\(^{26}\) A total of 43 countries have submitted data to the program, tracking more than 400 contaminants over a great many food products. Variables in the dataset include, among others, the type of food (e.g. vegetable, fruit, etc.), the type of contaminant (e.g. arsenic, iron, etc.), the contamination level, the sampling date and the country.

This dataset underwent substantial cleaning before being incorporated into the analysis for this paper. That is, the data is categorized in terms of the origin of the food, the composition of the food, and the portion of the food analyzed. To maximize both the comparability and the generalizability of the data, I subset the contaminant data such that the data categories that appeared the most number of times and were

\(^{26}\) Accessible here: http://www.who.int/foodsafety/areas_work/chemical-risks/gems-food/en/
the most alike were kept for the analysis. This meant that the contaminant data is based on food in the following categories: origin of the food — ‘domestic’ origin, of ‘mixed origin’ or of ‘unknown’ origin; composition of the food — ‘as is (raw, fresh)’ or ‘as consumed’; portion of the food analyzed — ‘edible’. Finally food categories and contaminant categories were cleaned and standardized. For more details on the cleaning methodology, please see Appendix A.2.

While the WHO GEMS/Food database has been widely used in the natural sciences to analyze contamination levels, to my knowledge it has not been used in a social science study. Moreover, scientific studies are generally limited to investigating the incidence of a few contaminants in a handful of countries and to my knowledge, no other study has tried to meaningfully standardize the dataset across all countries in the dataset.

2.4.2 Independent variable of interest

Urban Bias

The main independent variable of interest in this paper is the extent to which a country pursues urban bias policies. The World Bank Distortions to Agricultural Incentives database provides the most comprehensive measurement of urban bias for the years 1955-2011 (Anderson and Valenzuela, 2008). The 82 countries in its database account for 90 percent of the global agricultural output. In particular, I make use of its ‘relative rate of assistance’ measure which is constructed as follows:

\[ RRA = 100 \left[ \frac{100 + NRAnonag}{100 + NRAag} - 1 \right] \]

Where \( NRAnonag \) is the Nominal Rate of Assistance to Non-Agricultural Production and \( NRAag \) is the Nominal Rate of Assistance to Agricultural Production.
Positive values indicate urban bias while negative values indicate agricultural bias. I refer to this variable as *Urban Bias* in the rest of the paper.\(^{27}\)

*Urban Population*

*Urban Population (% Total Population)* is included more generally as a control variable as there is good evidence to suggest that as countries urbanize, people’s dietary habits change and food production processes change alongside in order to meet this new demand in ways that can increase risk to food safety.

However in order to assess the degree to which the combination of both urban bias and urbanization affects food safety, the interaction between *Urban Bias* and *Urban Population (% Total Population)* will also be used as independent variables of interest. Data for *Urban Population (% Total Population)* was collected from the World Bank Development Indicators database (2016).

### 2.4.3 Covariates

Finally, I include a number of variables that are only used as controls in the analysis. First, I control for *GDP per Capita* as the level of wealth of a country likely affects the food safety of a country. Wealthier countries are likely to have fewer issues with food safety than less wealthy countries because of their relatively more sophisticated markets and stronger regulatory regimes.

In addition, I also control for *Log Population*, as the larger the market of food consumers, the more the domestic agricultural industry has to produce. As such, food producers in countries with a bigger population are likely to have bigger agricultural markets, increasing the probability for food safety problems to occur in absolute terms.

\(^{27}\) Note that the original ‘RRA’ measure is constructed such that positive values indicate agricultural bias and negative values indicate urban bias. To facilitate the interpretation of the subsequent analysis, I reconstruct the variable such that positive values indicate urban bias and negative values indicate agricultural bias.
Next I also control for Agricultural Land (% Total Land Area), Log of Agricultural Land (sq. km), Log of Food Production Per Capita. All of these variables were included in order to account for variations in the amount of agricultural production that different countries engage in. Agricultural Land (% Total Land Area) accounts for the relative level of agricultural production, Log of Agricultural Land (sq. km) accounts for the absolute level of agricultural production, and Log of Food Production Per Capita accounts for the efficiency of agricultural production.

Data for GDP per capita, Log Population, Agricultural Land (% Total Land Area), Log of Agricultural Land (sq. km), Log of Food Production Per Capita were all obtained from the World Bank Development Indicators database (2016).

Lastly I also control for political institutions by including Polity 2 in the analyses. Polity 2 is a categorical variable which measures the degree to which countries possess authoritarian or democratic attributes on a 21 point scale from -10 to 10. To the extent that some political institutions have less stringent regulations toward food safety or less robust regulatory capacity, they might affect a country’s relative food safety. For example, authoritarian regimes in general have reputations for pursuing economic development at the expense of potential externalities like environmental degradation, labor rights and more relevant, food safety. The data was retrieved from the Polity IV project (Marshall and Jaggers, 2015).

Finally, note that the full dataset of independent variables (that is the urban bias variable and the covariates), were assessed for potential multicollinearity and no major issues were found on this front.²⁸

²⁸ Potential multicollinearity was assessed on the imputed data (see the next section) using variance inflation factor scores.
2.5 Missing Data

Missing data is a common problem in social science research. In the face of a large body of evidence which suggest that list-wise deletion generally leads to a number of estimation problems (Little and Rubin, 2014), scholars have increasingly turned to multiple imputation methods to address missing data issues. Such methods have almost uniformly been shown to produce less biased and more efficient analysis than list-wise deletion (Honaker and King, 2010).

As the name suggests, with a multiple imputation strategy, missing data are imputed not just once, but multiple times to create multiple imputed datasets. These missing values are generated based on a posterior predictive model. The desired statistical analysis is then conducted on each imputed dataset. Finally, parameter estimates are averaged over the different imputations and standard errors are combined using Rubin’s Rules. This algorithm accounts for variation within each dataset as well as across the imputed datasets.

In this paper, I turn to a semi-parametric copula approach developed by Hoff (2007) to multiply impute the data. Hollenbach et al. (2013a) have validated this multiple imputation approach against two other commonly used multiple imputation strategies, AMELIA II (Honaker and King, 2010) and MICE (Buuren and Groothuis-

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29 To understand the intuition behind this approach, it would be helpful to briefly discuss what copulas are and why they are useful. Broadly speaking, the purpose of a copula function is to describe the correlation structure between multiple random variables. It does so by linking the joint distribution of a set of random variables to their marginal distributions (Schmidt, 2007). Indeed, Sklar’s theorem (Sklar, 1959) showed states that any joint distribution of random variables can be described by its marginal distributions and a copula. With regards to the multiple imputation model then, instead of drawing predictions for missing data on the joint distribution of the data, one draws predictions of the missing data on its marginal distribution and a copula.

However, many copula functions often place restrictions on the types of marginal distributions it can handle and is generally not amenable to dealing with discrete or ordered data. This is problematic given the regularity with which such data is used in political science (i.e. Polity scores).

Hoff (2007)’s innovation was to construct a likelihood estimator which imposes no restrictions on the marginal distributions and depends only on the correlations between variables. As such, there are no restriction on imputing datasets with non-continuous distributions.
Oudshoorn, 2011). They found that Hoff (2007)’s method performed at least as well than the other two strategies but has the added benefit of being computationally far less intensive to implement.

2.5.1 Imputing separate datasets for i) pesticides and fertilizers and ii) food contaminants

Though common practice would be to impute all the dependent variables and co-variates together, I instead impute two separate datasets. I pursue this imputation strategy despite research which suggests that the more variables in a dataset, the better the subsequent efficiency and unbiasedness of the imputed dataset (Mustillo and Kwon, 2015). However to my knowledge, such research does not extend to imputing missing data for variables which exhibits substantial missingness of whole panels, like the contaminant measure does. A particular cause for concern would be imputing food contaminant data before 1997, given the substantial degree of missingness. Though the WHO/GEMS data does indeed go back to 1976, it does so only for New Zealand and the bulk of the data is available only from 1997. As such, it seems to make little sense to impute contaminant data from 1960 to 1996 given the paucity of actual observations for food contamination. Meanwhile, as there is contaminant data for only 38 countries but urban bias data for 82 countries, there is a substantial degree of missingness on the country-level as well.

As such, I impute two datasets. The first is composed of the the dependent variables of pesticides, fertilizers and the covariates and represents 80 countries and 52 years (1960 to 2011), which for convenience I call Dataset 1. In Dataset 1, I imputed the values for pesticides, fertilizers, the covariates and the 1, 3 and 5 year lags for each. I run 20,000 imputations, of which I save 1,000 or every 20th imputation. I then validate the convergence and validity of the imputation model by assessing the

---

30 An exception includes Hardt et al. (2012), who finds evidence to suggest a U-relationship between increasing the number of auxiliary variables and the precision of the subsequent imputation.
I then randomly select 20 of the last 200 saved imputations to run models.

Meanwhile the second dataset is composed of both the food contaminants and the variables in the first dataset – pesticides, fertilizers and the covariates, which I call Dataset 2. The number of countries and years included in this dataset is more circumscribed compared to the first dataset because I impute only data for which there were at least 85 country-year-food-country observations in total and at least 2 country-years for each country. Using this criteria, we are left with an unbalanced panel data of 35 countries, 18 years (1997-2014), 15 food categories and 13 contaminants, for a total of 9,810 observations. This data is imputed using a three-level multiple imputation algorithm that I adapted from Hoff (2007) to preserve the multilevel nature of the data (Level 1: country-year; Level 2: country-year-food category; Level 3: country-year-food category-contaminant category).

Similar to Dataset 1, for Dataset 2 I impute the values for contaminants and the 1 year lag of the covariates. Ultimately, I run 40,000 imputations, of which I save 1,000 or every 40th imputation. I also assess the fit of the imputation model by examining the subsequent trace plots and distributions of the subsequent parameters. Again, as in the first dataset, I burn the first 800 saved imputation and randomly select 20 of the last 200 saved imputations to conduct statistical analyses (see Appendix A.3 for more details about the multiple imputation methodology and a table of the included food-contaminant pairs).

I then plot the trace plots of $\text{cor}(\text{var}_j, \text{var}_{-j})$, the workhorse of the imputation model, all of which suggest convergence. I further validate subsequent multiply imputed data by plotting the distributions of each variable across the multiply imputed datasets and find them to have conformed well against the distributions of variables non-imputed original dataset.
2.6 Empirical Analysis

I analyze the relationship between urban bias and food safety both across time and across countries using a linear random effects model using a specification developed by Bell and Jones (2015). In this model specification, the relationship between a covariate and the dependent variable is estimated using the demeaned covariate (within effect)$^{32}$ and the overall country mean of the covariate (between effect). The within effect represents the change in the covariate over time while the between effect represents the relative size of the covariate compared to other groups, in this case, countries.

Such a specification has several advantages over a standard random effects model. Besides allowing separate estimation of the within and between effects, by group centering a variable, any potential endogeneity between the lower and higher levels is sidestepped.$^{33}$ Meanwhile, if there is multicollinearity between the various different variable’s group means, they can be removed without risk of heterogeneity bias. For a more detailed discussion, see Bell and Jones (2015).$^{34}$

Ideally I would like to present the results of the models using each of the de-

$^{32}$ Note, that this the same procedure used to estimated fixed effects regressions more generally.

$^{33}$ This is because the group-demeaned variable (the within variable) by definition always has a mean of 0.

$^{34}$ As Bell and Jones (2015) note, practitioners often decline to estimate random effects models because of this concern over correlation between lower-level covariates and higher order terms. Fixed effects models address this problem by controlling away all unit level heterogeneity by either including fixed effects dummies or differencing the mean of each variable, which comes to the same thing. This has led some to declare fixed effects regressions the “gold standard” for hierarchical modeling in economics and political science (Schurer and Yong, 2012).

However controlling away all unit-level variation means that it is only possible to model within country variation, neglecting across country variation completely. Bell and Jones’ insight was to recognize that in the standard random effects model, each variable has both a time-varying and cross-sectional effect on the dependent variable. When the time-varying and cross sectional effects are identical, this is not a problem, but if they are different, then the resulting, single parameter estimate will represent an un-interpretable weighted average of the two. Under their specification then, both are estimated simultaneously and without concerns for potential endogeneity between the fixed effects and random effects.
ependent variables (pesticide use, fertilizer use, food contamination) that I had previously collected and cleaned. However after conducting some extensive exploratory data analysis of these dependent variables, it became apparent that the measures for pesticide use and food contamination in particular exhibited an extreme right skew which subsequently made them difficult to fit. While I tried to model these dependent variables using a variety of transformation and linear and non-linear modeling techniques, ultimately only the log of the fertilizer use variable demonstrated acceptable model fit (See Appendix A.4.1 for more details). For now then, I restrict the subsequent analysis of the results to fertilizer use.\textsuperscript{35} Summary statistics for the fertilizer data are shown in Table 2.2.

Restricting the analysis to fertilizer use then, in Model 1 in Table 2.3, I test \textit{Hypothesis 1} by investigating the relationship between \textit{Urban Bias} on \textit{Log Fertilizer Use} a linear random effects model with country and year effects following (Bell and Jones, 2015)’s model specification. From here we can see that contrary to my hypothesis, there is a \textit{negative} relationship between the within effect of urban bias and fertilizer use.

To examine the substantive impact of these results, I further plot the predicted value of \textit{Fertilizer Use} with 95\% confidence intervals given the range of the within effect of \textit{Urban Bias}. Note for ease of interpretation, I estimate the marginal effect of these variables on \textit{Fertilizer Use} instead of \textit{Log Fertilizer Use}.\textsuperscript{36} As shown in Figure 2.1, the results suggest that there is indeed a substantive negative relationship

\textsuperscript{35} Some headway has been made in terms of modeling the degree to which lead contamination is influenced by urban bias using GAMLSS models. However further checks are needed to further validate the fit of these models, such as assessing the fit of the subsequent worm plots.

\textsuperscript{36} Because of the extreme right skew of the unlogged \textit{Fertilizer Use} variable, I do not reestimate the model using \textit{Fertilizer Use} as the dependent variable. Instead, I simply exponentiate \textit{Log Fertilizer Use} to obtain the predicted marginal effects plot. Note the proper log error correction was also accordingly used (See Gould, William. ‘Use poisson rather than regress; tell a friend.’ \textit{The Stata Blog}. 22 August 2011. Accessed February 2017: http://blog.stata.com/2011/08/22/use-poisson-rather-than-regress-tell-a-friend/).
<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>Median</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertilizer Use (1961-2002)</td>
<td>1.17e+06</td>
<td>3.45e+06</td>
<td>2.27e+05</td>
<td>0</td>
<td>3.96e+07</td>
</tr>
<tr>
<td>Urban bias</td>
<td>-0.0587</td>
<td>0.582</td>
<td>0.0562</td>
<td>-4.06</td>
<td>0.946</td>
</tr>
<tr>
<td>Agricultural (sq. km.)</td>
<td>4.57e+05</td>
<td>9.34e+05</td>
<td>1.29e+05</td>
<td>90</td>
<td>5.24e+06</td>
</tr>
<tr>
<td>GDP per capita</td>
<td>8.91e+03</td>
<td>1.15e+04</td>
<td>2.72e+03</td>
<td>83.3</td>
<td>6.26e+04</td>
</tr>
<tr>
<td>Population</td>
<td>4.94e+07</td>
<td>1.36e+08</td>
<td>1.32e+01</td>
<td>1.76e+05</td>
<td>1.28e+09</td>
</tr>
<tr>
<td>Urban Population (% Total Population)</td>
<td>0.492</td>
<td>0.243</td>
<td>0.511</td>
<td>0.047</td>
<td>0.926</td>
</tr>
<tr>
<td>Agricultural Land (% Total Land)</td>
<td>0.432</td>
<td>0.202</td>
<td>0.46</td>
<td>0.00234</td>
<td>0.835</td>
</tr>
<tr>
<td>Polity2</td>
<td>1.94</td>
<td>7.51</td>
<td>4.95</td>
<td>-9</td>
<td>10</td>
</tr>
<tr>
<td>Food Production per capita</td>
<td>0.995</td>
<td>0.693</td>
<td>0.752</td>
<td>0.0228</td>
<td>3.6</td>
</tr>
</tbody>
</table>

All covariates lagged by one year for the years 1960-2002

All values shown to three significant figures

between urban bias and fertilizer use.

Together then, both the statistical and substantive results suggest that as countries pursue more urban biased policies over time, they are less likely to use more fertilizer, and by extension their food safety is less likely to be at risk than that of countries that do not pursue urban biased policies over time. In particular these results suggest that if a country goes from having an economic policy that favors neither agriculture or non-agriculture (when Urban Bias takes a value of 0) to a policy which completely favors non-agricultural producers relative to agricultural producers (when Urban Bias takes a value of 1\(^37\)), fertilizer use decreases by 12%. On the one

\(^{37}\) Note that if food producers are to earn anything, Urban Bias cannot be more than 1, that is
hand, this result is the exact opposite of what I had originally predicted. On the other hand, at the very least it does provide evidence that policies put in place to encourage food production can have an impact on food safety.

To put in another way, these results suggest that increased rural bias increases the likelihood of food safety problems. Meanwhile, the relationship between the between effect of Urban Bias on fertilizer use is not significant, suggesting that countries that pursue more urban biased policies compared to other countries are not more likely to use more fertilizer than countries that pursue less urban biased policies, which also does not provide evidence for Hypothesis 1. I will more fully explore the implications of this antithetical results after first testing Hypothesis 2.

I test Hypothesis 2 by estimating the interaction between Urban Bias and Urban Population (% Total Population) on Log Fertilizer Use. In doing so, I interact the between and within effects of both Urban Bias and Urban Population (% Total Population)
Population). The parameter estimates are shown in Model 2. I find that there is a positive and statistically significant relationship between the within effect of Urban Bias and the between effect of Urban Population (% Total Population) on Log Fertilizer Use. Though at face value, this results suggests support for Hypothesis 2, the substantive effect of this interaction on fertilizer use must be evaluated before this conclusion can be supported. As such, I further plot the marginal effects of this interaction, shown in Figure 2.3. From Figure 2.3 it is clear that the substantive effect of Urban Bias (Within) on Fertilizer Use conditional on Urban Population (% Total Population) (Between) is in fact negligible.

Moreover I also explore the substantive effects of not only the interaction terms for which there is a statistically significant effect but the substantive effect of all the interaction terms because as noted by and further elaborated by Brambor et al. (2006), it is perfectly plausible for an interaction term to have a substantive effect on the dependent variable even if the parameter estimate of their interaction is insignificant. Similarly, the substantive relationship between the interaction of Urban Bias and Urban Population (% Total Population) more generally is also negligible. These results suggest that conditional on Urban Population (% Total Population), there is no substantive relationship between Urban Bias policy and fertilizer use.

In general then, the analyses that I have conducted of the relationship between Urban Bias and Fertilizer Use show no evidence that increasing Urban Bias will lead to increased fertilizer use and hence greater risk to food safety. However, this does not mean that little can be learned from the statistical analysis or the previous theoretical discussion. Following Berry et al. (2012), I also explore the substantive effect of the interaction between Urban Population (% Total Population) and Urban Bias on

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38 As before, for ease of interpretation the marginal effect is actually estimated for the unlogged fertilizer use
assumed in Figure 2.7 we can see that the statistically significant interaction uncovered in Model 2 between *Urban Bias (Within)* and *Urban Population (% Total Population) (Between)* is in fact driven by changes in the between effect of *Urban Population (% Total Population)*. Specifically, countries that are at the 75th percentile in terms of the percent of the population that live in urban areas relative to other countries are likely to use 390,357 more tonnes of fertilizers on average compared to countries that are in the 25th percentile over the range of urban bias policies. This empirical evidence dovetails with the previous discussion about the ways in which an increasingly urbanized population is more susceptible to food safety problems.

Meanwhile, the generally downward sloping relationship between *Urban Bias* and *Fertilizer Use* in Figures 2.6, 2.8, 2.7, and 2.9 provide further evidence to suggest that, as in Figure 2.1, increasing *rural bias* may lead to increased fertilizer use and risk to food safety. Furthermore, in order to further probe the empirical relationship between *Urban Bias* and decreasing risk to food safety, I examine this relationship for the subset of non-OECD countries and find that this relationship still holds for both Models 1 and 2 (models available upon request).

Before definitively concluding that contrary to my original hypotheses there is in fact a negative relationship between *Urban Bias* and food safety however, I would want to further validate these results by examining the relationship between *Urban Bias* and *Pesticide Use* and perhaps more importantly *Urban Bias* and *Food Contamination*. I would also want to further examine the relationship between the deconstructed *Urban Bias* variable to further probe what is driving the negative

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39 Berry et al. (2012) note that while theoretically one might view one variable as being a conditioning variable and another variable as the variable of interest, empirically no such distinction can be made since interactions are symmetric in nature. Thus one loses valuable empirical evidence for one’s theory estimating only a single marginal effects plot where each variable is strictly defined as being the variable of interest and the conditioning variable.
relationship between *Urban Bias*\(^{40}\) and food safety.

However even if the negative relationship estimated in Models 1 and 2 between *Urban Bias* and *Log Fertilizer Use* does hold across these other dependent variables, and it is in fact rural bias as opposed to urban bias which has a negative impact on food safety, such a finding would not undercut the overall argument that efforts to improve food production, as rural-biased policies also aim to do, can have a substantial and negative impact on food safety. They would however suggest that the mechanisms proposed in this chapter as to how such policies do so would need to be substantially adjusted.

### 2.7 Conclusion

Policymakers and politicians often place a great deal of emphasis on the economic fruit that agricultural growth may yield. Yet economic development is ultimately only as meaningful to the extent it represents an improved quality of life. The promise of economic development is greatly undermined when even baby milk powder cannot be trusted. Until recently, much less attention has been paid toward evaluating the quality and safety of the actual fruit (vegetables, and other food products) which underpin the whole enterprise. As such, while we know a fair bit about the relationship between economic growth and agricultural production, we know strikingly little about how policies that encourage agricultural production may subsequently effect food safety.

In this chapter, I make the argument that urban bias policy, which aims to accelerate a country’s economic development and agricultural production, can sub-

\(^{40}\) Recall from the Data section that the *Urban Bias* variable is constructed as follows:

\[
RRA = 100\left[\frac{100 + NRAnonag}{100 + NRAag} - 1\right]
\]

Where *NRAnonag* is the *Nominal Rate of Assistance to Non-Agricultural Production* and *NRAag* is the *Nominal Rate of Assistance to Agricultural Production*.
Estimated substantive effects of Urban Bias on Fertilizer Use Conditional on Urban (%) Population, Model 2

**Figure 2.2:** Effect of Urban Bias (Between) at its 25th or 75th percentile on Fertilizer Use over the range of Urban (% Population) (Between)

**Figure 2.3:** Effect of Urban Bias (Within) at its 25th or 75th percentile on Fertilizer Use over the range of Urban (% Population) (Between)

**Figure 2.4:** Effect of Urban Bias (Between) at its 25th or 75th percentile on Fertilizer Use over the range of Urban (% Population) (Within)

**Figure 2.5:** Effect of Urban Bias (Within) at its 25th or 75th percentile on Fertilizer Use over the range of Urban (% Population) (Within)

stantively increase a country’s propensity to experience food safety problems in one of two possible pathways. First, I hypothesize that farmers who are encouraged to increase agricultural production with chemical input subsidies but who are also si-
Estimated substantive effects of Urban (% Population) on Fertilizer Use Conditional on Urban Bias, Model 2

**Figure 2.6**: Effect of Urban (% Population) (Between) at its 25th or 75th percentile on Fertilizer Use over the range of Urban Bias (Between)

**Figure 2.7**: Effect of Urban (% Population) (Between) at its 25th or 75th percentile on Fertilizer Use over the range of Urban Bias (Within)

**Figure 2.8**: Effect of Urban (% Population) (Within) at its 25th or 75th percentile on Fertilizer Use over the range of Urban Bias (Between)

**Figure 2.9**: Effect of Urban (% Population) (Within) at its 25th or 75th percentile on Fertilizer Use over the range of Urban Bias (Within)

multaneously taxed on agricultural output to keep the price of agricultural products low for urban workers (as is typical of urban biased policies) may be more likely to increase their use of the subsidized chemical inputs. Such behavior likely increases
the risk to the safety of the subsequent food produced. Second, in the face of policies that simultaneously subsidize and tax the agricultural sector, some agricultural workers are incentivized to leave the agricultural sector to find employment in the industrial sector. To the extent that urban biased policies occur in the context of an urbanized society then, the greater the potential risk to food safety as i) feeding an urban population requires transformations in food distribution (i.e. increasingly regionalized or globalized food chains) that can be harmful to food safety and ii) urban residents often have dietary practices, that either because they require transformations in food production systems (i.e. industrial livestock production) or rely on existing food distribution systems (i.e. wet markets), pose greater risks to food safety.

In testing my hypotheses however, I find that there is in fact a negative relationship between urban biased policies and risks to food safety, as measured by fertilizer use. Ultimately further testing of this relationship will be required (i.e. I would like to test the relationship between urban bias policies and other food safety variables, that is, pesticide use and incidence of food contaminants) before such a finding can be embraced with full confidence. It would also be extremely useful to further investigate the relationship between urban bias policies and the incidence of foodborne disease using the newly created cross-national foodborne disease dataset.41

At the very least however, the results that have been estimated that government policy to increase agricultural production through rural bias policies may have a substantially negative effect on food safety. While the precise mechanisms for why we might observe this relationship would still need to be worked out, they suggest that government policies to increase agricultural policy can have a substantially negative impact on food safety.

Meanwhile, though risks to food safety are possible irrespective of what government policy toward agricultural production is in place, investigating whether government policy can induce such risks is still a worthwhile endeavor. Governments that are committed to improving food security are ultimately reliant not only on the subsequent quantity of the food produced but its subsequent quality as well. As shown in this paper, policies designed to affect the former can have a substantial impact on the latter, though further investigation will be necessary to probe the exact mechanism for this relationship. What is certain however, is that considerations of food safety should be incorporated into the governmental policy-making calculus.
Table 2.3: Linear random effects model of the relationship between *Urban Bias* and *Log Fertilizer Use*

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban Bias (Between)</td>
<td>0.431</td>
<td>0.019</td>
</tr>
<tr>
<td></td>
<td>(0.990)</td>
<td>(1.847)</td>
</tr>
<tr>
<td>Urban Bias (Within)</td>
<td>−0.120</td>
<td>−0.515</td>
</tr>
<tr>
<td></td>
<td>(0.049)</td>
<td>(0.133)</td>
</tr>
<tr>
<td>Urban (% Population)(Between)</td>
<td>3.661</td>
<td>3.526</td>
</tr>
<tr>
<td></td>
<td>(1.468)</td>
<td>(1.561)</td>
</tr>
<tr>
<td>Urban (% Population) (Within)</td>
<td>1.407</td>
<td>1.202</td>
</tr>
<tr>
<td></td>
<td>(0.473)</td>
<td>(0.485)</td>
</tr>
<tr>
<td>Urban Bias (Between)*Urban (% Population) (Between)</td>
<td>0.862</td>
<td>(3.275)</td>
</tr>
<tr>
<td>Urban Bias (Within)*Urban (% Population) (Within)</td>
<td>0.233</td>
<td>(0.750)</td>
</tr>
<tr>
<td>Urban Bias (Between)*Urban (% Population) (Within)</td>
<td>−1.191</td>
<td>(0.674)</td>
</tr>
<tr>
<td>Urban Bias(Within)*Urban (% Population)(Between)</td>
<td>0.763</td>
<td>(0.224)</td>
</tr>
<tr>
<td>Polity(Between)</td>
<td>0.121</td>
<td>0.121</td>
</tr>
<tr>
<td></td>
<td>(0.059)</td>
<td>(0.059)</td>
</tr>
<tr>
<td>Polity (Within)</td>
<td>0.005</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>GDP per capita(Between)</td>
<td>−9.62e⁻⁶</td>
<td>−1.87e⁻⁶</td>
</tr>
<tr>
<td></td>
<td>(4.68e⁻⁵)</td>
<td>(5.63e⁻⁵)</td>
</tr>
<tr>
<td>GDP per capita (Within)</td>
<td>−4.06e⁻⁵</td>
<td>−4.16e⁻⁵</td>
</tr>
<tr>
<td></td>
<td>(6.64e⁻⁶)</td>
<td>(6.72e⁻⁶)</td>
</tr>
<tr>
<td>Log Population(Between)</td>
<td>0.541</td>
<td>0.535</td>
</tr>
<tr>
<td></td>
<td>(0.202)</td>
<td>(0.204)</td>
</tr>
<tr>
<td>Log Population (Within)</td>
<td>1.463</td>
<td>1.507</td>
</tr>
<tr>
<td></td>
<td>(0.230)</td>
<td>(0.251)</td>
</tr>
<tr>
<td>Log Agricultural Land (sq km)(Between)</td>
<td>−0.241</td>
<td>−0.240</td>
</tr>
<tr>
<td></td>
<td>(0.197)</td>
<td>(0.197)</td>
</tr>
<tr>
<td>Log Agricultural Land (sq km) (Within)</td>
<td>−0.087</td>
<td>−0.096</td>
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<tr>
<td></td>
<td>(0.139)</td>
<td>(0.143)</td>
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<tr>
<td>Agricultural Land (% Total Land)(Between)</td>
<td>0.016</td>
<td>0.016</td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
<td>(0.011)</td>
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<tr>
<td>Agricultural Land (% Total Land) (Within)</td>
<td>−0.007</td>
<td>−0.006</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>Log Food Production Per Capita(Between)</td>
<td>−0.959</td>
<td>−1.010</td>
</tr>
<tr>
<td></td>
<td>(0.458)</td>
<td>(0.496)</td>
</tr>
<tr>
<td>Log Food Production Per Capita (Within)</td>
<td>0.460</td>
<td>0.467</td>
</tr>
<tr>
<td></td>
<td>(0.085)</td>
<td>(0.085)</td>
</tr>
<tr>
<td>Intercept</td>
<td>4.041</td>
<td>4.257</td>
</tr>
<tr>
<td></td>
<td>(2.459)</td>
<td>(2.604)</td>
</tr>
<tr>
<td>N</td>
<td>63</td>
<td>2851</td>
</tr>
<tr>
<td>Countries</td>
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</table>

Standard error in parentheses. Parameters with at least 95% significance are in bold.
All covariates lagged by one year
Unraveling Food Safety Crises in Authoritarian Regimes

3.1 Introduction

In the spring of 2016, 74% of Chinese respondents in a Pew Research Survey expressed concern over food safety, with 40% of respondents stating that food safety was a ‘very big problem’ and 34% stating that food safety was a ‘moderately big problem.’¹ While this is an astonishingly large number, such a high level of concern for food safety is hardly outside of the norm.² Indeed according to the Pew data, concern over Chinese food safety was already as high as 49% in 2008 before rising even more


² Note, Pew has only been tracking this trend since 2008. The earliest data that the Chinese government has released on public opinion survey of food safety appears to be a poll of Beijing residents conducted in 2007 by the Chinese Academy of Science and Technology for Development, Ministry of Science and Technology (Zhang and Zhao, 2007). The most similar question that they asked to Pew’s question on ‘concern about food safety’ was a question over ‘satisfaction with food safety’. They found that 6.8% and 27.1% of respondents were unsatisfied with ‘the status quo of food safety’, for a total of around 34% total. If levels of dissatisfaction and levels are concern are roughly equivalent, this finding tracks with the Pew 2008 findings of concern toward food safety in that it accords with view that food safety has been a growing topic of concern for Chinese citizens.
Figure 3.1: Level of Concern Toward Food Safety in China as reported by the Pew Global Attitudes Survey, 2008-2016

Figure created using data from the Pew Global Attitudes Survey (2008, 2012, 2013, 2014, 2015, 2016). Note that questions about food safety were not asked in the Pew Global Attitudes Survey for 2009, 2010, or 2011. Note also that the data for respondents who replied that food safety is a ‘small problem’ or ‘not a problem at all’ are not separately available for the years 2015 or 2016. As such, here I plot the combined measure, ‘small problem or not a problem at all’, for all years.

The already substantially large proportion of people concerned about food safety in China in 2008 certainly did not feel this way without reason. Indeed by September of that year, the country was in an uproar over a huge baby-milk scandal— melamine-laced baby milk powder was found to have sickened an estimated 300,000 infants, leading to the death of at least 6 of them (Yang, 2013). But while the 2008 baby milk scandal has arguably been the most prominent of China’s food safety scares, dramatically to 80% in 2012. It has stayed relatively elevated ever since (See Figure 3.1).

Indeed the milk scandal likely impelled the Pew Research group to include a question on food safety in its yearly global surveys.
it is only one of many to drive political and social furor over food safety in China. For many living in China, especially those living in its growing urban centers, food scares have become a fixture of daily life with at least 5900 incidents reported since 2004. This amounts to an average of 287 food safety scares each year since 2004, with 2012 being an especially disastrous year with regards to the number of reported food safety scares (the distribution of food safety scares over time is shown in Figure 3.2). To live in China in the past decade has meant to be barraged with reports of vendors selling food prepared with oil extracted from sewer drains (first reported in 2000 but ongoing reports continue), of food processors using illegal additives in the manufacture of noodles (reported in 2011) and of international fast food chains like McDonalds, Starbucks and Burger King using expired meat in their food offerings (reported in 2014).

The seemingly endless string of food safety scares has not only encouraged consumer anxiety over food safety, but has also contributed to a growing trust deficit in political and social institutions in China. Distrust of food producers has fueled ongoing rumors that farmers, cognizant of the dangers of pesticide overuse, plant organic

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4 This data was collected from the ‘Throw it out the Window’ website, an online database of newspaper reports on food safety scandals started by a Shanghainese, graduate student. In this database, a food safety incident is measured as occurring if there was newspaper coverage on that incident. Each food scare is represented by a unique newspaper article so that there is no double counting of food safety incidents. See Wu Jiawen and Han Xiaorong. ‘Catalogue of a crisis’. China Dialogue. 28 May 2012. Accessed November 2016: https://www.chinadialogue.net/article/show/single/en/4946-Catalogue-of-a-crisis; The ‘Throw it out the Window’ database is available here: http://www.zccw.info/index


8 See footnote 4 for information on the source for this data.
plots for personal consumption and pesticide-deluged plots for public consumption. Meanwhile doubts as to whether government officials have adequate incentive to enforce food safety regulation have helped lend credence to reports that high-ranking government officials enjoy exclusive access to special organic farms. For many, grievances over food safety scares have translated into disaffection with the broader society and political economy. In an online weibo post written in 2012 for example, one netizen lamented:

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18 years ago, I started practicing the bad habit of smoking; my roommate practiced the good habit of drinking milk. These days I am doing very well but my roommate is dead. Because in China, cigarettes have no tobacco and milk is poison.

But while it would be intuitive to argue for a direct relationship between an increasing number of food safety incidents and increasing social instability, doing so would likely mask a great deal of nuance and complexity. In particular, one would also expect the extant political context to temper any relationship between food safety scares and social instability. How people react to food safety scares is undoubtedly shaped by both the avenues available for them to do so and the degree to which they feel comfortable using them. Both are inarguably more circumcised in an authoritarian regime than a democratic one. However, most work on food safety scares to date fails to explicitly account for political context.

Moreover, most research has generally been confined to understanding consumer reactions to individual food safety scares. As such, we have little understanding of the nature of relationship between multiple food safety scares and subsequent social stability. While it is possible that an increasing number of food safety scares leads to an increasing number of grievances and social instability, it is similarly reasonable to posit that at a certain point, desensitization and resignation becomes a rational response when food safety scares become a ubiquitous — as opposed to an occasional — part of daily living.

The authoritarian nature of the Chinese government and the sheer magnitude of food safety problems in China makes it an ideal case with which to explore how food safety scares unravel along these two dimensions. To preview, I find evidence to suggest that 1) people temper their grievances about food safety for fear of potential political repercussions 2) people’s willingness to express grievances about food safety
is sensitive to tacit government sanction of the reporting of some food safety scares over others 3) people who live in areas that experience high levels of food safety scares compared to other areas are more likely to express grievances about food safety when they experience increases in food safety scares over time compared to people who live in areas with low levels of food safety. While this analysis is firmly rooted in examining citizen grievances over food safety, arguably these findings may also provide insight toward understanding people’s willingness to express social grievances in China more generally.

These findings are based on an analysis of originally-collected data on both food safety grievances as measured by Sina Weibo (often referred to as China’s version of Twitter) posts and Chinese newspaper articles on food safety. In what follows, I briefly review the theoretical literature on social protest and food safety before laying out three testable hypotheses about how the political context as well as the sheer number of food safety scares may shape the propensity for citizens to publicly express their grievances. I then detail how the datasets on food safety grievances and food safety articles were created. Finally, I present the empirical findings, robustness checks and offer some concluding remarks.

3.2 Food Safety and Political Contention

Lessons and paradigms developed from the social protest literature can provide useful frames for understanding political contention vis-a-vis food safety incidents. They have alternately put greater emphasis on investigating the nature of the grievances driving political contention (Gurr, 1970; Thompson, 1971; Scott, 1977; Wood, 2003), the configurations of the social infrastructure necessary to support it (Olson, 1965; Chong, 1988; Lohmann, 1994; Gould, 1995; Kuran, 1995; Siegel, 2009) and the political opportunity structures which shape its dynamics (Kitschelt, 1986; Tarrow, 1994; Meyer and Minkoff, 2004). In what follows, I discuss how each of these paradigms
can illuminate how food safety crises unravel in China.

3.2.1 Food safety grievances

To start, the grievance paradigm raises the question of why food safety problems often lead to a slew of public grievances. The risk literature speaks directly to this issue as it has explored the nature of food safety grievances with particular depth (Slovic, 1987; Yeung and Morris, 2001; Wilcock et al., 2004; Grunert, 2005). Work in this field suggests that among food safety problems that are likely to draw the most public attention are those that are perceived to be i) due to new food technologies (i.e. chemical fertilizers, GMOs) as opposed to lifestyle choices (Wilcock et al., 2004; Verbeke et al., 2007)\(^\text{11}\) ii) a function of direct human intervention, both as a function intentional malevolent intervention or which simply have ‘tragic unforeseen consequences’ (Wansink, 2004) iii) catastrophic, that is those which affect a large number of people (Yeung and Morris, 2001). As such, even though the most serious risks to China’s food safety are due to microbial contamination,\(^\text{12}\) public fears over food safety are more likely to revolve around technologies related to food production. These include concerns over the overuse of agricultural inputs, with the highest level of concern reserved for cases in which food has been found to be intentionally adulterated (Zhang and Zhao, 2007).

3.2.2 Food safety scares

However, while grievance models are well suited for helping us evaluate the reasons for public unhappiness with food safety problems, they do relatively little in forwarding our understanding of how such grievances become political problems.

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\(^\text{11}\) These include choosing between eating out or eating at home as well as choices over personal diet.

\(^\text{12}\) Lam et al. (2013) find that in 2012, of the 6685 food poisoning incidents reported, 56.1% were found to be due to microbial agents. Note that this number likely severely under reports the actual number of food poisoning incidents in China. Meanwhile, (Xue and Zhang, 2013)
that end, research on social organization and social dynamics may perhaps provide
greater analytical leverage. In particular the degree to which food safety incidents
are politicized may be a function not of whether individuals independently perceive
food safety to be problematic, but of the extent to which they base their percep-
tions on that of others. This can lead to a cascade of people holding a perception
about food safety which does not necessarily reflect their own assessment or, more
worryingly — reality (Kuran and Sunstein, 1999).

Food safety crises may be especially susceptible to these dynamics as information
about food safety generally cannot be directly observed but is mediated through
the media or informal networks (Hoban and Kendall, 1993; Holdaway and Husain,
2014)\(^{13}\) — China is no exception in this regard.\(^{14}\) Moreover not only does news
coverage substantively influence consumer’s perceptions of food safety (Kasperson
et al., 1988; Frewer et al., 2002; De Jonge et al., 2010), media outlets themselves
may be susceptible to similar dynamics of social amplification. Swinnen et al. (2005)
for example posits that once one newspaper reports on a food safety scare, other
newspapers have every incentive to pile on in order to maintain readership.\(^{15}\) Such
a dynamic can serve to intensify the scale of a food scare (McCluskey and Swinnen,
2011).

\(^{13}\) As Slovic (1987) notes, not only does the ‘the majority of citizens rely on intuitive risk judgments,
typically called risk perceptions. For these people, experience with hazards tends to come from the
news media.’

\(^{14}\) ‘A Bite of China Food Safety: 2nd Tracking Survey on Food Safety.’ IPSO Marketing and
sites/default/files/A%20Bite%20of%20China%20Food%20Safety%20En.pdf

\(^{15}\) Swinnen et al. (2005) also note that once one newspaper breaks a story, other newspapers have
some cover should the story prove false. A number of works have investigated the degree to which
such coverage provides accurate information about food safety scares or may irresponsibly stoke
public fears. For instance Rowe et al. (2000) show that different newspapers report on risk events
differently. They further posit that such differences in reporting likely affect public understanding of
risks though their analysis does not actually include data on consumer risk perceptions. Meanwhile
Freudenburg et al. (1996) argue that the media actually does a decent job in sticking to objective
facts (as opposed to emotional ones) when reporting on risk events. As such they argue that the
media has been unfairly maligned for stoking food scares.
3.2.3 Food safety scares and political opportunity structures

Yet the emphasis on investigating the factors that inform public perceptions of food safety risk, both cognitive and social, tends to override consideration of how the expression of these perceptions can be mediated by the political context. To some extent this neglect is function of the fact that the growing literature on food safety problems in China notwithstanding, most scholarly attention focuses on food safety scares which occur in democratic countries (Herrmann et al., 1997; Pennings et al., 2002; Wilcock et al., 2004; Yeung and Morris, 2001; Swinnen et al., 2005). The focus on food safety scares in democratic countries not only means that research is focused in areas where translating food safety grievances into the public sphere is much less likely to be impeded by political constraints, but more importantly, that the possibility that political constraints may constrain the expression of public grievances is difficult to observe due to lack of variation in regime type.

Indeed, the broader social movement literature suggests that the existing political context can substantially influence a person’s strategic calculation to speak out (Scott, 1985; Chenoweth and Stephan, 2011). Indeed the fear of potential political consequences may raise the threshold for which a person is willing to publicly express her beliefs, thus limiting the breadth of the cascade (Kuran, 1995). To that end, much of the research related to China has focused on the form that political contention takes in reaction to result political constraints. For instance, O’Brien (1996) shows how, with the judicious and strategic use of language and policy framing, Chinese peasants can exploit divisions between the party and state to redress grievances. Meanwhile others show how Chinese internet users engage in creative tailoring of messages and posts in order to evade censors (Yang, 2013, 2014).

A cursory comparison of how food safety incidents which have caused similar lev-

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16 Indeed, even cross-national studies of food safety risk appear to be largely limited to European countries (Glitsch, 2000; Van Kleef et al., 2006; Kher et al., 2013)
els of public furor in the United States and China suggest that how people translate their perceptions about food safety into public expressions of grievances can indeed depend to a large degree on the existing political environment. In the United States, public perceptions of the potential carcinogenicity of Alar, a chemical growth regulator for apples, arose from a flurry of media attention which spread fears of its potential negative health consequences, most prominently via a report by the National Defense Council and 60 Minutes special on the topic. Such fears led to the creation of an activist group called Mothers and Others for Pesticide Limits and a great deal of publicity around Congressional testimonials which urged the government to ban the use of Alar in food (Herrmann et al., 1997; Kuran and Sunstein, 1999).17

Meanwhile in China, following substantiated evidence of baby milk powder adulterated with melamine, media coverage emphasized the government response to the crisis, with very little coverage about the health consequences for the children or about public response to the scandal (Dai, 2010; Feng et al., 2012; Yang, 2013).18 While the broad public response to the crisis on social media was loud, pointed citizen activism efforts to hold the government to account was limited. Leading the one-person campaign was one of the fathers of the affected infants who among other objectives, sought to persuade the government to give a full accounting of the potential negative consequences of consuming tainted milk and called for a national food safety day through social media postings. While he built up a sizable online following, the governments stymied many of his efforts and ultimately he was arrested and subsequently sentenced to two and half years of prison for ‘disturbing social order’

17 Note these efforts placed considerable pressure for the EPA to ban Alar for food use, which it did in 1989. Before the ban took affect however, the lone company which manufactured Alar, Uniroyal, agreed to voluntarily ceases all sales of Alar for food use.

18 Dai (2010) in particular finds that in the People’s Daily Online coverage of the crisis, 3.5% of articles reported on the health consequences for affected children and 2.5% of articles contain references to the public response to the crisis.
In the United States then, public discussion about Alar were open, with deep media coverage of its potential ill health effects and open petitioning of grievances to the relevant power brokers. In contrast, media coverage of the baby milk scandal in China was circumscribed to emphasizing government responsiveness toward the matter instead of its health consequences. Despite the content of its media coverage, attempts by ordinary citizens to elicit greater government responsiveness have not been tolerated.

To summarize, while there is a substantial literature on why food safety problems are likely to become a source of public grievance and how food safety problems might become politicized, there is less research on how the existing political environment can condition the nature of this politicization. In conducting a cursory comparison of how food safety scares unravel in democratic versus authoritarian regimes, it would seem that political context can matter quite a bit. Given this likely variation and the relative dearth of research on this subject, this paper is largely interested in investigating the peculiarities of how food safety scares unravel in authoritarian regimes. In what follows, I lay out some hypotheses about the ways in which authoritarian politics can affect how food safety scares unfold.

3.3 Theory and Hypotheses

3.3.1 Food safety scares and fear of government reprisal

Those living in authoritarian regimes may adjust not just the form, but the targets of political contention to the political environment. That is, people may be more willing to speak out against food safety scares which occur under the jurisdiction of governments outside of where they personally reside, that is — food safety crises that take place in another county or province, for example. This may be because
the potential political costs of expressing grievances about food safety scares that occur in another jurisdiction are lower. Indeed previous research has found that local governments may use suppression when dealing with instances of resistance, especially if ‘concessions are difficult to make and citizen resistance threatens social stability, policy implementation or local official’s images’ (Cai, 2008).

This argument also dovetails with existing behaviors exhibited by many Chinese internet users, in particular the rise of ‘human flesh engines’ in China. This term describes a collective internet phenomenon wherein citizens crowdsource information and collaborate to expose socially undesirable events, ranging anywhere from government corruption to animal abuse (Zhang et al., 2012b). As such, while human flesh engines do not necessarily describe acts of political resistance, they sometimes can. While the nature of human flesh engines have often been held up as an example of how technology can break down social barriers, they also serve as examples of how people can also sidestep political ones as well.

With regards to food safety in particular, potential explanations for what motivates this type of behavior are 1) people strategically take advantage of the existence of food safety scares which occur elsewhere as cover for their frustrations with the state of their own food safety. Perhaps more likely, 2) people are generally outraged by the existence of food safety scares but feel more comfortable expressing such grievances when the food safety scare does not come under the jurisdiction of governmental and political leaders that directly rule over them. This overall argument is formalized in the following hypothesis:

**H1:** People are more likely to express grievances over food safety scares that occur in political jurisdictions outside of the ones in which they reside because of fear of potential reprisal by the government that directly presides over them.
3.3.2 Food safety scares and government signaling

While the advent of internet and social media have given citizens an unprecedented ability to share information and express public grievances, cyberspace is far from free of government influence. On the contrary, internet censorship is a widespread phenomenon in China, with the bulk of the state’s censorship tools concentrated within the central government and supported by censorship privately exercised by social media platforms themselves. As such while food safety problems are regularly covered in the media and the central government has itself made public pledges to improve food safety, in a society where there are few de facto guarantees of civil liberty and freedom of expression, people may still be hesitant to publicly voice grievances about food safety for fear of government reprisal. Indeed, to the extent that political contention on social media exists, those who have have raised grievances have done so with regards to specific, narrowly-defined issues (Yang, 2009; Sullivan, 2014).

At the same time, blanket censorship is often not the optimal strategy for an authoritarian government as such a policy blunts its ability to be responsive to public sentiment and to root out particularly egregious corruption or incompetence within its ranks. As Lorentzen (2014) argues, allowing some investigative reporting, conditional on the level of underlying social tensions, can help improve governance without risking an overthrow of the government. Indeed, King et al. (2013) finds evidence that the Chinese internet censorship is guided by this rationale. They find that the Chinese government is more likely to censor social media posts about collective action problems, but are not any more likely to censor posts critical of the government.

Meanwhile, much of the existing research on internet censorship has explored how and why the Chinese government engages in internet censorship (Fu et al., 2013; King et al., 2013; Sullivan, 2014; King et al., 2014a; Hassid, 2015). Though some work has
shown that certain segments of the Chinese population are attuned to government signaling (Stern and O’Brien, 2012), less work has focused on whether citizens more broadly are responsive to this type of strategic censorship. That is, given that most citizens are cognizant that the government practices conditional rather than absolute censorship, media reports that do make it through the government’s censorship thicket may be interpreted by citizens to have the tacit approval of the government. Given this implicit sanction, they may be less fearful of potential repercussions for speaking out. In other words, in such an environment, citizens may be more likely to speak out about food safety problems, whether they take place in their own jurisdiction or outside their jurisdiction, if they observe a tacit central government signal of approval. This leads to the following hypothesis:

**H2**: Citizens are more likely to express grievances over food safety in response to food safety coverage that enjoys implicit government sanction as opposed to coverage without such approval.

3.3.3 Food safety scares grievance fatigue or social amplification

Finally, while most existing research on food safety scares concentrate on the social and political ramifications of *individual* food safety scares, the food safety environment in China is distinct in that a multitude of new food safety scandals have emerged one after another over the past decade. In the literature on individual food safety scares and social movements more broadly, it is precisely the viral transmission of information which politicizes an individual food safety incident into a full blown political crisis. Indeed, the high percentages of people who cite food safety as a serious problem in China (as discussed in the introduction of this chapter) is emblematic of this dynamic.

At the same time, after a decade of unending news coverage on food safety, for at least some citizens, food safety scares have become increasingly normalized and have
been correspondingly met with increasing resignation. For example, after news broke that McDonalds and KFC had been supplied with rotten meat in 2014, a woman purchasing a chicken burger for her son at a McDonalds in Beijing told a reporter from the *Financial Times*, ‘What can you do?.....You can only avoid the food for a while. As long as you don’t eat it on a regular basis, it should be fine.’ 19 In another interview undertaken by the *BBC* in 2015, a woman at an outdoor restaurant in Beijing noted, ‘The food here is obviously unhygienic, but I have no other choice but to buy it.’20

The difference may not merely be a question of of magnitude but perhaps more importantly, causal narrative. Whereas many of the food safety scares commonly studied in the scholarly literature focus on compromises in the food safety of specific foods21 for reasons that are largely *sui generis* (Bánáti, 2011), the food safety scandals being generated in China range across a variety of foodstuffs and are largely driven by systemic regulatory challenges (Yasuda, 2015). For citizens who perceive food safety scares to be a result of systemic governance problems, the emergence of new food safety scandals may merely confirm the persistence of these systemic problems and be cause for demoralization rather than renewed outrage. Meanwhile even for those who are more apt to blame food safety problems on the atomistic machinations of various unscrupulous vendors, repeated exposure to food safety scares may cause desensitization to reports of new food safety scares.

As such, reports of new safety crises in locales that already have experience with food safety problems can lead to either even more grievances, according to the

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21 For example Mad Cow Disease in the UK in the 1980s, the Alar Apple scandal in the US in the 1980’s, dioxin crisis in Belgium in 1999 and Ireland in 2008 (Wilcock et al., 2004).
reasoning that cumulative food safety scares lead to even more outrage, or lead to fewer grievances, according to the reasoning that cumulative food safety scares have a demoralizing effect. This leads to two plausible hypotheses to test:

**H3a:** People are less likely to express grievances toward reports of additional food safety scares if they have already been exposed to a high number of food safety scares compared to people who have previously been exposed to few food safety scares because such people are more sensitized to food safety problems.

**H3b:** People are more likely to express grievances toward reports of additional food safety scares if they have already been exposed to a high number of food safety scares compared to people who have previously been exposed to few food safety scares because such people are more desensitized to food safety problems.

### 3.4 Data

In order to test the hypotheses laid out in the previous section, I constructed original databases for both food safety grievances — the dependent variable, and food safety incidences — the independent variable, in China for the year 2012. Substantial effort was expended in order to extract and create a dataset of food safety grievances and incidents. See Appendix B.1 for more details about the methodology that I employed to construct this data. In what follows, I restrict myself to explaining how I operationalize these measures.

#### 3.4.1 Food safety grievances

Chinese citizens have a variety of social forums in which to express grievances about food safety, including microblogging platforms, Bulletin Board Systems (BBS)\(^{22}\)

\(^{22}\) A BBS is a computer server which allows users to among other things, interact with other users on public message boards. While its use has declined with the introduction of dial-up internet
and website comment sections. This analysis measures food safety grievances in terms of microblogging posts from Sina Weibo for reasons of both feasibility and scope.

In terms of feasibility, weibo posts from Sina Weibo\textsuperscript{23} have been made publicly available by the Journalism and Media Studies Center from the University of Hong Kong (HKU) for the year 2012.\textsuperscript{24} The project regularly samples posts of more than 350,000 Chinese microbloggers who have more than 1000 followers as well as a random sample of Chinese microbloggers, for a total of 14,388,385 users and 111 million posts for 2012 (Fu et al., 2013). Selectively sampling microbloggers with more than 1000 followers allows one to account for microbloggers who are more likely to have a substantive impact on public discourse than the average microblogger. Furthermore, it also ensures that a subset of the data is relatively free from spam and fake accounts.\textsuperscript{25} In contrast to the relative ease in accessing weibo posts, extracting BBS posts or website comments presents much greater logistical challenges as they are more finely distributed over many individual sites (King et al., 2013).

Perhaps more importantly, sampling from Sina Weibo posts maximizes the scope for capturing potential food safety grievances. Sina Weibo in particular was not only the prevailing microblogging platform in China in 2012, but microblogging in general also dominated China’s social media sphere in 2012. According to data collected by the China Internet Network Information Center (CNNIC),\textsuperscript{26} 274 million Chinese citizens were microblogging by mid-2012 and 309 million citizens were microblogging service, it has had remarkable staying power in China.

\textsuperscript{23} Whereas individual messages on Twitter are called ‘tweets’, individual messages on Sina Weibo and other microblogging sites are called ‘weibo’.

\textsuperscript{24} See: http://weiboscope.jmsc.hku.hk/datazip/


\textsuperscript{26} CNNIC is the administrative agency responsible for Internet affairs under the Ministry of Information Industry of the People’s Republic of China.
by the end of 2012.\textsuperscript{27} To put these numbers in perspective, microbloggers accounted for 54.6\% of all internet users in 2012 (CNNIC, 2013).\textsuperscript{28}

Meanwhile, Sina Weibo was the leading platform for microblogging in China in 2012. Founded relatively recently in 2009, Sina Weibo is often described as China’s answer to Twitter, as it allows users to post 140 character messages (which given the compactness of the Chinese language, allows Chinese-language users to post approximately twice the content of English-language users). In many ways it goes beyond Twitter however, as it also allows users to post videos and pictures, comment on other people’s updates and add comments when reposting a comment.\textsuperscript{29} In 2012, Sina Weibo experienced a dramatic 73\% growth to 503 million registered users\textsuperscript{30} and around 46.2 million active users.\textsuperscript{31,32}

In general, users are disproportionately young, educated and urban.\textsuperscript{33} In 2013, 53\% of users were born after 1990, 37\% were born during the 1980’s, 8\% born in the 1970’s and 2\% born before the 1970’s. Meanwhile 70.8\% of the population reported


\textsuperscript{28} Note also that in addition, 65.6\% of microblog users accessed microblogs through their mobile phones.


\textsuperscript{32} The discrepancy between the 503 million users signed up for Sina Weibo and the 309 million microbloggers identified by CNNIC can be attributed to the fact that not all people who signed up for Weibo accounts were active users.

attending college or beyond and lived disproportionately in China’s wealthier, more urban east coast.34

By only relying on weibo posts as my measure of social grievances then, I am missing a potentially large population of people who also have grievances but do not have the resources to express them online. At the same time, original interviews conducted by the author in Yunnan province with interviewees from a broad demographic suggest that food safety issues are overwhelmingly a concern of the educated and urban, and concern over food safety did not seem to be systematically related to age. Moreover, while relying on Weibo posts undoubtedly fail to capture grievances expressed privately or locally, arguably, grievances expressed in a public sphere such as the Internet reflect grievances that are 1) more deeply held or 2) have greater potential to spark collective outrage, making them of greater substantive interest.

Finally, it is also worthwhile to pause and consider the relative merits of analyzing posts from the year 2012. First, note that sampling from any time before 2012 or before the start of this project in 2015 was not feasible as Sina Weibo only allows users to extract the 20 latest public weibo posts.35

Meanwhile, by 2015, not only had the likelihood of increased (self-)censorship increased but Sina Weibo usership had also come down from its historic highs. The combination of these two elements would likely affect the quality of the recall in any subsequent database. With regards to the former the potential promise that Sina Weibo held as a facilitator of public discourse was severely curtailed in the face of governmental heavy-handedness in 2012. As The Economist notes:

“The microblogs were full of user-led activism in 2012 ... starting in


2013, officials have dramatically escalated their efforts to control them. Propaganda outlets have intensified attacks on the spread of rumors online, authorities browbeat online celebrities to be ‘more responsible’ (at least two have been arrested on unrelated charges), and microbloggers can now be jailed for up to three years for tweeting false information that is forwarded 500 times or viewed 5,000 times. President Xi Jinping, in a speech to party leaders in August, said that the internet was the prime battleground in the fight over public opinion, and that officials must seize control of it.”

Indeed, in work commissioned by The Telegraph, researchers at the Institute for Data Science and Engineering of East China Normal University sampled 1.6 million Sina Weibo users and tracked their activity in the face of government censorship and arrests. They found that while Weibo users remained resilient to new regulations that required users to register their real names and suspended accounts of anyone found to have posted five ‘sensitive’ weibo in 48 hours, once the Party began arresting Weibo users from June through August 2012, weibo posts decreased by half and the number of active users fell by 73% (See Figures 3.3 and 3.4).

In the aftermath, many users migrated to WeChat, at the cost of not only of Sina Weibo’s market share, but perhaps more importantly, of public discourse. Following


Figure 3.3: Highly active Weibo users (among sample group) 2011-2013

This figure shows the number of highly active users among a sample of 1.6 million weibo users tracked by researchers at East China Normal University from 2011 to 2013.

Figure 3.4: Posts by highly active users (among sample group) 2011-2012

This figure shows the number of weibo posts posted by highly active users among a sample of 1.6 million weibo users tracked by researchers at East China Normal University from 2011 to 2013.

increased government crackdowns, it has become less a hub for frank debate of society and politics, and more a repository for celebrity gossip and photos of food (Economy, 2014; Davies, 2015).³⁹

The same kind of frank and public discourse that had increasingly been found on Sina Weibo is not present to the same extent in WeChat. If Sina Weibo is analogous

to Twitter, then WeChat is analogous to WhatsApp – a private messaging service. While WeChat does host public accounts, only subscribers to a public account can see a post and only a subscriber’s circle of friends can see a post that s/he forwards. Moreover, users of many types of public accounts can only send one post to subscribers a day. On Sina Weibo by contrast, virtually anyone can see anyone else’s posts.

WeChat’s dominance is now undisputed, surpassing 700 million active users as of early 2016, compared to Sina Weibo’s 261 million monthly active users. The private nature of communicating via WeChat means that it is not feasible to scrape messages on WeChat and that the grievances sent over WeChat are much more likely to have a circumcised audience compared to Sina Weibo. While Sina Weibo is still a vibrant and active force in Chinese social media, its ability to promote social and political discussion arguably peaked in 2012.

In short, building a measure of grievances is an inherently difficult task; this is not made any easier under an authoritarian regime. I attempt to mitigate these difficulties by sampling from the most dominant of the social media platforms at a time of both rapid growth and unprecedented openness.


Dependent Variable: Censored Weibo

In order to test the hypotheses laid out above, as my main dependent variable, the log number of censored weibo posts. Censored weibo posts represent the most robust available measure of grievances as, by definition, the content of such weibo posts has been deemed to contain damaging material by the government. Though weibo posters themselves of course cannot know whether their posts will ultimately be censored, it is far likelier that people who post weibo that ultimately end up being censored are aware that their posts might be inflammatory. In other words, while a given weibo user cannot know with certainty whether what she posts will be found to be objectionable, as a group, those who do post censored weibo posts are likely to include more people who are cognizant that they are straddling dangerously over the line but nevertheless decide to voice their grievances, compared to those whose posts are not censored.

Meanwhile, to give readers a better sense of what kind of posts actually do end up getting censored, after sampling 100 censored weibo posts, I find that, at least with regards to food safety, censored posts seem to be either provide information about food safety and criticisms of either businesses or the government but do not overtly call for collective action. While previous work has shown that the Chinese government is especially sensitive to weibo posts which are perceived to organize collective action against the government and target such posts for censorship (King et al., 2013), censored posts about food safety seem to me benign. For example, many censored posts have the following flavor:
35 tons of mushrooms soaked in carcinogenic industrial-grade citric acid were seized in Fujian. These mushrooms were headed for a food processing plant and cannery in Fuzhou. Citric acid is added to extend the shelf life of mushroom. Long-term consumption will lead to the loss of calcium in the body, resulting in hypocalcemia, chemical residues may damage the nervous system, induce allergic diseases, and even cancer."

Meanwhile, posts which more explicitly complain about food safety stop short of a call to action:

Melamine, waste oil, clenbuterol, leather capsules... When a country obsessed with innovation and the next big thing, which worships Apple and Steve Jobs, we can’t help but despair when we see that this ingenuity and creativity is working toward harming one’s compatriots. Why can’t their creativity be directed upward and not downward?

Finally, censored weibo posts likely have better precision than the raw number of weibo posts. A sample of 100 censored weibo posts in the dataset suggests that 83% of the posts are legitimate grievances about food safety, compared to 73% for the raw number of weibo. See Appendix B.1 for more context.

3.4.2 Food safety incidents

With regards to food safety incidents, ‘the relevant information in existence’ is narrowed to publicly reported food safety incidents in China, as opposed to every single

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45 Interestingly, another 9% of the posts that were sampled were either advertisements for different food stuffs or ‘food safety tips’ of questionable scientific value. This suggests that the government may also be censoring with the aim of protecting public food safety.
food safety incident to ever occur in China for the purposes of this study. This narrowing can be justified on a number of grounds. First, this paper is interested in investigating the extent to which a food safety incident may spur a social crisis via shaping public perception as opposed to via direct exposure. If a food safety event is not publicly known, then by design it cannot affect public perception. More fundamentally, it is also very difficult for consumers to independently confirm the existence of a food safety incident. Without the requisite equipment and expertise, consumers cannot themselves test the quality of their food and must rely on outside institutions to do so for them. While consumers can and do form hypotheses about how their individual health has been affected by the food they consume, it is difficult to determine whether their experience is widespread or isolated without relying on outside information and communication. In this sense, food safety incidents that the average consumer is aware of are by definition publicly known.

Public information about food safety incidents can come from a variety of intermediaries, including newspaper articles, television newscasts, and government reports. In this analysis, I chose to measure food safety incidents in terms of newspaper articles for a number of reasons. First, because newspapers exist on a range of scales, from local to national, it is likely that a measure of food safety built on newspaper articles will also reflect both local and national food safety incidences. Second, newspapers can and do report not only on food safety incidents that they themselves have uncovered, but also food safety incidents that other institutions have uncovered. Finally, for practical reasons, newspaper articles are also the most feasible to collect and analyze. Not only would collecting information on food safety from television transcripts or government reports require substantially more time and resources, there is no reason to think that the relative quality of any subsequent measure of food safety incidents would be any better than one based on newspaper articles.

To that end, I collect articles about food safety from the WiseSearch database,
which offers the world’s largest collection of Chinese newspaper articles, in order to extract food safety articles. I limit my search to Chinese-language newspapers from mainland China.\textsuperscript{46} For the year 2012, the WiseSearch database contains articles from 110 national, regional and municipal newspapers.\textsuperscript{47}

The geographic distribution of newspapers available from the WiseSearch database for 2012 appear to be reasonably statistically representative of the geographic distribution of newspapers available in China overall. To assess the geographic representativeness of the newspapers available from the WiseSearch database, I collected data on all Chinese-language newspapers published in China. In total, I found information for 1453 newspapers and their respective provinces.\textsuperscript{48}\textsuperscript{49} This

\textsuperscript{46} That is, excluding Hong Kong and Macau.

\textsuperscript{47} Note that while the database had 286 newspapers to search from, WiseSearch’s coverage did not extend to 2012 for many of them. A more generous definition of the number of newspapers in the WiseSearch database is 329, but such a definition counts different editions of the same newspaper as separate newspapers. For example, The Nanfang Daily prints editions for a number of cities, including Dongnan, Foshan, Guangzhou, Huizhou, Jiangmen, Qingyuan, Shenzhen, and Zhongshan. Because this analysis will focus on inter-provincial variation as opposed to intra-provincial variation, when newspapers have multiple, intra-provincial editions, I collapse them into one. Note that none of articles that were ultimately extracted as being about food safety came from newspapers that the WiseSearch database defined as having several different editions. Thus, there was no ‘double-counting’ of articles in this respect in the data actually used.


\textsuperscript{49} While the Chinese government does collect information on newspapers in China (All newspapers are required to register with the State Administration of Press, Publication, Radio, Film and Television of the People’s Republic of China and once registered, each gets an individual identification number called the 国内统一刊号), I have been unable to locate a central database which makes this information publicly available. Similarly though it appears that the World Press Trends database has a centralized database on newspapers in China (at http://www.wptdatabase.org), Duke University currently does not have a subscription to access this database nor do any of databases available through the Duke Library appear to have this information. Meanwhile, arguably a benefit of using a dataset culled from information readily available from the Internet is that such newspapers are likely to be more prominent and have higher circulation than newspapers than those not easily searchable.
represents a sizable proportion of the total number of newspapers in China, with available figures ranging from 1,928 newspapers in circulation at the end of 2011\(^{50}\), 1,912 in 2014\(^{51}\) or as high as 2,200 in 2015 (Li, 2016)[p. 359].\(^{52}\)

For the year 2012, there are papers from 16 provinces available (along with newspapers on the national level) out of 31 provinces in mainland China. These are:

Table 3.1: Provinces of the newspapers available from the WiseSearch database in 2012

<table>
<thead>
<tr>
<th></th>
<th>Beijing</th>
<th>Chongqing</th>
<th>Fujian</th>
<th>Gansu</th>
<th>Guangdong</th>
<th>Guangxi</th>
<th>Hubei</th>
<th>Hunan</th>
<th>Inner Mongolia</th>
<th>Jiangsu</th>
<th>Jiangxi</th>
<th>Shandong</th>
<th>Shanghai</th>
<th>Sichuan</th>
<th>Tianjin</th>
<th>Zhejiang</th>
</tr>
</thead>
</table>

Though it would be ideal if the WiseSearch database had at least one newspaper from each province for 2012, statistically, this lack of coverage is not surprising given a sample size of 110 newspapers. Indeed, I find that the provincial distribution of newspapers in the dataset are statistically indistinguishable from the population distribution for 24 of the 31 Chinese provinces. See Appendix B.2 for more details. Meanwhile, in the subsequent analyses, as a robustness check, I validate that the subsequent analyses that I conduct still hold despite this discrepancy.

Finally, note that there are a number of newspapers in China that have national audiences, like *The People’s Daily* or *Southern Weekly*. Since the subsequent analysis seeks to analyze how differences in tacit government approval of food safety coverage may affect the propensity for citizens to speak out against food safety, I also code

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\(^{52}\) Note that this 2,200 statistic has been used to describe the number of newspapers in China for various points in time, including 1986 (Lull, 2013)[p. 19], 1997 (Jones, 1999)[p. 267] and in each case without any further attribution which suggests that one should be cautious of giving it too much weight.
for national newspapers and regional newspapers in the subsequent dataset. If a ‘national newspaper’ generally has a readership beyond its provincial borders, then it may not only be uniquely positioned to affect public perceptions by dint of its reach, but perceived as having the tacit approval of the government to do so. Indeed while newspapers with national audiences have circulations in the millions,\textsuperscript{53} most newspapers only have a circulation in the hundreds of thousands because they are province or city based.\textsuperscript{54} A newspaper was classified as being a ‘National newspaper’ if it was identified as having a national audience on its Baidu page\textsuperscript{55} or was identified as such on Wikipedia (See Appendix B.3).\textsuperscript{56}

3.4.3 Control variables

The \textit{Log GDP per capita} and the percent of the provincial population that is urban, \textit{Urban Population (\% Total)}, are both included as controls. Whether a weibo user comes from a relatively prosperous or more urbanized province is likely to affect his or her weibo use, as weibo users are disproportionately more likely to come from wealthy, urbanized provinces. The data for these measures was extracted from the China Data Center at the University of Michigan and is measured at the province-year level. As such, with regards to the models run here, it is equivalent to the Bell and Jones (2015)’s ‘between effect’ (see the Empirical Analysis section for more information on Bell and Jones).


\textsuperscript{55} Many Chinese newspapers have a Baidu page which provide information on the target audience for the paper.

Note that I also tried controlling for the log of total population, but for some of the models below, this resulted in multicollinearity problems (as measured by the variance inflation factor). To make the presentation of the results consistent for all models, I do not present the results that control for the log of total population though the results do hold throughout all the models, despite the potential issues of multicollinearity. Summary statistics are available in Table 3.2

<table>
<thead>
<tr>
<th>Table 3.2: Summary statistics</th>
<th>Mean</th>
<th>SD</th>
<th>Median</th>
<th>Min</th>
<th>Max</th>
<th>IQR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Censored Weibo†</td>
<td>3.1</td>
<td>7.95</td>
<td>0</td>
<td>0</td>
<td>108</td>
<td>2</td>
</tr>
<tr>
<td>Articles About Home Province† †</td>
<td>2.37</td>
<td>4.72</td>
<td>1</td>
<td>0</td>
<td>65.9</td>
<td>2.6</td>
</tr>
<tr>
<td>Provincial Articles About Home Province† †</td>
<td>2.19</td>
<td>4.56</td>
<td>1</td>
<td>0</td>
<td>63.8</td>
<td>2.25</td>
</tr>
<tr>
<td>National Articles About Home Province†</td>
<td>0.414</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>0.303</td>
</tr>
<tr>
<td>Articles About Outside Provinces† †</td>
<td>3.27</td>
<td>6.24</td>
<td>1</td>
<td>0</td>
<td>97.1</td>
<td>3.23</td>
</tr>
<tr>
<td>Provincial Articles About Outside Provinces† †</td>
<td>2.71</td>
<td>5.19</td>
<td>1</td>
<td>0</td>
<td>86.3</td>
<td>3</td>
</tr>
<tr>
<td>National Articles About Outside Provinces†</td>
<td>0.557</td>
<td>1.76</td>
<td>0</td>
<td>0</td>
<td>22.3</td>
<td>0</td>
</tr>
<tr>
<td>GDP per capita (¥)</td>
<td>5.02e+04</td>
<td>2.29e+04</td>
<td>4.53e+04</td>
<td>1.96e+04</td>
<td>1e+05</td>
<td>3.38e+04</td>
</tr>
<tr>
<td>Urban Population (% Total Population)</td>
<td>0.363</td>
<td>0.0954</td>
<td>0.347</td>
<td>0.22</td>
<td>0.538</td>
<td>0.152</td>
</tr>
</tbody>
</table>

† Note weibo posts and newspaper articles are measured on the province-day level.
‡ Measures for newspaper articles are drawn from home province newspapers, as opposed to newspapers from all provinces.
SD = Standard Deviation; Min = Minimum; Max = Maximum; IQR = Interquartile Range.

3.5 Empirical Analysis

Using the data collected on weibo posts on food safety and newspaper article on food safety, I test whether an authoritarian political environment can condition citizen response to food safety (Hypotheses 1 and 2) and further, whether over-saturation of
news about food safety scares can lead to grievance exuberance or grievance fatigue (Hypothesis 3).

Following Bell and Jones (2015), I estimate a hierarchical random effects model that separates out the within and between effect of the independent variable of interest on the dependent variable of interest. The model is specified as follows:

\[ y_{j,d} = \beta_0 + \beta_1 \cdot (X_{j,d-1} - \bar{X}_j) + \beta_2 \cdot (\bar{X}_j) + \beta_3 \cdot (Z_j) + (\mu_j + \epsilon_{j,d}) \]  

(3.1)

where \( y_{j,d} \) is a vector of outcomes, \( X_{j,d-1} \) and \( Z_j \) are matrices of regressors. These variables are measured in \( j \in [1, \ldots j] \) provinces and \( d \in [1, \ldots d] \) days. Finally \( \mu_j \) represents the random provincial effect and \( \epsilon_{j,d} \) estimates the province-date residual. Methodologically, such a model is attractive because it allows us to evaluate the effect of food safety scares on grievances \( y_{j,d} \) both within provinces \( X_{j,d-1} - \bar{X}_j \) (the within effect) and across provinces \( \bar{X}_j \) (the between effect), while controlling for province level characteristics \( Z_j \). Empirically, this model offers many advantages over other commonly used models. For example, the OLS model assumes pooled standard errors, which can lead to decreased standard errors. Meanwhile fixed effects models can only estimate within province effects, not across province effects. Finally standard random effects models often produce biased results because of endogeneity between higher level covariates and lower level ones. In using a random effects model with distinct within and between effects, which Bell et al. (2016) abbreviate to ‘REBW’, we are able to circumvent these potential endogeneity problems (See Bell and Jones (2015) and Bell et al. (2016) for more details). Province, month and date random effects were used in the models presented below.

3.5.1 Hypothesis 1: Fear of government reprisal

According to Hypothesis 1, citizens should be more willing to express grievances about food safety incidents that occur outside the jurisdiction in which they live
Table 3.3: Hypothesis 1: Fear of government reprisal

<table>
<thead>
<tr>
<th>Model</th>
<th>All Obs.</th>
<th>Months Before Crackdown</th>
<th>Months After Crackdown</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log Articles About Home Province (Within)</td>
<td>0.048 (0.015)</td>
<td>0.069 (0.023)</td>
<td>0.020 (0.023)</td>
</tr>
<tr>
<td>Log Articles About Outside Provinces (Within)</td>
<td>0.084 (0.015)</td>
<td>0.14 (0.023)</td>
<td>0.073 (0.023)</td>
</tr>
<tr>
<td>Log Articles About Home Province (Between)</td>
<td>−0.29 (0.34)</td>
<td>−0.24 (0.30)</td>
<td>−0.30 (0.38)</td>
</tr>
<tr>
<td>Log Articles About Outside Provinces (Between)</td>
<td>1.01 (0.32)</td>
<td>0.72 (0.27)</td>
<td>1.3 (0.36)</td>
</tr>
<tr>
<td>Log GDP per capita (Between)</td>
<td>0.68 (0.28)</td>
<td>0.53 (0.25)</td>
<td>0.73 (0.30)</td>
</tr>
<tr>
<td>Urban Population (% Total) (Between)</td>
<td>−0.47 (1.42)</td>
<td>0.12 (1.2)</td>
<td>−1.1 (1.5)</td>
</tr>
<tr>
<td>Intercept</td>
<td>−7.1 (2.8)</td>
<td>−5.7 (2.7)</td>
<td>−7.4 (2.9)</td>
</tr>
<tr>
<td>N</td>
<td>5124</td>
<td>2128</td>
<td>1694</td>
</tr>
<tr>
<td>Province</td>
<td>14</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>AIC</td>
<td>7837</td>
<td>3362</td>
<td>2246</td>
</tr>
<tr>
<td>BIC</td>
<td>7909</td>
<td>3424</td>
<td>2306</td>
</tr>
</tbody>
</table>

Results that are significant at the 5% level are in bold.

because they fear complaints about food safety problems which occur at home will be more likely to invite government reprisal. To that end, I assess the propensity to express grievances in reaction to both food safety incidents reported to occur in one’s home province, Log Articles About Home Province, and food safety incidents reported to occur in outside provinces, Log Articles About Outside Provinces. Both of these measures of food safety articles are taken from newspapers published in one’s home province to better capture the type of news coverage a person living in a particular province is exposed to.
The results are shown as Model 1 in Table 3.3. First note that while the between effect of Log Articles About Outside Provinces has a positive and significant effect on the propensity for citizens to publicly express grievances over food safety, the between effect for Log Articles About Home Province is not significant. With regards to the former effect, more specifically, a 1% increase in the between effect of Articles About Outside Provinces is associated with a 1.01% increase in the number of censored weibo posts about food safety, all else equal. This suggests that people in provinces that receive a high level of coverage about food safety scares outside of their province, relative to other provinces, are more likely to post grievances about food safety scares compared to people in provinces who receive relatively little coverage about food safety scares outside of their province, all else equal. The substantive effect of this relationship is shown in Figure 3.5. In particular, a move from the 20th to 80th percentile in terms of Log Articles About Outside Provinces (Between) is associated with an increase of 4.2 censored weibo, twice the interquartile range of censored weibo.57

Meanwhile a lack of a similar significant parameter estimate for the between effect of Log Articles About Home Provinces suggests that people that receive a high level of coverage about food safety scares in their home province are not any more likely to post grievances about food safety scares compared to people who receive relatively little coverage about food safety scares in their home province. Together with the between effect of Log Articles About Outside Provinces then, these results suggest that people are more likely to express grievances about food safety when the level of coverage about food safety problems which occur in other provinces increases but are not similarly inclined to do so when the level of coverage about food safety problems reported at home increases, supporting Hypothesis 1.

From Model 1, we can also see that the within effect for both the number of

57 See Table 3.2 for the summary statistics of censored weibo.
Figure 3.5: Effect on the number of censored weibo posted in the home province over the range of the number of articles about food safety problems that occur in outside provinces, relative to coverage in other provinces.

food safety scares reported about one’s home province, Log Articles About Home Province, and the number of food safety scares reported about outside provinces, Log Articles About Outside Provinces, are positive and significant. The larger parameter estimate for Log Articles About Outside Provinces, compared to Log Articles About Home Province, however, suggests further support for Hypothesis 1. In particular, the model suggests that a 1% increase in the within effect of Articles About Outside Provinces is associated with an 0.084% increase in the number of censored weibo posts, while a 1% increase in the within effect of Articles About Home Province is only associated with a 0.048% increase in censored weibo posts, all else equal. Together, these results suggest that an increased number of reported food safety scares which occur in outside provinces over time, has a greater positive effect on people’s propensity to complain about food safety problems than an increased number of food safety scares reported in one’s home province.

To get a better idea of the substantive meaning of these results, I simulate the predicted values of the unlogged number of censored weibo posts over the range of
the within effect of Log Articles About Home Province (Figure 3.6) and the within effect of Log Articles About Outside Provinces (Figure 3.7). Both show an upward trend between the increase in the number of food safety articles though the slope for the within effect of Log Articles About Outside Provinces is steeper, again supporting Hypothesis 1. More specifically, moving from the 20th to 80th percentile in terms of Log Articles About Outside Provinces (Within) leads to an 0.17 increase in the number of censored weibo posts on average, almost twice as much as moving from the 20th to 80th percentile in terms of Log Articles About Home Province (Within), which leads to a comparatively smaller 0.10 increase in censored weibo. On the whole however, the between component of Log Articles About Outside Provinces has a bigger substantive effect on the extent to which people are willing to express their grievances than the within effect of Log Articles About Outside Provinces (4.2 censored weibo vs. 0.17 weibo). Overall, all the model results are consistent with the hypothesis that people are more responsive to food safety scares reported outside of their province relative to those reported about their home province.

Under this modeling strategy however, one cannot discount the possibility that instead of testing whether weibo users are more likely to post grievances in reaction to food safety scares (both in one’s home province and in outside provinces), I am actually estimating the aggressiveness with which the government censors articles about food safety. To address this possible confounding interpretation, I take advantage of a natural experiment.

Recall in the previous discussion about the role of Sina Weibo in China that from June to August of 2012, the Chinese government signaled a much more authoritarian approach to social media by arresting weibo users for posting ‘rumors’ on Weibo. This crackdown was followed by a notable decline in the number of highly active weibo users and user posts by highly active users. If people’s willingness to express
grievances over food safety is conditioned by fear of government reprisal then, I would expect fewer posts in reaction to food safety scares that occur within one’s own province after the government crackdown compared to before the government crackdown. As such, I further estimate the model using data subset to the 5 months before the crackdown, from January to May 2012 (Model 2), and using data subset to 4 months after the crackdown, from September to December 2012 (Model 3).

In the months before the government crackdown, we can see that while both the within effect of Log Articles About Home Province and the within effect of Log Articles About Outside Provinces are significant for the time period in which the Chinese government took a relatively liberal stance toward social media (Model 2). However, following the government crackdown of social media only the within effect of Log Articles About Outside Provinces remains significant (Model 3). If censored
weibo posts only reflected the aggressiveness of the government, as opposed to the intensity of the citizen’s grievances, we would not expect the parameter estimates for *Log Articles About Home Province* to change from significant to non-significant following the government crackdown. If anything we would expect the parameter estimates to change from non-significant to significant. Instead this change from significance to non-significance suggests support for the interpretation of censored weibo as a measure of grievance intensity — as the political environment becomes more uncertain, people are less willing to voice grievances about food safety in their home province.

Meanwhile, the relative size of the parameter estimates for *Log Articles About Home Province* and *Log Articles About Outside Provinces* further buttress Hypothesis 1. Both before and after the government crackdown on social media, food safety scares reported to occurred outside one’s home province were likely to have a greater effect on the propensity to express food safety grievances than food safety scares reported to occur inside one’s home province. That is, before the government crackdown, all else equal, a 1% change in the within effect of *Articles About Outside Provinces* was associated with a 0.14% increase in food safety grievances, compared to *Articles About Home Province*, which was associated with only a 0.069% increase (Model 2). Meanwhile, after the government crackdown, a 1% change in the within effect of *Articles About Outside Provinces* was associated with a 0.073% increase in food safety grievances, while there was no statistically significant relationship estimate between *Log Articles About Home Province* and food safety grievances.

Lastly, however, because there is no change in the significance of the between effect of *Log Articles About Home Province*, it is more difficult to parse out what this means for the interpretation of censored weibo. On the one hand, the lack of significance of the between effect of *Log Articles About Home Province* both before and after the government crackdown in of itself tells us little about whether cen-
sored weibo posts are indicative of government aggressiveness or grievance intensity. On the other hand, using a more liberal interpretation of censored weibo posts as a sign of government aggressiveness, there is no reason to think that a government crackdown would censor weibo posts in reaction to food safety scares at home or in outside provinces differently. Indeed, if the government did exhibit such differential treatment we would expect it to censor food safety posts in reaction to food safety problems at home more aggressively. The fact that grievances in reaction to food safety problems in outside provinces are censored more often both before and after the government crackdown of social media compared to food safety grievances in reaction to homegrown food safety problems suggests that censoring is not a sign of government overaggressiveness per se, but the intensity of the grievances themselves.

3.5.2 Hypothesis 2: Citizen responsiveness to government signaling

Next, to test whether citizens are responsive to government signaling (Hypotheses 2), I explore whether citizens are responsive to coverage on food safety scares by newspapers with a national audience. The rationale here is that Chinese government is either more likely to censor papers with national level coverage because of its wider readership or that newspapers with national level coverage are more likely to self-censor because they know the Chinese government is keeping close tabs on them. As such, if a newspaper with a national audience does reports on a food safety scare in one’s home province, citizens could perceive such a report to have tacit government approval and be more emboldened to express their grievances about it.

To that end I first investigate whether people are more responsive to coverage of food safety in their home provinces by newspapers with a national audience (Log National Newspaper Articles About Home Province) as opposed to newspapers published in their home province that do not enjoy national readership (Log Provincial
Articles About Home Province).\textsuperscript{58} I further control for Log Articles About Outside Provinces because from Hypothesis 1, we have reason to believe that people may be more willing to express grievances about food safety crises that occur outside of their home province.

The results for the full model are reported in Model 4. Here we can see a positive and significant effect of both the between effect and the within effect of Log National Newspaper Articles About Home Province on the propensity to express grievances about food safety. In particular, a 1% increase in the number of articles written by a newspaper with a national readership about food safety scares in one’s home province, compared to other provinces, Log National Newspaper Articles About Home Province (Between), is associated with a 1.89% increase in the number of food safety grievances. Meanwhile, a 1% increase in the number of articles written by a newspaper with a national readership about food safety scares in one’s home province, over time, Log National Newspaper Articles About Home Province (Within), is associated with a 0.13% increase in the number of food safety grievances. Meanwhile, there is no statistically significant relationship between either the within or between effect of Log Provincial Articles About Home Province on food safety grievances.

From Figure 3.8 we can further observe that there is a substantive relationship between the between of Log National Newspaper Articles About Home Province on the propensity to express grievances about food safety, though the between effect’s substantive impact is larger. In particular, moving from the 20th to 80th percentile of provinces that receive more national coverage of food safety scares compared to other provinces, Log National Newspaper Articles About Home Province (Between), is

\textsuperscript{58} Note that when a province does not possess a newspaper that has a national audience, the variable Provincial Articles About Home Province is equivalent to the Log Articles About Home Province, which was used in Hypothesis 1. When a province does have a newspaper that has a national audience, any articles that this newspaper reports on food safety is subtracted from the Articles About Home Province variable when creating the Provincial Articles About Home Province variable.
Figure 3.8: Effect on the number of censored weibo posted over the range of the number of national articles about food safety problems that occur in the same province, relative to other provinces.

Simulated predicted values of the number of censored weibo posts per province-day over the range of the between effect of Log National Newspaper Articles About Home Provinces variable.

associated with an increase of 1.7 censored weibo posts, about 83% of the interquartile range of censored weibo posts. Meanwhile a similar move from the 20th to 80th percentile of provinces that receive more national coverage of food safety scares over time, Log National Newspaper Articles About Home Province (Within), is associated with an increase of 0.06 censored weibo posts, a relatively negligible substantive effect equivalent to about 3% of the interquartile range of weibo posts.

These results support the hypothesis that citizens see coverage of food safety scares by newspapers with a national audience as tacit government support for such reporting, and are more willing to voice their grievances in response. This relationship appears to be more firmly rooted in the overall level of national coverage of food safety scares, that is the between effect of Log National Newspaper Articles About Home Province.
Home Province, as opposed to the relative level national coverage of food safety scares over time, that is the within effect of Log National Newspaper Articles About Home Province.

However, again, one cannot discount the possibility that the censored weibo variable is measuring government aggressiveness rather than the intensity of citizen grievances. To try and parse this distinction, I again use the central government crackdown of social media in the summer months of 2012 as natural experiment. As such, I test Hypothesis 2 first using data subset first to the 5 months before the government crackdown (January to May 2012) on social media and then subset to the 4 months after the crackdown (September to December 2012). If censored weibo was merely a sign of government overzealousness, then I would expect the government to censor weibo posts in reaction to food safety posts not tacitly approved by them even more zealously after the government crackdown of social media.

Turning to Models 5, which models citizen response to food safety scares in a relatively permissive social media environment, we can see that there is now a positive and significant effect for the within effect of Log Provincial Articles About Home Province. Meanwhile in Model 6, which models citizen response to food safety scares in a relatively restrictive social media environment, the effect of the within effect of Log Provincial Articles About Home Province drops out. This change from significance to non-significance in the face of the government crackdown suggests that censored weibo are more likely a reflection of the intensity of citizen grievances as opposed to government aggressiveness. Indeed, if the latter interpretation were correct, we would expect the relationship between Log Provincial Articles About Home Province and censored weibo to grow stronger, not weaker, after the government crackdown.

Meanwhile the larger parameter estimate for the within effect of Log National
Newspaper Articles About Home Province compared to the within effect of Log Provincial Articles About Home Province both in the relatively more permissive social media environment (Model 5) and the relatively more restrictive one (Model 6) further supports the contention that people are sensitive to tacit government approval when expressing grievances about food safety.

Finally, the fact that the between effect of Log Provincial Articles About Home Province is not significant both before and after the government crackdown of social media does not offer similarly clear-cut evidence as to whether censored weibo should be interpreted as expressions of citizen grievances or government aggressiveness. Again, using a more expansive understanding of censored weibo posts as a sign of government aggressiveness, there is no reason to think that a government crackdown would censor weibo posts in reaction to food safety scares reported with its tacit approval differently then those without its tacit approval. Indeed, if the goal of the tacit approval is to further monitor and put pressure on local governments to enforce food safety regulation, we might expect central government censors to be less aggressive of weibo posts in reaction to food safety scares that receive tacit government approval. The fact that grievances in reaction to food safety problems with tacit government approval are censored more often both before and after the government crackdown compared to food safety problems without such approval, suggests that censoring is not a sign of government over aggressiveness per se, but the intensity of the grievances themselves.
Table 3.4: Hypothesis 2: The effect of government signaling vis-a-vis food safety scares in one’s home province

<table>
<thead>
<tr>
<th></th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Obs.</td>
<td>Months Before Crackdown</td>
<td>Months After Crackdown</td>
</tr>
<tr>
<td>Log National Newspaper Articles</td>
<td>0.13 (0.02)</td>
<td>0.18 (0.04)</td>
<td>0.11 (0.04)</td>
</tr>
<tr>
<td>About Home Province (Within)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log Provincial Articles About Home Province (Within)</td>
<td>0.03 (0.01)</td>
<td>0.05 (0.02)</td>
<td>-0.00 (0.02)</td>
</tr>
<tr>
<td>Log Articles About Outside Province (Within)</td>
<td>0.08 (0.01)</td>
<td>0.13 (0.02)</td>
<td>0.07 (0.02)</td>
</tr>
<tr>
<td>Log National Newspaper Articles</td>
<td>1.89 (0.62)</td>
<td>1.68 (0.54)</td>
<td>1.63 (0.57)</td>
</tr>
<tr>
<td>About Home Province (Between)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log Provincial Articles About Home Province (Between)</td>
<td>0.04 (0.25)</td>
<td>0.14 (0.22)</td>
<td>-0.23 (0.28)</td>
</tr>
<tr>
<td>Log Articles About Outside Province (Between)</td>
<td>0.35 (0.30)</td>
<td>0.09 (0.26)</td>
<td>0.93 (0.29)</td>
</tr>
<tr>
<td>Log GDP per capita (Between)</td>
<td>0.39 (0.24)</td>
<td>0.25 (0.21)</td>
<td>0.55 (0.24)</td>
</tr>
<tr>
<td>Urban Population (% Total) (Between)</td>
<td>-0.98 (1.10)</td>
<td>-0.60 (0.96)</td>
<td>-1.87 (1.22)</td>
</tr>
<tr>
<td>Intercept</td>
<td>-3.83 (2.33)</td>
<td>-2.55 (2.11)</td>
<td>-5.32 (2.37)</td>
</tr>
<tr>
<td>N</td>
<td>5124</td>
<td>2128</td>
<td>1694</td>
</tr>
<tr>
<td>Province</td>
<td>14</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>AIC</td>
<td>7801.98</td>
<td>3334.28</td>
<td>2234.90</td>
</tr>
<tr>
<td>BIC</td>
<td>7887.02</td>
<td>3407.90</td>
<td>2305.55</td>
</tr>
</tbody>
</table>

Results that are significant at the 5% level are in bold.

Are citizens similarly sensitive to tacit government approval to report food safety problems that occur in outside provinces? Indeed, there is a priori no reason to
think that people may not similarly be more responsive to newspaper reports about food safety scares outside their own province if they are reported by a newspaper with national readership (*National Newspaper Articles About Outside Province*) as opposed to a newspaper that do not have such a following (*Provincial Articles About Outside Province*).\(^{59}\) I investigate this possibility in Table 3.5, where I again also test to see if the results are robust to partitioning the data to months before the government crackdown and the months after.\(^{60}\)

The results for the full model for all the months is reported in Model 7 in Table 3.5. Note that the between effect of *Log National Newspaper Articles About Outside Province* is positive and significant while the between effect of *Log Provincial Newspaper Articles About Outside Province* is not significant. This suggests that the more national coverage there is about food safety problems that occur outside one’s home province, compared to other provinces, the greater the propensity to complain about food safety. Indeed a 1% increase in such national coverage is associated with a 1.36% increase in food safety grievances. Moving from the 20th to 80th percentile of national coverage of food safety incidents that occur in other provinces, this is equivalent to about 2.4 censored weibo. Meanwhile, greater provincial coverage about food safety problems in outside provinces, compared to other provinces, has no effect on the level of food safety grievances in that province.

Moreover both the estimates for the within effect of *Log National Newspaper Articles About Outside Province* and the within effect for *Log Provincial Articles About Outside Province* are positive, suggesting that over time as more food safety

\(^{59}\) Note that the two variables of interest, *National Newspaper Articles About Outside Province* and *Provincial Articles About Outside Province* are partitions of the *Articles About Outside Provinces* variable used in Hypothesis 1.

\(^{60}\) Note that theoretically, it is possible to regress the variables in Table 3.4 ad Table 3.5 in the same model. However, unfortunately there is a high degree of multicollinearity between the between effect of *National Newspaper Articles About Outside Province* and the other variables, making it difficult to trust the parameter results for any subsequent analysis.\(^{61}\) As such, I keep the analyses separate.
scares are reported outside of one’s home province, the more likely it is that a person will publicly express his or her grievances toward food safety. In particular a 1% increase in National Newspaper Articles About Outside Province is associated with an 0.18% increase in food safety grievances, which is larger than the 0.05% change in food safety grievances associated with a 1% increase in Provincial Articles About Outside Province, all else equal. Finally, while the parameter estimates for both variables are significant in the months before the government’s crackdown on social media (Model 8), the effect of Provincial Articles About Outside Province drops out after the crackdown (Model 9). These results support the interpretation of censored weibo posts as a measure of the intensity of citizen grievances as opposed to government aggressiveness and further lend credence to the hypothesis that citizens are more likely to express food safety grievances toward coverage of food safety scares that are perceived to be implicitly sanctioned by the government.
Table 3.5: Hypothesis 2: The effect of government signaling vis-a-vis food safety scares in outside home provinces

<table>
<thead>
<tr>
<th></th>
<th>Model 7 All Obs.</th>
<th>Model 8 Months Before Crackdown</th>
<th>Model 9 Months After Crackdown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log National Newspaper Articles About Outside Province (Within)</td>
<td><strong>0.18</strong> (0.02)</td>
<td><strong>0.30</strong> (0.03)</td>
<td><strong>0.17</strong> (0.03)</td>
</tr>
<tr>
<td>Log Provincial Articles About Outside Province (Within)</td>
<td><strong>0.05</strong> (0.01)</td>
<td><strong>0.09</strong> (0.02)</td>
<td>0.02 (0.02)</td>
</tr>
<tr>
<td>Log Articles About Home Province (Within)</td>
<td><strong>0.03</strong> (0.01)</td>
<td>0.04 (0.02)</td>
<td>0.01 (0.02)</td>
</tr>
<tr>
<td>Log National Newspaper Articles About Outside Province (Between)</td>
<td>1.36 (0.34)</td>
<td><strong>0.94</strong> (0.29)</td>
<td><strong>1.89</strong> (0.39)</td>
</tr>
<tr>
<td>Log Provincial Articles About Outside Province (Between)</td>
<td>0.15 (0.36)</td>
<td>0.19 (0.31)</td>
<td>0.06 (0.39)</td>
</tr>
<tr>
<td>Log Articles About Home Province (Between)</td>
<td>0.12 (0.30)</td>
<td>0.01 (0.28)</td>
<td>0.21 (0.30)</td>
</tr>
<tr>
<td>Log GDP per capita (Between)</td>
<td><strong>0.52</strong> (0.22)</td>
<td><strong>0.41</strong> (0.21)</td>
<td><strong>0.53</strong> (0.22)</td>
</tr>
<tr>
<td>Urban Population (% Total) (Between)</td>
<td>−1.68 (1.16)</td>
<td>−1.09 (1.12)</td>
<td>−1.91 (1.10)</td>
</tr>
<tr>
<td>Intercept</td>
<td>−4.71 (2.23)</td>
<td>−3.87 (2.10)</td>
<td>−4.73 (2.18)</td>
</tr>
<tr>
<td>N Province</td>
<td>5124 14</td>
<td>2128 14</td>
<td>1694 14</td>
</tr>
<tr>
<td>AIC</td>
<td>7778.35</td>
<td>3286.63</td>
<td>2221.94</td>
</tr>
<tr>
<td>BIC</td>
<td>7863.39</td>
<td>3360.25</td>
<td>2292.59</td>
</tr>
</tbody>
</table>

Results that are significant at the 5% level are in bold
3.5.3 Hypothesis 3: Grievance Fatigue

Lastly I explore whether experiencing a constant barrage of reports about food safety scares can lead to grievance fatigue or renewed vigor in grievances. That is, one might expect changes to food safety over time to affect the propensity for people to voice grievances about food safety differently depending on whether one lives in a place that already has a high level of food safety problems versus a low level of food safety problems. Theoretically, it seems equally plausible that reports of an additional food safety scare in a locale that already experiences many food safety problems may lead either to grievance fatigue (Hypothesis 3a) or even more outrage (Hypothesis 3b) about food safety problems.

Recall that with regards to news coverage of food safety scares, within effect captures changes in coverage of food safety scares over time while the between effect captures the overall level of food safety scares in a province compared to other provinces. If protracted experience with food safety crises indeed affects the propensity to voice grievances in response to a new crisis, I would expect that people in provinces that already have significant experience with food safety scares (having a relatively a high between effect of articles about food safety) will act differently than people in provinces that do not have the same protracted experience with food safety scares when there is an increase in the number of food safety scares it experiences over time (experiencing a relatively high within effect of reported food safety scares at home or in outside provinces). If this change is significant, it should be captured in the parameter estimate for the interaction term of the within effect of reported food safety scares with the between effect of reported food safety scares.

To empirically test Hypotheses 3a and 3b then, I interact the within effect and between effect of i) food safety scares reported at home, Log Articles About Home Province, in Model 10 ii) food safety scares reported in outside provinces, Log Articles
About Outside Provinces, in Model 11 and iii) both food safety scares reported at home and in outside provinces, Log Articles About Home Province and Log Articles About Outside Provinces, in Model 12. Note I test the interaction for both the within and between effects of food safety problems reported to occur at home (Model 10) and food safety problems reported to occur in outside provinces (Model 11) because I have previously found evidence to suggest that people’s propensity to express food safety grievances are tempered by fears of government reprisal (Hypothesis 1). I estimate these effects together in Model 12 to both assess the robustness of the findings in Models 10 and 11.

To that end, Model 10 shows a positive and significant relationship in the interaction term between the within effect and between effect of Log Articles About Home Province and Model 11 also shows a positive and significant relationship between the within and between effect of Log Articles About Outside Provinces. Both of these results suggest support for Hypothesis 3b. However, when interpreting interaction terms, the real test of the relationship is in the marginal effects. As such, in Figure 3.10, I plot a marginal effects plot which simulates the effect of increasing the number of reported food safety scares at home over time, Log Articles About Home Province (Within), conditional on being ranked in the 20th or 80th percentile of reported food safety scares at home, relative to other provinces, Log Articles About Home Province (Between). Similarly in Figure 3.11, I plot a marginal effects plot which simulates the effect of increasing the number of reported food safety scares in outside provinces over time, Log Articles About Outside Provinces (Within), conditional on being ranked in the 20th or 80th percentile of reported food safety scares in outside provinces, relative to other provinces, Log Articles About Outside Provinces (Between).

From Figure 3.11, we can see that the more food safety scares are reported in outside provinces over time in a province that has already been exposed to a fair
Figure 3.10: Effect on the number of censored weibo posted over the range reported food safety scares in one’s home province over time, conditional on being in the 20th percentile or 80th percentile of reported food safety scares at home, across provinces. (Model 10)

Figure 3.11: Effect on the number of censored weibo posted over the range reported food safety scares in outside provinces over time, conditional on being in the 20th percentile or 80th percentile of reported food safety scares outside one’s home province, across provinces (Model 11)

number of food safety scares in outside provinces (the 80th percentile), the more grievances people in that province are likely to express grievances about food safety compared to people who have experienced relatively little coverage of food safety scares in outside provinces (20th percentile), an increase of around 2.8 censored weibo on average. While Figure 3.10 shows a similar relationship with regards to censored weibo posted at home, the substantive effect is not as large—it is associated with an increase in 1.8 censored weibo on average. Neither is the effect as clear cut — as can be observed in Figure 3.10 the 95% confidence intervals between the 20th and 80th percentiles of Log Articles About Home Province (Between) are not cleanly separable. Overall then, the results from Model 10 and 11 suggest support for Hypothesis 3b, that is — places which already have had significant experience with food safety scares are likely to express even more outrage if they experience more food safety scares over time, compared to places that have not had significant
Table 3.6: Hypothesis 3: grievance fatigue

<table>
<thead>
<tr>
<th>Model</th>
<th>Log Articles About Home Province (Within)</th>
<th>Log Articles About Home Province (Between)</th>
<th>Log Articles About Outside Provinces (Within)</th>
<th>Log Articles About Outside Provinces (Between)</th>
<th>Log Articles About Home Province (Within) × Log Articles About Outside Provinces (Within)</th>
<th>Log Articles About Home Province (Between) × Log Articles About Different Province (Between)</th>
<th>Log Articles About Outside Provinces (Within) × Log Articles About Home Province (Between)</th>
<th>Log Articles About Same Province (Within) × Log Articles About Outside Provinces (Between)</th>
<th>Log GDP per capita (Between)</th>
<th>Urban Population (% Total Population) (Between)</th>
<th>Intercept</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0.01</td>
<td>0.02</td>
<td>(0.02)</td>
<td>(0.03)</td>
<td>0.66</td>
<td>0.08</td>
<td>1.01</td>
<td>0.06</td>
<td>(0.02)</td>
<td>(0.01)</td>
<td>(0.04)</td>
</tr>
<tr>
<td>11</td>
<td>0.66</td>
<td>−0.29</td>
<td>0.02</td>
<td>0.03</td>
<td>1.01</td>
<td>0.20</td>
<td>1.01</td>
<td>0.08</td>
<td>0.02</td>
<td>0.01</td>
<td>(0.04)</td>
</tr>
<tr>
<td>12</td>
<td>0.77</td>
<td>1.01</td>
<td>0.20</td>
<td>0.32</td>
<td>−0.19</td>
<td>−0.20</td>
<td>0.20</td>
<td>−0.05</td>
<td>0.68</td>
<td>(1.42)</td>
<td>(2.75)</td>
</tr>
</tbody>
</table>

| N     | 5124                                     | 5124                                      | 5124                                        | 1694                                         | 14                                          | 14                                          | 14                                          | 7865.54                                     | 7885.34                                     | 7902.78                                     |

experience with food safety scares, though this effect is stronger with regards to food safety scares reported in outside provinces. This may be because as suggested in Hypothesis 1, people are still reluctant to express their grievances about food safety problems in their home province because they fear government reprisal.

Meanwhile, Model 12 again shows a positive and significant relationship between within and between effect of Log Articles About Outside Provinces as in Model 11, again suggesting support for Hypothesis 3b. Further, it also shows a negative
and significant relationship between the within effect of Log Articles About Outside Provinces and the between effect of Log Articles About Home Province, suggesting support for Hypothesis 3a. Again, marginal effects plots will help us interpret not only the substantive effects of these interactions, but the substantive effects of the other interaction terms in Model 12 as well. As Brambor et al. (2006) notes, there may be a substantive relationship between interaction terms even if the parameter estimate is not significant.

From Figure 3.13, we can see that there is still substantive support for Hypothesis 3b with regards to food safety scares reported in outside provinces. That is, if one lives in a province that gets a lot of coverage of food safety scares which occur in outside provinces (80th percentile), increases in food safety scares that are reported in outside provinces over time, will lead to even more food safety grievances compared to living in a province that gets relatively low coverage of food safety scares in outside provinces (20th percentile), an increase of around 4.8 censored weibo posts on average. However from Figure 3.12 it is apparent that while the interaction effect between the within and between effects of Log Articles About Home Province suggested support for Hypothesis 3b in Model 10 and in Figure 3.10, once reports about food safety scares in other provinces are taken into account, there is no longer any substantive support for this hypothesis vis-a-vis reported food safety scares at home.

Meanwhile, the marginal effects plotted in Figure 3.15 further suggest that people are more likely to express grievances about food safety problems that occur at home over time, (Log Articles About Home Province (Within)), conditional on living in a province which receives a relatively high amount of coverage of food safety scares in other provinces (80th percentile) compared to living in a province that receives a low amount of coverage of food safety scares in other provinces (20th percentile). This is equivalent to an increase of around 4.1 censored weibo posts, all else equal. However,
this effect does not change over the range of Log Articles About Home Provinces (Within); rather it only manifests as a shift in the level of average grievances.

Lastly, the marginal effects plotted in Figure 3.14 suggest that the relative number of food safety scares reported at home compared to other provinces, Log Articles About Home Province (Between), has no effect on the propensity to express food safety grievances in response to reported food safety scares outside of one’s home province over time, Log Articles About Outside Provinces (Within).

Overall then, the model results suggest that relative to other provinces, people who live in provinces that receive a high amount of coverage of food safety problems that occur in other provinces, Log Articles About Outside Provinces (Between), are more likely to be more sensitive to increases in food safety problems reported over time, both in terms of food safety problems reported at home, Log Articles About Home Provinces (Within) (Figure 3.15), and food safety problems reported in outside provinces, Log Articles About Outside Provinces (Within) (Figure 3.13). The effect on the propensity to express food safety grievances is stronger when there are increases in food safety coverage of outside provinces over time, compared to coverage of homegrown food safety problems, conditional on a high level of coverage of outside food safety problems across provinces. Meanwhile, while there is some statistical evidence to support the hypothesis of grievances fatigue, there is little evidence of a substantive relationship, as shown in Figure 3.14.

Finally, according to Berry et al. (2012), one should also investigate the marginal effects plot of interaction terms switching the theoretical variable of interest and conditioning variable. This is because, empirically, there is no difference between the two interacted variables and examining the conditional effect of both can provide further empirical evidence for or against one’s theory. I do so for each of the interacted terms and find that the theoretical relationship between the interaction terms is
supported. That is, there is no clear conditioning effect of the within effect of the reported food safety measures on the between effect of the reported food safety measures. In the interest of space, these plots are given in Appendix B.4.
Figure 3.12: Effect on the number of censored weibo posted over the range of reported food safety scares in one’s home province over time, conditional on being in the 20th percentile or 80th percentile of reported food safety scares at home, across provinces (Model 12).

Figure 3.13: Effect on the number of censored weibo posted over the range of reported food safety scares in outside provinces over time, conditional on being in the 20th percentile or 80th percentile of reported food safety scares outside one’s home province, across provinces (Model 12).

Figure 3.14: Effect on the number of censored weibo posted over the range of reported food safety scares in outside provinces over time, conditional on being in the 20th percentile or 80th percentile of reported food safety scares at home, across provinces (Model 12).

Figure 3.15: Effect on the number of censored weibo posted over the range of reported food safety scares in one’s home province over time, conditional on being in the 20th percentile or 80th percentile of reported food safety scares outside one’s home province, across provinces (Model 12).
Robustness Checks

A number of robustness checks were conducted to test the validity of these findings. That is, I evaluated whether these hypotheses were robust to subsetting the provinces to those for which the WiseScrape database had newspaper coverage which mirrored the national average. Overall, they conformed with the results shown above. I also re-ran all of the models using a Poisson and negative binomial regression. However, these results are somewhat attenuated when estimating province, month and day random effects, they were robust when using province and month random effects.

3.6 Conclusion

Food safety problems often leads to a torrent of public grievances and most of the research to date has been devoted to investigating the nature of this wellspring. Yet conspicuously missing from this research is the extent to which political institutions can mediate the expression of public grievances. This chapter seeks to fill this gap.

In particular I have shown evidence to suggest that in authoritarian regimes, citizens may exercise restraint in voicing their grievances about food safety scares near to home but feel relatively more at ease at directing them toward food safety scares outside of their home. Meanwhile, citizens are also more responsive to coverage on food safety scares that have tacit government approval. Such tacit approval is conceptualized in the form of articles about food safety published by newspapers with a national readership, as the central government is likely more vigilant in monitoring the content of such newspapers. Finally, I also provide evidence to show that the relationship between the food safety scares and subsequent expression of grievances can be contingent on their prior level of exposure to food safety scares. People who are already highly exposed to food safety scares are found to be prone to even more
public expression of grievances when they experience new safety scares over time compared to people who have enjoyed relatively less exposure. In particular, this conditional effect is found with regards to exposure to reported food safety problems in outside provinces, suggesting that fear of government reprisal is again an important factor in conditioning public grievances about food safety.

While this chapter shows that the expression of public grievances can depend on the political context, left open is the question of to what end and purpose such grievances serve. On the one hand, increasing grievances about food safety may stoke greater political instability as both the volume and extent to which people are upset about food safety problems is publicly revealed. To that end, fear of government reprisal may ironically lead people to greater political instability, as more food safety problems are reported about outside provinces (on average 97 per province day) than about one’s home province (on average 65 per province day). On the other hand, such expressions of grievances may actually represent a political safety valve. While these grievances may signal to other observers that societal discontent with regards to food safety is high, as long as such discontent is not organized, it may be safely allowed to escape. Finally, the informational and psychological aspects of expressing food safety grievances aside, the expression of grievances about food safety may in fact put pressure on local governments to improve their enforcement of food safety regulation. While I explore the extent to which public grievances about food safety can be used for such political purposes in the following chapter, more research on the informational and psychological purpose of such grievances is needed.

Meanwhile, also left unaddressed are the factors which explain the pattern of newspaper coverage of food safety problems. To what extent do newspapers also feel politically constrained from reporting about food safety problems in their own province? To what extent might they react to such constraints by reporting on food safety events that occur outside of their provinces? The extent to which newspapers
may feel political constraints in their reporting may similarly shape how the public reacts to such reports. More research will be needed to explore these dynamics.

Finally, the findings from this chapter not only raises further questions but also contribute to the broader literature on political contention and censorship. While a host of research has investigated the degree to which the arrival of the internet can alternately pose as a challenge to government power or a tool for political control, less work has shown how citizens sensitivity to political control can shape their subsequent behavior in not just how they shape their message but who they target their grievances against.
4

Authoritarian Governance: The Case of Food Safety in China

4.1 Introduction

How responsive are authoritarian regimes to mass preferences? In addressing this question, scholars have alternately explored how authoritarian regimes deal with mass challenges to their hold on power (Svolik, 2012), as well as how the public preferences can shape how authoritarian leaders apply the economic levers of the regime. Yet, though the former literature has explored the conditions under which authoritarian regimes may accede to public demands, much of it has been limited to exploring this question when an authoritarian regime is in the midst of a severe political crisis (Przeworski, 1991; Lohmann, 1994; Kuran, 1995; Svolik, 2012) and thus has little room to equivocate (Acemoglu and Robinson, 2000). Meanwhile the latter literature generally does not systematically explore how mass preferences enter into its decision-making. Instead, such work tends to focus on how different institutional arrangements affect economic outcomes or the central government’s ability to maintain political control (Landry, 2008; Montinola et al., 1995; Oi, 1992).
The politics of food safety in China is an ideal issue with which to explore the extent to which authoritarian governments incorporate mass preferences in its governance decisions. For one, it is an issue for which government must take an active role in overseeing to ensure order and thus constitutes an important government responsibility. At the same time, a seemingly unending litany of food safety scandals for the last ten years or so has also rendered it both politically salient and potentially explosive to the political legitimacy of the Chinese government.

In what follows, I first provide a review of the literature on food safety regulation in China before laying out my theory and hypotheses. I then detail the data that I use to operationalize the concepts used in this chapter before presenting the subsequent results of a Bayesian hierarchical model using Chinese sub-provincial data. To preview, I find that local government officials are generally responsive to citizen grievances that have collective action potential and are even more responsive to media coverage of food safety events — the greater the number of either grievances or newspaper articles, the greater the increase in food safety regulation enforcement. Conversely, the more the government is reliant on the food industry as a source of tax revenue, the less likely it is to rigorously enforce food safety regulations.

4.2 Food Safety in China

For more than a decade now, serious safety and quality issues have affected all manner of foods across both urban and rural China. Both of these attributes, its diffusion and its persistence, distinguish food safety problems in China from contemporaneous food safety problems in other countries. For instance, though the United Kingdom has grappled with the economic and political ramifications of Mad Cow Disease for more than 20 years\textsuperscript{1}, ultimately this scandal was circumcised to a particular food

\footnote{Here I use ‘Mad Cow Disease’ to refer collectively to Bovine Spongiform Encephalopathy (BSE) and variant Creutzfeld-Jacob Disease (vCJD). BSE is the label for a rare, neurodegenerative disease}
item. In China however, not only are some food items similarly persistently unsafe (i.e. baby milk powder\(^2\)), but the safety of virtually all kinds of food have, at various times, been compromised. Such problems range anywhere from the chemical contamination of raw fruits and vegetables (Lam et al., 2013), to the adulteration of processed goods vis-a-vis toxic chemicals, antibiotics, colorants and food additives (Yan, 2012)\(^3\).

Meanwhile though other countries do experience problems with a variety of food and its use is reserved for its presentation in cattle while vCJD is the label used for the presentation of a similar degenerative brain disorder when presented in humans. While BSE was discovered in cattle in the UK in 1986, the link between BSE and vCJD was only made in 1996 (Powell, 2001; Washer, 2006). Following this 1996 discovery, European countries banned UK beef imports, which in many cases lasted for at least 10 years (‘End to 10-year British beef ban.’ \(BBC\) News. 3 May 2006. Accessed January 2017: http://news.bbc.co.uk/2/hi/4967480.stm).

\(^2\) One of the earliest instances of tainted milk was found in Anhui province in 2004. Much more widespread problems with baby milk powder were later found in 2008 and problems continued to be found well into 2015:

- 2004: Tam and Yang (2005);
- 2008: Pei et al. (2011);

items at once — a notable example being the 2015 outbreak of *E. Coli* at Chipotle, an American fast-casual chain, which implicated fresh produce, meat and dairy items\(^4\) — such food safety problems are generally not indicative of systemic issues with the national food safety regime. Indeed, the Chipotle incident was resolved within a matter of months. Its swift resolution both demonstrated the isolated nature of the incident vis-a-vis the United State’s food production and distribution system as well as the efficacy and competence of the US Food and Drug Administration (FDA) and the Center of Disease Control and Prevention (CDC), which were integral in responding to the outbreak.\(^5\)

By contrast, with some 200 million farming households (with an average of 1-2 acres per farm) and at least 400,000 food processing centers (most with 10 employees or fewer (Gale and Buzby, 2009)\(^6\)), the sheer scale of China’s food system poses an enormous regulatory challenge for the Chinese government, especially with regards to the cost, design and applicability of its food safety regime (Yasuda, 2015). Regulatory fragmentation — until recently China has had a veritable alphabet soup of agencies alternately engaging in turf wars or buck-passing — has further exacerbated successful enforcement of food safety regulation (Tam and Yang, 2005; Yang et al., 2008). Moreover, with regards to political dynamics, many local government officials have allowed a degree of regulatory forbearance, driven both by local revenue imperatives and outright corruption (Tam and Yang, 2005). Meanwhile, uneven resource distribution for food safety bodies has contributed to a regulatory gap in food safety

\(^4\) Note even this is an expansive description of Chipotle’s food safety problems. Because the *E. Coli* outbreak could not be definitively traced to any one food item, this meant that for the purposes of the resolution of the crisis, all were considered to be implicated. (‘FDA Investigates Multistate Outbreak of *E. coli* 026 Infections Linked to Chipotle Mexican Restaurants.’ 1 Feb 2016. Accessed Jan 2017: http://www.fda.gov/Food/RecallsOutbreaksEmergencies/Outbreaks/ucm470410.htm)

\(^5\) http://www.foodsafetynews.com/2016/05/cdc-to-chipotle-public-has-a-right-to-know-about-outbreaks/#.WICR6zKZNQI

across urban and rural locales (Liu and McGuire, 2014).

4.2.1 Food safety and political legitimacy

Yet while identifying and overcoming challenges in regulatory and policy design will be crucial to resolving food safety problems in China, ultimately public furor will be, and has been, the fuel necessary to power any such endeavor. At stake is not only the public health but political legitimacy, which Chinese leaders themselves have recognized from the outset. For instance, following the 2004 milk powder scandal in Anhui province, the Vice Premier of China at the time, Wu Yi, stated in a national teleconference that, ‘the incident . . . has taught us a lesson written in blood. This lesson is that we can not afford any bureaucratic indifference or just go through the motions when handling public health and safety issues [sic].’

Chinese leaders have continued to sound the alarm bells as food safety problems have dragged on. In the wake of yet another food scandal, this time involving tainted meat, the Chinese premier Li Keqiang warned that ‘never again should we allow a new credibility crisis like the milk powder crisis,’ referring to the 2008 milk powder scandal. In 2014, a year after assuming the office of the presidency, Xi Jinping also weighed in on the food safety situation in China, warning that, ‘if our party can’t even handle food-safety issues properly, and keeps on mishandling them, then people will ask whether we are fit to keep ruling China.’

The central government’s acknowledgment of the importance of addressing food safety problems, coupled with the national urgency instilled by the fear of repercussions at both the economic and political levels, has laid the foundation for reform. Several key developments have captured the attention of policymakers and the public alike.

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safety problems in China is rooted in the Mencian idea of *minben*, which the modern cohort of Chinese leaders have increasingly tapped into as the basis of their political legitimacy (Guo, 2003; Nathan, 2003; Shi and Lu, 2010). Under *minben*, people are seen as the roots of the state and the interests of the people are thus seen as as the foremost priority of governance (Guo, 2010). Meanwhile the even older concept of the ‘Mandate of Heaven’ gives *minben* its bite. According to the Mandate of Heaven, leaders could acquire political legitimacy by ruling justly and virtuously, thereby furthering ‘the will of Heaven.’\(^\text{10}\) The combined logic of the Mandate of Heaven and *minben* consequently advanced the idea that good rulers were those who successfully ruled in the interest of the people while bad rulers were those who neglected their duties and caused its people to be visited by disasters upon disasters. A new ruler would be legitimated precisely because he was able to remove a bad or incompetent ruler from power.

The use of *minben* and the Mandate of Heaven to legitimize political authority has specific significance with regards to food security. Historically, natural disasters in one way or another have devastated food crops and livelihoods, presenting serious threats to political legitimacy (Kimura, 1981; Jia, 2014; Chen, 2015). Building on the concepts of *minben* and the Mandate of Heaven, Chinese philosophers further tied political legitimacy to the capacity of governments to respond to food crises in particular. Mencius insisted for example, that the blaming starvation on a poor harvest was no less fallacious than “killing a man by running him through, while saying at the time, ‘It is none of my doing. It is the fault of the weapon.’ ” The government instead had a responsibility to look after its citizens in times of dearth, which historically the Chinese state did by building an elaborate bureaucracy of granaries (Will and Wong, 1991; Edgerton-Tarpley, 2014) and investing in a sophisticated hydraulic

\(^{10}\) More systematically, the Mandate of Heaven states that 1) The right to rule is granted by Heaven 2) There is only one Heaven and thus there can only be one ruler 3) The right to rule is based on the virtue of the ruler 4) the right to rule is not limited to one dynasty.
infrastructure to facilitate the transportation of grain (Dodgen, 2001). While under the concept of *minben*, food insecurity was seen as a sign of the governments failure to look after the people and under the Mandate of Heaven it is a reflection of God’s disfavor of a particular ruler, under the combination of the two it was license for the masses to question the political legitimacy of the ruling class and justification to overthrow them.

However though shocks to food quantity have historically played an outsized role in affecting the political stability of the Chinese state, the perceived quality of food has also been an important concern of the people. Even under near-famine conditions in early 20th century China for example, consumers were highly sensitive to perceived differences in the quality of rice aid. Such distinctions often conflated the perceived nutritional value of different types of rice with issues of gustation and economic class (Lee, 2011). It would be more accurate to say then, that *minben* and the Mandate of Heaven have imparted substantial government responsibility in ensuring the economic livelihood and security of the populace more broadly (Perry, 2008) — for historical reasons concerns about food quantity have gotten more attention than food safety. As China’s economic development has put to bed concerns about shocks to the food supply for the nation as a whole, it has also been accompanied by increasing threats to food safety. As such, concerns about food safety have played an increasingly prominent role in challenging political legitimacy.

But despite the centrality of political legitimacy in motivating the central governments efforts to ensure food safety, existing studies on food safety in China generally confine citizen grievances to the perimeter of their investigations of food safety politics. In his study of the politics of scale problem with regards to food safety regulation for example, Yasuda (2015) notes that food safety campaigns,\(^{11}\) though

\(^{11}\) As defined by Yasuda (2015), food safety campaigns are ‘intensive bursts of regulatory activity’ which are cost-effective, ‘cut through administrative complexity’ and aim to clean bureaucracies of
quick and cost-effective, often come at the expense of the hard and slow institution-
building needed to create a sustainable food safety regime. While he further notes
that ‘campaigns can do much to restore confidence in the market,’ his analysis of
food safety campaigns is focused on assessing their regulatory efficacy, as opposed to
their potential as a political tool to ease social tensions.

Meanwhile, Liu and McGuire (2014), after establishing that the capacity of rural
officials to safeguard food safety has fallen far behind that of urban officials,12 further
argue that such differences stem in part due to urban-bias dynamics, both historical
and contemporary.13 Governments that pursue urban-biased policies do so as much
to encourage industrialization as to head-off potential challenges to their rule from
urban residents, who are better equipped to organize against and threaten their hold
on power (Bates, 1981). As such, Liu and McGuire (2014) demonstrate that public
preferences, particularly of urban residents, can have a large role in shaping both
regulatory design and enforcement, though they do not explicitly frame their argu-
ment as such.

corrupt officials and food of illegal additives and adulterants, which are essentially ad hoc in nature,
but ‘provide a clear signal from the centre that food safety issues are important and of immediate
concern.’

12 Based on a field work of Changping province, Liu and McGuire (2014) argue that the rural food
regulation regime suffers from a less centralized policy structure and fewer economic and human
resources. Meanwhile, whereas the allocation of resources within urban districts is relatively even,
the relative geographic sprawl of food safety problems in rural China means that resources are often
unevenly concentrated in central towns, to the detriment of the relatively more rural areas within
rural districts.

13 Since the inception of the modern communist state, urban-biased policies meant that while
both rural and urban areas had hygiene control regulatory bodies, Weisheng Fanyi Zhan (WFZs),
food safety in urban areas were additionally regulated by ‘the Ministry of Light Industry, the
Ministry of Food, the Ministry of Agriculture, the Ministry of Chemical Industry and the Ministry
of Commerce’ because of the various economic industries that food manufacturers, distributors and
retailers engaged with. Meanwhile, Liu and McGuire (2014) further contend urban food safety is
more likely to be better regulated than rural food safety because urban residents generally have
greater access to information about food safety and have more channels with which to express their
grievances.
4.2.2 Food safety and authoritarian responsiveness

By contrast, in investigating the efficacy of enforcement of food safety in China, this paper seeks to systematically incorporate citizen grievances as a potential motivating factor. While the previous discussion of minbin and the Mandate of Heaven suggest that the Chinese government may be receptive to responding to citizen grievances about food safety, it also suggests that such responsiveness is predicated on the potential for citizens to threaten political legitimacy. To that end, this paper investigates the conditions under which citizens can do so.

In so doing, this study also contributes to the broader literature on authoritarian governance and authoritarian responsiveness. While by design, authoritarian regimes are not built to be responsive to the public (Wintrobe, 1990; Przeworski, 1991; Olson, 1993; Cheibub et al., 2010; Marshall and Jaggers, 2015), implicit to the functioning of many authoritarian regimes is the ‘authoritarian bargain’, in which citizens relinquish political rights in exchange for economic benefits (Desai et al., 2009). Such bargains can take a variety of different forms, from high percentage of public sector employment in resource-rich authoritarian countries like Saudi Arabia (Ali and Elbadawi, 2012),14 to the proliferation of food and fuel subsidies Middle Eastern authoritarian regimes,15 notably Egypt (Gutner et al., 1999),16 and perhaps most successfully, to the export-led economic growth by authoritarian Asian countries,17 including China.


16 In Egypt for example, (Singerman, 1995) notes, ‘The Egyptian Government’s policies of political exclusion have gone hand in hand with their public commitment to provide for the basic needs of the population....(T)he government maintains its legitimacy by providing goods and services to the population.’

17 Kharas, Homi. ‘What do the China Development Forum, Lee Kuan Yew,
Indeed, a rich scholarship has explored how the Chinese government has held up its end of the bargain by engineering an unprecedented run of high economic growth (Montinola et al., 1995; Oi, 1992; Li and Zhou, 2005; Tao and Yang, 2008). However, despite the importance of the masses toward shaping political incentives toward economic growth, the systematic incorporation of public opinion is often missing from these studies. This disconnect arguably mirrors the same disconnect in the implementation of these policies — if the imperative to grow the economy was originally driven by the need to maintain political legitimacy, for many officials it has become an end to itself and has conversely proven to have come at significant costs to number of issues that a substantial portion of the population cares about, including the environment (Qi and Zhang, 2014; Kostka and Nahm, 2017), labor rights (Solinger, 1999) and land requisitioning (Hsing, 2010).

A fledgling scholarship has, however, begun to examine how the government responds to mass preferences. For instance, in an experiment, Chen et al. (2015) find that Chinese county-level officials were more likely to be responsive to citizens who 1) threatened collective action or 2) threatened to tattle to higher-levels of government. However, for ethical and practical reasons, their evidence is limited to instances in which ‘citizens’ (who were in fact, the researchers) submit requests for information as opposed to any real programmatic demands. Wallace (2013b) and the World Bank have in common? The Economist. 27 March 2015. Accessed January 2017: https://www.brookings.edu/blog/future-development/2015/03/27/what-do-the-china-development-forum-lee-kuan-yew-and-the-world-bank-have-in-common/

18 In particular, the process of fiscal decentralization has been found to be an important factor in encouraging local officials to play an active role in engaging in strong pro-business behavior, such as promoting local infrastructure, encouraging local business and attracting foreign investment (Montinola et al., 1995; Oi, 1992).

19 Indeed, the Chinese government now finds itself in a similar predicament that Wallace (2013a) describes with regards to its urban bias policy. While favoring urban residents over rural runs can help stay challenges to the government in the short run, Wallace (2013a) finds that in the long run such a policy leads only to greater urban concentration as and an even greater threat to the regime.

20 Chen et al. (2014) moreover found no evidence that self-identification as a loyal Communist party member on the part of the citizen increased a country-level official’s likelihood of responsiveness.
further provides evidence to suggest that this responsiveness is substantive as he shows that the Chinese central government is more likely to distribute transfers to rural provinces that exhibit more social unrest. In seeking to show that citizen grievances can have an impact on food safety enforcement then, this paper seeks to show that citizen grievances can lead not only to increases in redistribution, but can affect regulatory enforcement as well.

4.3 Theory and Hypotheses

4.3.1 Local government responsiveness to public grievances

Citizens can directly communicate their preferences to local governments in a number of ways — petitioning local government officials, expressing their grievances via social media, or staging organized protests. The degree to which they can successfully influence government behavior is not necessarily a function of the medium they choose to use but of the degree which their demands have collective action potential. Indeed, a number of previous works have demonstrated that government officials are particularly sensitive to public challenges with collective action potential (King et al., 2013; Wallace, 2013a; Chen et al., 2015; O’Brien et al., 2006).

In this paper, I evaluate in particular whether expressing grievances about food safety on social media (particularly messages with collective action potential) can influence regulatory enforcement. Though scholars are in agreement that food safety problems ‘have contributed to a rapid decline in social trust’ in China (Yan, 2012), and have further demonstrated that citizen dissent with regards to food safety problems can take on a variety of forms (Yang, 2013), the systematic impact of such dissent with regards to food safety outcomes is still unclear. That being said, in their case study of a district in Beijing, Liu and McGuire (2014) do provide some anecdotal evidence that public grievances can push regulators to devote more resources to food safety, at least in urban districts. That is, they note that in the
wake of ‘public outcry...most of the regulatory officials [in the Changping district near Beijing] admitted that they felt more pressure to improve urban food safety, and as a result, they had allocated more regulatory resources to urban food safety’ (Liu and McGuire, 2014)[p. 133].

Meanwhile, existing work on the effect that social media can have on political outcomes more generally is not sanguine about the potential for social media to systematically affect governance decisions. In fact, though some popular commentators had expressed hope that, ‘the Internet will one day be remembered as helping to transform China, byte by byte. Let a billion blogs bloom,’21 scholars have been more subdued in their assessments and so far reality has corroborated their caution (Leibold, 2011).

The findings from this paper then, will provide evidence as to whether pressure from social media can affect policy in a systematic, as opposed to a particularistic, manner. On the one hand, when governments have given in to social media pressure, they have generally been limited to specific one-off events tied to a particular person or event as opposed to buckling to society-wide grievances (Sullivan, 2014; Hassid, 2015). On the other hand, central government censors have proven to be remarkably effective have in engaging in internet censorship, particularly with regards to content that has collective action potential (King et al., 2013, 2014b) — if the central government can censor grievances, than the local government may have less incentive to be responsive to them.

The above discussion suggests that only social media posts with collective action potential will put pressure on the local government to enforce food safety regulations. However, the central government can also choose to react to food safety posts that it deems as particularly incendiary by censoring them. To the extent that they do so,

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the local government should not feel pressure to react by increasing its food safety enforcement as it will not be able to observe these posts. As such, the first set of hypotheses I will test are as follows:

**H1a:** The greater the number of social media posts [*with collective action potential*], the more likely it is that local officials will feel pressured to enforce food safety regulation.

**H1b:** Larger numbers of *censored* social media posts will have a negligible impact on the degree to which local officials feel pressured to enforce food safety regulation.

### 4.3.2 Local government responsiveness to the media

The media can also play an important role in indirectly influencing local government behavior as well. Media reports on food safety problems can alert both citizens and the central government to the existence of local food safety problems, thereby applying further pressure on local government officials to act. Their importance with regards to alerting citizens of potential food safety problems cannot be overstated. As Yang (2013) notes, ‘most consumers are likely to experience food safety problems through the media rather than directly. The relationship between food safety and the media is therefore of critical concern.’ Media reports of food safety problems may pressure local government officials to address food safety problems in anticipation of public fallout.

Meanwhile media reports also allow the central government a mechanism with which to monitor local government performance. Indeed, Lorentzen (2014) argues that wholesale media censorship by an authoritarian regime is not an optimal strategy precisely because the central leadership would forgo a potentially valuable tool to monitor local government performance. In fact, in her address to a special national-level meeting on product quality and food safety in 2007, then Vice Premier Wu...
Yi echoes this logic in stating that the ‘full publication of news reports and public opinion about food safety problems is useful for monitoring and exposing the manufacture and sale of fake and shoddy products.’\textsuperscript{22,23} Indeed, in many of the more famous, and thus more studied food safety scandals like the 2004 and 2008 baby milk scandals (Tam and Yang, 2005; Yan, 2012), the media has played an important role in exposing harmful food production practices, prompting subsequent regulatory action.

This leads to the next set of hypotheses:

**H2a:** The greater number of local newspaper articles about food safety, the more likely it is that local officials will feel pressured to enforce food safety regulation because of fears of bottom-up pushback.

**H2b:** The greater number of newspaper articles that attract national attention about food safety, the more likely it is that local officials will feel pressured to enforce food safety regulation because of fears of top-down admonishment.

### 4.3.3 Competing bureaucratic incentives

While the above discussion emphasizes factors that may incentivize local officials to regulate food safety more forcefully, it is also important to account for countervailing forces that can lead local officials do shirk their duties.


\textsuperscript{23} One may contend that the central government may also have self-interested reasons to allow greater media freedom with regards to food safety if the foods that high government officials consume are exposed to the same risks as ordinary citizens. However, for all intents and purposes, high government officials and other members of the elite consume specially sourced food where such risks are minimal. Demick, Barbara. ‘In China, what you eat tells who you are.’ Los Angeles Times. 16 September 2011. Accessed January 2017: http://articles.latimes.com/2011/sep/16/world/la-fg-china-elite-farm-20110917; ‘Beware the cult of Xi.’ The Economist. 2 April 2016. Accessed January 2017: http://www.economist.com/news/leaders/21695881-xi-jinping-stronger-his-predecessors-his-power-damaging-country-beware-cult

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Though the central government has clearly voiced its commitment (through public statements, see the literature review for examples) and taken tangible actions (through both new legislation and regulatory reform\textsuperscript{24}) to improve food safety, actual implementation and enforcement of food safety regulation is undertaken at the local level whose officials may not have the incentive to do so.

Local government officials may decline to rigorously enforce food safety regulation out of pressure to raise tax revenue. The focus on maximizing local government revenue has grown out of China’s 1994 fiscal reforms (Tam and Yang, 2005; Tao and Yang, 2008). Since these reforms, local governments have increasingly relied on fines and license fees to make up for their budgetary shortfall. Revenue maximization is an imperative for local government for a slew of reasons: it affects their personal income and welfare benefits and it affects their ability to run other government programs and policy, which in turn also affects their career prospects (Li and Zhou, 2005).

To that end, there there are a variety of ways in which local government officials can circumvent their duty vis-a-vis food safety. For one, in the absence of national standards, local governments may develop their own standards that protect local industries instead of the public interest.\textsuperscript{27} For another, they may also interpret the

\textsuperscript{24} Indeed the central government has backed up its strong rhetoric by taking tangible steps to address the food safety crisis most notably with the ratification of Food Safety Law (FSL) in 2009 and its subsequent revision in 2015.\textsuperscript{25} The FSL provides the overall framework for food safety regulation in China and details guidelines monitoring and supervision, increasing regulatory standards, establishing recall and notification systems, providing increased consumer rights and creating liability for offenders (Pagnattaro and Peirce, 2010). The FSL is joined by a number of other laws which set quality and standards for agricultural commodities (the Agri-Food Quality and Safety Law of 2006 and Agricultural Law of 2003), processed foods (the Law of Product Quality of 2000 and the Law of Standardization of 2003), and imported or exported foods (Law on the Inspection and Import and Export Commodities of 2003) (Jia and Jukes, 2013a). Meanwhile subordinate laws and regulations deal with regulating specific aspects of the food chain or specific food products.\textsuperscript{26}

\textsuperscript{25} The FSL is joined by a number of other laws which set quality and standards for agricultural commodities (the Agri-Food Quality and Safety Law of 2006 and Agricultural Law of 2003), processed foods (the Law of Product Quality of 2000 and the Law of Standardization of 2003), and imported or exported foods (Law on the Inspection and Import and Export Commodities of 2003) (Jia and Jukes, 2013a).

\textsuperscript{26} Meanwhile subordinate laws and regulations deal with regulating specific aspects of the food chain or specific food products.

\textsuperscript{27} Indeed implementation and enforcement of some food safety laws are codified in regulations at the provincial level and disseminated below. Compared to those passed by the central government, provincial food safety laws are ‘fast, flexible and customized’ (Thompson and Hu, 2007). They are larger in number and more detailed than those set by the central government and can be revised much more quickly to match changing food safety conditions. (Thompson and Hu, 2007; Jia and Jukes, 2013a)
lack of national level standards as indication that there is no ‘need’ to implement new standards, thus protecting the profits of local food industries (Pagnattaro and Peirce, 2010). Moreover, as empowered by Article 77 of the 2009 Food Safety Law, they are further given the ability to take the following measures in the face of food safety violations:

- Apply punitive fines for non-complying enterprises
- Conduct field inspections of food producing or food trading sites
- Sample and test food products for product quality
- Quarantine or detain food, raw materials, food additives or food-related production equipment which violate food safety standards and laws
- Shut down enterprises that are producing or trading food illegally

Indeed, local government officials have tolerated substandard, even counterfeit food because of the considerable economic benefit they enjoy from collecting taxes and fees from local food industries (Yang et al., 2008; Thompson and Hu, 2007). Tam and Yang (2005) document that some local officials have even gone so far as to embrace businesses that produce counterfeit food. For example, government officials in Zhejiang’s Taishun County stated that they were willing to grant hygiene licenses to businesses that clearly lacked it because the business imperative of attracting investment overrode other concerns. With regards to drug safety, Yang (2009) notes that, ‘[e]ven in the best circumstances, the local drug administration often failed to crack down on local firms that were important to the local economy.’ Moreover even in Shanghai, which is widely agreed to have one of the country’s best food safety regulatory bodies (Yasuda, 2015), inspectors were found to engage in convenience sampling as opposed to random sampling not because of ignorance of
statistical methods, but because higher-ups rarely punished violators (Wei, 2014). Such behavior mirrors local officials negligence of other issues in favor of economic growth, such as the environment.\footnote{As Elizabeth Economy notes with regards to environmental protection, local regulatory officials report to local government officials, not the central government. Meanwhile the local government often colludes with local industry “to pollute well above legal limits—either because the officials have a financial stake in the enterprise or because they are afraid that closing a factory, or making it more expensive to operate, will diminish local employment and lead to social unrest, which is now a very serious problem all across China. In other cases, local officials want to do the right thing but are too weak in the face of powerful enterprise managers.” (Economy, Elizabeth. “China vs. Earth.” \textit{Council on Foreign Relations} 7 May 2007. Accessed September 2015: \url{http://www.cfr.org/china/china-vs-earth/p13233} )}

This leads to the final hypotheses:

\textbf{H3: The more reliant the local government is on the food industry for its tax revenue, the less likely it is to enforce food safety regulations.}

\section*{4.4 Data}

\subsection*{4.4.1 Measuring food safety regulation}

A good measure of responsiveness to food safety should be able to capture both the amount of resources that the government expends to address the food safety crisis as well as the efficacy of such an expenditure. Given this, I argue that a reasonable proxy for food safety regulation in China is a measure of profits from the food industry.

For one, the pursuit of higher profits is itself the main driver of the proliferation of adulterated or unhygienic food. Any regulatory action that actually succeeds in restricting the degree to which companies use less expensive food products that are unsafe for consumption should impact profits. It follows, then, by using this measure, we can further assess the extent to which food safety regulation actually has a real impact on food safety.

For another, the reliability of this measure is also likely to be better than alternative measures of food safety regulation, like government spending on food safety regulation or food safety related health incidents. With regards to the former, gov-
ernment officials may have strong evidence to over-report the amount that they spend on food safety enforcement. If governments are more likely to do this in response to public pressure for better food safety, this would bias any subsequent analysis of government responsiveness to food safety concerns up. Moreover with regards to the latter, there is strong evidence to suggest that the Chinese government under-reports food-related illnesses. For example, in the past ten years, the Chinese government has reported fewer than 20,000 major food poisoning incidents a year. The real number is undoubtedly higher considering that this number is lower than those reported by developed countries like the US, which has both much more stringent food safety laws and much fewer people (Lam et al., 2013). If government officials are more likely to under-report following a food safety scandal to obscure the extent of the problem, then any subsequent analysis may falsely attribute government response to a food safety crisis to be much larger than it really is. Though the use of other measures would be welcome as robustness checks, they are unfortunately neither available nor likely to be as reliable as the profit measure.

Moreover, even if such variables were available, their ability to measure both the effort and efficacy of food safety regulators would be limited. The amount of money that the government devotes to enforcing food safety regulation is a good measure of government effort but not efficacy. Meanwhile, the number of people negatively affected by poor food safety would better reflect the efficacy of food safety regulation, not effort. A measure of food profits, by contrast, is able to capture both government effort and the efficacy of food safety regulation (the trade-off being that it is not possible to estimate these effects separately).

Meanwhile, given that economic growth is the primary criterion in Chinese government officials performance evaluations and that greater industry profits are an important criteria for economic growth, any incentive to mis-report profits should lean towards over-reporting, rather than under-reporting. Such a bias would make
it more difficult to find any evidence of government regulatory intervention, lending
more credence to any relationship that is found between grievances and food safety
regulation.

There may, however, be concerns that using changes to the profits from the food
industry as a measure of regulatory enforcement may be problematic if the food
industry exhibits too much concentration. This is because undue market power can
give firms the ability to protect their profits by manipulating prices, thereby muting
the ability to use profits as a reliable indicator of food safety enforcement. Given, as
previously mentioned, that there are some 200 million farming households (with an
average of 1-2 acres per farm) and at least 400,000 food processing centers (most with
10 employees or fewer), concerns about a monopolistic food industry are not realistic.
Meanwhile, though the food industry has generally been moving in the direction of
increasing market concentration, it would be premature to characterize the structure
of the Chinese food industry as anything close to approximating oligopolistic. As
shown in Table 4.1, market concentration as measured by the Herfindahl index (where
0 describes a perfectly competitive market and 1 describes a market with a single
monopoly) in the food industry is still quite low.

At the same time, the food industry in China is moving toward increased spatial
agglomeration (Ge, 2009; Wu et al., 2016b). While the Spatial Gini Coefficient sug-
gests that the absolute level of agglomeration is still quite low, the values reflected
in the Ellison-Glaeser index suggest the amount of agglomeration is substantive.29
There is however no clear relationship between greater agglomeration and compet-
titive pricing, as this relationship is further conditional on existing transportation

29 The ad hoc thresholds that Ellison and Glaeser (1997) provide for interpreting their index
is as follows: given $\gamma$ represents the value computed by the Ellison-Glaeser index, industries with
$\gamma > 0.050$ are very localized, industries with $0.020 < \gamma \leq 0.050$ are somewhat localized and industries
with $\gamma < 0.020$ are barely localized. However, these ad hoc thresholds should be interpreted with
cautions especially as they were constructed vis-a-vis how they aligned with anecdotal knowledge
of the degree of localization in US industries. To that end, Cassey and Smith (2014) suggest that
interpretation of the index can be improved by simulating confidence intervals for the index.
Table 4.1: Concentration and industrial agglomeration of food and tobacco industry in China, 2000-2009

<table>
<thead>
<tr>
<th>Year</th>
<th>Herfindahl Index</th>
<th>Spatial Gini Coefficient</th>
<th>Ellison-Glaeser Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>0.0118</td>
<td>0.0898</td>
<td>0.1045</td>
</tr>
<tr>
<td>2001</td>
<td>0.0139</td>
<td>0.0216</td>
<td>0.0151</td>
</tr>
<tr>
<td>2002</td>
<td>0.0080</td>
<td>0.0354</td>
<td>0.0381</td>
</tr>
<tr>
<td>2003</td>
<td>0.0090</td>
<td>0.0705</td>
<td>0.0820</td>
</tr>
<tr>
<td>2004</td>
<td>0.0116</td>
<td>0.0329</td>
<td>0.0320</td>
</tr>
<tr>
<td>2005</td>
<td>0.0115</td>
<td>0.0429</td>
<td>0.0485</td>
</tr>
<tr>
<td>2006</td>
<td>0.0107</td>
<td>0.1042</td>
<td>0.1366</td>
</tr>
<tr>
<td>2007</td>
<td>0.0309</td>
<td>0.0976</td>
<td>0.1049</td>
</tr>
<tr>
<td>2007</td>
<td>0.0419</td>
<td>0.0700</td>
<td>0.0621</td>
</tr>
<tr>
<td>2009</td>
<td>0.0365</td>
<td>0.0530</td>
<td>0.0387</td>
</tr>
</tbody>
</table>

Recreated from Tables 1, 2, and 3 of Qian et al. (2014)

costs. Generally, economic models suggest that firms charge competitive prices when customers bear the whole of the transportation costs, under the so-called shopping model, which fits consumer buying habits for food (Fujita and Thisse, 1996, 2013).

Finally, using profits as a measure of food safety enforcement may also better reflect existing evidence of how local officials choose to enforce food safety. As Tam and Yang (2005) argues, the revenue imperative may also affect the type of regulation that officials are likely to pursue, leading them to favor revenue-generating measures such as financial penalties over other more effective, but less lucrative measures such as closing down factories or criminal prosecution of violators. Indeed, while the 2009 FSL law increased the potential penalties for food safety violators (Jia and Jukes, 2013a), many noted that these fines are still often much too low to do much to deter illegal behavior, especially for larger companies.\footnote{Liang, Jiangtao. ‘Increasing the intensity of management of food safety in those large-scale food enterprises.’ [对大企业食品安全监管需“两个加大”] [English translation from Jia and Jukes (2013a)] Hubei Daily (Jingchu Online). Accessed January 2017 : http://focus.cnhubei.com/original/201104/t1671057.shtml} While such penalties are less likely to put people out of business, they are likely to both hurt the bottom line and increase the stream of revenue to the local government.
Data for the total profits made by businesses engaged in food production related activities are available on a province-monthly basis from the University of Michigan China Data Center’s Monthly Industrial Database.\textsuperscript{31}

4.4.2 Measuring food safety grievances

Grievances over food safety in China are measured by the number of messages, or \textit{weibo}, concerning food safety posted to the Sina Weibo website, a Chinese microblogging social media platform launched in 2009. The University of Hong Kong Journalism and Media Studies Center Weiboscope Project has regularly sampled weibo posts since 2011 and has made the posts it has collected in 2012 publicly available.\textsuperscript{32} The sample includes more than 222 million posts, a portion of which was sampled from 350,000 Chinese microbloggers with more than 1,000 followers as well as another portion of microbloggers randomly sampled. Along with the posts themselves, the Weiboscope project provides information with regards to the time of posting, the provincial location of the poster, whether the weibo post was retweeted to other weibo users and whether or not the weibo post was censored. The methodology for how the weibo posts were extracted and refined is detailed in Appendix B.1. To briefly summarize, weibo posts were extracted using key words related to food safety. A supervised machine learning model was then used to classify weibo posts as being about food safety or being not about food safety.

In order to test the hypothesis that governments are more likely to be responsive to grievances that have collective action potential, I test government responsiveness to \textit{Log Retweeted Weibo Posts} the log of the number of weibo grievances that were retweeted, that is, forwarded, from other weibo users. The more posts that have

\textsuperscript{31} These include agricultural goods, processed foodstuffs and drinks. The specific categories, as labeled by the China Data Center are “Agricultural and Sideline Foods Processing”, “Food Production”, and “Wine, Drinks and Refined Tea Manufacturing Industry.”

\textsuperscript{32} Data available here: http://weiboscope.jmsc.hku.hk/datazip/. Data methodology is detailed in Fu et al. (2013)
been forwarded or retweeted, the greater the potential for collective action in that province. If the government is motivated by concerns of social unrest in responding to citizen grievances, then their response to retweeted posts should be reflected in lower profits for the food industry as the government increases enforcement of food safety regulation.

I also test government responsiveness to Log Raw Weibo Posts and Log Censored Weibo Posts. If the government is only responsive to grievances with collective action potential, then I would expect there to be either no relationship between the number of raw weibo posts (because they have no bite) or censored weibo posts (because no one can see them) on government enforcement of food safety problems. If on the other hand, the government is somewhat responsive to grievances even without collective action potential, then I would expect there to be some relationship between the number of raw weibo posts on government enforcement of food safety problems, but this responsiveness should still be less than local government responsiveness to retweeted weibo posts, that is, posts with a collective action potential.

4.4.3 Measuring media coverage of food safety

Media coverage on food safety is measured by the number of Chinese news articles concerning food safety in 2012 extracted from the WiseSearch database, which offers the world’s largest collection of Chinese language newspaper articles. More detailed information about the database and how this data was extracted is again available in Chapter 2. To briefly summarize, newspaper articles were extracted using key words related to food safety. A supervised machine learning model was then used to classify newspaper articles as being about food safety or being not about food safety.

While it is not possible to cleanly separate whether media of food safety coverage pressures local government officials to enforce food safety regulation because they are anticipating bottom-up reproach from its citizens or top-down reprimands from
the central government, I nevertheless attempt to gauge the relative importance of the former by estimating the relationship between $\log$ Articles about Province$_j$ from Province$_j$ on food safety regulatory enforcement. The rationale here is that reports about coverage about food safety problems in one’s one province is more likely to attract local attention and thus bottom-up displeasure with the local government’s enforcement of food safety regulation.

Meanwhile, in order to assess how much top-down monitoring can spur local government enforcement, I also estimate the relationship between $\log$ Articles about Province$_j$ from Province$_{\neq j}$ and $\log$ National Articles about Province$_j$. The former measures the media coverage that outside provinces devote to food safety problems in one’s own province while the latter measures national media coverage of food safety problems in one’s own province. The rationale is that the more outside media coverage there is, the more national attention there is of a food safety crisis. Such coverage is more likely to attract the attention of higher level government officials, which may encourage local government officials to more vigorously enforce food safety regulation.

4.4.4 Measuring countervailing incentives to enforce food safety

The model also tests whether provincial governments may be swayed by competing economic interests in regulating food safety by including the covariate Food Taxes (% Government Revenue) which is a measure of the proportion of provincial government revenue contributed by taxes from food-related industries for a given provincial month. This variable was constructed by dividing the amount of taxes remitted to the provincial government from the food industry by the total volume of taxes that the provincial government received. This data was obtained from the University of Michigan China Data Center’s Monthly Industrial Database.$^{33}$

$^{33}$ The categories used to delimit the food industry are the same categories outlined in footnote 31.
Here, the expectation is that local governments which are more reliant on tax revenues from food production may be less inclined to rigorously enforce food safety policies because they are reliant on such revenues to fund other government expenditures and because such enforcement may negatively affect economic growth, a key part of a government’s cadre’s performance evaluation.

4.4.5 Controls

Dissatisfaction with food safety may lead to lower profits not only through government regulation but also through decreased consumer demand as people are simultaneously citizens and consumers and can use their status as the latter to express their discontent with food safety levels. In order to isolate the effect of government responsiveness, I include the covariates Food Sales Revenue per Capita. Food Sales Revenue per Capita measures the sales revenue from the food industry divided by the total number of people per province to arrive at the average consumer sensitivity to food safety concerns per province. This data was obtained from the University of Michigan China Data Center’s Monthly Industrial Database using the same categories outlined in footnote 31.

I also control for provincial level covariates including GDP per capita, the per capita GDP of a particular province and Log Population and the Urban %, the percent of the population that is classified as urban. GDP per capita is also likely an important indicator of the purchasing power of provincial consumers while Log Population is a good indicator of the market size of a particular province.

Summary statistics for the variables can be found in Table 4.2.
Table 4.2: Summary statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Median</th>
<th>Min</th>
<th>Max</th>
<th>IQR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food Industry Profits (¥)</td>
<td>1.63e+06</td>
<td>1.9e+06</td>
<td>9.95e+05</td>
<td>-7.85e+04</td>
<td>9.41e+06</td>
<td>1.71e+06</td>
</tr>
<tr>
<td>Raw Weibo Posts</td>
<td>544</td>
<td>1.14e+03</td>
<td>165</td>
<td>1</td>
<td>8.87e+03</td>
<td>344</td>
</tr>
<tr>
<td>Retweeted Weibo Posts</td>
<td>200</td>
<td>454</td>
<td>52</td>
<td>0</td>
<td>3.88e+03</td>
<td>118</td>
</tr>
<tr>
<td>Censored Weibo Posts</td>
<td>48.7</td>
<td>143</td>
<td>10</td>
<td>0</td>
<td>1.22e+03</td>
<td>23.5</td>
</tr>
<tr>
<td>Food taxes (% Gov Revenue)</td>
<td>0.0464</td>
<td>0.0387</td>
<td>0.0332</td>
<td>-0.00622</td>
<td>0.195</td>
<td>0.0399</td>
</tr>
<tr>
<td>Food Sales Revenue per Capita (¥)</td>
<td>0.462</td>
<td>0.327</td>
<td>0.389</td>
<td>0.0321</td>
<td>1.39</td>
<td>0.425</td>
</tr>
<tr>
<td>GDP per Capita (¥)</td>
<td>4.34e+04</td>
<td>1.95e+04</td>
<td>3.64e+04</td>
<td>1.64e+04</td>
<td>1e+05</td>
<td>2.45e+04</td>
</tr>
<tr>
<td>Urban (% Pop)</td>
<td>0.361</td>
<td>0.101</td>
<td>0.369</td>
<td>0.17</td>
<td>0.538</td>
<td>0.158</td>
</tr>
<tr>
<td>Population</td>
<td>4.35e+07</td>
<td>2.74e+07</td>
<td>3.75e+07</td>
<td>3.03e+06</td>
<td>1.06e+08</td>
<td>3.61e+07</td>
</tr>
</tbody>
</table>

4.5 Empirical Analysis

Where both the number of observations per panel is small and the number of panels is small, Bayesian multilevel models have been found to be more efficient than maximum likelihood estimators. This is because because instead of using the post-estimation adjustments that are common in maximum likelihood strategies, Bayesian estimation strategies directly model heteroscedasticity and contemporaneous correlation in the data (Shor et al., 2007). As such, I use a Bayesian multilevel model to estimate to what degree social grievances and economic interest affect food safety

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34 Note that Stegmueller (2013) finds that both the parameter estimates and the 95% confidence intervals (i.e. efficiency of the estimates) for individual effects in linear and non-linear mixed models for both maximum likelihood and Bayesian estimation strategies are similar. However, his analysis is based on data where there are at least 500 observations (T) per country (5, 10, 15, 25, and 30), whereas Shor et al. (2007) test the results for much smaller time periods, 5, 20 and 50 observations (T) per country (5, 15, 50, 500), which more closely approximates the type of data used in the analysis in this chapter. As a side note, recall that in Chapter 2 on unraveling food safety crises, the observations were measured on a province-day level, such that each group (province) had 365 observations (T) and with 14 provinces total. This better approximates the conditions that Stegmueller (2013) based his findings on and suggests that a Bayesian analysis would probably not give very different results from the ML analysis conducted in that chapter.
regulation (note I also estimate the maximum likelihood estimates and find that the results are substantively similar, models available upon request). All covariates are lagged by one month. The model was specified as follows:

\[ y_{j,t} = \theta^T X_{j,t-1} + \gamma_j^T + \delta_t + \epsilon_{j,t-1} \]

\( y_{j,t} \) is the dependent variable and \( X_{j,t-1} \) is a \( n \times k \) matrix of independent variables. Both are measured on the provincial-month level where \( j \in [1, 2, \ldots, j] \) denotes the province and \( t \in [1, 2, \ldots, t] \) denotes the month. Meanwhile \( \theta \) is a \( k \) dimensional parameter which estimates the relationship between the dependent and independent variables. Finally \( \gamma_j \) is measure of provincial-level random effect, \( \delta_t \) is a measure of the month-level random effect and \( \epsilon_{j,t-1} \) is the unit-level error. The model is estimated using the following prior distributions:

\[ \theta \sim \text{multivariate normal}(\mu_0, \sigma_0^2) \]
\[ \gamma_1, ..., \gamma_J \sim \text{i.i.d. multivariate normal}(0, \Sigma_\gamma) \]
\[ \delta_1, ..., \delta_T \sim \text{i.i.d. multivariate normal}(0, \Sigma_\delta) \]

\[ \sigma^2 \sim \text{inverse-gamma}(\nu/2, \nu_0 \sigma_0^2/2) \]
\[ \Sigma_\gamma \sim \text{inverse-Wishart}(\eta_0, \Sigma_{\gamma_0}^{-1}) \]
\[ \Sigma_\delta \sim \text{inverse-Wishart}(\eta_0, \Sigma_{\delta_0}^{-1}) \]

The models were run using non-informative priors and convergence of three par-

---

35 Theoretically if we are interested in not merely reactionary but more systemic, programmatic by the government responses to food safety scares, then it is reasonable to expect that the result of any sustained effort to have a time delay.
allel chains.\textsuperscript{36,37} The models were assessed to have converged if 1) the trace plots for each parameter suggest convergence, 2) if there no evidence of autocorrelation in the plots for each of the parameters and with regards to the effective sample size for each parameter, the Geweke convergence diagnostic statistic does not reject the null hypothesis that the Markov chain is stationary\textsuperscript{38} Finally note that since Bayesian models return posterior distributions of parameters, the results reported in Table 4.3 then are not the same as the classical framework’s point but the mean and standard deviation of the posterior distribution for each parameter.

4.5.1 Testing local government responsiveness to citizen grievances

In order to assess how responsive the local government is to citizen grievances, in Table 4.3, I estimate how much enforcement of food safety regulation changes in response to i) the raw number of weibo posts (Model 1) ii) retweeted weibo posts (Model 2) and iii) censored weibo posts (Model 3). Of the three measures of food safety grievances, only the within effect \textit{Log Retweeted Weibo} is found to have a statistically significant effect on government enforcement. This suggests that governments do indeed pay attention to grievances, but only if they demonstrate collective active potential. Moreover, the results suggest that local officials are more likely to be responsive to food safety concerns when they receive an unusual level of grievances with collective action potential over time. The importance of the threat of collective action in spurring the local government to action is further corroborated by the lack of statistical significance in the parameter estimates for \textit{Log Raw Weibo}, suggesting further support for Hypothesis 1a. Further, the null effect of the censored

\textsuperscript{36} I also estimate a version of the model that uses the MLE estimates are the priors. This is commonly known as an empirical Bayes model. The results are largely consistent.

\textsuperscript{37} These models are run using Hadfield et al. (2010). See (Hoff, 2009) for more details on the distributions for the full conditionals.

\textsuperscript{38} In particular, the Geweke diagnostic takes two non-overlapping parts of the Markov chain, and conducts a difference in means test to see if the two parts of the chain are from the same distribution.
Table 4.3: Effect of citizen grievances on food safety enforcement by month

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Raw Weibo</td>
<td>Retweeted Weibo</td>
<td>Censored Weibo</td>
</tr>
<tr>
<td>Log Raw Weibo (Within)</td>
<td>−0.138</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.079)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log Raw Weibo (Between)</td>
<td>−0.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.097)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log Retweeted Weibo (Within)</td>
<td></td>
<td>−0.109</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.055)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log Retweeted Weibo (Between)</td>
<td></td>
<td>−0.006</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.102)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log Censored Weibo (Within)</td>
<td></td>
<td></td>
<td>−0.069</td>
</tr>
<tr>
<td></td>
<td>(0.092)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log Censored Weibo (Between)</td>
<td></td>
<td></td>
<td>−0.019</td>
</tr>
<tr>
<td></td>
<td>(0.051)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Taxes (% Total) (Within)</td>
<td>0.721</td>
<td>0.758</td>
<td>0.699</td>
</tr>
<tr>
<td></td>
<td>(1.176)</td>
<td>(1.164)</td>
<td>(1.178)</td>
</tr>
<tr>
<td>Food Taxes (% Total) (Between)</td>
<td>10.596</td>
<td>10.523</td>
<td>10.723</td>
</tr>
<tr>
<td></td>
<td>(3.922)</td>
<td>(3.929)</td>
<td>(3.943)</td>
</tr>
<tr>
<td>Food Sales Revenue Per Capita (Within)</td>
<td>0.845</td>
<td>0.851</td>
<td>0.839</td>
</tr>
<tr>
<td></td>
<td>(0.381)</td>
<td>(0.375)</td>
<td>(0.381)</td>
</tr>
<tr>
<td>Food Sales Revenue Per Capita (Between)</td>
<td>0.948</td>
<td>0.942</td>
<td>0.905</td>
</tr>
<tr>
<td></td>
<td>(0.439)</td>
<td>(0.454)</td>
<td>(0.455)</td>
</tr>
<tr>
<td>Log GDP per capita</td>
<td>0.714</td>
<td>0.736</td>
<td>0.765</td>
</tr>
<tr>
<td></td>
<td>(0.406)</td>
<td>(0.435)</td>
<td>(0.410)</td>
</tr>
<tr>
<td>Log Population</td>
<td>0.778</td>
<td>0.786</td>
<td>0.790</td>
</tr>
<tr>
<td></td>
<td>(0.146)</td>
<td>(0.139)</td>
<td>(0.123)</td>
</tr>
<tr>
<td>% Urban</td>
<td>−1.926</td>
<td>−1.977</td>
<td>−1.913</td>
</tr>
<tr>
<td></td>
<td>(1.025)</td>
<td>(1.028)</td>
<td>(1.021)</td>
</tr>
<tr>
<td>Intercept</td>
<td>−7.552</td>
<td>−7.880</td>
<td>−8.254</td>
</tr>
<tr>
<td></td>
<td>(5.110)</td>
<td>(5.397)</td>
<td>(4.894)</td>
</tr>
<tr>
<td>N</td>
<td>279</td>
<td>279</td>
<td>279</td>
</tr>
<tr>
<td>Province</td>
<td>31</td>
<td>31</td>
<td>31</td>
</tr>
</tbody>
</table>

Standard deviations in parentheses

Estimates in bold indicate that the MCMC p-value is 0.05 or lower.
Figure 4.1: Effect of retweeted weibo over time on food safety enforcement

weibo suggest that while censorship may be effective in limiting awareness about grievances more generally, this also has the effect of limiting the local government’s particular awareness about food safety grievances, limiting any possible response, which suggests support for Hypothesis 1b.

Turning to the substantive interpretation of the parameter estimates, we can see in Figure 4.1, that while the within effect of Log Retweeted Weibo Posts does have a substantive impact on food safety governance, this effect pales in comparison to the between effect of Food Taxes as Percentage of Government Revenue. To further probe the magnitude of this difference, I find that the predicted level of profits in the food industry falls by around 160,000 yuan (approximately 25,000 USD\(^{39}\)) if a province goes from the 10th percentile in terms of the number of food safety grievances to the 90th percentile.

\(^{39}\) All conversions were done using the 2012 RMB/USD nominal exchange rate of 6.3123 provided by the World Bank.
4.5.2 Testing local government responsiveness to media reports

Next I turn to assessing local government responsiveness to media reports about food safety. As theorized, media reports about food safety may either motivate local governments to better enforce food safety regulation because of either fear of citizen grievances from the bottom-up or fear of top-down admonishment from higher levels of government.

To test whether local governments may be motivated to improve food safety regulation because of fears that local media reports about food safety problems may have a galvanizing effect on the local populace, in Table 4.4, I assess the relationship between Log Articles about Province\(_j\) from Province\(_j\) on food safety regulation. While there is a negative relationship between the within effect of Log Articles about Province\(_j\) from Province\(_j\) on food safety regulation, it is not significant at the 5% level, only at the 10% level. Despite the relatively weak level of statistical significance, I find that there is a strong substantive relationship between Log Articles about Province\(_j\) from Province\(_j\) and food safety regulation. In particular, I find that going from the 10th to 90th percentile of locally reported food safety scares over time is associated with a 220,000 yuan (a little less than 35,000 USD) fall in food industry profits. Meanwhile, from the marginal effects plot in Figure 4.2, there is a clear negative relationship between local media coverage and food industry profits, suggesting support for Hypothesis 2a.

Meanwhile to assess the degree to which local governments may feel compelled to enforce food safety regulation because of top-down monitoring, I test the relationship between Log Articles about Province\(_j\) from Province\(_-j\) and Log National Articles about Province\(_j\) and food safety enforcement in Models 5 and 6 respectively. From Model 5, we can see that the between effect Log Articles about Province\(_j\) from Province\(_-j\) has a negative and statistically significant effect on profits in the food
industry. Meanwhile, in Model 6, though neither the between nor within effect of \( \text{Log National Articles about Province}_j \) is significant at the 5\% level, the between effect of \( \text{Log National Articles about Province}_j \) is significant at the 11\% level. Together, these results which provide evidence to suggest that local governments are also sensitive to food safety coverage from newspapers with a national audience, supporting Hypothesis 2b.

Indeed, regardless of the statistical significance of the parameter estimates, Figures 4.3, 4.4 provide strong evidence to suggest that these variables have a large substantive effect on food safety governance. Indeed, despite having a lower level of statistical significance, the substantive effect of \( \text{Log National Articles about Province}_j \ (\text{Between}) \) is even larger than that of \( \text{Log Articles about Province}_j \text{ from Province}_{-j} \ (\text{Between}) \), suggesting that local governments are particularly sensitive to food safety coverage from newspapers with newspapers that explicitly have national readership. Indeed, while the predicted level of food profits falls by more than 1 million yuan (around 158,000 USD) if a province goes from the 10th to 90th percentile in terms of general outside newspaper coverage of food safety problems across provinces, the predicted level of profits falls by 1.45 million yuan (around 230,000 USD) if a province goes from the 10th to 90th percentile in terms of food safety coverage by a newspaper with a national level audience.

Overall then, the model estimates across Models 4, 5, and 6 suggest that media coverage of food safety problems can have an important effect on local government enforcement of food safety regulation. The results further suggest that if the relationship between media coverage and food safety regulation is driven by fear of public fallout, the effect of more likely to be temporal (recall only the within effect of \( \text{Log Articles about Province}_j \text{ from Province}_{-j} \) is significant). Meanwhile if the relationship between media coverage and food safety regulation is driven by fear of top-down admonishment, the effect is more likely to be structural (recall only the
between effects of $\log \text{Articles about Province}_j$ from Province$_{-j}$ (Between) and $\log \text{National Articles about Province}_j$ are found to affect food industry profits). Finally, the size of the parameter estimates also suggest that local government officials are more sensitive to potential admonition from above than push back from below.

Meanwhile recall that when examining the effect of newspaper coverage on food safety governance, the dataset is limited to the 14 provinces for which there are newspapers available from the WiseSearch database, so the results are not strictly comparable to those found in Table 2. It is noteworthy however, that while citizen grievances are able to affect food safety governance within provinces, there appears to be no relationship between responsiveness to grievances over food safety across provinces (i.e. the between effect). This suggests that governments are only responsive to citizen grievances when they represent a break from the past behavior. Meanwhile, the relationship that we uncover between food safety governance and media coverage of food safety crises is more systematic in nature — provinces that generally get more press about food safety compared to other provinces are more likely to do something about it. These results suggest systematic change in food safety enforcement is more likely to come about through media coverage than through social media posts, especially media coverage that attracts national attention.
Table 4.4: Effect of media coverage on food safety enforcement by month

<table>
<thead>
<tr>
<th></th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bottom-up</td>
<td>Top-Down</td>
<td>Top-Down</td>
</tr>
<tr>
<td>Log Articles about Province(_j) from Province(_j) (Within)</td>
<td>-0.230 (0.139)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log Articles about Province(_j) from Province(_j) (Between)</td>
<td>0.061 (0.148)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log Articles about Province(_j) from Province(_j) (Within)</td>
<td></td>
<td>-0.084 (0.055)</td>
<td></td>
</tr>
<tr>
<td>Log Articles about Province(_j) from Province(_j) (Between)</td>
<td></td>
<td>-0.519 (0.253)</td>
<td></td>
</tr>
<tr>
<td>Log National Articles about Province(_j) (Within)</td>
<td></td>
<td>-0.080 (0.055)</td>
<td></td>
</tr>
<tr>
<td>Log National Articles about Province(_j) (Between)</td>
<td></td>
<td>-0.694 (0.437)</td>
<td></td>
</tr>
<tr>
<td>Food Taxes (% Total) (Within)</td>
<td>1.234 (1.886)</td>
<td>-0.110 (1.434)</td>
<td>-0.125 (1.415)</td>
</tr>
<tr>
<td>Food Taxes (% Total) (Between)</td>
<td>3.946 (7.046)</td>
<td>11.982 (6.187)</td>
<td>11.489 (6.897)</td>
</tr>
<tr>
<td>Food Sales Revenue Per Capita (Within)</td>
<td>1.754 (0.539)</td>
<td>1.483 (0.472)</td>
<td>1.462 (0.475)</td>
</tr>
<tr>
<td>Food Sales Revenue Per Capita (Between)</td>
<td>1.497 (0.742)</td>
<td>0.199 (0.736)</td>
<td>0.162 (0.897)</td>
</tr>
<tr>
<td>Log GDP per capita (Between)</td>
<td>0.521 (0.468)</td>
<td>1.619 (0.626)</td>
<td>1.751 (0.832)</td>
</tr>
<tr>
<td>Log Population (Between)</td>
<td>0.949 (0.290)</td>
<td>1.262 (0.233)</td>
<td>1.335 (0.308)</td>
</tr>
<tr>
<td>Urban (% Population) (Between)</td>
<td>-1.118 (1.817)</td>
<td>0.107 (1.297)</td>
<td>0.184 (1.478)</td>
</tr>
<tr>
<td>N</td>
<td>126</td>
<td>126</td>
<td>126</td>
</tr>
<tr>
<td>Province</td>
<td>14</td>
<td>14</td>
<td>14</td>
</tr>
</tbody>
</table>

Standard deviations in parentheses
Estimates in bold indicate that the MCMC p-value is 0.05 or lower.
4.5.3 Testing local government responsiveness to food industry tax revenues

Lastly, I also evaluate the degree to which local governments may be motivated by competing economic incentives when enforcing food safety regulation. That is, local governments are often tasked with implementing other other policy objectives. To the extent that local government officials rely on tax revenues from the food industry to implement these other objectives, the less likely they are to enforce regulations for those industries. A less charitable rationale may be that the more local government officials rely on tax revenues from the food industry to line their own pockets, the less likely the more likely they are to overlook food safety problems in the food industry.

In either case, if this hypothesis is true, we should expect an increase in Food Taxes as Percentage of Government Revenue to be associated with increased food industry profits. In Models 1, 2, and 3 in Table 4.3, we indeed find a positive and significant relationship between the between effect of Food Taxes as Percentage of Government Revenue and food industry profits. These results suggest that a 1% increase in Food Taxes as Percentage of Government Revenue over time is associated
with 10.5% (Model 2) increase in food industry profits. The substantive effect of this relationship is explored in Figure 4.5. In particular the predicted effect on profits increases by almost 840,000 (approximately 133,000 USD) yuan if a province goes from being in the 10th percentile to the 90th percentile in terms of reliance on taxes from the food industry as a source of a revenue.

Meanwhile in Models 5 and 6, there is a similar relationship estimated between the between effect of Food Taxes as Percentage of Government Revenue and food industry profits, though it is only significant at the 10% level. However, as in Models 1, 2 and 3, the substantive effect of still reigns large. The estimated difference (using the parameter estimates from Model 5) in going from the 10th to 90th percentile in terms of its between effect is estimated to be an even larger 2.3 million yuan (approximately 370,000 USD). The marginal effects plot for the relationship between Food Taxes as Percentage of Government Revenue and food safety profits given in Model 5 is shown in Figure 4.6. Meanwhile recall that because the models estimated in Table 4.4 are subset to only the 14 provinces for which there are newspapers about food safety. As such, the different substantive effect estimated for the relationship between Food Taxes as Percentage of Government Revenue and food industry profits, in Models 1, 2, and 3 on the one hand and Models 5 and 6 on the other hand may be due to this discrepancy.
Finally, it is worth questioning whether the positive and significant effect found between Food Industry Profits and Food Taxes as Percentage of Government Revenue more broadly is a result of an endogenous relationship between the two. It is perfectly conceivable for instance, that when profits in the food industry are high, they will contribute a greater share of total government revenue, explaining the positive effect that found between Food Taxes as Percentage of Government Revenue and food industry profits. To examine this possibility, I include the lag of the dependent variable in the model to control for the potential endogeneity between the two variables. If the only reason that food taxes collected by the government at time $t-1$ have a positive and significant relationship with food profits at time $t$ is because of higher food profits at time $t-1$, than including higher food profits at time $t-1$ should eliminate any relationship that we find between Food Taxes as Percentage of Government Revenue and Food Industry Profits.

Unfortunately the design matrix exhibits a high degree of multicollinearity when
I include the lagged dependent variable, $Food Industry Profits_{t-1}$, as a control for both the dataset with the weibo data\textsuperscript{40} and the dataset with the newspaper articles\textsuperscript{41} However, no such issues with multicollinearity are apparent when I drop both the weibo and newspaper variables from the dataset as this allows me to expand the dataset beyond the year 2012, to all available province-months, December 1999 to January 2013. Given that the relationship between $Food Taxes as Percentage of Government Revenue$ holds regardless of whether these variables are included, such an analysis should still be valid.

In Table 4.5, I present the results of estimating a model with a lagged DV when the data is measured at the province-month level (Model 6). Here we can see that the parameter estimate for $Food Taxes as Percentage of Government Revenue$ is still significant, albeit noticeably reduced in size. This suggests that while an aspect of the relationship between $Food Taxes as Percentage of Government Revenue$ and $Food Industry Profits$ is endogenous, $Food Taxes as Percentage of Government Revenue$ also has an independent effect on $Food Industry Profits$. Moreover, there is now evidence to suggest that this relationship exists both within provinces over time and across provinces as well, as evidenced by the positive and significant parameter estimates for both the within and between effects of $Food Taxes as Percentage of Government Revenue$.

In Figures 4.7 and 4.8 we can see that both the between and within effect of $Food Taxes as Percentage of Government Revenue$ have a substantive impact on food profits, though the between effect is larger. Compared to the previous models where the potential endogeneity between $Food Taxes as Percentage of Government Revenue$ and profits was not addressed, if anything the substantiveness of the relationship has increased. Instead of an increase of anywhere from 840,000 to 1.45 million yuan

\textsuperscript{40} The variance inflation factor of the between effect of the lagged DV was 19.6
\textsuperscript{41} The variance inflation factor of the between effect of the lagged DV was 23.4
Table 4.5: Effect of food taxes as a percentage of total revenue on food safety enforcement by month

<table>
<thead>
<tr>
<th></th>
<th>Model 7*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>21.598</td>
</tr>
<tr>
<td></td>
<td>(1.942)</td>
</tr>
<tr>
<td>Food Taxes (% Total) (Within)</td>
<td>0.140</td>
</tr>
<tr>
<td></td>
<td>(0.040)</td>
</tr>
<tr>
<td>Log Food Profits (Within)</td>
<td>0.365</td>
</tr>
<tr>
<td></td>
<td>(0.102)</td>
</tr>
<tr>
<td>Food Sales Revenue Per Capita (Within)</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
</tr>
<tr>
<td>Food Taxes (% Total) (Between)</td>
<td>0.442</td>
</tr>
<tr>
<td></td>
<td>(0.171)</td>
</tr>
<tr>
<td>Log Food Profits (Between)</td>
<td>-0.219</td>
</tr>
<tr>
<td></td>
<td>(0.109)</td>
</tr>
<tr>
<td>Food Sales Revenue Per Capita (Between)</td>
<td>0.050</td>
</tr>
<tr>
<td></td>
<td>(0.046)</td>
</tr>
<tr>
<td>Log GDP per capita</td>
<td>0.008</td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
</tr>
<tr>
<td>Log Population</td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
</tr>
<tr>
<td>Urban (% Population)</td>
<td>-0.002</td>
</tr>
<tr>
<td></td>
<td>(0.036)</td>
</tr>
<tr>
<td>N</td>
<td>279.000</td>
</tr>
<tr>
<td>Province</td>
<td>31.000</td>
</tr>
</tbody>
</table>

increase in profits predicted by previous model specifications, the predicted increase in profits for a province that goes from the 10th to 90th percentile of Food Taxes as Percentage of Government Revenue vis-a-vis other provinces (that is, the between effect) is an even greater 1.8 million yuan (approximately 285,000 USD). Meanwhile the substantive impact of increasing reliance on food taxes as a source of revenue over time (the within effect) is associated with a predicted increase of a more modest 325,000 yuan (approximately 51,000 USD). This is still substantively larger than the 160,000 shortfall predicted for a similar change in the number of grievances (Model
2), though smaller than the 1 million yuan shortfall predicted by increased monitoring by the central government (Model 5).

To give a brief overview, while I find substantive evidence of local government responsiveness to public grievances, such responsiveness is highly conditional in nature. In particular, evidence from my analyses suggest that the public’s ability to prod local government officials into better food safety enforcement is contingent on the degree to which they are able to back up their complaints with threats to collective action. Meanwhile, local news coverage of food safety problems may also motivate local government enforcement of food safety regulation, though the nature of the relationship appears to be temporal rather than structural in nature. Top-down monitoring of local officials vis-a-vis media coverage from outside provinces appears to be a stronger motivator, especially if the coverage attracts a national readership. However, overall, local government officials are still far more sensitive to potential
competing government incentives when making decisions about food safety enforcement, suggesting that while pushing or prodding from the bottom-up or top-down can have an effect on local government behavior, such an effect is limited.

4.6 Conclusion

Governments cannot reasonably be expected to monitor and inspect all businesses to validate that they are producing or selling food that is safe for public consumption — indeed the size of China’s food production and distribution market all but precludes this possibility. They should however, set the rules of the game and enforce them to signal the consequences of violations and the serious of their resolve to enforce them in order to maintain the health and safety of food consumers.

Many local government officials, unfortunately, have neglected this duty as they have often been more interested in fulfilling the demands of the revenue imperative as opposed to public health. To the extent that citizens are able to threaten domestic instability because of their displeasure with food safety outcomes or that media coverage is able to expose food safety violations, it may incentivize governments toward better enforcement of food safety regulation.

The reactive approach that a concerned public and media landscape provide to reducing food safety risk however can only be a complement, not a substitute for a functioning regulatory body — a fuel for reform but not sufficient to constitute the reform itself. For example, though the Fuyang government began to take action to address quality problems with baby milk formula in Anhui in 2004 following media coverage on the subject, such measures were “at best ineffectual and the number of babies suffering from serious malnourishment caused by the consumption of fake milk continued to rise” (Tam and Yang, 2005). And more broadly, though media coverage of food safety incidents highlights incidents of chemical contamination, according to the Chinese Ministry of Health, the main threat to food safety is actually micro-

As such, though authoritarian responsiveness can perhaps help stave off regime instability, it leaves much to be desired with regards to effective food safety regulation. Ultimately, however, though purely relying on citizen grievances or media coverage has obvious shortcomings with regards to effective food safety regulation, it is still important to take these factors into account in order to understand the politics of food safety regulation in China.
Perceptions and Food Safety Regulation in China

5.1 Introduction

With 582 million incidences of foodborne disease and 351,000 associated deaths in 2010,\(^1\) the consumption of unsafe food poses significant risks to both global health and economic growth. Unfortunately given current trends, these risks are only likely to grow over time. For one, though technological innovation has made the realization of a Malthusian catastrophe increasingly improbable, the resulting bounty has been and will likely continue to be predicated on agricultural and industrial inputs which have proven harmful to human health. Moreover, as rising incomes and increased urbanization shifts food consumption toward meat, dairy, fresh produce and processed goods, the risk of foodborne disease and chemical contamination is also correspondingly augmented. Finally, as the volume of international agricultural trade expands, tracing and sourcing primary and processed foods becomes an ever greater challenge, putting an increasing strain on quality assurance.

In the face of these risks, food regulatory bodies can play an important role in

safeguarding public health. Indeed, that regulatory bodies are necessary at all for ensuring food safety is a function of the very invisibility of food safety problems — consumers are unable to rely on heuristics like sight, taste and smell to detect biological and chemical contaminants, nor do they possess the knowledge or resources to conduct the testing necessary to doing so. To push this logic further however, consumers are also no more capable of validating the evaluations that regulatory bodies make on their behalf. As such, consumer *perceptions* of the role that food safety regulations play in safeguarding public health may be just as important as their *actual* ability to do so with regards to the efficacy of such regulations.²

Perceptions about food safety regulation may shape the subsequent efficacy of such regulations in a number of ways. In a narrow sense, the extent to which a consumer is willing to purchase a product regulated by a particular regulatory body may be conditional on the extent to which citizens believe either that the responsible regulatory body has the public interest at heart or the ability to adequately enforce regulation. Moreover, perceptions of the regulatory agency may also influence broader perceptions of food safety in general. A straightforward implication is that people who are confident in the ability of regulators to faithfully execute regulatory policy may perceive their overall food safety levels to have risen after purchasing the regulated product. However, interestingly, it may also conversely lead those who cannot afford to pay a premium for the ‘safer’ product to be less certain about the safety of the food they are able to purchase. The overall effect of the introduction of such regulation may be a sharper bifurcation of people who do and who do not have confidence in their food safety.

I provide evidence for these arguments in the context of food safety certification systems in China. In so doing, I seek to answer the following questions: To what

² Note previous literature has also noted the importance of perceptions and risk communication to shaping regulations (Frewer et al., 1996; Kuran and Sunstein, 1999; Grunert, 2005)
extent do consumers make evaluations about food safety regulation based on the degree to which they trust the regulatory institution in question? And to what extent does the accessibility of ‘safe food’ affect subsequent consumer perceptions of their individual food safety level?

In what follows I give a brief overview of the food safety situation in China. I then further flesh out the main arguments of the paper. Next I outline the survey design for the survey questionnaire I developed for probing these arguments and present some preliminary results from the sample of internet respondents. To preview, I find that public trust in regulatory institutions has a positive and substantive effect on the efficacy of food safety regulation. Meanwhile, I also find evidence to suggest that trust in food safety regulatory bodies also plays an important role in influencing one’s perceptions of food safety. However, I only find limited evidence to support the hypothesis that for those who do not choose to purchase certified foods, greater trust in a regulatory agency leads to lower evaluations of one’s personal food safety.

5.2 Food Safety in China

Food safety scandals have been a touchstone of Chinese politics since the early 2000’s. Such scandals have been brought on by a range of processes, from unsanitary production processes to harmful chemical additives and even the explicit production of fake food. The 2008 baby milk powder scandal is perhaps the most well-known case to date, with as many as 300,000 babies suffering ill health effects from unknowingly consuming melamine laced in their milk. Food safety problems in China have continued unabated with more recent scandals including the so-called “gutter oil” phenomenon wherein discarded oil is reused using rudimentary processing tech-
niques, the selling of expired meat and the proliferation of fake alcohol, among other unsavory practices.

The Chinese central government has undertaken extensive measures to address such compromises to food safety. For one, it ratified its first major piece of domestic legislation, the Food Safety Law (FSL), to deal specifically with food safety in 2009, followed by an update in 2015. This legislative change has also been accompanied by bureaucratic reshuffling of China’s food safety regulatory structure. Since the early 2000’s, the central government has also continuously experimented with different ways of distributing responsibility among the different ministries before finally consolidating responsibility in the newly created Chinese Food and Drug Administration (CFDA) in 2013.

But ultimately, the central government seeks not only to redress the food safety problem themselves, but to also address the underlying societal grievances that such problems engender. As such, they have not only initiated regulatory reform, but have publicized such efforts in a bid to enhance the positive perception of food safety. The importance of doing so is underscored by the public statements of China’s leaders. For example, former President Hu Jintao and Premier Wen Jiabao publicly pledged to improve food safety and product quality and in the wake of the pet food

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6 Previous legislation dealt solely with the issue of food hygiene.


contamination crisis. Current President Xi Jinping has gone so far as declaring, ‘Whether we can provide a satisfying solution on food safety to the people is an important test on our capacity of governance.’\(^9\) Indeed, at stake is not only the public health, but public trust.

Existing survey research suggests that despite these legislative and regulatory changes, the Chinese government faces an uphill battle in regaining public trust. In a survey done of 978 Beijing residents in 2007 for example, Zhang and Zhao (2007) find that 40.5% of citizens believe that food safety problems are difficult to resolve because of ineffective governmental management, 10.9% believe that it is because current standards and rules are not rigorous enough and 48.6% believe that these two problems combined make food safety problems difficult to resolve. Meanwhile, in a cross section of Weibo\(^{10}\) posts collected on 9 February 2010, Yang (2013) finds that most netizens blamed government agencies and officials for tainted milk scandals. This corresponds to original interviews that I conducted in China in 2015, where both the government and corporate greed were named as culprits in propagating the food safety crisis in China more generally.

5.3 Trust in government regulation

What, however, is meant by the term ‘trust’? While there is no universal definition of this nebulous term, a minimal characterization emphasizes that it is both relational and conditional in nature in that it ‘involves an individual making herself vulnerable to another individual group or institution that has the capacity to do her harm or to betray yet’ and is ‘given to specific individuals or institutions over specific


\(^{10}\) Weibo is China’s version of Twitter. Please see chapter 2 for more details.
domains’ (Levi and Stoker, 2000). Extrapolating to the context of food safety then, an individual makes herself vulnerable to institutions when she purchases products regulated by them without having the ability to verify whether that institution actually executed the regulatory safeguards that they purported to. Trust can thus theoretically play an important component of regulatory efficacy in that even if a regulator faithfully certifies a food product, its relevance toward safeguarding food safety is moot if people do not trust the regulatory enough to purchase said product, what is referred to in this paper as regulatory buy-in.

Meanwhile Mayer et al. (1995) further unpacks trust into three dimensions: benevolence, ability and integrity. Building on this work, in this paper I specifically assess the degree to which the first two dimensions of trust, benevolence and ability affect regulatory buy-in. Benevolence refers to the degree to which ‘a trustee is believed to want to do good to the trustor [sic], aside from an egocentric profit motive.’ Correspondingly, I hypothesize that the extent to which a consumer buys into a regulation may depend on the extent to which she believes the regulator is acting in the best interest of the consumer. Ability meanwhile, refers to whether the trustee has domain-specific ‘skills, competencies and characteristics that enable a party to have influence.’ As such, I further hypothesize that regulatory buy-in is more likely when consumers have greater confidence in the regulator’s technical and administrative expertise to do so.

Though much work acknowledges that public trust in institutions that regulate food safety in China may affect subsequent consumer behavior, and by extension regulatory buy-in, few studies have systematically explored the nature of this relationship. Many do, however, hint at its importance. For example, Giovannucci (2005) points out that at a time when public trust in regulatory institutions has yet to be established, urban consumers are increasingly seeking alternatives which allow them to establish direct relationships with farmers. These efforts include community
supported agriculture, urban gardening farm-community linkages and collective purchasing. Indeed, in their study of a single Beijing Community Supported Agriculture (CSA), Shi et al. (2011) find that 41% of survey respondents (who were members of the CSA) indicated that they wanted “wanted to know where the food they ate was grown and by whom and the same percentage indicated that they trusted the cultivation practices of CSA farm personnel.” Yang (2013) tackles the issue of perceptions more directly in his study on how food safety is contested in the Chinese media by the government and corporations on the one side and citizens on the other. However, the motivation of his paper is to identify the different forms that citizen dissent can take and what conditions are more likely to lead to them vis-a-vis the governmental and corporate narrative as opposed to how food safety regulation itself can influence citizen perceptions of their food safety environment.

Meanwhile, the larger literature on the relationship between trust and regulation also suggests that further investigation of this relationship with regards to China may be fruitful. As Bratspies (2009) argues, when regulators make high-stakes regulatory choices in the face of uncertainty, trust can play an important role in legitimizing their actions. For example, while the French public has expressed as much concern over nuclear energy as the American public has (Slovic et al., 2000), they have also expressed greater trust in scientists, industry and government officials to design, build, operate and regulate nuclear power plants safely. These differing levels of trust have led France to rely on nuclear power for more than 75% of its energy\textsuperscript{11} while in the United States, only 20% of total energy is from nuclear power.\textsuperscript{12} The lack of such trust can also have significant societal repercussions. For example, in the United States while the majority of researchers believe that childhood immunization

\begin{footnotesize}
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\end{enumerate}
\end{footnotesize}
is crucial to preserving public health, 40 percent of American parents have either refused or delayed a recommended vaccine for one of their children. Such actions are often predicated on a lack of trust in the corporate and scientific establishment. Trust can thus have large consequences for regulatory buy-in.

Based on the discussion above then, I seek to evaluate the following hypotheses:

_**Hypothesis 1a:** The more a citizen perceives a food regulatory institution to be acting in the public interest, the more likely she is to purchase food regulated by it._

_**Hypothesis 1b:** The more a citizen perceives a food regulatory institution to be capable of regulating food safety, the more likely she is to purchase food regulated by it._

5.4 Perceptions of government regulation and access

While consumer trust may influence the efficacy food safety regulation, food safety regulation itself may conversely also influence the consumer perceptions of their food safety environment. That is, it stands to reason that if, following the logic of the previous section, people are willing to pay a premium for food safety attributes because they trust the responsible regulatory body, then they are also more likely to evaluate their individual food safety as being safer after paying such a premium.

More interestingly however, is the way in which food safety regulation can affect the perceptions of a consumer’s food safety environment for those who are unwilling to pay. On the one hand, one might expect that the existence of food safety regulation to have a neutral effect on those who do not pay a premium for it. On a purely practical level, since such consumers do not actively consume food protected with the food safety attribute, the existence of such a regulation is irrelevant to their

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food safety. On a perceptual level, if the reason that they do not choose to pay a premium for such a food safety attribute is because they have low levels of trust in the responsible regulatory body, then they would also not have reason to believe that their food is any more or less safe than before for having not purchased it. However, a third possibility is that consumers do trust that the responsible regulatory body has faithfully implemented the regulation but they cannot afford to pay the premium for such food. As such, the inability to afford a premium for safer food may cause the consumer to evaluate the safety of the food she is able to afford as being lower even though objectively, no change has taken place. Again, in exploring these hypotheses I further unpack trust into two components: ability and benevolence. This discussion leads to the next set of hypotheses:

**Hypothesis 2a:** The more a citizen perceives a food regulatory institution to be acting in the public interest, the more likely she is to judge her food to be safe.

**Hypothesis 2b:** The more a citizen perceives a food regulatory institution to capable of regulating food safety, the more likely she is her food to be safe.

5.5 Survey Design

5.5.1 Overview

In this paper, I seek to probe the relationship between trust and food safety regulation by conducting a survey of Chinese consumers in which I first ask survey respondents about their trust in the following institutions: the central government, provincial government, private company, non governmental organization, both in terms of the perceived degree to which these institutions are acting in the public interest (Q4-Q7) and the degree to which they have confidence in these institutions to implement food safety regulations (Q8-Q11). These four institutions were selected because a
priori, there is ample reason to suspect that citizens may have different levels of trust in the above four institutions — as shown in the previous section, citizens have often attributed responsibility for food safety problems to government neglect and corporate malfeasance. It is thus reasonable to expect that trust in these institutions in regulating food safety is low, particularly relative to third party institutions.

Next, followed by a brief description of what food certification is, I randomly ask half of the respondents whether they are willing to pay (WTP) more for food certified by these various institutions. The other half are asked whether they would be willing to accept (WTA) uncertified pork given the availability of certified pork for a higher price, where the price, or bid, is randomly selected beforehand (Q12, Q14, Q16, Q18). This set of questions is designed to investigate the degree to which trust influences a respondent’s propensity to purchase certified pork.

Finally, I further ask respondents to evaluate how their how their perceived level of food safety might change depending on whether they are willing to pay (unwilling to accept) or unwilling to pay (willing to accept) certified pork. This set of questions was included to investigate whether the purchase or lack of a purchase of certified pork influences respondents’ perceptions of their subsequent food safety (Q13, Q15, Q17, Q19). Socio-demographic questions, including age, gender, hukou status, education, number of children, household size, and household income were also included to serve as controls (Q21-Q33). Please see the Appendix for the survey questionnaire.

In what follows, I first review the rationale for grounding my empirical analysis on food safety about pork in particular, followed by a discussion of why I further chose to concentrate on food certification over other possible food safety attributes. Next I discuss the reasons for why I include both WTP and WTA questions in my survey questionnaire. I then explain the reasoning behind why the decision to use the contingent valuation method to elicit WTP and WTA in the survey. Finally, I detail the corresponding WTP/WTA bid design, that is the randomly selected prices
used under the contingent valuation method.

5.5.2 Food safety and pork

The choice of asking about certified pork over other food products was made because of its prominence in Chinese food production, food consumption and food safety. In terms of food production, China is the world’s largest pork producer, producing nearly 50% of the world’s total. Meanwhile its per capita consumption of 35.6 kg of pork in 2011 was not only double the world’s average, it also constituted 60% of China’s total meat consumption.\(^{14}\) Such increases in production have not been accomplished free of food safety scandals however — in 2011 farmers in Henan were found to have been adding clenbuterol (which is harmful to human health but helps promote the growth of lean meat) to pig feed.\(^{15}\) In 2013, 16,000 diseased pigs were found floating in a river near Shanghai\(^{16}\) while in 2015, 110 were charged with selling pork from diseased pigs.\(^{17}\) The importance of pork consumption in the Chinese diet thus means that a large number of people living both inside and outside of China could be affected by a potential pork scare. It is no surprise then, that pork has been a centerpiece of much of the existing WTP research on food safety attributes in China (Wang et al., 2008; Yin et al., 2010; Ortega et al., 2011b,a; Wu et al., 2011; Zhang et al., 2012a; Zheng et al., 2012).

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5.5.3 Food safety and food certification

I chose to root my investigation on WTP for food certification in particular over other possible food safety attributes because previous studies have found that consumers are more willing to pay for certification over other food safety measures, including food traceability and food labeling. As such, it represents the most relevant food safety attribute in China today and makes understanding why consumers are willing or are not willing to pay for it substantively important. Meanwhile, moving from a regime in which food safety violators are caught after the fact to one in which there are few incentives to commit food safety violations in the first place, which a certification system encourages, marks an important step in building an effective food safety regulatory regime.

Overall, however, existing research on food safety regulation has largely consisted of cut and dried studies which are framed as objective investigations into the efficacy of regulatory policies. The majority of such studies consist of WTP studies of various food safety attributes across different product groups and geographical areas and have shown that some consumers are willing to pay a premium for food safety attributes (Wang et al., 2008; Yin et al., 2010; Ortega et al., 2011b,a; Wu et al., 2011; Zhang et al., 2012a; Zheng et al., 2012). The extent to which willingness to pay is predicated on trust in a regulatory institution, that is, further investigation into which factors might affect regulatory buy-in, is not fully explored in these papers. Moreover the implications for how willingness (or unwillingness) to pay may shape a consumer’s subsequent evaluation of her food safety is similarly neglected.

Nevertheless a few studies do provide some indirect evidence for a relationship between trust and regulatory efficacy. For example, Wu et al. (2011) conduct a principal components analysis of 8 potential reasons that consumers declined to pay
a premium for traceable food, and identified three factors that may explain why consumers do not purchase traceable food: unfamiliarity with certified traceable (CT) food and doubts regarding its function (34 %), dislike for the information presentation style and preference for simpler and more direct quality assurance labels (21 %), concern about the higher price (19 %). The grouping they identified as ‘unfamiliarity with CT food and doubts regarding its function’ was derived from the factor loadings from the following statements:

- Corporations may not follow the FTS [food traceability system strictly and provide qualified food]
- I am not familiar with CT food
- Traceability does not imply higher quality of food
- Traceability cannot increase consumers food-safety perceptions

Clearly, the issue of trust is relevant to all of these statements, though, since none of these statements speak specifically to the issue of trust, it is neither clear

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18 The following 8 statements were rated by consumers on a five-point scale, where 1 = totally disagree and 5 = totally agree:

1. Traceability does not imply higher quality of food.
2. Traceability cannot increase consumers’ food-safety perceptions.
3. It is troublesome to check the traceability information through machine, telephone or internet.
4. Direct indications of quality like a quality assurance label are better for me. I am not familiar with CT food.
5. The price of CT food is unaffordable for me.
6. I am afraid information on the traceability labels can not be fully understood.
7. Corporations may not follow the Food Traceability System strictly and provide qualified food.

19 These three factors explained 74% of the variance for why consumers were unwilling to purchase traceable food.
the degree to which it is important nor which dimensions of trust in particular is more salient. Similarly, Yin et al. (2010) find that expense, lack of knowledge and ‘distrust of organic food’ are also reasons why consumers are unwilling to pay for organic foods. However, the meaning of ‘distrust of organic food’ is rather vague — with this wording it is unclear whether respondents are distrustful in the scientific rationale for organic food, or distrustful of the regulatory institution vouching for it.

Another benefit of rooting my empirical analysis in food certification is that I am also able to probe existing WTP studies for potential confounding factors that may explain consumer behavior toward food safety regulation. For example, working against the hypothesis that trust is an important component to regulatory success is the work done by Ortega et al. (2011b,a), who find that consumers preferred government certification over independent, third-party certification. These results are surprising as we would expect that consumers refrain from purchasing government certified milk if they have low trust in government regulation, as other survey work has suggested (Zhang and Zhao, 2007).

Since Ortega et al. (2011b,a) do not specifically ask their respondents to evaluate their trust in government versus their trust in independent, third-party certification however, its implications for the case for a relationship between trust and regulatory efficacy is inconclusive. Indeed there are a number of alternative interpretations that may explain why consumers in the Ortega et al. (2011b,a) surveys preferred government certification over private certification. For one, the survey did not differentiate the various levels of Chinese government. As the central government is seen as relatively blameless in the proliferation of food safety problems and the phrase ‘government certification’ did not distinguish between central or local government certification, it is plausible that while consumers may trust the central government to oversee the regulation of their food, they would not trust the local government to do so. For another, consumers may perceive government certification as being
preferable to private certification not because they trust the government more per se, but because they believe that government non-responsiveness is a major reason for food safety problems in the first place — in other words consumers may believe that food safety problems arise because governments have previously done nothing to regulate them. Any governmental action then would be seen as a signal that the government is actually taking steps to address the food safety problem and would be preferred by the consumer accordingly. Finally, it is also possible that different dimensions of trust may be more important than others — while relative to the government, people may have greater confidence in independent third parties to act in the interest of the public, they may not confident that the third party players have the ability to actually implement any such food safety regulations. To the extent possible the survey questionnaire will attempt to account for these possibilities in its design.

5.5.4 WTP vs. WTA

The counterpart to ‘willingness to pay’ (WTP) questions are ‘willingness to accept’ (WTA) questions. Whereas WTP questions ask respondents whether they are willing to pay a premium to avoid an undesirable outcome, WTA questions ask respondents the minimum amount they are willing to accept to put up with an undesirable outcome. In theory then, a consumer’s WTP and WTA should be equivalent. In reality, scholars have found that WTP and WTA prices can be substantially different, with WTA prices often being much higher than WTP prices.

In their review of the literature, Horowitz and McConnell (2002) find that the WTP/WTA gap is likely due to other confounding issues – including unsound experimental features and the nature of the good, in particular whether close substitutes exist or not. Indeed, where markets are incomplete or goods are not easily substitutable, Hanemann (1991) argues that WTA compensation for undesirable goods
should be larger than WTP for desirable goods. Shogren et al. (1994) provides evidence for Hanemann (1991) arguments by analyzing consumers WTP and WTA perfectly substitutable goods like candy bars and coffee mugs compared to their WTP and WTA goods for which there are imperfect substitutes, such as goods that have a high risk for transmitting foodborne illnesses. As this paper is itself concerned with a good that has no close substitute — certified pork — I have designed the survey such that one half of sample respondents is asked WTP questions and the other half is asked WTA questions to investigate whether there is indeed a difference in how trust relates to regulatory buy-in across WTP and WTA questions.

5.5.5 Contingent valuation method

Following Zhang et al. (2012a) I use a single-bounded dichotomous choice contingent valuation method (CVM) to operationalize WTP/WTA questions. Single-bounded CVM has the benefit of being simple to implement. With this method, the respondent is only required to answer a yes or no when she is willing to pay a given amount for a good. The amount is randomly assigned across different respondents.

The tradeoff of this approach is that single-bounded CVM is less efficient than other WTP methods. For example, the double-bounded procedure is known to be more efficient than the single-bounded procedure (Hanemann et al., 1991). In the double-bounded procedure, participants respond to a first dollar amount as in the single-bounded procedure and then are additionally asked a question involving a second dollar amount, higher or lower depending on the response to the first question. However, the advantage becomes negligible for medium sample sizes, generally sample sizes larger than 250 (Calia and Strazzera, 2000). With 1000 respondents, the size of this survey sample will cross over this threshold comfortably.

Directly eliciting WTP from respondents (which single-bounded CVM is a specific
method of) more generally is not without its own potential methodological problems however, which Breidert et al. (2006) summarize as follows:

1. ‘By directly asking the customers for a price, there is an unnatural focus on price which can displace the importance of a product’s other attributes;

2. Customers do not necessarily have an incentive to reveal their true WTP and may overstate or understate their true WTP because of prestige effects;

3. Even if customers reveal their true valuations, this does not necessarily translate into real purchasing behavior; and

4. Directly asking for WTPs for complex or unfamiliar goods is cognitively challenging and may lead to overstating or understating.’

For this particular survey, such concerns are likely to be muted. With regards to the first issue, since this survey asks about WTP for a safety attribute of the product, the potential bias from asking directly about price is likely subdued. Moreover, with regards to the second issue, unlike most willingness to pay studies, this study is agnostic about the absolute value of willingness to pay, as it is focused primarily on measuring relative valuation. As such, whether customers give biased estimates of their WTP is relatively unproblematic if biases are constant across different product groups. A priori, there is little reason to suspect that such biases would be systematically different for different food safety certifiers. With regards to the third issue, whether valuations translate into real purchasing is to some extent tangential as the primary focus of this paper is to understand how regulatory trust affects regulatory buy-in and consumers’ perceptions of their food safety environment and is only secondarily interested in understanding how these perceptions may translate into actual purchasing behavior. More directly problematic is the fourth issue, that is the potential cognitive challenge in asking for WTP for complex or unfamiliar goods,
which food certification may be for many consumers. However, even if consumers are unfamiliar with food certification systems, i) there is no reason to think a priori that this is systematically related to levels of trust in food safety regulators\textsuperscript{20} and ii) this should stay constant whether they are being asked about government, business or third party food certification systems.

5.5.6 Bid design

The WTP bids in this survey were constructed with an emphasis on ensuring both the efficiency and validity of any subsequently estimated relationship between trust and WTP or WTA. By the efficiency of the WTP analysis I am referring to the process of calibrating the optimal bid distribution to estimate the consumers WTP or WTA. To draw an extreme example, imagine that the bid design was such that all respondents were presented with option of buying certified pork at 50 yuan a half kilo and were told that regular uncertified pork is available at 15 yuan a half kilo. In this case, it is is likely that almost all respondents will decline to purchase the certified pork because it is too expensive for them to afford. Any analysis of the subsequent relationship between respondent trust of certifying institutions or any other measure and WTP for certified pork would thus have very little power unless the sample size was substantially expanded. In other words, the efficiency of the WTP analysis would be greatly reduced under such a scenario. Prior to the main telephone survey then, I conducted a pilot internet survey with the express purpose of calibrating accurate WTP bids.\textsuperscript{21}

The pilot survey is nearly identical to the telephone survey except with regards to the WTP bids. For one, the range of WTP bids in the internet pilot survey is

\textsuperscript{20} That is, a priori it is plausible to think that greater knowledge about food certification systems may be correlated with either greater or less trust in regulators.

\textsuperscript{21} Though ideally I would also use a telephone survey to conduct the the pilot survey, due to budget constraints, only an internet survey was realistically feasible.
by design much larger than that of the main telephone survey. This of course begs
the question of how to choose the range for the internet survey. As Hanemann and
Kanninen (1999) note:

‘This is the basic paradox of optimal experimental design in non-linear models.
The optimal design depends on the true parameter valuers. Therefore, one must
know these in order to engineer the best design for collecting data. But there would
be no point collecting these if one already knew the true parameter value.”

Following the advice of Hanemann and Kanninen (1999), rather than resort to
infinite regress (wherein a pre-pilot survey must be launched to calibrate the WTP
bids for the internet pilot survey and so on and so forth), I rely on prior information to
design the WTP bids. Specifically, I take the price ranges from previous WTP studies
for food safety attributes in China as my guide. Studies that focused specifically on
WTP for food safety attributes for pork in China were given the greatest weight
though I also looked at WTP studies for food safety attributes for other foods in
China.

After reviewing the literature and running a pilot internet survey to assess the
most appropriate bid design, I construct the following bid design for for the telephone
survey: 16, 17, 18, 19, 20, and 22 yuan. See Appendix C.1 for more details.

5.6 Survey Logistical Overview

In order to evaluate the degree to which perceptions affect the efficacy of food safety
regulation, I conducted an internet survey of 1007 respondents and a telephone sur-
vey of 1000 residents. The survey questionnaire for the internet sample is almost
identical to the survey questionnaire for the telephone sample in content, but as
discussed above, the internet survey included additional questions to suss out the
optimal bid design for the telephone survey, as will be discussed further. Prior to
implementing these surveys, I convened a focus group of 5 Duke graduate students
with backgrounds in either survey design or Chinese politics to ascertain how to adjust the survey to better fit the Chinese context. Their comments and suggestions were incorporated into the final survey design.

5.6.1 Internet survey

The internet pilot survey was conducted through the Chinese crowd-sourcing site zhubajie.com from June 28, 2016 to November 15, 2016. zhubajie.com is a relatively new Chinese crowdsourcing website similar to Amazon MTurk (Berinsky et al., 2011; Goodman et al., 2012). The popularity of such websites has taken off in China in recent years, with 9 million users signing up for zhubajie in particular since its launch in 2005 (Yang et al., 2008). Its use in academic research outside the US is relatively new, with Huang (2015) being among the first to do so.\(^{22}\)

The survey was implemented as follows: 1) A description of the project and a link of the survey is posted on zhubajie.com 2) The participant clicks on a link to a survey hosted by Qualtrics, a commonly used survey software. 3) At the end of the survey, the respondent receives a randomly generated code that shows that she has completed the survey. The participant then returns to zhubajie.com and posts the Qualtrics code to zhubajie.com. After a spot check of the survey responses for completeness, I then award each participant 1 USD. Note that I also make use of the option to seal the usernames of respondents and to hide the survey from search engines to keep the survey as confidential as possible.

zhubajie.com also shows how many people viewed a job posting. Ultimately 8366 people viewed the posting, of which there were 1007 valid responses, for a

\(^{22}\) Note another popular survey site in China is 问卷星 (Sojump), which for a fee, allows users to recruit sample populations that are balanced on a number of attributes, including gender, age and location. However, it also forces users to use Sojump’s customized survey tool, which was not flexible enough to accommodate the survey design used in this paper. http://www.sojump.com/html/promote/intro.aspx
response rate of 11.7%.

5.6.2 Telephone survey

The telephone survey was administered by the Research Center for Contemporary China (RCCC) at Peking University from August 25, 2016 to October 27, 2016. Respondents were selected by first generating random cell phone numbers for residents living and and then validating to see if they are in use. A total of 12,772 people were sampled, for a response rate of 12.77%. β

1000 respondents equally sampled from 5 city pairs (10 cities in total) that were chosen to balance regional and political differences: Beijing and Shanghai (municipalities controlled directly by the central government), Harbin and Changchun (municipalities in Northeast China), Hohhot and Taiyuan (municipalities in Northern China), Kunming and Chengdu (municipalities in Southwest China), Wuxi and Changsha (municipalities in China’s Southeast). The sample was further balanced on gender and age. 8 enumerators from the RCCC institute were tasked with implementing the survey. Each enumerator received 3 hours of training with regards to the project background, basic interviewing skills, and the technical skills needed to record survey responses. The audio for each survey response was recorded and reviewed by the survey coordinator to ensure quality and fidelity.

5.7 Data

5.7.1 Telephone Survey

In the interest of brevity, I limit myself to giving a brief overview of the telephone survey data. Similar summary statistics for the internet survey can be found in Appendix C.2 and model results for the internet survey are available upon request. Before presenting the descriptive statistics the questions in the survey however, note that there was some item non-response for some of these questions the telephone
sample.\(^{23}\) As evident in Figure 5.2, respondents were especially reluctant to reveal their household income. To deal with this missing data problem, I multiply impute 5 datasets using the copula method introduced by Hoff (2007) and shown by Hollenbach et al. (2013b) to work as well and indeed under certain conditions, more efficiently than other existing multiple imputation strategies (i.e. E-M maximization and chained equations). The trace plots of the subsequent imputations (available upon request) and the similarity of distribution of the imputed variables to the unimputed variables (see tables below) provide evidence of the validity of this imputation method for this dataset.

Turning now to the descriptive statistics for WTP and WTA for certified pork, Figure 5.1 shows the average percent of people willing to pay for certified pork or unwilling to accept regular pork over all bid prices for each institution with 95% confidence intervals.\(^{24}\) One can clearly see that respondent’s baseline willingness to pay for certified pork also differs by institution. However, respondents appear not to distinguish between the central government and the provincial government in their WTP or WTA. Overall, respondents were more much more willing to pay pork certified by the central and provincial government, followed by NGO certified pork and private certification. This in fact contradicts my a priori expectation that consumers would have lower trust in the central government to regulate food safety compared to third-party regulators because of previous research which suggests that Chinese consumers attribute food safety problems at least in part to ineffective government regulations (Zhang and Zhao, 2007). These results suggests that further research is necessary to probe at the relationship between blame and trust with regards to food safety in China.

\(^{23}\) There was no item-non response for the dependent variables.

\(^{24}\) Note that there was no item-non response for the WTP/WTA questions. As such, there was no missing data to impute for these variables.
Meanwhile, Figure 5.1 also shows a clear separation between WTP and WTA, with respondents much more willing to pay for certified pork than unwilling to accept regular pork. This difference is statistically significant for all institution types at the 95% level. Such a result echoes the existing literature on WTP and WTA.

For the rest of the control variables, the mean and standard deviation for both the unimputed and imputed data for Likert and continuous scale variables are shown in Table 5.1 and the categorical variables are shown in Table 5.2. From Table 5.1 we can see that respondents are on average 37 and a half years old, mirroring the average age of 37.1 years for China as a whole.\(^{25}\) The standard deviation is relatively large at 12.5 years suggesting a large range of ages in the sample. Meanwhile, the majority, or 57.7% of the sample holds an urban hukou, also mirroring the national


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average of 56%. The average number of children is 0.465 which indicates that most respondents do not have a child, which given the legacy of China’s one-child policy is perhaps not particularly surprising. Furthermore, the average household size of the respondents is 3.54 persons, a bit more than the 2013 (the latest available year) national average household size of 3. The average household income per month is around 30,000 RMB or around 4,500 USD. This is equivalent to around 15,000 USD per capita, which is consistent with the approximate China’s GDP per capita of around 15,500 USD for the cities represented in the sample. For reference, this

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28 Note, this conversion is based on RMB to USD exchange rate reported for September 26, 2016 the midway point in time for the telephone survey execution.

29 Note this number was derived by finding the average GDP per capita of the
is a little less than double China’s national GDP per capita for 2015 of 8,000 USD (in 2015 dollars).

Table 5.1: Summary statistics for unimputed and imputed telephone survey

<table>
<thead>
<tr>
<th></th>
<th>Unimputed Data</th>
<th>Imputed Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>(Q01) Interest in Food Safety Level</td>
<td>2.98</td>
<td>1.32</td>
</tr>
<tr>
<td>(Q02) Worry About Food Safety Level</td>
<td>3.29</td>
<td>1.35</td>
</tr>
<tr>
<td>(Q04) Perceived Benevolence Level in Central Govt</td>
<td>3.08</td>
<td>0.775</td>
</tr>
<tr>
<td>(Q05) Perceived Benevolence Level in Provincial Govt</td>
<td>2.87</td>
<td>0.81</td>
</tr>
<tr>
<td>(Q06) Perceived Benevolence Level in Private Industry</td>
<td>2.16</td>
<td>0.856</td>
</tr>
<tr>
<td>(Q07) Perceived Benevolence Level in NGO</td>
<td>2.52</td>
<td>0.844</td>
</tr>
<tr>
<td>(Q08) Perceived Ability Level of Central Govt</td>
<td>2.96</td>
<td>0.833</td>
</tr>
<tr>
<td>(Q09) Perceived Ability Level of Prov Govt</td>
<td>2.74</td>
<td>0.817</td>
</tr>
<tr>
<td>(Q10) Perceived Ability Level in Private Industry</td>
<td>2.08</td>
<td>0.806</td>
</tr>
<tr>
<td>(Q11) Perceived Ability Level in NGO</td>
<td>2.33</td>
<td>0.815</td>
</tr>
<tr>
<td>(Q12) WTP/WTA Central Govt</td>
<td>0.756</td>
<td>0.43</td>
</tr>
<tr>
<td>(Q13) Safety Level — Central Govt Pork</td>
<td>3.88</td>
<td>0.743</td>
</tr>
<tr>
<td>(Q14) WTP/WTA Provincial Govt</td>
<td>0.708</td>
<td>0.455</td>
</tr>
<tr>
<td>(Q15) Safety Level — Prov Govt Pork</td>
<td>3.76</td>
<td>0.728</td>
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<tr>
<td>(Q16) WTP/WTA Private Industry</td>
<td>0.429</td>
<td>0.495</td>
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<tr>
<td>(Q17) Safety Level — Private Industry Pork</td>
<td>3.37</td>
<td>0.809</td>
</tr>
<tr>
<td>(Q18) WTP/WTA NGO</td>
<td>0.489</td>
<td>0.5</td>
</tr>
<tr>
<td>(Q19) Safety Level — NGO Pork</td>
<td>3.41</td>
<td>0.812</td>
</tr>
<tr>
<td>(Q21) Pork Consumption Level</td>
<td>3.24</td>
<td>0.969</td>
</tr>
<tr>
<td>(Q22) Consumption of Unsafe Pork Level</td>
<td>2.77</td>
<td>1.06</td>
</tr>
<tr>
<td>(Q23) Familiarity with Certified Pork Level</td>
<td>2.27</td>
<td>0.661</td>
</tr>
<tr>
<td>(Q25) Number of Children</td>
<td>0.465</td>
<td>0.556</td>
</tr>
<tr>
<td>(Q26) Number of Family Members</td>
<td>3.54</td>
<td>1.13</td>
</tr>
<tr>
<td>(Q27) Age</td>
<td>37.6</td>
<td>12.5</td>
</tr>
<tr>
<td>(Q28) Hukou Registration Dummy</td>
<td>0.577</td>
<td>0.494</td>
</tr>
<tr>
<td>(Q30) Gender Dummy</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>(Q31) Household Income</td>
<td>2.98e+04</td>
<td>2.93e+05</td>
</tr>
</tbody>
</table>

Table 5.2 on the other hand shows that most people receive information about food safety from government domestic news sources followed by social media and non-

10 cities included in the telephone survey using 2013 data, which the most recent statistics available (Available here as of December 2016: http://www.chinawhisper.com/top-100-richest-cities-in-china-by-gdp-per-capita/) for the cities included in the telephone survey. The approximate GDP per capita for these cities in 2016 was derived by multiplying the 2013 GDP per capita by the national growth rate for 2014, 2015 and 2016.
governmental domestic news sources. Most respondents say that they themselves are responsible for food preparation in their household, followed by their parents and their spouses. Meanwhile, most people in the sample have either high school or college education, which is consistent with China’s high school enrollment rate. Finally respondents in the telephone survey represent a wide sector of society with regards to occupation.
Table 5.2: Distribution of categorical variables for unimputed and imputed data, telephone survey

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unimputed</td>
<td>Imputed</td>
</tr>
<tr>
<td><em>(Q3)</em> Information sources about food Safety (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Person to Person</td>
<td>0.146</td>
<td>0.147</td>
</tr>
<tr>
<td>Governmental Domestic News</td>
<td>0.672</td>
<td>0.668</td>
</tr>
<tr>
<td>International News</td>
<td>0.0413</td>
<td>0.043</td>
</tr>
<tr>
<td>Non-Governmental Domestic News</td>
<td>0.419</td>
<td>0.419</td>
</tr>
<tr>
<td>Social Media</td>
<td>0.532</td>
<td>0.53</td>
</tr>
<tr>
<td>Other News</td>
<td>0.0466</td>
<td>0.0462</td>
</tr>
<tr>
<td><em>(Q24)</em> Responsibility for Household Food Preparation (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Me (Respondent)</td>
<td>0.383</td>
<td>0.382</td>
</tr>
<tr>
<td>My spouse or partner</td>
<td>0.161</td>
<td>0.161</td>
</tr>
<tr>
<td>My parents</td>
<td>0.252</td>
<td>0.252</td>
</tr>
<tr>
<td>My children</td>
<td>0.00307</td>
<td>0.0032</td>
</tr>
<tr>
<td>Whoever has time</td>
<td>0.202</td>
<td>0.202</td>
</tr>
<tr>
<td><em>(Q32)</em> Education Level (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some elementary school or less</td>
<td>0.0255</td>
<td>0.025</td>
</tr>
<tr>
<td>Elementary School</td>
<td>0.047</td>
<td>0.046</td>
</tr>
<tr>
<td>Middle School</td>
<td>0.138</td>
<td>0.135</td>
</tr>
<tr>
<td>High School</td>
<td>0.266</td>
<td>0.26</td>
</tr>
<tr>
<td>College</td>
<td>0.465</td>
<td>0.455</td>
</tr>
<tr>
<td>Graduate School</td>
<td>0.0592</td>
<td>0.058</td>
</tr>
<tr>
<td><em>(Q33)</em> Occupation (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper level management</td>
<td>0.0103</td>
<td>0.0104</td>
</tr>
<tr>
<td>Middle management</td>
<td>0.0277</td>
<td>0.028</td>
</tr>
<tr>
<td>White collar worker</td>
<td>0.132</td>
<td>0.133</td>
</tr>
<tr>
<td>Educator, Researcher</td>
<td>0.0997</td>
<td>0.0996</td>
</tr>
<tr>
<td>Blue collar worker</td>
<td>0.0863</td>
<td>0.0858</td>
</tr>
<tr>
<td>Service sector worker</td>
<td>0.0946</td>
<td>0.0946</td>
</tr>
<tr>
<td>Agricultural/forestry worker or miner</td>
<td>0.0627</td>
<td>0.0632</td>
</tr>
<tr>
<td>Professional (Lawyer, Accountant, Reporter etc.)</td>
<td>0.0658</td>
<td>0.0664</td>
</tr>
<tr>
<td>Self-employed</td>
<td>0.0915</td>
<td>0.0916</td>
</tr>
<tr>
<td>Retired</td>
<td>0.0483</td>
<td>0.0494</td>
</tr>
<tr>
<td>Student</td>
<td>0.0761</td>
<td>0.0752</td>
</tr>
<tr>
<td>Military</td>
<td>0.00617</td>
<td>0.0062</td>
</tr>
<tr>
<td>Housewife</td>
<td>0.0668</td>
<td>0.0662</td>
</tr>
<tr>
<td>Other</td>
<td>0.0134</td>
<td>0.0134</td>
</tr>
<tr>
<td>Unemployed (Xiaogang)</td>
<td>0.01131</td>
<td></td>
</tr>
<tr>
<td>Unemployed (Wuye)</td>
<td>0.1069</td>
<td>0.118</td>
</tr>
<tr>
<td>Unemployed (Shiye)</td>
<td>187</td>
<td>0.00102</td>
</tr>
</tbody>
</table>

† The multiple imputation model showed convergence only after collapsing the difference unemployment types.
5.8 Empirical Analysis

5.8.1 Relationship between perceived trust and WTP/WTA certified pork

I assess the degree to which trust plays a factor in one’s willingness to pay for government certified pork in Table (?). To that end, using a logistic regression, I estimate the effect of perceived levels of trust of the central government on WTP for government certified pork in Models 1 and 2. While Models 1 and 2 use the same covariates, in Model 1 I treat variables that are measured on a Likert scale as continuous variables — I drop this assumption in Model 2 to check to see if the effect of the Likert-scale variables still hold when estimated individually. In both Models 1 and 2, I find that respondents who are more likely to positively assert that the central government is looking out for their interests with regards to food safety (Perceived Benevolence) are more willing to pay for certified pork, suggesting support for Hypothesis 1a. Similarly, respondents who express increasing levels of confidence in the central government’s ability to safeguard food safety are also more likely to be willing to pay for for pork certified by the central government, supporting support for Hypothesis 1b. The relative parameter sizes suggest that perceived ability plays a greater factor in respondent’s willingness to pay for certified pork than the perceived benevolence of the central government.

Meanwhile I similarly estimate a logistic regression of unwillingness to accept regular pork in Models 3 and 4. Again, I drop the assumption that Likert-scale variables are continuous in Model 4 while I operate on this assumption in Model 3. Both

30 Note that I also models which included random effects for the province type. However, the random effects were very small, the model fit with and without random effects were largely comparable and the model estimates were also substantively the same. As such, I chose to present the simpler generalized linear model without random effects.

31 Note however, that the model fit is generally much better if one makes the assumption that Likert-scale variables are continuous. That is Model 1, Model 3 and Model 5 have smaller AIC and BIC scores than Models 2, 4 and 6 respectively. An exception to this is that the model fit of Model 8 (without the continuity assumption) is better than that of Model 7 (with the continuity assumption).
models suggest again that the perceived ability of the central government to safeguard food safety is an important factor in influencing a respondent’s unwillingness to accept regular pork, suggesting support for Hypothesis 1b. However, unlike in the WTP models, whether respondents perceive the central government to be looking out for their interests with regards to food safety is not found to affect whether one is less unwilling to accept regular pork, suggesting little support for Hypothesis 1a in this case.

Table 5.3: Logistic regression of WTP/WTA pork certified by the central government, telephone survey

<table>
<thead>
<tr>
<th></th>
<th>WTP</th>
<th></th>
<th>WTA</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
<td>Model 3</td>
<td>Model 4</td>
</tr>
<tr>
<td>Perceived Benevolence (Central Gov.)</td>
<td>0.768</td>
<td>0.103</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Disagree</td>
<td>1.305</td>
<td>-0.049</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.844)</td>
<td>(0.653)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Agree</td>
<td>1.873</td>
<td>-0.119</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.830)</td>
<td>(0.622)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Strongly Agree</td>
<td>2.243</td>
<td>0.138</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.985)</td>
<td>(0.634)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Ability (Central Gov.)</td>
<td>1.062</td>
<td>0.318</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Unconfident</td>
<td>1.101</td>
<td>0.890</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.784)</td>
<td>(0.513)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Confident</td>
<td>2.532</td>
<td>1.172</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.887)</td>
<td>(0.479)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Very Confident</td>
<td>4.029</td>
<td>1.319</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.081)</td>
<td>(0.517)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price</td>
<td>-0.347</td>
<td>-0.388</td>
<td>-0.013</td>
<td>-0.008</td>
</tr>
<tr>
<td></td>
<td>(0.109)</td>
<td>(0.122)</td>
<td>(0.056)</td>
<td>(0.059)</td>
</tr>
<tr>
<td>Level of Interest in Food Safety</td>
<td>0.132</td>
<td>0.113</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.177)</td>
<td>(0.100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- A Little Interested</td>
<td>1.066</td>
<td>0.527</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.720)</td>
<td>(0.384)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Somewhat Interested</td>
<td>1.219</td>
<td>0.649</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.765)</td>
<td>(0.434)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Really Interested</td>
<td>1.258</td>
<td>-0.003</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.841)</td>
<td>(0.488)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Extremely Interested</td>
<td>1.170</td>
<td>0.906</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.890)</td>
<td>(0.476)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level of Worry about Food Safety</td>
<td>-0.175</td>
<td>0.191</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.170)</td>
<td>(0.095)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- A Little worried</td>
<td>-1.895</td>
<td>0.637</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level of Pork Consumption</td>
<td>Coefficient</td>
<td>Standard Error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------------</td>
<td>----------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- At least once a year</td>
<td>15.575</td>
<td>2.011</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1507.906)</td>
<td>(1.323)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- At least once a month</td>
<td>-0.567</td>
<td>0.645</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.366)</td>
<td>(0.719)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- At least once a week</td>
<td>-0.131</td>
<td>-0.325</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.085)</td>
<td>(0.593)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- At least once a day</td>
<td>-1.605</td>
<td>-0.282</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.100)</td>
<td>(0.605)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level of Perceived Unsafe Pork Consumption</th>
<th>Coefficient</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Probably Not</td>
<td>1.560</td>
<td>0.825</td>
</tr>
<tr>
<td></td>
<td>(0.698)</td>
<td>(0.386)</td>
</tr>
<tr>
<td>- Unsure</td>
<td>2.021</td>
<td>0.749</td>
</tr>
<tr>
<td></td>
<td>(0.623)</td>
<td>(0.347)</td>
</tr>
<tr>
<td>- Probably</td>
<td>1.956</td>
<td>1.856</td>
</tr>
<tr>
<td></td>
<td>(0.856)</td>
<td>(0.537)</td>
</tr>
<tr>
<td>- Definitely</td>
<td>2.964</td>
<td>1.386</td>
</tr>
<tr>
<td></td>
<td>(0.909)</td>
<td>(0.563)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level of Familiarity with Food Certification</th>
<th>Coefficient</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Heard of it but not very familiar</td>
<td>0.872</td>
<td>-0.518</td>
</tr>
<tr>
<td></td>
<td>(0.640)</td>
<td>(0.441)</td>
</tr>
<tr>
<td>- Moderately familiar</td>
<td>2.573</td>
<td>-0.899</td>
</tr>
<tr>
<td></td>
<td>(0.821)</td>
<td>(0.478)</td>
</tr>
<tr>
<td>- Very familiar</td>
<td>3.117</td>
<td>-1.743</td>
</tr>
<tr>
<td></td>
<td>(2.216)</td>
<td>(0.796)</td>
</tr>
</tbody>
</table>

| Number of Children                        | 0.521       | 0.683          |
|                                          | (0.381)     | (0.432)        |
|                                          | 0.196       | 0.232          |
|                                          | (0.200)     | (0.226)        |
| Age                                       | 0.003       | 0.004          |
|                                          | (0.021)     | (0.023)        |
| Urban Hukou Dummy                         | 0.213       | 0.178          |
|                                          | (0.445)     | (0.505)        |
| Gender Dummy (Female)                     | 0.717       | 0.545          |
|                                          | (0.434)     | (0.476)        |
| Log Income                                | 0.029       | 0.019          |
|                                          | (0.093)     | (0.103)        |
| Education Level (Elementary School)       | 0.225       | -0.836         |
|                                          | (1.174)     | (1.355)        |
| Education Level (Middle School)           | 1.041       | 0.404          |
|                                          | (0.935)     | (1.075)        |
To facilitate the interpretation of the substantive effect of the two different dimensions of trust (perceived benevolence and perceived ability) on willingness to pay for certified pork, I plot the predicted willingness to pay for certified pork across the different levels of perceived benevolence (Figure 5.3) and perceived ability (Figure 5.4) holding all other variables constant at their means and using the parameter estimates from Model 1. These figures suggest that both perceived benevolence and ability do have a substantive affect on willingness to pay for central government certified pork, with the effect of perceived ability being larger. More concretely, while a citizen who strongly disagrees with the sentiment that the central government is looking after her interests with regards to food safety is only likely to purchase government certified pork with a 44% probability, somebody who strongly agrees with this sentiment is likely to purchase government certified pork with an 82.5% probability, a difference of 38%, all else equal. Meanwhile, a citizen who is very confident in the central government’s ability to safeguard her food safety is likely to purchase

<table>
<thead>
<tr>
<th>Education Level (High School)</th>
<th>0.940</th>
<th>0.129</th>
<th>1.296</th>
<th>1.468</th>
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</thead>
<tbody>
<tr>
<td>(0.892)</td>
<td>(1.014)</td>
<td>(0.616)</td>
<td>(0.682)</td>
<td></td>
</tr>
<tr>
<td>Education Level (Undergraduate)</td>
<td>1.623</td>
<td>1.087</td>
<td>1.013</td>
<td>1.144</td>
</tr>
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<td>(0.962)</td>
<td>(1.084)</td>
<td>(0.619)</td>
<td>(0.683)</td>
<td></td>
</tr>
<tr>
<td>Education Level (Graduate School)</td>
<td>1.716</td>
<td>0.807</td>
<td>0.773</td>
<td>0.975</td>
</tr>
<tr>
<td>(1.313)</td>
<td>(1.460)</td>
<td>(0.781)</td>
<td>(0.848)</td>
<td></td>
</tr>
<tr>
<td>Food Responsibility (Respondent)</td>
<td>0.377</td>
<td>0.493</td>
<td>-0.463</td>
<td>-0.664</td>
</tr>
<tr>
<td>(0.613)</td>
<td>(0.648)</td>
<td>(0.304)</td>
<td>(0.318)</td>
<td></td>
</tr>
<tr>
<td>Food Responsibility (Respondent’s Spouse)</td>
<td>-0.483</td>
<td>-0.420</td>
<td>-0.151</td>
<td>-0.231</td>
</tr>
<tr>
<td>(0.648)</td>
<td>(0.688)</td>
<td>(0.397)</td>
<td>(0.418)</td>
<td></td>
</tr>
<tr>
<td>Food Responsibility (Respondent’s Parents)</td>
<td>0.164</td>
<td>0.265</td>
<td>-0.455</td>
<td>-0.601</td>
</tr>
<tr>
<td>(0.683)</td>
<td>(0.713)</td>
<td>(0.352)</td>
<td>(0.373)</td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>-3.999</td>
<td>-0.358</td>
<td>-3.070</td>
<td>-3.611</td>
</tr>
<tr>
<td>(2.793)</td>
<td>(2.864)</td>
<td>(1.617)</td>
<td>(1.778)</td>
<td></td>
</tr>
</tbody>
</table>

N 502 502 498 498
AIC 318.220 340.232 668.184 680.085
BIC 512.276 610.223 861.872 949.564

Dummy variables for occupation type and city were included in this model but not shown.
Occupation Dummy reference is ‘Unemployed’ and City Dummy reference city is Shanghai
Reference category for Likert scale variables is the ‘lowest’ category. Reference category for
‘Food Responsibility variable’ is ‘Whoever has time’
Standard errors in parentheses. Parameters that are statistically significant at the 5% level are in bold.
pork certified by the central government with a probability of 86%, 51.7% higher than a citizen who is very unconfident in the central government’s ability who only purchases government certified pork with a 34% likelihood, all else equal.

I similarly plot the predicted unwillingness to accept regular pork across the different levels of perceived benevolence (Figure 5.5) and perceived ability (Figure 5.6), using the parameter estimates from Model 3. The slight positive slope exhibited in Figure 5.5 suggests that there may be a very small substantive effect of perceived benevolence on the unwillingness to accept regular pork. Specifically, a citizen who strongly disagrees with the sentiment that the central government is looking after her interests with regards to food safety is 6% less likely than somebody who strongly believes that the central government is looking out for their interest to be unwilling to accept uncertified pork. However, Meanwhile, in absolute terms, when framed in the language of WTA people are less willing to accept uncertified pork (that is in the language of WTP, they are more willing to pay for certified pork), than when the choice is framed in the language of WTP. Indeed, a person who strongly disagrees with the sentiment that the central government is looking out for her interests is still unlikely to accept uncertified pork at the rate of 67.9%, much higher than the 38% of citizens willing to purchase certified pork. Meanwhile, a person who strongly agrees with this sentiment is unwilling to accept uncertified pork at a likelihood of 74%.

A similar dynamic is also portrayed with regards to citizen’s perceptions of the central government’s ability to safeguard their food safety. That is, a citizen who is very unconfident in the central government’s ability to safeguard her food safety is still likely to be unwilling to accept uncertified pork when central government certified pork is available for purchase at a rate of 59%. This likelihood increases to 77.4%, a difference of 18%, when a citizen is very confident in the central government’s ability. These results suggest that framing a purchasing decision in terms of WTA instead of WTP can substantially affect a person’s overall propensity to purchase certified
pork and the degree to which trust influences her decision-making.
Figure 5.3: Predicted effect of perceived central government benevolence on the willingness to pay for central government certified pork

Predicted willingness to pay for central government certified pork over the range of perceptions of central government benevolence (Model 1) assuming the respondent is a resident of Beijing and holds a job as a white-collar worker, holding all other variables constant at their mean.

Figure 5.4: Predicted effect of perceived central government ability on the willingness to pay for central government certified pork

Predicted willingness to pay for central government certified pork over the range of perceived ability (Model 1) assuming the respondent is a resident of Beijing and holds a job as a white-collar worker, holding all other variables constant at their mean.

Figure 5.5: Predicted effect of perceived central government benevolence on unwillingness to accept central government certified pork

Predicted unwillingness to accept central government certified pork over the range of perceptions of central government benevolence (Model 1) assuming the respondent is a resident of Beijing and holds a job as a white-collar worker, holding all other variables constant at their mean.

Figure 5.6: Predicted effect of perceived central government ability on the unwillingness to accept central government certified pork

Predicted unwillingness to accept central government certified pork over the range of perceived ability (Model 1) assuming the respondent is a resident of Beijing and holds a job as a white-collar worker, holding all other variables constant at their mean.
I further investigate the relationship between trust and willingness to pay when all institutions are considered together. In Model 5 in Table 5.8.1, I find that there is still a strong, positive relationship between perceived trust and willingness to pay as well as perceived ability and willingness to pay. As before, I relax the assumption that Likert-scale variables can be conceptualized as being on a continuous scale in Model 6 and find that the relationship between the two dimensions of trust and WTP for certified pork still. Meanwhile as before, perceived ability is found to have a significant affect on the unwillingness to accept regular pork, though no such statistically significant effect is found for perceived benevolence. However, the significance of the dummy variables for institution type suggests that even given the control variables, there are still other factors not included in the model which influence the degree which respondents are WTP or WTA across institution types. What factors explain this persistent difference could be an interesting avenue of future research.

Overall then, I find substantial evidence to suggest that trust plays an important role in influencing the degree to which people ‘buy-in’ to food safety regulation. This relationship holds both when parsing out different levels of trust toward a particular regulatory institution as well as across a broad swath of regulatory institutions.

To that end however, I also find that the degree to which perceptions of trust color people’s propensity to purchase certified pork is also highly suggestible to differences in framing. When people are asked if they are willing to pay for certified pork, given that it costs X yuan more than uncertified pork, both perceptions about the extent to which the certifying institution are acting in the public interest and the certifying institution’s perceived ability to faithfully implement the certification protocol impinge on their purchasing decisions. By contrast, when people are asked if they are willing to accept uncertified pork, conditional on the possibility of purchasing certified pork for X yuan more, only the certifying institution’s perceived ability
to faithfully implement the certification protocol appears to affect their decision-making. These results suggest that when consumers are prodded to think about how much they might value certified pork, which a WTP framing pushes them to do, the perceived intentions of the certifying institution matters a great deal more than when consumers are prodded to think about how much they are willing to relinquish access to certified pork, which a WTA framing encourages. However, the results also suggest that framing food safety decisions in terms of the willingness to relinquish food safety also encourages citizens to be less willing to accept uncertified foods overall. How food safety regulation is framed then, can have important implications for both its success and the role that trust plays in conditioning that success.

Table 5.4: Logistic regression of WTP/WTA for certified pork by all institutions, telephone survey

<table>
<thead>
<tr>
<th></th>
<th>WTP</th>
<th>WTA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 5</td>
<td>Model 6</td>
</tr>
<tr>
<td>Perceived Benevolence</td>
<td>0.553</td>
<td>0.098</td>
</tr>
<tr>
<td></td>
<td>(0.094)</td>
<td>(0.074)</td>
</tr>
<tr>
<td>- Disagree</td>
<td>0.371</td>
<td>0.103</td>
</tr>
<tr>
<td></td>
<td>(0.214)</td>
<td>(0.207)</td>
</tr>
<tr>
<td>- Agree</td>
<td>1.223</td>
<td>0.056</td>
</tr>
<tr>
<td></td>
<td>(0.237)</td>
<td>(0.219)</td>
</tr>
<tr>
<td>- Strongly Agree</td>
<td>1.336</td>
<td>0.257</td>
</tr>
<tr>
<td></td>
<td>(0.310)</td>
<td>(0.247)</td>
</tr>
<tr>
<td>Perceived Ability</td>
<td>0.757</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.097)</td>
<td></td>
</tr>
<tr>
<td>- Unconfident</td>
<td>0.494</td>
<td>0.707</td>
</tr>
<tr>
<td></td>
<td>(0.199)</td>
<td>(0.191)</td>
</tr>
<tr>
<td>- Confident</td>
<td>1.519</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.236)</td>
<td></td>
</tr>
<tr>
<td>- Very Confident</td>
<td>1.870</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.334)</td>
<td></td>
</tr>
<tr>
<td>Price</td>
<td>-0.071</td>
<td>-0.064</td>
</tr>
<tr>
<td></td>
<td>(0.034)</td>
<td>(0.036)</td>
</tr>
<tr>
<td>Institution Type Dummy (Private Industry)</td>
<td>-1.572</td>
<td>-1.514</td>
</tr>
<tr>
<td></td>
<td>(0.193)</td>
<td>(0.197)</td>
</tr>
<tr>
<td>Institution Type Dummy (NGO)</td>
<td>-1.463</td>
<td>-1.448</td>
</tr>
<tr>
<td></td>
<td>(0.189)</td>
<td>(0.192)</td>
</tr>
<tr>
<td>Institution Type Dummy (Prov. Govt.)</td>
<td>-0.077</td>
<td>-0.086</td>
</tr>
<tr>
<td></td>
<td>(0.209)</td>
<td>(0.212)</td>
</tr>
<tr>
<td>Level of Interest in Food Safety</td>
<td>-0.028</td>
<td></td>
</tr>
</tbody>
</table>

196
<table>
<thead>
<tr>
<th>Level of Interest</th>
<th>(0.057)</th>
<th>(0.049)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Little Interested</td>
<td>0.271</td>
<td>0.548</td>
</tr>
<tr>
<td>(0.235)</td>
<td>(0.196)</td>
<td></td>
</tr>
<tr>
<td>Somewhat Interested</td>
<td>0.234</td>
<td>0.864</td>
</tr>
<tr>
<td>(0.245)</td>
<td>(0.223)</td>
<td></td>
</tr>
<tr>
<td>Really Interested</td>
<td>0.235</td>
<td>0.215</td>
</tr>
<tr>
<td>(0.270)</td>
<td>(0.247)</td>
<td></td>
</tr>
<tr>
<td>Extremely Interested</td>
<td>0.036</td>
<td>1.072</td>
</tr>
<tr>
<td>(0.275)</td>
<td>(0.239)</td>
<td></td>
</tr>
<tr>
<td>Level of Worry about Food Safety</td>
<td>0.038</td>
<td>0.103</td>
</tr>
<tr>
<td>(0.055)</td>
<td>(0.046)</td>
<td></td>
</tr>
<tr>
<td>A Little worried</td>
<td>-0.352</td>
<td>0.188</td>
</tr>
<tr>
<td>(0.277)</td>
<td>(0.212)</td>
<td></td>
</tr>
<tr>
<td>Somewhat Worried</td>
<td>-0.569</td>
<td>0.025</td>
</tr>
<tr>
<td>(0.274)</td>
<td>(0.230)</td>
<td></td>
</tr>
<tr>
<td>Really Worried</td>
<td>-0.371</td>
<td>0.582</td>
</tr>
<tr>
<td>(0.290)</td>
<td>(0.247)</td>
<td></td>
</tr>
<tr>
<td>Extremely Worried</td>
<td>-0.079</td>
<td>0.439</td>
</tr>
<tr>
<td>(0.286)</td>
<td>(0.235)</td>
<td></td>
</tr>
<tr>
<td>Level of Pork Consumption</td>
<td>-0.222</td>
<td>-0.147</td>
</tr>
<tr>
<td>(0.073)</td>
<td>(0.056)</td>
<td></td>
</tr>
<tr>
<td>At least once a year</td>
<td>-0.347</td>
<td>0.566</td>
</tr>
<tr>
<td>(0.788)</td>
<td>(0.479)</td>
<td></td>
</tr>
<tr>
<td>At least once a month</td>
<td>-0.755</td>
<td>0.225</td>
</tr>
<tr>
<td>(0.430)</td>
<td>(0.345)</td>
<td></td>
</tr>
<tr>
<td>At least once a week</td>
<td>-0.755</td>
<td>-0.261</td>
</tr>
<tr>
<td>(0.361)</td>
<td>(0.295)</td>
<td></td>
</tr>
<tr>
<td>At least once a day</td>
<td>-1.061</td>
<td>-0.413</td>
</tr>
<tr>
<td>(0.371)</td>
<td>(0.299)</td>
<td></td>
</tr>
<tr>
<td>Level of Perceived Unsafe Pork Consumption</td>
<td>0.218</td>
<td>0.287</td>
</tr>
<tr>
<td>(0.061)</td>
<td>(0.053)</td>
<td></td>
</tr>
<tr>
<td>Probably Not</td>
<td>0.563</td>
<td>0.350</td>
</tr>
<tr>
<td>(0.251)</td>
<td>(0.194)</td>
<td></td>
</tr>
<tr>
<td>Unsure</td>
<td>0.842</td>
<td>0.451</td>
</tr>
<tr>
<td>(0.232)</td>
<td>(0.176)</td>
<td></td>
</tr>
<tr>
<td>Probably</td>
<td>0.690</td>
<td>1.329</td>
</tr>
<tr>
<td>(0.285)</td>
<td>(0.248)</td>
<td></td>
</tr>
<tr>
<td>Definitely</td>
<td>0.983</td>
<td>1.137</td>
</tr>
<tr>
<td>(0.287)</td>
<td>(0.272)</td>
<td></td>
</tr>
<tr>
<td>Level of Familiarity with Food Certification</td>
<td>0.422</td>
<td>-0.336</td>
</tr>
<tr>
<td>(0.099)</td>
<td>(0.086)</td>
<td></td>
</tr>
<tr>
<td>Heard of it but not very familiar</td>
<td>0.525</td>
<td>-0.531</td>
</tr>
<tr>
<td>(0.229)</td>
<td>(0.203)</td>
<td></td>
</tr>
<tr>
<td>Moderately familiar</td>
<td>0.940</td>
<td>-0.778</td>
</tr>
<tr>
<td>(0.251)</td>
<td>(0.225)</td>
<td></td>
</tr>
<tr>
<td>Very familiar</td>
<td>1.072</td>
<td>-1.537</td>
</tr>
<tr>
<td>(0.449)</td>
<td>(0.387)</td>
<td></td>
</tr>
<tr>
<td>Food Responsibility (Respondent)</td>
<td>0.332</td>
<td>0.383</td>
</tr>
<tr>
<td>(0.196)</td>
<td>(0.196)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.126</td>
<td>-0.225</td>
</tr>
<tr>
<td>(0.156)</td>
<td>(0.157)</td>
<td></td>
</tr>
<tr>
<td>Food Responsibility (Respondent’s Spouse)</td>
<td>-0.289</td>
<td>0.096</td>
</tr>
<tr>
<td>(0.213)</td>
<td>(0.193)</td>
<td>0.075</td>
</tr>
<tr>
<td></td>
<td>(0.215)</td>
<td>(0.199)</td>
</tr>
</tbody>
</table>
5.8.2 Relationship between perceived trust and personal food safety assessments

Next, I investigate the degree to which different dimensions of trust affect respondents’ subsequent evaluation of their food safety, conditional on whether they have decided whether they are willing to pay for certified pork or not for each regulatory body. As the safety variable is measured via a Likert scale, I model this relationship using an ordinal logit. I first estimate respondents’ evaluation of their food safety given that they are willing to pay for certified pork (Models 9, 13, 17 and 21). Over-
all, the results suggest given that the respondent is willing to pay for certified pork, the more a respondent perceives the regulatory body to be capable of safeguarding food safety, the safer she perceives her subsequent food safety to be. Meanwhile there is also statistically significant relationship between perceived benevolence and professed feelings of safety with regards to pork consumption. Next, conditional on having decided that they are unwilling to accept regular pork given the option of purchasing certified pork (Models 11, 15, 19 and 23), respondents are similarly more likely to evaluate their food as being safer if the more they perceive the responsible regulatory body as looking after their interests, that is for higher values of perceived benevolence. There is no similar evidence however, of a relationship between increased perceived ability and safety evaluations.

I then estimate respondents’ evaluation of their own food safety given that they are not willing to pay for certified pork (Models 10, 14, 18 and 22). Here, there is generally no evidence of a statistically significant relationship between perceived benevolence and perceived ability on how safe a respondent evaluates her food safety to be after making to decision to not pay for certified pork, with the exception of a positive and significant relationship between perceived ability and safety for NGO certified pork. However, I find that conditional on willingness to accept regular pork, perceived ability has a positive and significant affect on a respondent’s evaluation of her food safety. One plausible explanation for this result is that the more a respondent perceives a regulatory agency to be able to safeguard food safety in general, the more she is likely to feel that even food that is not certified to be safer.

Further research will be necessary to investigate this hypothesis.

Overall then, this analysis suggests that there is a positive relationship between the degree to which a respondent trusts a regulatory body and her subsequent evaluation of her own food safety. However, there is little evidence to suggest that conditional on being unwilling to pay for certified pork or being willing to accept
regular pork, increased trust in regulatory institutions leads to lower evaluations of one’s food safety. If there had been a negative and statistically significant parameter estimate for the trust variables in Models 6 and 7, this would have provided strong evidence for this argument. However, the lack of significance of these parameter estimates provides only limited evidence for this hypothesis.
Table 5.5: Ordinal regression of the relationship between perceived benevolence and perceived ability on personal food safety levels conditional on WTP/WTA status

<table>
<thead>
<tr>
<th>WTP/WTA Status:</th>
<th>Willing to Pay</th>
<th>Unwilling to Pay</th>
<th>Unwilling to Accept</th>
<th>Willing to Accept</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Central Gov.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 9</td>
<td>0.302</td>
<td>(0.185)</td>
<td>0.712</td>
<td>0.462</td>
</tr>
<tr>
<td>Model 10</td>
<td>-1.271</td>
<td>(0.783)</td>
<td>(0.205)</td>
<td>(0.239)</td>
</tr>
<tr>
<td>Model 11</td>
<td>1.365</td>
<td>(0.187)</td>
<td>0.891</td>
<td>0.657</td>
</tr>
<tr>
<td>Model 12</td>
<td>2.034</td>
<td>(1.169)</td>
<td>(0.195)</td>
<td>(0.217)</td>
</tr>
<tr>
<td>N</td>
<td>447</td>
<td>55</td>
<td>309</td>
<td>189</td>
</tr>
<tr>
<td><strong>Prov. Gov.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 13</td>
<td>0.486</td>
<td>(0.194)</td>
<td>1.075</td>
<td>0.220</td>
</tr>
<tr>
<td>Model 14</td>
<td>-0.189</td>
<td>(0.556)</td>
<td>(0.250)</td>
<td>(0.206)</td>
</tr>
<tr>
<td>Model 15</td>
<td>0.740</td>
<td>(0.186)</td>
<td>0.417</td>
<td>0.421</td>
</tr>
<tr>
<td>Model 16</td>
<td>0.051</td>
<td>(0.686)</td>
<td>(0.240)</td>
<td>(0.184)</td>
</tr>
<tr>
<td>N</td>
<td>431</td>
<td>71</td>
<td>277</td>
<td>221</td>
</tr>
<tr>
<td><strong>Priv. Indust.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 17</td>
<td>0.642</td>
<td>(0.214)</td>
<td>1.062</td>
<td>0.582</td>
</tr>
<tr>
<td>Model 18</td>
<td>-0.083</td>
<td>(0.209)</td>
<td>(0.245)</td>
<td>(0.207)</td>
</tr>
<tr>
<td>Model 19</td>
<td>0.210</td>
<td>(0.218)</td>
<td>0.120</td>
<td>0.443</td>
</tr>
<tr>
<td>Model 20</td>
<td>0.274</td>
<td>(0.219)</td>
<td>(0.243)</td>
<td>(0.194)</td>
</tr>
<tr>
<td>N</td>
<td>233</td>
<td>269</td>
<td>196</td>
<td>302</td>
</tr>
<tr>
<td><strong>NGO</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 21</td>
<td>0.370</td>
<td>(0.185)</td>
<td>0.860</td>
<td>0.171</td>
</tr>
<tr>
<td>Model 22</td>
<td>-0.008</td>
<td>(0.288)</td>
<td>(0.256)</td>
<td>(0.198)</td>
</tr>
<tr>
<td>Model 23</td>
<td>0.558</td>
<td>(0.204)</td>
<td>-0.106</td>
<td>0.356</td>
</tr>
<tr>
<td>Model 24</td>
<td>0.598</td>
<td>(0.264)</td>
<td>(0.261)</td>
<td>(0.193)</td>
</tr>
<tr>
<td>N</td>
<td>283</td>
<td>219</td>
<td>206</td>
<td>292</td>
</tr>
</tbody>
</table>

Occupation and city dummies, were included in these models but are not shown.

Standard errors in parentheses.

Parameters that are statistically significant at the 5% level are in bold.
The same overall relationship between the two dimensions of trust and the other institutions (provincial government, private industry and NGOs) echo that found for the central government. Given the number of models estimated, in Table 5.6, I show only the parameter estimates and standard errors for the benevolence and ability variables.\textsuperscript{32} Here we can see that as before, perceived benevolence and perceived ability are still positive and statistically significant predictors of the willingness to pay for certified pork when the certifier is the provincial government, private industry or a NGO. Meanwhile, again as before, only perceived ability is found to have a positive and statistically significant affect on unwillingness to accept regular pork given the alternative of purchasing provincial government certified pork and NGO certified pork. Note that perceived ability is not significant predictor of unwillingness to pay when privately certified pork is available (Model 33 and 34) at the 5\% level. However, ‘Perceived Ability’ (Model 33), ‘Perceived Ability - Confident’ and ‘Perceived Ability - Very Confident’ (Model 34) are significant at the 10\% level which suggests that there is a relationship between perceived ability of private certifiers and unwillingness to accept regular pork given the possibility buying privately certified pork, albeit a weaker one. Similarly, for NGO certified pork ‘Perceived Ability’ (Model 35) is also significant at the 10\% level, though not at the 5\% level.

I further validate the relationship between trust and WTP/WTA by estimating a LASSO variable selection equation. That is, in the original model specification, I control for all possible confounding factors that may affect WTP/WTA. However, while one might have a priori strong theoretical reasons to suspect that any of these variables may confound the estimation of the relationship between the main independent variables of interest (trust) and the dependent variable, whether these control

\textsuperscript{32} The full models available upon request.
Table 5.6: Logistic regression of WTP/WTA for certified pork by each institution, telephone survey

<table>
<thead>
<tr>
<th></th>
<th>Prov. Gov.</th>
<th>Priv. Indust.</th>
<th>NGO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 25</td>
<td>Model 26</td>
<td>Model 27</td>
</tr>
<tr>
<td><strong>Perceived Benevolence</strong></td>
<td>0.601</td>
<td>0.495</td>
<td>0.629</td>
</tr>
<tr>
<td></td>
<td>(0.249)</td>
<td>(0.156)</td>
<td>(0.164)</td>
</tr>
<tr>
<td>- Disagree</td>
<td>0.992</td>
<td>0.263</td>
<td>-0.056</td>
</tr>
<tr>
<td></td>
<td>(0.623)</td>
<td>(0.327)</td>
<td>(0.410)</td>
</tr>
<tr>
<td>- Agree</td>
<td><strong>1.490</strong></td>
<td><strong>0.812</strong></td>
<td><strong>1.400</strong></td>
</tr>
<tr>
<td></td>
<td>(0.699)</td>
<td>(0.399)</td>
<td>(0.439)</td>
</tr>
<tr>
<td>- Strongly Agree</td>
<td><strong>1.958</strong></td>
<td><strong>1.507</strong></td>
<td>0.847</td>
</tr>
<tr>
<td></td>
<td>(0.825)</td>
<td>(0.554)</td>
<td>(0.558)</td>
</tr>
<tr>
<td><strong>Perceived Ability</strong></td>
<td><strong>1.001</strong></td>
<td><strong>0.885</strong></td>
<td><strong>0.585</strong></td>
</tr>
<tr>
<td></td>
<td>(0.259)</td>
<td>(0.170)</td>
<td>(0.163)</td>
</tr>
<tr>
<td>- Unconfident</td>
<td>0.415</td>
<td><strong>0.918</strong></td>
<td>0.515</td>
</tr>
<tr>
<td></td>
<td>(0.563)</td>
<td>(0.340)</td>
<td>(0.364)</td>
</tr>
<tr>
<td>- Confident</td>
<td><strong>2.294</strong></td>
<td><strong>2.140</strong></td>
<td><strong>1.252</strong></td>
</tr>
<tr>
<td></td>
<td>(0.714)</td>
<td>(0.422)</td>
<td>(0.416)</td>
</tr>
<tr>
<td>- Very Confident</td>
<td><strong>2.434</strong></td>
<td><strong>1.918</strong></td>
<td><strong>1.460</strong></td>
</tr>
<tr>
<td></td>
<td>(0.860)</td>
<td>(0.645)</td>
<td>(0.610)</td>
</tr>
</tbody>
</table>

**WTA**

<table>
<thead>
<tr>
<th></th>
<th>Prov. Gov.</th>
<th>Priv. Indust.</th>
<th>NGO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 31</td>
<td>Model 32</td>
<td>Model 33</td>
</tr>
<tr>
<td><strong>Benevolence</strong></td>
<td>0.123</td>
<td>0.072</td>
<td>0.062</td>
</tr>
<tr>
<td></td>
<td>(0.156)</td>
<td>(0.159)</td>
<td>(0.152)</td>
</tr>
<tr>
<td></td>
<td>(0.153)</td>
<td>(0.167)</td>
<td>(0.162)</td>
</tr>
<tr>
<td>- Disagree</td>
<td>0.573</td>
<td>-0.033</td>
<td>0.278</td>
</tr>
<tr>
<td></td>
<td>(0.566)</td>
<td>(0.324)</td>
<td>(0.437)</td>
</tr>
<tr>
<td>- Agree</td>
<td>0.339</td>
<td>-0.354</td>
<td>0.223</td>
</tr>
<tr>
<td></td>
<td>(0.579)</td>
<td>(0.409)</td>
<td>(0.453)</td>
</tr>
<tr>
<td>- Strongly Agree</td>
<td>0.604</td>
<td>0.644</td>
<td>-0.007</td>
</tr>
<tr>
<td></td>
<td>(0.609)</td>
<td>(0.549)</td>
<td>(0.561)</td>
</tr>
<tr>
<td><strong>Ability</strong></td>
<td><strong>0.356</strong></td>
<td>0.282</td>
<td>0.276</td>
</tr>
<tr>
<td></td>
<td>(0.490)</td>
<td>(0.328)</td>
<td>(0.410)</td>
</tr>
<tr>
<td>- Unconfident</td>
<td><strong>1.480</strong></td>
<td>0.553</td>
<td><strong>0.818</strong></td>
</tr>
<tr>
<td></td>
<td>(0.503)</td>
<td>(0.409)</td>
<td>(0.452)</td>
</tr>
<tr>
<td>- Confident</td>
<td><strong>2.227</strong></td>
<td>0.772</td>
<td><strong>1.251</strong></td>
</tr>
<tr>
<td></td>
<td>(0.552)</td>
<td>(0.645)</td>
<td>(0.656)</td>
</tr>
<tr>
<td>- Very Confident</td>
<td><strong>1.215</strong></td>
<td>0.424</td>
<td>0.177</td>
</tr>
<tr>
<td></td>
<td>(0.552)</td>
<td>(0.645)</td>
<td>(0.656)</td>
</tr>
</tbody>
</table>

Control variables (mirroring those in Table 5.8.1) were included in these models but are not shown.
Standard errors in parentheses. Parameters that are statistically significant at the 5% level are in bold.
variables ultimately do significantly condition the effect of the main independent variables of interest on the dependent variable is an empirical question.

Thus since it is a priori unclear which variables best predict the dependent variable, I estimate a logistic LASSO model for each institution type. A LASSO regression is a penalized regression model that is often used for variable selection. From Table 5.7 and Table 5.8 we can see that the measures for perceived benevolence and perceived ability are found to be important predictors for both WTP and WTA.33

Note that no standard errors are presented in these tables — to date estimation of standard errors for LASSO regressions is still an area of active research (Kyung et al., 2010). Unlike the main models, the tables also report standardized coefficients. Because the LASSO estimation procedure penalizes large coefficient sizes, it is important to standardize the data beforehand. Finally note that while it is possible of course to estimate a standard logistic regression using the variables selected by the LASSO model, this would not be methodologically correct. That is, the subsequent significance of the parameter estimates derived from the subsequent ordinary logistic regression is conditional on those variables being selected in the first place.34

33 Note that there the literature on variable selection with multiply imputed data is still in its infancy. Wood et al. (2008) suggest a two-step procedure in which Step 1) only variables that are selected in the majority of the imputations are included in the final model Step 2) given the variables selected in Step 1, the average of the parameter estimates over the multiply imputed data is reported though they caution that further research is needed to validate the scope conditions for this approach. Despite this caveat, given available knowledge this method is currently among the best possible for conducting variable selection for multiply imputed data. As such, the variables presented in Tables 5.7 and 5.8 are only presented if they are selected from at least 3 of 5 of the imputed datasets and the parameter estimates represent the average of the values over those models.

34 Despite this however, when I have gone ahead and done so the statistical significance of the trust variables and the dependent variable hold.
Table 5.7: Variable selection using LASSO logistic regression for willingness to pay, telephone survey

<table>
<thead>
<tr>
<th></th>
<th>Central Govt Model 37</th>
<th>Prov Govt. Model 38</th>
<th>Private Indust. Model 39</th>
<th>NGO Model 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>-0.14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benevolence</td>
<td>0.33</td>
<td>0.16</td>
<td>0.36</td>
<td>0.35</td>
</tr>
<tr>
<td>Ability</td>
<td>0.71</td>
<td>0.69</td>
<td>0.66</td>
<td>0.45</td>
</tr>
<tr>
<td>Level of Worry about Food Safety</td>
<td>-0.04</td>
<td></td>
<td>-0.14</td>
<td></td>
</tr>
<tr>
<td>Level of Pork Consumption</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level of Perceived</td>
<td>0.17</td>
<td>0.04</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>Unsafe Pork Consumption</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level of Familiarity with Food Certification</td>
<td>0.46</td>
<td>0.20</td>
<td>0.16</td>
<td>0.07</td>
</tr>
<tr>
<td>Number of Children</td>
<td>0.27</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td>0.01</td>
</tr>
<tr>
<td>Urban Hukou Dummy</td>
<td>0.19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education Level</td>
<td></td>
<td></td>
<td></td>
<td>-0.11</td>
</tr>
<tr>
<td>(Undergraduate)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Responsibility</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Respondent’s Spouse</td>
<td>-0.13</td>
<td></td>
<td>-0.05</td>
<td></td>
</tr>
<tr>
<td>- Respondent’s Parents</td>
<td></td>
<td></td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td>Gender Dummy (Female)</td>
<td>0.22</td>
<td>0.19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log Income</td>
<td>0.06</td>
<td>0.06</td>
<td>0.06</td>
<td>0.02</td>
</tr>
<tr>
<td>Occupation Dummy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Educator/Researcher</td>
<td>0.25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Blue collar worker</td>
<td>-0.58</td>
<td></td>
<td>-0.19</td>
<td></td>
</tr>
<tr>
<td>- Service sector worker</td>
<td>0.41</td>
<td></td>
<td>0.23</td>
<td>0.18</td>
</tr>
<tr>
<td>- Agricultural/</td>
<td>-0.34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>forestry worker or miner</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>City Dummy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Beijing</td>
<td></td>
<td></td>
<td>-0.24</td>
<td></td>
</tr>
<tr>
<td>- Harbin</td>
<td>0.04</td>
<td></td>
<td>-0.27</td>
<td></td>
</tr>
<tr>
<td>- Taiyuan</td>
<td></td>
<td></td>
<td>0.26</td>
<td></td>
</tr>
<tr>
<td>- Chengdu</td>
<td></td>
<td></td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>- Kunming</td>
<td></td>
<td></td>
<td>0.22</td>
<td></td>
</tr>
<tr>
<td>- Changsha</td>
<td>-0.65</td>
<td>-0.14</td>
<td>-0.50</td>
<td>-0.20</td>
</tr>
</tbody>
</table>

Table reports standardized coefficients
Occupation Dummy reference is ‘Unemployed’
City Dummy reference city is Shanghai
Table 5.8: Variable selection using LASSO logistic regression for willingness to accept, telephone survey

<table>
<thead>
<tr>
<th></th>
<th>Central Govt Model 41</th>
<th>Prov Govt. Model 42</th>
<th>Private Indust. Model 43</th>
<th>NGO Model 44</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>-0.03</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benevolence</td>
<td>0.01</td>
<td>0.06</td>
<td>0.01</td>
<td>0.03</td>
</tr>
<tr>
<td>Ability</td>
<td>0.16</td>
<td>0.16</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>Level of Interest in Food Safety</td>
<td>0.06</td>
<td>0.11</td>
<td>0.08</td>
<td>0.14</td>
</tr>
<tr>
<td>Level of Worry about Food Safety</td>
<td>0.14</td>
<td>0.02</td>
<td>0.02</td>
<td>0.06</td>
</tr>
<tr>
<td>Level of Perceived</td>
<td>0.18</td>
<td>0.19</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Unsafe Pork Consumption</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level of Familiarity</td>
<td>-0.11</td>
<td>-0.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>with Food Certification</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Children</td>
<td></td>
<td></td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>0.00</td>
<td>0.00</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>Urban Hukou Dummy</td>
<td>0.20</td>
<td>0.31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log Income</td>
<td></td>
<td>0.02</td>
<td></td>
<td>0.01</td>
</tr>
<tr>
<td>Food Responsibility</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Respondent’s Spouse</td>
<td>0.20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupation Dummy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Middle management</td>
<td>0.52</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- White collar worker</td>
<td>0.39</td>
<td>0.28</td>
<td>0.16</td>
<td>0.35</td>
</tr>
<tr>
<td>- Blue collar worker</td>
<td>0.08</td>
<td>0.21</td>
<td></td>
<td>0.35</td>
</tr>
<tr>
<td>- Service sector worker</td>
<td></td>
<td>-0.28</td>
<td></td>
<td>0.06</td>
</tr>
<tr>
<td>- Self-employed</td>
<td></td>
<td></td>
<td></td>
<td>-0.04</td>
</tr>
<tr>
<td>- Retired</td>
<td>0.19</td>
<td>0.56</td>
<td>0.18</td>
<td>0.04</td>
</tr>
<tr>
<td>- Student</td>
<td></td>
<td>-0.37</td>
<td>-0.41</td>
<td></td>
</tr>
<tr>
<td>- Military</td>
<td></td>
<td>-0.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Housewife</td>
<td></td>
<td>-0.21</td>
<td>-0.20</td>
<td>-0.83</td>
</tr>
<tr>
<td>City Dummy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Hohhot</td>
<td>0.17</td>
<td>0.35</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>- Chengdu</td>
<td></td>
<td>-0.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Changsha</td>
<td></td>
<td></td>
<td></td>
<td>-0.03</td>
</tr>
</tbody>
</table>

Table reports standardized coefficients
Occupation Dummy reference is ‘Unemployed’
City Dummy reference city is Shanghai

Lastly I further estimate the relationship between trust and respondent’s evaluations of their personal food safety through a Heckman selection model (not shown). As such, it allows one to estimate the general relationship between trust and safety, conditional on whether the respondent is WTP/WTA or not. The general relation-
ship between both dimensions of trust and one’s subsequent evaluations of one’s food safety holds across all institution types. The relationship between perceived ability and safety is strongest when the regulatory institution is the central government, provincial government or NGO while perceived benevolence has a stronger effect on one’s subsequent food safety evaluation when the regulatory institution is a private company.

5.9 Conclusion

To be a citizen in a modern society is to make economic decisions that are supported not by a web of social networks and obligations but by one that is built on an infrastructure of market rules and regulations that set and enforce certain standards of conduct. To this end, regulatory institutions can perform an important role in setting these standards and regulations. While depending on the kindness of strangers is not an impossible proposition, in an increasingly globalized and anonymized world, to do so blindly is an increasingly risky one.

At the same time though social networks and ties no longer provide an effective means to coordinate economic transactions, social attitudes and information still play an important role in buttressing market-based rules and regulations. In particular, trust in regulatory institutions can play an important role in ensuring regulatory efficacy. That is, regulatory standards and rules, including food safety ones, by themselves mean little. While it is the exercise and application of such rules and regulations that gives them their bite, it is the trust that such rules and regulations will actually be faithfully executed that gives them their efficacy.

In this paper, I present evidence to suggest consumers are more willing to pay for certified pork the more they trust the certifying institution. This evidence is based on a sample of 1000 respondents in a telephone survey. Such evidence supports the argument that two different dimensions of trust, the perception that a regulatory
institution has the best interests of the consumer at heart and the perception that a regulatory institution is capable of safeguarding food safety, can have a significant and substantive impact on regulatory buy-in. This relationship is consistently found when respondents are asked if they are willing to pay for certified pork. For respondents who are asked if they are willing to accept regular pork, only the perceived ability of the certifying institution is found to have statistical significance. Overall then, perceived ability is found to be a strong predictor of a respondent’s regulatory buy-in, while the importance of perceived benevolence seems to be have greater sensitivity to framing.

But while these different framing effects can have substantial consequences for regulatory success, we know relatively little about the degree to which 1) the distribution of citizens naturally adopt frames that are more in line with the WTP or WTA framework when making purchasing decisions, both about certified pork and more generally 2) what factors that can be pinpointed which encourages citizens to naturally adopt either a WTP or WTA frame 3) what factors can be manipulated that encourage citizens to shift their frames toward a WTP or WTA one. Such research is especially important given framing a purchasing decision is either WTP or WTA can substantially influence both the propensity of a citizen to buy-into a food safety regulation but the degree to which they subsequently judge their food safety environment to be safe. Further investigation into this topic may be a fruitful topic of further research.
Appendix A

Appendix to Chapter 2: Food Safety and Urban Bias

A.1 Constructing the Pesticide Use Data

As the FAOSTAT database itself notes, “a strict inter-country comparison on the basis of the database is not feasible” because the units of pesticide use are not homogeneous across countries.¹ For one, different countries may report different compositions of pesticide use. That is, pesticide use may be expressed in terms of active ingredients (AI) or ‘formulated products’ depending on the country.² Because AI are typically only a fraction of formulated products, a straight comparison of countries which use one or the other would lead to spurious results. Meanwhile, different countries may also use different points of the distribution chain as the basis of their measure of pesticide use. For example, countries may report pesticide use in


² The AI is the chemical which actively destroys the pest. However, the AI is usually combined with other materials to improve its handling, storage and applications. The combination of the AI with other materials is referred to as the ‘formulated product’ by the FAO.
terms of sales or in terms of production which also makes a raw comparison noisy.\footnote{A number of countries also report pesticide use in terms of imports. Without conducting substantially more research on the subject, it is unclear the extent to which a particular country relies on imports for its pesticides. As such, I drop these observations from my analysis}

This measurement problem is also present within some countries as well, as some countries are also inconsistent how they define pesticide use in the manner described above.\footnote{‘Inputs —> Pesticide Use —> Country Notes.’ \textit{FAOSTAT}. Accessed April 2016: http://faostat3.fao.org/download/RP/*/E}

In order to circumvent such measurement issues, I first document how pesticide use has been defined by each country with the help of the extensive ‘Country Notes’ that the FAO provides\footnote{‘Inputs —> Pesticide Use —> Country Notes.’ \textit{FAOSTAT}. Accessed April 2016: http://faostat3.fao.org/download/RP/*/E}. I then transform the raw FAO data for pesticide use in tonnes into the \textit{percentage change} of pesticide use, which is unit-less, as my outcome measure.\footnote{Note in instances where pesticide use changes from 0 tonnes to a positive number of tonnes, mathematically, this change should be ‘infinity’. However, substantively a nonsensical result. I code this as a change of 100%.} As such, how each country defines pesticide use becomes irrelevant as this variable measures relative changes in pesticide use as opposed to absolute changes in pesticide use.

A.2 Cleaning Incidence of Food Contaminantation Data

In cleaning the dataset for the purposes of this analysis, I made a number of cleaning and classification decisions to standardize the observations across countries as much as possible, which I detail here. The first of these dealt with the types of food included in the dataset. The dataset differentiates between the origin of the food (‘domestic’, ‘imported’, ‘mixed origin’ or ‘unknown’), the composition of the food (‘as is (raw, fresh)’, ‘as consumed’, ‘fat content’, ‘dry weight’) and the portion analyzed (‘edible only’ or ‘total food (edible + inedible)’).
In order to make the results as comparable as possible, I pared the dataset by first dropping imported food from the dataset under the rationale that since the focus of the study is to investigate how domestic government policy affects domestic food safety, including imported food would at best be a very indirect way to measure this effect and at worst only add noise to the analysis. There were 288,335 entries for imported food out of a total of 2,803,009 entries, or around 10.3% of the dataset.

Of the remaining 2,514,674 observations, I then dropped observations that are categorized the composition of the food as ‘Fat content’, ‘Dry weight’, which comprised a combined 8.3% of the non-imported dataset (and correspondingly kept the compositions ‘as is (raw, fresh)’, ‘as consumed’). This paring was executed under the reasoning that most people consume food ‘as is’ or, by definition, ‘as consumed.’ Note that the representativeness of these categories also played a role in the cleaning process— if 90% of the submissions were of the fat content of the food for example, I would have likely kept observations that were based on fat content instead of food ‘as is.’

Finally I dropped the ‘Total food (edible + inedible)’ from the data, which comprised 2.3% of the non-imported, ‘as is (raw, fresh)’, ‘as consumed’ data. This choice was made because by definition, the food that people consume should be edible.

Figure A.1 provides a visualization of these subsetting decisions as a proportion of the size of the dataset.

A greater undertaking involved constructing the classification rules for both food types and contaminants types. As I had previously noted, the WHO GEMS/Food database tracked contamination levels over ‘a great many food products’ — this description was deliberately vague as the total number of food products ultimately depends on how one defines different food categories. If we use the categories that collaborating institutions use when they submit contamination data to their national
Figure A.1: Proportion of WHO/GEMS dataset used

The number of observations in the dataset is scaled to be between 0 to 1. The relative proportion of observations in the different categories for each variable of interest (food origin: imported, domestic, mixed, unknown; composition of food: as is, as consumed, fat content, dry weight; portion of food analyzed: edible only, total food (edible + inedible)) are then represented by the either blue if they are kept from the dataset, or grey if they are dropped from the dataset.

Institutions, then there are more than 14,000 types. However, when submitting such data to GEMS/Food, collaborating centers are also required to map local food names into food categories recognized by WHO and FAO. The FAO keeps data and which the FAO has data for, of which there are more than 400. For example, one submission
noted that the food in question was ‘cattle meat’. This FAO subcategory can be mapped to the larger FAO category of ‘Bovine Meat’. Note a large part of the reduction in categories was also due to cleaning up mis-spellings and standardizing spellings of data submissions.

Meanwhile contamination categories were also aggregated from 754 to 419 categories. In this case, the degree of aggregation was limited to that which was already present in the dataset. For example, some countries might report the total amount of Aflatoxins, while other countries might report the level of Aflatoxin B1 and Aflatoxin M1. In order to maximize the number of observations that might plausibly be comparable then, I aggregated based on all Aflatoxin types. Like food categories, some of the reduction in contaminant categories was also due to correcting and standardizing spellings of data submissions. While a number of online resources are available to allow one to aggregate the contaminants in terms of common parlance, i.e. herbicides or fungicides, I chose not to aggregate based on this criteria. With the limited knowledge of chemistry that I do have, I was wary of aggregating contaminants based on these socially understood categories because the degree to which a contaminant may harm human health may be on wildly divergent scales across different contaminants and aggregating them based on anything but a solid understanding of the underlying chemistry seemed like a precarious undertaking.

Finally, while the vast majority of submissions were individual level contamination tests, around 2% of the submissions were aggregations assays. As these aggregated assays also included information on the number of samples that they were based on, I recombined the dataset as a weighted mean, where the weights were the number of samples (if the submission was an individual level assay, the weight was

---

A.3 Multiple Imputation of Food Contaminants data (Dataset 2)

The food contaminants data has a substantial amount of missingness across its various panels, including its country-year panels and its food category-contaminant panel. While it might be possible to impute all the data in the dataset despite this missingness, the validity of the subsequently imputed values might be suspect given the severe sparsity of data.

Though existing research suggests that the more variables in a dataset, the better the subsequent efficiency and unbiasedness of the imputed dataset (Mustillo and Kwon, 2015), to my knowledge, such research does not extend to imputing missing data for variables which exhibits substantial missingness of whole panels, like the contaminant measure does. To put the problem concretely, it seems of dubious value to impute the values for missing food-contaminant observations for one country based the fact that food-contaminant observations exist for another country. That is, it does not seem to make much sense to have much confidence in the imputed values of cadmium contamination of vegetables for Brazil just because Australia has submitted data on the incidence of cadmium contamination in its vegetables.

A visualization of the degree of missingness on the year level and the country level in the dataset is visualized in Figure A.2. As is apparent from the figure, most country-year observations are concentrated in the mid to late 1990s, with few observations before than with a few exceptions.

Meanwhile a visualization of the degree of missingness for a random sample of food-contaminant pairs is shown in Figure A.3. Here it is clear that the level of

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8 Other units submitted included ug/kg, ng/kg and pg/kg

9 An exception includes Hardt et al. (2012), who finds evidence to suggest a U-relationship between increasing the number of auxillary variables and the precision of the subsequent imputation.
For each country-year combination, this plot visualizes the number of food-contaminant observations there are. The country is on the x axis and the year is on the y-axis. The size of each point increases with the number of observations. Where there are no points, there were no submissions to the WHO/GEMS database for that country-year.

overlap across country-year panels and food category-contaminant panels is scant.

Another strategy to deal with this missingness might be to impute all of the variables together and then subsequently restrict the analysis to the subset of panels for
Plotting all the possible food category-contaminant combinations would have led to a 28 (# of food categories) by 407 (# of contaminants) plot, which would have been unreadable. As such, the above plot presents the plot of a random sample of 5 food categories and 10 contaminants. The color of each point indicates a different country and the size of the point shows the number of years for which there is data for that particular country-food-contaminant combination. With this subsample, one can see that countries habitually report non-overlapping food-contaminant combinations.

which there were actual data. For example, I could impute the values for the dataset for all countries and all years, but restrict the actual analysis to only observations from 1997 to 2011 and for countries that actually submitted food contaminant data in those years. This would adhere better to the maxim that the more the data the better the imputation model.
However, the fact that the food contaminants data is multi-level it is calls into question the prudence of such a strategy. Note that as a result of the multi-level nature of the food contaminant data, any dataset which includes the food contaminant data is also multilevel in that it can be partitioned into three levels, where the first level represents the country-year-food-contaminant covariates, the second level represents the country-year-food covariates, and the third level represents of the country-year covariates. Imputing all of the data together would mean imputing on 48,455,680 observations — 80 countries × 52 years (1961-2014) × 28 food categories × 416 contaminants. These observations would be characterized by an extremely high degree of missingness for the food contaminant variable and a high degree of duplication for the other covariates (i.e. because Log GDP per capita is calculated on a country-year level for example, there would be a large degree of duplication in a dataset has country-year-food and country-year-food-contaminant levels) which would likely make it correspondingly extremely difficult to fit.\footnote{In future work, it may be worthwhile to examine the relative performance of data analyzed by a dataset that is first subsetted and then imputed vs a dataset that is first imputed and then subsetted, given a more tractable dataset.}

Because of both the substantial level of missingness in the data and the multi-level nature of the data, in order to increase the confidence in the validity of the subsequent imputation, the paper only analyzes food contamination levels for food-contaminant pairs that have a reasonable degree of coverage both across and within different countries. To that end, food-contaminant pairs for which there were at least 85 country-year-food-country observations in total and at least 2 country-years for each country. Using this criteria, we are left with an unbalanced panel data of 35 countries, 18 years (1997-2014), 15 food categories and 13 contaminants for a total of 9,810 observations.
A.4 Imputing Three Level Data

Making the decision to separately impute the food contaminant data and to restrict it to observations for which there is not missingness in whole panels increases confidence in the subsequently imputed values but it does not, however, solve the more general issue of how to multiply impute multi-level data. The problem of ignoring the clusters in multi-level data and simply imputing as if they did not exist is that the subsequent imputed values of the higher level clusters are attenuated (Van Buuren, 2011) and substantively affect the standard errors of the parameter estimates (Roudsari et al., 2008).

While the problem is clear the solution is not, as multiple imputation of multi-level data is a relatively new research area. Most of the work has concentrated on imputing two-level data and some software packages are available for that purpose. For example, in STATA’s `mi impute` function, one can cluster on two levels. It is also possible to impute two level data using the MICE package, though the specification is such that it cannot impute a data that has simultaneous missingness in both the levels (Keller, 2015).

However, there is more limited work that has explored imputation of three-level data. Existing contributions to this line of research appear to be limited to Keller (2015), who proposes a fully conditional approach for a three-level multiple imputation and Asparouhov and Muthén (2010) Yucel (2008) both use a joint modeling approach. In his evaluation of the three methods, Keller (2015) finds that they exhibit comparable performance. Currently however, only Asparouhov and Muthén (2010)’s model appears to be available for wider use in their MPlus software package,

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but for a not insubstantial fee\textsuperscript{12}.

Lacking readily available tools to multiply impute three level data then, I adapt Hoff (2007) semi-parametric copula imputation model for three level hierarchical data. Under this protocol, the country-year data (first level) is imputed first, followed by the country-year-food data (second level) merged with the imputations from the first level and finally the country-year-food-contaminant level (third level), merged with the imputations from the first and second levels, is imputed last. One drawback of this approach is that while the first level can inform the imputation of the second level and the third level, and the second level can inform the imputation of the third level, the second level cannot inform the imputation of the first level and the third level cannot inform the imputation of the first and second levels. This problem is not unique to this model however, as Yucel (2008) and Keller (2015) use a similar strategy in their multi-level multiple imputation models and have found them to perform well. However again, research on this topic is still quite limited and none of it, to my knowledge, has examined the relative performance of semi parametric copula imputation model for three-level multiple imputation. Assessing its performance against other models could be a fruitful avenue for future work.

In this paper however, I limit myself to validating its effectiveness for multiply imputing this particular dataset. Using the above method, I impute the values for contaminants and the 1 year lag of the covariates. Ultimately, I run 40,000 imputations, of which I save 1,000 or every 40th imputation. Like the first dataset (without the contaminant data), I then plot the trace plots of $\text{cor}(\text{var}_j, \text{var}_{-j})$. In all, all of the trace plots seem to converge to the target distribution. Again as in the first dataset, I burn the first 800 saved imputation and randomly select 20 of the last 200 saved imputations to conduct statistical analyses with. Finally, I also

\textsuperscript{12} The current student price for the Mplus software program is $195 plus a $240 add-on fee for the multi-level package: https://www.statmodel.com/pricing.shtml This of course, does not include the cost in time and energy in learning the language for a new software package
validate the subsequent multiply imputed data by plotting the distributions of each variable across the multiply imputed datasets and find them to have conformed well against the distributions of variables non-imputed original dataset.

A.4.1 Distribution of dependent variables

Exploratory data analysis reveals that the distributions of all the dependent variables of interest (pesticide use, fertilizer use and incidence of food contamination) have extreme right skews, as shown in Figure A.4.

Figure A.4: Distributions of Untransformed Dependent Variables
Suffice it to say then, change in pesticide use, levels of fertilizer use\textsuperscript{13} and incidence of food contamination do not follow a normal distribution. While it is not uncommon to log-transform dependent variables in order to better approximate a normal distribution in order to fit a linear model, the logged transformed variables are still far from normal for change in pesticide use and incidence of food contaminants. While the log of fertilizer use (1961-2002) better approximates the normal distribution, it also exhibits some slight left skew as shown in Figure A.5

\textsuperscript{13} Note that I had previously noted that the fertilizer use variable had three variations: fertilizer use levels from 1961 to 2002, fertilizer use levels from 2002-2013 and the percentage change of fertilizer use from 1961 to 2013. As of the writing of this draft, I have only analyzed the performance of the first of these variations.
Figure A.5: Distributions of Untransformed Dependent Variables

Given the extreme skew of these dependent variables then, identifying a well-fitting model to analyze the data is no trivial matter and in the course of this analysis, I assess the fit of the following types of models to the data:

With regards to the generalized linear models, I assess the relative fits of the log-normal, Poisson and negative binomial distributions, all of which fit strictly positive data and are flexible to fitting data with right skews. Here I provide a brief overview of these various distributions. A random variable $X$ is said to follow a log-normal distribution if $\log(X)$ follows a normal distribution. While a regression of a log-

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transformed variable and the log-normal regression of an untransformed variable can be quite similar, a key difference is that while the former assumes that the error is normally distributive and additive on the logarithmic scale, the latter assumes the error is normally distributive and additive on the arithmetic scale (Xiao et al., 2011). Depending on the nature of the data then, one or the other can provide a better fit for the data (Lindsey and Jones, 1998; Limpert et al., 2001).

Meanwhile although the Poisson distribution is typically associated with modeling count data, it can also be applied to positive, continuous data. In fact, it has been shown to outperform linear regressions with log-transformed dependent variables because 1) it can handle natural zeros, whereas in a log transformation of a dependent variable that has a 0 value is – inf. Though a common rule of thumb is to add 1 to the dependent variable so that the log of (0+1) = 0, this adds measurement error to the subsequent variable. 2) Poisson regression is also able to handle small values well. Whereas small values like 0.01, 0.0001, and 0.00001 can be overly influential if log transformed because their logs are disproportionately large, Poisson regression does not have this problem because it does not log transform the dependent variable.

However, applying a straight Poisson regression to positive, continuous data would be problematic because of the restriction requiring the mean of a variable to equal its variance. Because the estimation of the parameters does not depend on the assumption that the mean equal the variance, this assumption can be relaxed with-
out undermining the benefits of using a Poisson regression instead of a log-linear regression. This assumption is relaxed under by a) using clustered standard errors b) using a quais-poisson regression b) using Poisson random effects. (Wooldridge, 2010).\textsuperscript{14}

Similarly one can also fit a negative binomial distribution to positive, continuous data. Like the Poisson distribution, a negative binomial distribution is often used to model count data. Unlike the Poisson distribution, there is no restriction for the variance to equal the mean. While theoretically, applying the negative binomial model on positive and continuous data could lead to biased results, simulations suggest that the negative binomial can actually perform on a level comparable to the Poisson regression in estimating models such models.\textsuperscript{15}

\textit{Model fit — dependent variable}

I first assess the fit of various linear models to the log transformation of the dependent variable. I do this by examining the residuals vs. fitted plots, which I show in Figure A.2. While the residuals vs. fitted plots for Log of Fertilizer Use (1961-2002) suggest a reasonable model fit, those for Log Change in Pesticide Use and Log Average Food Contamination are beset with numerous problems, including a suggestive relationship between the residuals and fitted values and many, large residuals. Though it is certainly possible that the poor fit is due to other factors and not a model misspecification. Given the extreme right skews of log transformation of pesticide use and average food contamination however, this seems unlikely. In addition, prior to fitting the models I assessed the variance inflation factor for each of the covariates included in the model to evaluate the extent to which the data may


suffer from multicollinearity. All variables had variance inflation factors below 5, a conservative rule of thumb\textsuperscript{16}

\textsuperscript{16} The final list of variables were of course selected through trial and error. For example, when I included Log GDP in the dataset, its variance inflation factor was over 10 and thus was excluded from the dataset.
Table A.2: Residual vs. fitted plots, linear models*

<table>
<thead>
<tr>
<th></th>
<th>Log Pesticide Use (%) Change</th>
<th>Log Fertilizer Use (1961-2002)**</th>
<th>Log Average Contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLS (country-clustered standard errors)</td>
<td><img src="image1" alt="Plot" /></td>
<td><img src="image2" alt="Plot" /></td>
<td><img src="image3" alt="Plot" /></td>
</tr>
<tr>
<td>Within FE</td>
<td><img src="image4" alt="Plot" /></td>
<td><img src="image5" alt="Plot" /></td>
<td><img src="image6" alt="Plot" /></td>
</tr>
<tr>
<td>Linear RE (country and year random effects)</td>
<td><img src="image7" alt="Plot" /></td>
<td><img src="image8" alt="Plot" /></td>
<td><img src="image9" alt="Plot" /></td>
</tr>
<tr>
<td>Linear RE (country and year random effects), Bell and Jones (2015)** specification</td>
<td><img src="image10" alt="Plot" /></td>
<td><img src="image11" alt="Plot" /></td>
<td><img src="image12" alt="Plot" /></td>
</tr>
</tbody>
</table>

* For the sake of legibility, the residuals vs. predicted plots presented here are only for one of the multiply imputed datasets. However, there is no substantive difference between the fit of the model for this imputed dataset and the fit of the model for the other imputed datasets.

** When the Log Fertilizer Use (1961-2002) measure is used as the dependent variable, the dataset is also subset to be between 1961 and 2002.

† Bell and Jones (2015) develop a model specification for country-year panel data which addresses the potential endogeneity problem between within and between estimators.

† No Bell and Jones model was specified for the log contaminant data because the Bell and Jones model specifically deals with specifically with country-year panel data.
I then assess the fit of various generalized linear models to the untransformed dependent variable. The model fit for Fertilizer Use is demonstrably worse for the generalized linear models than the linear models and in some cases, the model cannot even be fit due to non-convergence. This suggests that it would be better to stick to a linear analysis of the log transformation of fertilizer use. Meanwhile, though the model fits for pesticide use are still poor, they are arguably an improvement over the linear models in that there seems to be a reduction in the number of very large residuals when using the generalized linear models. This is also true to a lesser extent for the aggregate food contaminants data.
Table A.3: Residual vs. predicted plots, generalized linear models*

<table>
<thead>
<tr>
<th>Pesticide Use (% Change)</th>
<th>Fertilizer Use (1961-2002)†</th>
<th>Contaminant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log Normal</td>
<td></td>
<td></td>
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<tr>
<td>(country-clustered standard errors)</td>
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<tr>
<td>Quasipoisson</td>
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<tr>
<td>(country-clustered standard errors)</td>
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<tr>
<td>Negative Binomial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(country-clustered standard errors)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative Binomial</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>(within estimator FE)†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poisson</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>(country RE)</td>
<td></td>
<td></td>
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<tr>
<td>Negative Binomial</td>
<td>**</td>
<td></td>
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<tr>
<td>(country RE)</td>
<td></td>
<td></td>
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</tbody>
</table>

* For the sake of legibility, the residuals vs. predicted plots presented here are only for one of the multiply imputed datasets. However, there is no substantive difference between the fit of the model for this imputed dataset and the fit of the model for the other imputed datasets.

** These models did not converge.

† The negative binomial within estimator is fitted with the pglm package (Croissant, 2013). A Poisson within estimator FE model was not fit because under this model, the assumption that the mean of the dependent variable equals its variance still holds.
Appendix B

Appendix to Chapter 3: Unraveling Food Safety Crisis

B.1 Building a Dataset of Food Safety Incidents and Food Safety Grievances in China

As D’Orazio et al. (2014) note, central to any data collection effort is maximizing the resulting data archive’s recall and precision, where recall refers to ‘the ratio of relevant information in the archive to the total amount of relevant information in existence’ and precision refers to ‘the ratio of relevant information in the archive to the total amount of information in the archive.’ In constructing these databases, I aimed to maximize first recall and then precision. I detail the methods I employed to do so more fully below. To preview briefly, I:

1. Identified Chinese-language newspaper articles about food safety as my measure of food safety incidents and weibo posts on food safety as my measure of food safety grievances.

2. Extracted newspaper articles and weibo posts about food safety by using search terms curated from an existing database that has documented Chinese food
safety incidents. Note that using these search terms maximized the recall of both the measures of food safety incidents and food safety grievances, but at the expense of precision. In other words, while many newspaper articles and weibo posts were collected that would not have been if not for these search terms, many other newspaper articles and weibo posts were also collected that had nothing to do with food safety.

3. *Refined* the precision of both the measures of food safety incidents and food safety grievances through supervised machine learning models. These models estimate the likelihood that a newspaper article or weibo post is about food safety or not and categorizes them accordingly.

While in the Data section of the paper, I explain my reasoning for identifying Sina Weibo posts as my measure of food safety grievances and newspaper articles from the WiseSearch database as my measure of food safety incidents, in what follows below I elaborate on the steps that I took to extract and refine these measures.

**B.1.1 Extraction of measures**

Close attention was paid to how these newspaper articles and weibo posts were extracted. As D’Orazio et al. (2014) note, ‘given the large number of available sources and ways in which the concepts of interest may be described, bias is often induced into the data at these very early stages by selecting sources with limited coverage or not constructing a representative set from the start.’ With regards to this paper, while a straightforward extraction method may be to simply collect any article that contains the word ‘food safety,’ this could seriously bias the subsequent corpus if many food safety articles or weibo posts about food safety used only words to describe the specific food or contaminant in question, and not the term ‘food safety.’
To address this possibility (which was in fact borne out, as will be shown later on), I used not only the term ‘food safety’ as a search term, but search terms extracted from an existing archive of food safety incidents called ‘Throw it out the Window’.  

‘Throw it Out the Window’ is the best publicly available resource that documents food safety incidents in China. It was started by a Shanghainese student, Wu Heng to circulate information about food safety incidents and contains information on such incidents as far back as 2004. Since its inception in 2011, it has grown to include 34 volunteers. It further received official sanction from the Shanghainese municipal government in 2012, who praised the site for its ‘social service’. The site has documented more than 5900 food safety incidents from 2004 to 2015 and 901 food safety incidents from June 2011 to January 2013. However, because the purpose of the “Throw it Out the Window” site is to report the the existence of a food safety incident, not to document the degree of scrutiny around a food safety scare, using it as the basis for analyzing how information about food safety crises affects subsequent perceptions about food safety would provide an inaccurate analysis. It is however very well suited as the basis to search for the universe of food safety articles and food safety grievances.

Conveniently, each article posted on the ‘Throw it out the Window website’ is tagged with regards to a) location b) the food item in question c) relevant phrases

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1 The Chinese translation being 食品安全
4 http://www.zccw.info/index
5 On the website (http://www.zccw.info/query), this is referred to in Chinese as 地区查询
6 On the website (http://www.zccw.info/query), this is referred to in Chinese as 食品名查询

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(including additives or businesses involved, if any). These tags were used as the basis of the subsequent search for food safety articles and weibo posts.

In all there were 3,143 tags for food safety incidents reported on 2012. Note that many tags were either repeated or closely related to each other. In such instances, the word was stemmed to its root and only the root was retained. For example, one tag might read ‘pork’ and another tag might read ‘pork meat’ — in this case ‘pork meat’ is stemmed to ‘pork’ and of the two tags, only ‘pork’ is kept. After cleaning and collapsing similar tags, there remained 225 tags about the food in question. There were also an additional 130 tags which dealt with businesses implicated in a food safety incident and 147 tags which named the alleged additives deemed to compromise food safety.

**Food safety grievances**

Using the combination of the food tags, business tags and additive tags and the term ‘food safety’ yielded some 32 million potential Weibo posts about food safety. Though using such an expansive search criteria maximizes recall, it also results in poor precision. To validate whether the extent to which this collection of articles were truly about food safety, I randomly sampled 1000 articles and coded them. Unfortunately, only 6 of them were found to be about food safety. In other words, most weibo posts are likely not about food safety which would make any subsequent analysis based on the raw corpus of dubious value. As described in more detail below, I deal with the poor precision of the extraction method with supervised machine learning tools.

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7 On the website (http://www.zccw.info/query), this is referred to in Chinese as 关键词查询

8 Note that actually 406 tags were found to be related to food but only tags that were mentioned more than once were kept
Food safety incidents

I used a similar strategy to extract grievances about food safety as I did to extract food safety articles. That is, I used to food search tags culled from the ‘Throw it out the Window’ site to along with the term ‘food safety’ to search for articles about food safety.\(^9\) Using these tags as search terms, 1,331,412 articles were extracted from 99 of the 110 newspapers available in the WiseSearch database\(^10\) for the time period between December 1, 2011 and January 1, 2013. A full list of the newspapers included in the search, as well as the newspapers from which articles were ultimately extracted from, is available in Appendix B.3, below.

I similarly sample 1000 articles and coded them, again finding that poor precision was also a problem, though to a lesser degree than for the weibo posts. That is, only 26 were found to be about food safety. As with the problem of poor precision in the newspaper articles, I similarly deal with the issue of poor precision of the weibo posts with supervised learning methods, which I discuss more fully below.

\(^9\) Note that I did not use the search terms associated with businesses or additives when extracting food safety articles for a number of reasons: 1) Tags related to food were more expansive search terms with regards to the topic of food safety. Search terms that are related to food businesses or food additives should be subsumed within search terms related to food 2) Conversely search terms related to food businesses or food additives without mention of a particular food in the article are unlikely to be about food safety. Given these justifications, one is left to wonder why search tags for businesses and additives were not similarly excluded from the extraction of weibo posts. The reasons were both methodological and technical. With regards to the former, in weibo posts, where relatively few characters are used, it is much more plausible to come across a situation in which a weibo user talks about the safety problems associated with a particular food company or food additive without necessarily mentioning the food in question.\(^{11}\) With regards to the latter, because the entire weibo corpus was available for download from the HKU website, searching for and extracting weibo posts was a relatively straightforward endeavor compared to extracting newspaper articles from the WiseSearch database. Because it was not feasible to download the entire WiseSearch database for the year 2012 (or indeed any year), newspaper articles had to be scraped via the WiseSearch website which was relatively time-consuming. That is, it took about a month to extract all the newspaper articles that matched the ‘Throw it out the Window’ food search tags.

B.1.2 Refinement of measures

Resolving the low precision of the dataset can be thought of as a text classification problem in which some articles can be categorized as being about food safety and some articles can be categorized as being not about food safety. Given that I collected approximately 32 million weibo posts and 1.3 million newspaper articles, manual coding would not be a feasible strategy to resolve this classification problem, at least not without substantial time and resources. Instead, I turn to supervised machine learning models to do so.1112 Such methods have been shown to be efficient and effective alternatives to manual text categorization (Sebastiani, 2002; Lewis et al., 2004) (including Chinese language text categorization (He et al., 2000)) and have been widely used for that purpose. In political science for example, researchers have used machine learning to refine a variety of widely used datasets from MIDS (D’Orazio et al., 2014), to Polity 2 (Minhas et al., 2015). In what follows I first give a overview of what supervised machine learning is and the general steps that I undertook to categorize the texts for both corpuses. I then describe in greater detail the particular steps that I undertook to categorize the texts in each corpus.

11 Note in an early version of this paper, I had explored the possibility of increasing the precision of the corpus by culling articles based on the frequency with which certain words appear in a dataset, what is commonly known as the RIPPER technique (Cohen and Singer, 1999). The most generous rule that I used was to keep articles only if they mentioned the term ‘food safety’ at least once, an additive or a business associated with food safety at least twice and a food item associated with food safety problems at least 5 times, for a total of 448,813 articles. However, precision is likely still problematic under this method. For example with regards to the newspaper articles, recall that of the 1000 newspaper articles sampled in the previous section, 18 were about food safety. As such, this would suggest that the percent of articles about food safety is closer to 2%, or 26,000 articles. Moreover, none of the articles that were identified as being about food safety were present in the RIPPER generated corpus, suggesting that this algorithm would incorrectly classify many articles as being not about food safety when they in fact are.

12 Machine learning can generally be divided into supervised learning and unsupervised learning. In supervised learning, one first trains the machine on a subsample of data for which one has a pre-existing output (i.e. document category) for a sample of inputs (i.e. documents). In unsupervised learning, no such training datasets are provided. Supervised learning is better suited for analyses which seek to divide texts into pre-defined categories whereas unsupervised learning is more appropriate when the goal of the analysis is to organically uncover document categories.
General overview of text categorization

Briefly, supervised machine learning automates document classification by building a classifier based on its document term matrix or bag of words. In plainer English, it builds a statistical model that predicts whether a text is about food safety or not based on the frequency with which different words appear in its text corpus. In practice, this is accomplished in three parts:

1. Training Phase — In this phase, one ‘trains’ the text classifier. To do so, one must first randomly sample a subset of the text corpus and manually classify it — this is known as the training set or training data. With the training set, one can ‘train’ the model by pairing the inputs (document term matrix) with the expected outputs (the manually categorized texts).

2. Validation Phase – In this phase, one validates the performance of the classifier trained in the training phase. One does this by creating a validation set, which, like the training set is a random sample of texts that one then manually categorizes. The difference however is that the model is constructed based on the training set, not the validation set and thus one can evaluate the performance of the model by comparing the text classifications predicted by the model with the true text classifications.

3. Application Phase – In this phase, one applies the best-performing classifier to the rest of the text corpus. Because the remaining text corpus is by design not manually categorized, the quality of the text classification can only be inferred from the performance of the classifier in the validation phase.

13 A ‘document term matrix’ and ‘bag of words’ and are essentially equivalent concepts. The difference is mathematical — a document term matrix refers to a matrix in which the texts are the rows, the columns are the words and the content is the word frequencies whereas a bag of words refers to multiset of word frequencies for each text. Since the models take document term matrices as inputs, henceforth I will exclusively use the term document term matrices.
While implementing a supervised machine learning algorithm to a text corpus in theory is as straightforward as the steps outlined above, in practice there are a number of additional data preprocessing considerations which can both increase the complexity of the task and greatly influence the identification of the best classifier. These include decisions regarding how to: 1) transform a text into a document term matrix 2) subset the terms included in a document term matrix 3) weight the resulting document term matrix. Finally, there are also 4) a number potential classifiers all of which can affect the performance of the resulting classifier and can greatly complicate the process of building the best classifier. How to pre-process the document term matrices and which classifier should be chosen to build the best classifier is often contingent on the peculiarities of the text corpus. In what follows I describe the various considerations taken into account when building the classifiers for the newspaper article corpus and the weibo corpus:

Transforming text into a document term matrix There are unique challenges in transforming texts into a document term matrix for every language. For the Chinese language, the main challenge is segmenting text into different words because spaces are not used to delineate between words. Building an accurate segmenter has been a vigorous area of research in recent years — indeed since 2003 researchers in academia and industry have competed to build the best segmenter in numerous SIGHAN\textsuperscript{14} Chinese Word Segmentation Bakeoffs (Sproat and Emerson, 2003). Of the publicly available segmenters, the Stanford Natural Language Processing Group\textsuperscript{15} is among the best performing (Tseng et al., 2005; Chang et al., 2008). As such, I employ it to segment both the newspaper articles and weibo posts. It has also been used

\footnote{According to its website: SIGHAN is a Special Interest Group of the Association for Computational Linguistics. As such, it ‘provides an umbrella for researchers in industry and academia working in various aspects of Chinese Language Processing.’: http://sighan.cs.uchicago.edu}

\footnote{The Stanford Word Segmenter is available here: http://nlp.stanford.edu/software/segmenter.html. The latest version available as of this paper’s writing, Version 3.6.0 was used.}
in other social science research that employs Chinese language text analysis (King et al., 2013; Lucas et al., 2015).

Subsetting document term matrices Selecting which terms are included in the document term matrix\(^{16}\) is an important consideration when building a good classifier. Text categorization problems often exhibit problems of high dimensionality — that is a text corpus can have many tens or hundreds of thousands of terms but comparatively few texts. Selecting a subset of terms can substantially improve classification accuracy and can also help make text classification problems computationally more efficient (Forman, 2003). Both rare words and common words may be eliminated if they add little to the predictive accuracy of the model. To draw an example from the English language, if only one text in a corpus used the word ‘logomachy’, then it would be of very little use in helping to predict the categories for other texts in the corpus. On the other hand if most texts contain the word ‘the’, it too would add little to the accuracy of the model. In recognition of the importance of feature selection, I use a \(\chi^2\)-squared test to statistically select which terms should be kept to maximize categorization accuracy (Yang and Pedersen, 1997).

Scaling document term matrices Deciding how to scale terms in a document term matrix can also affect classifier performance. When texts are of differing lengths within a corpus for example, it may be helpful to scale the document term matrix so that longer documents do not unduly influence the performance of the classifier simply by virtue of length (Hsu et al., 2003).

There are a number of ways to scale a document term matrix. I assess the performance of some of the most commonly used weighting schemes: Min-Max weighting

\(^{16}\) The process of choosing which words to include in a document term matrix is also known as feature selection.
and Term Frequency-Inverse Document Frequency (td-idf) (Ramos, 2003). Min-Max weighting normalizes each term to between 0 and 1. The advantage of using this scaling method is that it is robust to very small standard deviations of terms — it also preserves zero entries in sparse data.

Meanwhile td-idf measures the frequency of a term in a text weighted by how rarely it is used in a text corpus. Words with high tf-idf numbers suggest that they have a strong relationship with the text that they appear in and thus scaling each term via td-idf can help improve the predictive power of the term. Previous work has found that td-idf scaling works well with Chinese language corpora (Zhang et al., 2008).

Choosing and building a classifier Though there is no shortage of previous work which offer guidelines on what kind of classifiers work best for textual classification, they are far from definitive. This is because the relative merits of one classifier over another is often quite dependent on the idiosyncrasies of the text corpus. With this in mind, I compared the performance of the most commonly used classifiers for both dataset on weibo posts and newspaper articles (Lewis et al., 2004), including:

- Multinomial Bayes

17 Newer work has suggested that a Bi-Normal Separation Scaling (BNS) (Forman, 2008) may outperform td-idf scaling and moreover, doing so obviates the need for feature selection. Development of a BNS scaling algorithm for public use is still in the beta mode (available here: https://github.com/dumoulma/fic-prototype/tree/master/ficlearn) however and I was confronted with a memory error when attempting to apply it to the newspaper article dataset, even when using Amazon’s largest EC2 server. This is because the version of the publicly available BNS scaling algorithm is currently written to handle non-sparse matrices and as such the function as currently written is not built to handle document term matrices of the size used in this paper.

18 Note, following (Hsu et al., 2003), the training and test sets are scaled together. This is as opposed to scaling the training and test sets separately, which leads to poor classification performance.


20 For example, Hsu et al. (2003); Lewis et al. (2004) recommend a linear SVM classifier for text classification problems.
• Elastic Net

• $k$-Nearest Neighbor

• Naive Bayes

• Perceptrons

• Passive Aggressive Classifier

• Ridge Classifier

• Random Forest

• Rocchio

• Stochastic Gradient Descent (SGD)

• Support Vector Machines (SVM)\textsuperscript{21}

For more detail on these classifiers, please see Aggarwal and Zhai (2012).

In order to compare the relative performance of the different classifiers, I estimate the optimum parameters for each of the different classifiers.\textsuperscript{22} That is, every classifier has at least one parameter which must be set beforehand, whether it be a regularization parameter (i.e. as in SVMs) or the type loss function (i.e. as in SGD classifiers), etc, and which can greatly influence the subsequent performance of the classifier. To assess the optimal parameter values for each of these classifiers, I evaluated the performance of each classifier over the range of its different possible

\textsuperscript{21} Ng, Andrew. ‘Machine Learning.’ Coursera. https://www.coursera.org/learn/machine-learning

\textsuperscript{22} These models were run using the \texttt{sklearn} module in Python
parameterizations. In jargon, such an optimization procedure is known as a grid search.

In order to reduce the probability of choosing parameters which overfit the training data, the parameters were estimated via 5-fold cross validation. Under this procedure, each training set was randomly divided into 5 subsets, or folds. One fold is set aside as the validation set, while the other 4 folds are used as the training set. The classifier is then trained on 1 subset of the training set and its performance was then evaluated on the other 3 folds. This is done 4 times so that each subset is used to train the classifier once. The optimum parameters are then an average of the parameter values estimated by the four folds. The classifier’s performance is assessed on the fifth fold that was set aside as the validation set.

Evaluating classifier performance  Note that there are a variety of benchmarks to evaluate model performance. Common ones include precision, recall, and F1-score. Here, precision and recall are conceptually equivalent to D’Orazio et al. (2014)’s characterization as ‘the ratio of relevant information in the archive to the total amount of information in the archive’ (precision) and ‘the ratio of relevant information in the archive to the total amount of relevant information in existence’ (recall). Here precision specifically refers to the ratio of the number of texts actually about food safety and classified as such to the number of all texts classified as being about food safety. Mathematically it is the number of true positives (TP) divided by the sum of true positives and false positives (FP):

\[
Precision = \frac{TP}{TP + FP} \quad (B.1)
\]

Meanwhile recall refers to ratio of the number of tests actually about food safety and classified as such to the number of all texts actually about food safety. Mathemati-
cally it is the number of true positives divided by the sum of true positives and false negatives (FN):

$$Recall = \frac{TP}{TP + FN}$$  \hspace{1cm} (B.2)

Lastly, an F1 score is a weighted average of the precision and recall. Its formula is given by:

$$F1 = 2 \times \frac{precision \times recall}{precision + recall}$$  \hspace{1cm} (B.3)

To summarize, like any other statistical model, building a robust classifier is as much a science as it is an art. The classifier for the newspaper corpus and the weibo corpus that was best able to maximize the number of true positives was chosen. This evaluation was done on all the different combinations of terms selected, scalings of the text corpus, classifier types and classifier parameters, as summarized in Table B.1.
Table B.1: Data and classifier combinations used in grid search

<table>
<thead>
<tr>
<th># terms</th>
<th>Scaling</th>
<th>Classifier Type</th>
<th>Classifier Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,000</td>
<td>Min-Max</td>
<td>Multinomial Bayes</td>
<td>$\alpha \in [2, 0.5, 1.15, 0.75, 0.01, 0.001, 0.0001, 0]$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Prior $\in {\text{Empirical Bayes, Uniform Prior}}$</td>
</tr>
<tr>
<td>50,000</td>
<td>Elastic Net</td>
<td>$\text{II} _\text{ratio} \in [0.05, 0.06, 0.075, 0.08, 0.1, 0.15, 0.25, 0.35, 0.75, 0.95]$</td>
<td>$\alpha \in [0.0000001, 0.0001, 0.001, 0.005, 0.01, 0.05, 0.1, 0.33, 0.5, 0.66, 0.99]$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Loss Function $\in {\text{hinge, squared hinge, log, modified-huber}}$</td>
</tr>
<tr>
<td>100,000</td>
<td>$k$-Nearest Neighbor</td>
<td>Number of neighbors $\in [1, 5, 10]$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Leaf Size $\in [15, 30, 45]$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Distance Measure $\in {L1, L2}$</td>
</tr>
<tr>
<td>All Terms</td>
<td>Tf-Idf</td>
<td>Naive Bayes</td>
<td>$\alpha \in [1, 0.1, 0.01, 0.001, 0.0001, 0]$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Prior $\in {\text{Empirical Bayes, Uniform Prior}}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perceptrons</td>
<td>Penalty Function $\in {\text{None, } L1', L2', \text{elasticnet}'} \alpha^* \in [1, 0.1, 0.01, 0.001, 0.0001, 0]$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Passive Aggressive Classifier</td>
<td>$C^\dagger \in [0.01, 0.1, 0.5, 1, 10, 100, 1000]$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ridge Classifier</td>
<td>Regularization Parameter $\in [1, 0.1, 0.01, 0.001, 0.0001, 0]$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Random Forest</td>
<td>Number of trees in the forest $\in [5, 10, 100]$, Criterion for measuring quality of the split $\in {\text{gini}', \text{entropy}}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$# \text{ of features} \in {\text{auto}', \text{sqrt}', \text{log2}', \text{None}}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rocchio</td>
<td>Shrink threshold $\in {\text{None}, 0.1, 0.15, 0.25, 0.35, 0.75, 0.99}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stochastic Gradient Descent (SGD)</td>
<td>Penalty Function $\in [L1, L2]$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$\alpha \in [0.0000001, 0.0001, 0.001, 0.005, 0.01, 0.05, 0.1, 0.33, 0.5, 0.66, 0.99]$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Support Vector Machines (SVM)</td>
<td>Penalty Function $\in [L1, L2]$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$C^\dagger \in [0.01, 0.1, 0.5, 1, 10, 100, 1000]$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Loss Function $\in {\text{hinge, squared hinge, log, modified-huber}}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Optimization $\in {\text{Primal, Dual}}$</td>
</tr>
</tbody>
</table>

$\dagger$ Terms selected using $\chi$-square test

$\dagger$ : $C$ is a regularization parameter

*: $\alpha$ a constant that multiplies the penalty parameter if it is used

L1: Manhattan distance; L2: Euclidean Distance
Categorizing food safety weibo posts

In this section, I turn to actually applying the supervised machine learning methods outlined above to the weibo corpus. Recall that the precision for the weibo posts was particularly poor — after sampling 1,000 of the 32 million posts, only 6 of them were found to be about food safety. Given the 5-fold cross-validation strategy outlined above, a training set with at least 500 posts (around 100 posts about food safety per fold) about food safety would be necessary to have a bare minimum number of observations to train on. As such, a training set of 80,000 to 100,000 would be needed to yield 480-600 weibo posts about food safety.

Unfortunately, time and resource constraints made coding a training set of 80,000 weibo posts unfeasible. As such, instead of using all the search terms from the ‘Throw it out the Window’ site at once, I used only tags extracted from the “Throw it Out the Window” repository that corresponded to food safety articles published within the last 10 days of a Weibo post. This yielded a far reduced 312,815 number of posts. Heuristically, the size of this dataset is in the same ballpark as the expected size of the dataset had I applied an automated text classification scheme to the entire 32 million corpus of weibo texts — 192,000 (.6% of 32 million). Moreover, a sample of 1,000 of these 312,815 posts (heretofore referred to as Weibo Training Set 1) revealed that 39.9% of the reduced dataset were about food safety, a dramatic improvement over the 0.6% rate of the sample of the full 32 million corpus.

Further examination of the set of 312,815 weibo posts revealed that 100,833 weibo Posts, or about 32%, were found to be duplicates or close duplicates. This is not

58,178 weibo texts were found to be exact duplicates. A further 42,655 were found to be close duplicates duplicates. Closely duplicated weibo posts are those which are essentially the same except for the addition of extra spaces, different use of special characters (i.e. using‘<’‘<’ instead of ‘”’), or at most, a difference of a few characters. Comparing each post against all other 254,637 posts (312,185 total posts - 58,178 exactly duplicated posts) all at once is computationally intractable however, given that to do so would essentially be a computational problem on the order of the factorial of 254,637. As such, I evaluate the degree to which there are close duplicates of weibo posts by date under the rationale that retweets are likely to occur temporally close in

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surprising given that it is common for weibo users to retweet\(^{24}\) that is copy and forward other people’s weibo posts. The high percentage of duplication poses a problem for automatic text classification however, as none of the classifiers performed very well when using the grid search combinations shown in Table B.1 on the 5-fold cross-validated Weibo Training Set 1 — the best performing classifiers hovered around 50% in terms of precision and recall.

As such a third sample of 1000 weibo posts was drawn from the set of 211,982 unique posts (312,815 total posts - 100,833 duplicated posts.). Further, 43 of the posts sampled in Weibo Training Set 1 were also found to be in the set of 211,982 unique posts, resulting in a combined 1043 sample (heretofore referred to as Weibo Training Sample 2). A grid search using the different combinations of parameters shown in Table B.1 was then performed on the 5-fold cross validated Weibo Training Set 2. The best performing classifier was the Elastic Net Classifier.\(^{25}\)

The confusion matrix for the classifier is given in Table B.2 and its performance vis-a-vis precision, recall and the F1-score is given in B.3. From B.3 we can see that the validation set had 209 observations, of which 65, or 31% were coded as being about food safety which is consistent with the percentage of observations about food safety in the training set overall. The recall for both weibo posts about food safety

\(^{24}\) If I was being consistent, I would of course be using the term ‘reweibo’. However, given that this term is a relative tongue-twister and that using the term ‘retweet’ to refer to weibo seems to be standard practice in English-speaking academic circles (As of November 2016, there were 1,220 articles that were found when searching for the terms ‘retweet weibo’ on Google Scholar versus 1 hit on Google Scholar when searching for the term ‘reweibo’), I stick with the term ‘retweet’ here.

\(^{25}\) An Elastic Net regression is a hybrid model which combines the penalty parameter of the coefficient parameter from the Lasso regression, L1 (manhattan distance) with the penalty parameter from the Ridge regression, L2 (euclidean distance). The \(l_{1\text{ratio}}\) parameter (in the Elastic Net row in Table B.1) controls how much the L1 or L2 penalization is used (where 0 is equivalent to a pure Ridge regression and 1 is equivalent to a pure Lasso regression).
Table B.2: Confusion matrix for categorizing weibo posts to be about food safety or not about food safety

<table>
<thead>
<tr>
<th></th>
<th>Weibo Predicted to be about Food Safety</th>
<th>Weibo Not Predicted to be about Food Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weibo Actually About Food Safety</td>
<td>58</td>
<td>7</td>
</tr>
<tr>
<td>Weibo Actually Not About Food Safety</td>
<td>25</td>
<td>120</td>
</tr>
</tbody>
</table>

Table B.3: Evaluation of the performance of the elastic net classifier for the weibo training data

<table>
<thead>
<tr>
<th></th>
<th>Precision</th>
<th>Recall</th>
<th>F1-score</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weibo About Food Safety</td>
<td>0.71</td>
<td>0.89</td>
<td>0.79</td>
<td>65</td>
</tr>
<tr>
<td>Weibo Not About Food Safety</td>
<td>0.94</td>
<td>0.83</td>
<td>0.89</td>
<td>144</td>
</tr>
<tr>
<td>Average</td>
<td>0.87</td>
<td>0.85</td>
<td>0.86</td>
<td>209</td>
</tr>
</tbody>
</table>

N: Number of observations

and weibo posts are similar and both reasonably good, at 89% and 83% respectively. This suggests that most posts about food safety will be classified as such and most posts not about food safety will also be classified as such. Meanwhile the classifier had a mediocre performance of 71% with regards to the precision of weibo’s about food safety. Conversely it had a very good performance of 94% with regards to weibo posts not about food safety.

Though other classifiers had better performance for the precision of weibo about food safety, the elastic net classifier was the best performing one in terms of recall for weibo’s about food safety. In essence, the choice of which classifier to choose is a bias versus variance problem. By choosing a classifier that maximizes recall but not precision, I am choosing a classifier with lower bias but higher variance. The effect should be that any subsequent analyses with this data will be as accurate as possible because of the relative unbiasedness of the measure. Meanwhile, the statistical significance of any subsequent finding will likely be a conservative because of its relatively high variance.
The next step is to apply the optimized classifier to the test set of 211,982 unique Weibo posts, which classified 161,934 of the posts as being about food safety. I then rematched the unique observations to any duplicated observations that it may have in the full corpus of 312,815 Weibo posts, of which there were 76,106. The final number of Weibo posts ultimately classified as being about food safety then, is 238,040. Note that this is also close to the predicted number of Weibo posts on the raw 32 million Weibo corpus, 192,000. As a final check of the quality of the classified data, I randomly sampled 100 Weibo posts and found that 73 (73%) were about food safety, which is consistent with the precision of the classifier given in Table B.2.26

Note that it is impossible to calculate the recall of the final dataset — if there existed a dataset of all Weibo posts about food safety problems that I could compare this dataset against, there would be no need to create this dataset in the first place. However, consider that of the Weibo posts predicted to be about food safety, only 49,466 actually used the term ‘food safety’. This suggests that the recall rate is much higher than it would have been if only the word ‘food safety’ had been used to extract Weibo posts about food safety — indeed it leads to a 500% increase. This also helps provide empirical justification for a more expansive data collection approach (in which food safety articles collected using search terms extracted by the ‘Throw it Out the Window’ dataset) over a more restrictive one (in which only articles that contained the term ‘food safety’ would have been collected).

The Weibo posts are plotted by date and grouped by color in Figures B.1 and B.2. From Figure B.1, it appears that grievances about food safety were most often expressed from April to July, followed by December to January. Weibo posts

26 Clearly the ideal would be to have 100% of the Weibo posts be about food safety. Time and resource constraints make coding even the substantially reduced corpus of 238,040 Weibo posts (relative to the original 32 million) unfeasible. Increasing the size of the training set up from 1000 posts would likely be the most effective way to improve the quality of the dataset, which I plan to do in future iterations of the paper. For now, a 73% precision rate, while nothing to write home about, is passable.
Note that while weibo posts were extracted from all 31 provinces in China, only weibo posts from 14 of these provinces were used in the final analysis. This is because articles about food safety were only available from 14 provinces. As such, I constrain the subsequent statistical analysis to just these 14 provinces and correspondingly present a visualization of only the provinces used in the statistical analysis in the figure above.

about food safety were the lowest in the fall and early spring months. The histogram also appears to show that weibo users who identified as being residents of Beijing, Guangdong, Shanghai and Zhejiang posted the most often about food safety problems. This is confirmed by the box plots of weibo posts by province shown in B.2. These figures suggest that there may be important panel and temporal effects to control for in the subsequent analyses.
Note that while weibo posts were extracted from all 31 provinces in China, only weibo posts from 14 of these provinces were used in the final analysis. This is because articles about food safety were only available from 14 provinces. As such, I constrain the subsequent statistical analysis to just these 14 provinces and correspondingly present a visualization of only the provinces used in the statistical analysis in the figure above.

### Categorizing food safety articles

I applied much of the same strategy of categorizing weibo posts as I did to categorizing newspaper articles. Here, I randomly sampled 20,000 articles\(^{27}\) to create the training set for the newspaper corpus classifier.\(^{28}\) For each of these articles, I

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\(^{27}\) Note that the discrepancy in the size of the training set for the newspaper articles (20,000) and weibo posts (1,000) can be explained by the prerogative of having a large enough sample size of food safety texts in order to train on. Because an estimated 2.6% (26 out of 1000) were initially identified as being about food safety, this suggested that at least 20,000 articles would have to be sampled in order to have a training set with around 500 food safety articles. Because the classifier is optimized using a 5-fold cross validated grid search, it seemed prudent to be able to have at least 100 articles about food safety represented in each fold

\(^{28}\) Note that I did not sample 20,000 articles outright. Rather, I sampled an additional 19,000 articles, which combined with the 1,000 articles that I had sampled to assess the precision of
manually coded whether it was about food safety or not, and found that a total of 619 articles out of 20,000, or 3.095% of the sample were about food safety. The articles were sampled from a raw corpus of 1,226,547 newspaper articles.\textsuperscript{29}

In Stage 1 of the text classification scheme, I then performed a 5-fold cross validated grid search different combinations of words selected, scaling methods, classifiers, and parameters summarized in Table B.1. Weighting the document term matrix with the Tf-Idf algorithm, subsetting it 50,000 terms via the $\chi^2$ test and classifying it via the Multinomial Bayes Classifier\textsuperscript{30} turned out to be the combination that maximized the number of true positives (correctly classifying food safety articles as such) in the article corpus. Given that the motivation for applying supervised machine learning techniques to the corpus is to improve the precision of the corpus, it would seem straightforward to use precision to evaluate model performance. However, as with the weibo data, after some experimentation, it became apparent that this was not the most appropriate benchmark because there are relatively few texts in the raw database on food safety. To frame it in another way, because there are many more articles that are not about food safety than articles that are about food safety, the corpus, summed to 20,000 articles. While this was not a pure simple random sample, given that there were more than a million articles on food safety to sample from, it is a very close approximation.

\textsuperscript{29} Note note that 1,226,547 is less than the 1,331,412 articles collected. This discrepancy is for two reasons — first upon closer inspection 1,904 of the scraped articles were found to contain only a word or two. As they were not articles, they were thus completely eliminated from consideration in the text classification. Further, another 82,961 articles were found to be reprints of other articles — that is these same articles appear in different newspapers. For for the purpose of text classification, having multiple entries of the same article is likely to bias the subsequent categorization and as such are omitted. Unlike with the weibo data, I did not attempt to look for close duplicates for two reasons. First, the limited number of newspapers in the newspaper article corpus imposes an upper limit on the number of close duplicates there can be, minimizing the problem. Second, computationally trying to find close duplicates of long texts is computationally challenging and given the first point, likely not worth the time and energy.

\textsuperscript{30} The Multinomial Bayes classifier is simply an implementation of the Naive Bayes classifier where the likelihood is the multinomial distribution. The Naive Bayes classifiers are a class of classifiers which classifies texts based on Bayes theorem and makes the assumption that different terms are mutually independent of each other. While this assumption is often violated, in practice the Naive Bayes classifier has often been shown to outperform more complex models.
Table B.4: Stage 1: Confusion matrix for categorizing newspaper articles to be about food safety or not about food safety

<table>
<thead>
<tr>
<th>Articles Actually About Food Safety Problems</th>
<th>Articles Predicted to be about Food Safety</th>
<th>Articles Not Predicted to be about Food Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Articles Actually About Food Safety Problems</td>
<td>166</td>
<td>7</td>
</tr>
<tr>
<td>Articles Not About Food Safety Problems</td>
<td>177</td>
<td>3650</td>
</tr>
</tbody>
</table>

Table B.5: Stage 1: evaluation of the performance of the multinomial bayes classifier

<table>
<thead>
<tr>
<th>Articles About Food Safety Problems</th>
<th>precision</th>
<th>recall</th>
<th>f1-score</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Articles About Food Safety Problems</td>
<td>0.48</td>
<td>0.96</td>
<td>0.64</td>
<td>173</td>
</tr>
<tr>
<td>Articles Not About Food Safety Problems</td>
<td>0.998</td>
<td>0.98</td>
<td>3827</td>
<td></td>
</tr>
<tr>
<td>avg total</td>
<td>0.98</td>
<td>0.95</td>
<td>0.96</td>
<td>4000 (total)</td>
</tr>
</tbody>
</table>

N: Number of observations

A classifier that maximizes precision will be heavily weighted toward maximizing the precision of the non-food safety articles. Under such a scenario, a classifier may classify every non-safety article correctly and every food safety article incorrectly and still have a very high value of precision because there are many more articles not about food safety problems than there are articles about food safety problems in the text corpus. As such, instead of maximizing precision, I benchmark each classifier on how high the recall is. The confusion matrix for the best validation set using this benchmark is shown in Figure B.4 and the values for precision, recall and the F1-score are given in Figure B.5.

From Figure B.5 we can see that the classifier and data combination produced a 96% recall for articles about food safety problems, and 98% for articles not about food safety problems, both very high. The recall for articles about food safety problems in particular suggest that very few articles about food safety were excluded from the dataset, thus minimizing the bias of the dataset. Articles not about food safety problems also have a very high level of precision at 99.8%. The same cannot be said of
articles about food safety problems however, as its precision is a relatively poor 48%. The low level of precision for food safety articles is due to the relative abundance of articles not about food safety problems. As is evident from the confusion table in Figure B.4, even though the classifier correctly classified 3650 out of 3827 articles to be not about food safety, the remaining 177 articles that it classified incorrectly is still larger than the number of food safety articles that the classifier classified correctly, 166.

Further examination of the types of articles that the classifier incorrectly classifies as being about food safety problems when it is in fact not about food safety suggest that expanding the training set is unlikely to fix the problem of low precision of articles about food safety. This is because the articles incorrectly classified as being about food safety problems were by and large topically similar to articles about food safety problems and thus employed many of the same terms. Typical of such misclassified articles were articles that discussed good dieting habits, new nutrition studies, and the finances of various food companies. Meanwhile, most articles in the dataset that were not about food safety and accurately classified as such were typically far more removed from articles about food safety problems, ranging anywhere to articles on natural disasters to writing novels in the workplace. As there are both relatively few articles about food safety problems (173/4000 in the validation set) and relatively few articles that were misclassified as being about food safety problems because they were topically about food (177/4000 in the validation set) compared to all other articles that were easily classified as not being about food safety problems (3650/4000), a more efficient strategy to improve the precision of the dataset would be to perform a second stage of text classifications on the set of data which the first stage of text classifications predicted to be about food safety problems, that is the left column of the confusion matrix in Figure B.4.

As such rather than expand the training set on the original corpus, I use the
classified texts from Stage 1 as the basis for further classification in Stage 2. After applying the Stage 1 classifier to the test set, 100,904 articles were predicted to be about food safety and make up what I term the Stage 1 data. I then sampled 2000 articles from the Stage 1 data for the training set, and coded 672 articles, or 33.6% of the training set, as being about food safety problems. Again after performing a 5-fold cross-validation grid search, the Multinomial Bayes Classifier was found to be the best performing.\footnote{The data was weighted using the Tf-Idf scaling algorithm and all terms were used. A Laplace/Lidstone hyperparameter (the $\alpha$ parameter in the ‘Multinomial Bayes’ row in Table B.1) with a value of 0.5 and a uniform prior were found to be the optimal parameters for this classifier according to a 5-fold cross-validated grid search. See Footnote 30 for a brief explanation of what a Multinomial Bayes Classifier is.} The confusion matrix and table of the classifier’s benchmarks are given in Figures B.6 and B.7 respectively. While the Stage 2 classifier does not perform as well as the Stage 1 classifier in terms of recall, this is not unexpected given that the articles that the Stage 2 classifier has a much more difficult classification job as the articles that it must categorize are much more similar in content than those that the Stage 1 classifier categorizes. Moreover, at 93% and 86% recall for newspaper articles about food safety problems and not about food safety problems respectively, it still performs very well. Meanwhile, the precision for articles about food safety problems has improved to a more respectable 80% while the precision for articles not about food safety is high, at 95%.

The classifier is then fit on the rest of the Stage 1 dataset. All articles that were noted as being duplicates were re-merged with their duplicates. The final number of articles classified to be about food safety is 39,959. Note that this is in the

\footnote{Note that (D’Orazio et al., 2014) also suggest a 2-stage classification strategy. For their second stage, they specifically advocate for the use of Transductive Support Vector Machines (TSVM). Transductive SVMs are well suited for classifying texts that have a low proportion of labeled data, as in the case for this dataset. It does so by running an SVM on a dataset wherein the labels for the training data are fixed but allows the labels on the test data to float, with the constraint that at least $r$ of the unlabeled test data will be positively labeled (that is will be labeled as food safety articles. Following their advice, I also tried implementing the second stage of classifications using TSVMs. However the Multinomial Bayes Classifier outperformed the TSVM.}
Table B.6: Stage 2: confusion matrix for categorizing newspaper articles to be about food safety or not about food safety

<table>
<thead>
<tr>
<th>Articles Actually About Food Safety</th>
<th>Articles Predicted to be about Food Safety</th>
<th>Articles Not Predicted to be about Food Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Articles Actually About Food Safety</td>
<td>138</td>
<td>11</td>
</tr>
<tr>
<td>Articles Actually Not About Food Safety</td>
<td>35</td>
<td>216</td>
</tr>
</tbody>
</table>

Table B.7: Stage 2: evaluation of the performance of the multinomial bayes classifier

<table>
<thead>
<tr>
<th>precision</th>
<th>recall</th>
<th>f1-score</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Articles About Food Safety Problems</td>
<td>0.80</td>
<td>0.93</td>
<td>0.86</td>
</tr>
<tr>
<td>Articles Not About Food Safety Problems</td>
<td>0.95</td>
<td>0.86</td>
<td>0.90</td>
</tr>
<tr>
<td>avg total</td>
<td>0.89</td>
<td>0.89</td>
<td>0.89</td>
</tr>
</tbody>
</table>

N: Number of observations

A ballpark of the number of food safety articles that we would expect to be about food safety if I had manually coded the raw corpus of food safety articles, 31,890 (2.6% * 1,226,547). To validate the precision of the final dataset, a last sample of 100 of the articles predicted by the Stage 2 classifier was taken. I found that of these, 82 were accurately predicted to be about food safety problems, which is consistent with the precision estimated for the Stage 2 classifier in Table B.6.33

Again, as with the weibo corpus, it is impossible to estimate the recall of the final dataset. This is because if I knew all the relevant articles about food safety to compare this database against, it would be unnecessary to create this database in the first place. Consider however, that a further analysis of the final dataset

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33 As with the corpus on weibo texts about food safety, clearly the ideal would be to have 100% of the newspaper articles be about food safety. Time and resource constraints make coding even the substantially reduced corpus of 39,959 articles (relative to the original 1.3 million) unfeasible. While manually coding 40,000 articles to achieve this ideal dataset does not seem like such a big stretch compared to the 20,000 newspaper articles were previously coded in Stage 1 of the text classification scheme, both the higher percentage of articles predicted to be about food safety and the fact that articles misclassified as being about food safety are very close in content to articles actually about food safety makes it more time consuming to code. That is, whereas it was often immediately obvious if an article was about food safety or not in the sample of 20,000 newspaper articles on the full dataset, it requires substantially more time to code articles in the refined Stage 2 dataset. Again while an 82% precision rate is not ideal, it is passable.
revealed that 13,295, or 33% of the 39,959 articles predicted to be about food safety contained the phrase ‘food safety’. At a minimum, this gives us a sense of how recall was improved by using an expansive list of search terms culled from the ‘Throw it out the Window website’ and subsequently refining it through a supervised machine learning algorithm. By doing so, I expanded the dataset by at least 300% compared to if I had only used articles with the word ‘food safety’ as the basis of this database.

Visualizations of the final dataset of articles predicted to be about food safety are given in Figures B.3 and B.4. Both of these figures suggest that articles about food safety were most likely to be written on Guangdong, Beijing, Shanghai and Sichuan. Further, there appear to be more coverage of food safety scares (possibly because there were more food safety scares to cover) in the spring and summer months compared to other months. Like the weibo data, this suggests that there are probably time and provincial effects that should be accounted for in the following analyses.

Finally, of the 16 provinces that there were food safety articles available to scrape from, articles about food safety were found for only 14 of these provinces. The two provinces not represented were Inner Mongolia and Jiangsu. Both had only one newspaper each represented in the WiseScrape database (See Appendix).

B.2 Analysis of the Sample Provincial Distribution of Chinese Newspapers in the WiseSearch Database

The geographic distribution of newspapers available from the WiseSearch database for 2012 appear to be reasonably statistically representative of the geographic distribution of newspapers available in China overall. To assess the geographic representativeness of the newspapers available from the WiseSearch database, I collected data on all Chinese-language newspapers published in China. In total I found in-
Figure B.3: Histogram of food safety articles posts by month, 2012

formation for 1453 newspapers and their respective provinces.\textsuperscript{34} This represents a

\textsuperscript{34} I culled this information from i) the Chinese-language website: http://www.dzbdq.com which provides information on Chinese newspapers available online ii) The Chinese-language version of the Wikipedia page which lists newspapers in China: https://zh.wikipedia.org/wiki/中国大陆报纸列表 iii) The English-language version of the Wikipedia page which lists newspapers in China: https://en.wikipedia.org/wiki/List_of_newspapers_in_China, iv) the website: http://www.listofnewspapers.com/ which provides information for newspapers available world wide, including in China and v) the website http://www.allnewsmedia.com which also provides information for newspapers available world wide, including in China

\textsuperscript{35} While the Chinese government does collect information on newspapers in China (All newspapers are required to register with the State Administration of Press, Publication, Radio, Film and Television of the People’s Republic of China and once registered, each gets an individual identification number called the 国内统一刊号), I have been unable to locate a central database which makes this information publicly available. Similarly though it appears that the World Press Trends database has a centralized database on newspapers in China (at http://www.wptdatabase.org), Duke University currently does not have a subscription to access this database nor do any of databases available
sizable proportion of the total number of newspapers in China, with available figures ranging from 1,928 newspapers in circulation at the end of 2011\(^\text{36}\), 1,912 in 2014\(^\text{37}\) or as high as 2,200 in 2015 (Li, 2016)[p. 359].\(^\text{38}\)

through the Duke Library appear to have this information. Meanwhile, arguably a benefit of using a dataset culled from information readily available from the Internet is that such newspapers are likely to be more prominent and have higher circulation than newspapers than those not easily searchable.


\(^{38}\) Note that this 2,200 statistic has been used to describe the number of newspapers in China for various points in time, including 1986 (Lull, 2013)[p. 19], 1997 (Jones, 1999)[p. 267] and in each
In Figure B.5 I plot the proportion of newspapers that are published in each province for all the newspapers available in the WiseSearch database compared to those available more widely in China. I further estimate the degree to which these proportions are statistically significantly different using an exact binomial test. The null hypothesis is that the provincial distribution of newspapers in the WiseSearch database and in the real world are not different at the 5% level and the alternative hypothesis is that they are different. I plot the subsequent p-values in Figure B.6.

The results from the exact binomial test suggest that while the provincial distribution of newspapers is similar for 24 of the 31 provinces in China, there are some discrepancies for 7 of these provinces. In particular the results suggest that there is a significantly greater proportion of newspapers from Beijing, Guandong, Guangxi, Hubei, and Shanghai and a significantly smaller proportion of newspapers from Anhui and Hunan in the WiseSearch database than would be expected based on the proportion of newspapers in each province estimated from the sample of all Chinese newspapers. The over-representation of newspapers of newspapers from Beijing is not surprising given its role as China’s capital nor is over-representation of newspapers from Guangdong (Chen, 2015) and Shanghai (Xu and Wan*, 2005) surprising given their relative centrality in the Chinese political, economic and media landscape. Nevertheless, both the over-and under-representation of provincial level newspapers merit further investigation however and I will assess whether this deviation unduly biases the subsequent substantive analyses.

39 Note that the exact binomial test is the preferred over the G-test or $\chi^2$-test when the expected values are small (the rule of thumb is that if all the expected values are 5 or greater, than using a G-test or $\chi^2$-test is acceptable) or the sample size is small (the rule of thumb being a sample size of less than 1000). The WiseSearch newspaper database fit both these criteria as expected values for newspapers in some provinces are likely to be less than 5 and the sample size is 110 (McDonald, 2014). This is also known as an exact goodness of fit test.

40 Not including Hong Kong or Macau.
Meanwhile, from Figure B.5 it is also apparent that not every province has a newspaper represented in the WiseScrape database. Specifically, for the year 2012, there are papers from 16 provinces available (along with newspapers on the national level) out of 31 provinces in mainland China. These are:
Table B.8: Provinces of the newspapers available from the WiseSearch database in 2012

<table>
<thead>
<tr>
<th>Province</th>
<th>Beijing</th>
<th>Chongqing</th>
<th>Fujian</th>
<th>Gansu</th>
<th>Guangdong</th>
<th>Guangxi</th>
<th>Hubei</th>
<th>Hunan</th>
<th>Inner Mongolia</th>
<th>Jiangsu</th>
<th>Jiangxi</th>
<th>Shandong</th>
<th>Shanghai</th>
<th>Sichuan</th>
<th>Tianjin</th>
<th>Zhejiang</th>
</tr>
</thead>
</table>

Though it would be ideal if the WiseSearch database had at least one newspaper from each province for 2012, the results from the exact binomial test suggest that in many cases this lack of coverage is not surprising given a sample size of 110
newspapers. That is, while no newspapers from Anhui, Guizhou, Hainan, Hebei, Heilongjiang, Jilin, Liaoning, Ningxia, Qinghai, Shaanxi, Shanxi, Tibet, Xinjiang or Yunnan are represented in the WiseSearch database, this is consistent with the fact that there are proportionally few newspapers from these provinces in China overall.
### B.3 List of Chinese Newspapers In the WiseSearch Database, 2012

Table B.9: Newspapers available from the WiseSearch database

<table>
<thead>
<tr>
<th>Province</th>
<th>Newspaper (English Name)</th>
<th>Newspaper (Chinese Name)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beijing</td>
<td>Beijing Business Today</td>
<td>北京商报</td>
</tr>
<tr>
<td></td>
<td>Beijing Daily</td>
<td>北京日报</td>
</tr>
<tr>
<td></td>
<td>Beijing Evening News</td>
<td>北京晚报</td>
</tr>
<tr>
<td></td>
<td>Beijing Morning Post</td>
<td>北京晨报</td>
</tr>
<tr>
<td></td>
<td>Beijing News</td>
<td>新京报</td>
</tr>
<tr>
<td></td>
<td>Beijing Times</td>
<td>京华时报</td>
</tr>
<tr>
<td></td>
<td>Beijing Youth Daily</td>
<td>北京青年报</td>
</tr>
<tr>
<td></td>
<td>China Business Journal</td>
<td>中国经营报</td>
</tr>
<tr>
<td></td>
<td>China Business Times</td>
<td>中华工商时报</td>
</tr>
<tr>
<td></td>
<td>China Economic Times</td>
<td>中国经济时报</td>
</tr>
<tr>
<td></td>
<td>China Enterprises News</td>
<td>中国企业报</td>
</tr>
<tr>
<td></td>
<td>China Financial News</td>
<td>中国金融时报</td>
</tr>
<tr>
<td></td>
<td>China High-Tech Industry Herald</td>
<td>中国高新技术产业导报</td>
</tr>
<tr>
<td></td>
<td>China Securities Journal</td>
<td>中国证券报</td>
</tr>
<tr>
<td></td>
<td>China Trade News</td>
<td>中国贸易报</td>
</tr>
<tr>
<td></td>
<td>Economic Daily</td>
<td>经济日报</td>
</tr>
<tr>
<td></td>
<td>Economic Information Daily</td>
<td>经济参考报</td>
</tr>
<tr>
<td></td>
<td>Entrepreneurs’ Daily</td>
<td>企业家日报</td>
</tr>
<tr>
<td></td>
<td>Global Times</td>
<td>环球时报</td>
</tr>
<tr>
<td></td>
<td>Guangming Daily</td>
<td>光明日报</td>
</tr>
<tr>
<td></td>
<td>Investor Journal</td>
<td>投资者报</td>
</tr>
<tr>
<td></td>
<td>Science and Technology Daily</td>
<td>科技日报</td>
</tr>
<tr>
<td></td>
<td>Securities Daily</td>
<td>证券日报</td>
</tr>
<tr>
<td></td>
<td>The Mirror</td>
<td>法制晚报</td>
</tr>
<tr>
<td></td>
<td>Wen Hua Bao</td>
<td>中国文化报</td>
</tr>
</tbody>
</table>

Chongqing     | Chongqing Morning Post            | 重庆晨报                   |
Fujian        | Fujian Daily                      | 福建日报                   |
               | *Hai Xia Du Shi Bao*              | 海峡都市报                 |
Gansu         | Gansu Daily                       | 甘肃日报                   |
               | Gansu Nong Min Bao                | 甘肃农民报                 |
               | Lanzhou Morning Post              | 兰州晨报                   |
               | Xi Bu Business                    | 西部商报                   |

*If a newspaper in the WiseScrape database was not found to have contained any food safety articles, it is italicized*

† These newspapers are also coded as newspapers with a national audience
Newspapers available from the wiseSearch database (Continued)

<table>
<thead>
<tr>
<th>Province</th>
<th>Newspaper (English Name)</th>
<th>Newspaper (Chinese Name)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guangdong</td>
<td>21st Century Business Herald</td>
<td>21世纪经济报道</td>
</tr>
<tr>
<td></td>
<td>Baoan Daily</td>
<td>宝安日报</td>
</tr>
<tr>
<td></td>
<td>Daily Sunshine</td>
<td>晶报</td>
</tr>
<tr>
<td></td>
<td>Guangdong Construction News</td>
<td>广东建设报</td>
</tr>
<tr>
<td></td>
<td>Guangzhou Daily</td>
<td>广州日报</td>
</tr>
<tr>
<td></td>
<td>Information Times</td>
<td>信息时报</td>
</tr>
<tr>
<td></td>
<td>Nan Fang Daily</td>
<td>南方日报</td>
</tr>
<tr>
<td></td>
<td>New Express Daily</td>
<td>新快报</td>
</tr>
<tr>
<td></td>
<td>Panyu Daily</td>
<td>番禺日报</td>
</tr>
<tr>
<td></td>
<td>Private Economy News‡</td>
<td>民营经济报</td>
</tr>
<tr>
<td></td>
<td>Securities Times‡</td>
<td>证券时报</td>
</tr>
<tr>
<td></td>
<td>Shan Tou Daily</td>
<td>汕头日报</td>
</tr>
<tr>
<td></td>
<td>Shan Tou Te Qu Evening Post</td>
<td>汕头特区晚报</td>
</tr>
<tr>
<td></td>
<td>Shantou City Daily</td>
<td>汕头都市报</td>
</tr>
<tr>
<td></td>
<td>Shenzhen Economic Daily</td>
<td>深圳商报</td>
</tr>
<tr>
<td></td>
<td>Shenzhen Evening News</td>
<td>深圳晚报</td>
</tr>
<tr>
<td></td>
<td>Shenzhen Special Zone Daily</td>
<td>深圳特区报</td>
</tr>
<tr>
<td></td>
<td>Shenzhen Urban Daily</td>
<td>深圳都市报</td>
</tr>
<tr>
<td></td>
<td>Southern Metropolis Daily</td>
<td>南方都市报</td>
</tr>
<tr>
<td></td>
<td>Southern Weekly‡</td>
<td>南方周末</td>
</tr>
<tr>
<td></td>
<td>Win Weekly‡</td>
<td>赢周刊</td>
</tr>
<tr>
<td></td>
<td>Yangcheng Evening News</td>
<td>羊城晚报</td>
</tr>
<tr>
<td>Guangxi</td>
<td>Guangxi Daily</td>
<td>广西日报</td>
</tr>
<tr>
<td></td>
<td>Modern Life Daily</td>
<td>当代生活报</td>
</tr>
<tr>
<td></td>
<td>Nan Guo Cheng Bao</td>
<td>南国城报</td>
</tr>
<tr>
<td></td>
<td>Nan Guo Jin Bao</td>
<td>南国今报</td>
</tr>
<tr>
<td></td>
<td>Nanguo Morning News</td>
<td>南国早报</td>
</tr>
<tr>
<td></td>
<td>South China Health Weekly</td>
<td>南国健报</td>
</tr>
<tr>
<td>Hubei</td>
<td>Changjiang Daily</td>
<td>长江日报</td>
</tr>
<tr>
<td></td>
<td>Chu Tian Golden News</td>
<td>楚天金报</td>
</tr>
<tr>
<td></td>
<td>Chutian Metropolis Daily</td>
<td>楚天都市报</td>
</tr>
<tr>
<td></td>
<td>Focus Weekly</td>
<td>人物汇报</td>
</tr>
<tr>
<td></td>
<td>Hubei Daily</td>
<td>湖北日报</td>
</tr>
<tr>
<td></td>
<td>Nong Cun Xin Bao</td>
<td>农村新报</td>
</tr>
<tr>
<td></td>
<td>Sanxia Evening News</td>
<td>三峡晚报</td>
</tr>
<tr>
<td></td>
<td>Sports Weekly</td>
<td>体育周报</td>
</tr>
<tr>
<td></td>
<td>Wuhan Evening News</td>
<td>武汉晚报</td>
</tr>
<tr>
<td></td>
<td>Wuhan Morning Post</td>
<td>武汉晨报</td>
</tr>
<tr>
<td></td>
<td>Xian Dai Jian Kang Bao</td>
<td>现代健康报</td>
</tr>
</tbody>
</table>

*If a newspaper in the WiseScrape database was not found to have contained any food safety articles, it is italicized.

‡ These newspapers are also coded as newspapers with a national audience.
<table>
<thead>
<tr>
<th>Province</th>
<th>Newspaper (English Name)</th>
<th>Newspaper (Chinese Name)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hunan</td>
<td>Changsha Evening News</td>
<td>长沙晚报</td>
</tr>
<tr>
<td>Inner Mongolia</td>
<td>Wealth</td>
<td>今日财富</td>
</tr>
<tr>
<td>Jiangsu</td>
<td>Jiang Nan Times</td>
<td>江南时报</td>
</tr>
<tr>
<td>Jiangxi</td>
<td>Information Daily</td>
<td>信息日报</td>
</tr>
<tr>
<td></td>
<td>Jiang Nan City Daily</td>
<td>江南都市报</td>
</tr>
<tr>
<td></td>
<td>Jiangxi Daily</td>
<td>江西日报</td>
</tr>
<tr>
<td>Shandong</td>
<td>Jinan Daily</td>
<td>济南日报</td>
</tr>
<tr>
<td></td>
<td>Life Daily</td>
<td>生活日报</td>
</tr>
<tr>
<td></td>
<td>Luzhong Morning Post</td>
<td>鲁中晨报</td>
</tr>
<tr>
<td></td>
<td>Qingdao Daily</td>
<td>青岛日报</td>
</tr>
<tr>
<td></td>
<td>The Economic Observer†</td>
<td>经济观察报</td>
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<td>Shanghai</td>
<td>Bao Kan Wen Zhai†</td>
<td>报刊文摘</td>
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<td></td>
<td>China Business News†</td>
<td>第一财经日报</td>
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<td>Fortune Weekly</td>
<td>理财1周</td>
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<td></td>
<td>Jiefang Daily†</td>
<td>解放日报</td>
</tr>
<tr>
<td></td>
<td>National Business Daily</td>
<td>每日经济新闻</td>
</tr>
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<td>News Times</td>
<td>天天新报</td>
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<td></td>
<td>Oriental Morning Post</td>
<td>东方早报</td>
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<td>Shanghai Daily</td>
<td>上海日报</td>
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<td>Shanghai Evening Post</td>
<td>新闻晚报</td>
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<td>Shanghai Morning Post</td>
<td>新闻晨报</td>
</tr>
<tr>
<td></td>
<td>Shanghai Securities News</td>
<td>上海证券报</td>
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<td></td>
<td>Shanghai Times</td>
<td>申江服务导报</td>
</tr>
<tr>
<td></td>
<td>Wen Hui Daily†</td>
<td>文汇报(上海)</td>
</tr>
<tr>
<td></td>
<td>Wenhui Book Review†</td>
<td>文汇读书周报</td>
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<td>Xinmin Evening News†</td>
<td>新民晚报</td>
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<td>Sichuan</td>
<td>Chengdu Daily</td>
<td>成都日报</td>
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<td>成都商报</td>
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<td></td>
<td>Chengdu Evening News</td>
<td>成都晚报</td>
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<tr>
<td></td>
<td>Sichuan Daily</td>
<td>四川日报</td>
</tr>
<tr>
<td></td>
<td>Sichuan Economic Daily</td>
<td>四川经济日报</td>
</tr>
<tr>
<td></td>
<td>The Manager’s Daily</td>
<td>经理日报</td>
</tr>
<tr>
<td></td>
<td>Western China Metropolis Daily</td>
<td>华西都市报</td>
</tr>
<tr>
<td>Tianjin</td>
<td>Jin Wanbao</td>
<td>今晚报</td>
</tr>
<tr>
<td></td>
<td>JinWan Economic Weekly</td>
<td>今晚报</td>
</tr>
<tr>
<td></td>
<td>Middle-aged Times</td>
<td>中老年时报</td>
</tr>
<tr>
<td>Zhejiang</td>
<td>Morning Express</td>
<td>今日早报</td>
</tr>
<tr>
<td></td>
<td>Qianjiang Evening News</td>
<td>钱江晚报</td>
</tr>
<tr>
<td></td>
<td>Zhejiang Daily</td>
<td>浙江日报</td>
</tr>
</tbody>
</table>

*If a newspaper in the WiseScrape database was not found to have contained any food safety articles, it is italicized
† These newspapers are also coded as newspapers with a national audience
Figure B.7: Effect on the number of censored weibo posted over the range of reported food safety scares at home, across provinces province over time, conditional on being in the 20th percentile or 80th percentile of reported food safety scares in one’s home (Model 12).

Figure B.8: Effect on the number of censored weibo posted over the range of reported food safety scares outside one’s home province, across provinces, conditional on being in the 20th percentile or 80th percentile of reported food safety scares in outside provinces over time (Model 12).

Figure B.9: Effect on the number of censored weibo posted over the range of reported food safety scares at home, across provinces, conditional on being in the 20th percentile or 80th percentile of reported food safety scares in outside provinces over time (Model 12).

Figure B.10: Effect on the number of censored weibo posted over the range of reported food safety scares outside one’s home province, across provinces, conditional on being in the 20th percentile or 80th percentile of reported food safety scares in one’s home province over time (Model 12).
Appendix C

Appendix to Chapter 5: Perceptions of Food Safety

C.1 Methodology of Bid Design

In what follows, I first provide an overview of how I use the previous literature to design the WTP/WTA bids for the internet survey. Based on this previous literature then, I construct a WTP bid schema for the internet survey. I then give an overview of how I used the results from the internet survey to guide the creation of bid design for the telephone survey.

C.1.1 Literature on bid design for WTP for certified pork in China

With regards to WTP for pork, researchers reported their findings in either yuan or percentages, sometimes both. In their study, Ortega et al. (2011b) find that consumers are willing to pay anywhere from 2 - 10 rmb per half kilo of pork \(^1\) for various food safety attributes. Specifically, consumers were willing to pay 10.59 rmb/half kilo for government certified pork, 6.9 rmb/half kilo for NGO certified pork, 5.86 rmb/half kilo for traceable pork and 2.89 rmb/half kilo for product-specific infor-

\(^1\) In Chinese, the common unit for measuring weight in the marketplace is the jin (斤), which is equivalent to half a kilo.
mation labels. Wu et al. (2015b) estimated similar WTP values, finding that that consumers are willing to pay 13.8, 15.8 and 4.8 yuan respectively for ‘government certification’, ‘domestic third-party certification’ and ‘international third-party certification’ of a half a kilo of pork, with standard errors of 4.5 yuan, 3.6 yuan and 4.1 yuan respectively.

Other studies estimated smaller levels of WTP for pork. Zheng et al. (2012) find that consumers were willing to pay 4.5 rmb/half kilo more for traceable pork, or a 11.25% premium. In their survey of consumers in Wuxi (Jiangsu Province) conducted the summer and fall of 2013, Wu et al. (2016a) find that consumers were willing to pay 2.79 yuan more for government certification of pork. Meanwhile in their survey of consumers in Wuxi (Jiangsu Province) conducted in the summer of 2014, Wu et al. (2015a) find that consumers are WTP approximately 2.11 yuan for government certified food. Zhang et al. (2012a) also use a continuous valuation method (CVM) to elicit WTP from survey respondents, though with regards to traceable pork. They set their WTP range for traceable pork at prices 5-30% greater than regular pork, at 5% intervals.

In addition WTP studies for other certified foods in China were also taken into account. Across these studies, consumers WTP for safer food ranged from 10-33 percent. Finally Xu et al. (2012) set their WTP range for green and eco-labeled

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2 The Ortega et al. (2011b) survey was conducted in seven Chinese cities: Beijing, Chengdu, Hohhot, Nanjing, Wuhan and Xi’an, between June and August 2009.

3 This survey does not make the distinction between private or non-governmental third party certifiers.

4 The survey was conducted in the following cities: Harbin (Heilongjiang Province), Jinan (Shandong Province), Wuxi (Jiangsu Province), Ninfu (Zhejiang Province), Zhengzhou (Henan Province), Changsha (Hunan Province), Chengdu (Sichuan Province.) in the fall of 2013.

5 Note that the original study reported their results in rmb/kilo. In order to maintain consistency of units across the studies and with the unit of measurement used in this study, I converted the results to rmb/half kilo.

6 With standard errors of around 0.4 yuan.

7 Wang et al. (2008) find that Beijing residents are willing to pay a 5% premium for HACCP-
seafood at prices 3-15% greater than regular seafood, at 3% intervals.

Given these previous studies, a reasonable WTP range for the internet survey is 15-30 yuan. Though such a range would allow WTP for certified pork to be as large as 100% greater than regular pork which is a larger effect estimated an previous WTP for pork studies, it is in line with effects found for WTP for food safety attributes for food in general in China. Meanwhile, in yuan amounts, a 15 yuan increase over regular pork would be in line with WTP studies that have found consumers WTP as much as 13 yuan more for certified pork in China.

Having determined a reasonable WTP range for the internet survey, a not inconsequential point of consideration is the number of bids to use within that range. Though prima facie, including one bid for each one yuan increment (so that there is a WTP bid for 16 yuan, 17 yuan, 18 yuan and so forth until 30 yuan is reached) seems reasonable, previous literature suggests that doing so may not be the best in terms of obtaining unbiased and efficient results.

A number of studies have shown that the estimated mean WTP may be sensitive to the inclusion of WTP bids in the upper tail of the distribution, thereby biasing estimates. Cooper and Loomis (1992) find that estimated mean WTP may be sensitive to different bid ranges. That is, they found that their WTP point estimates decreased as they dropped observations with bid values in the upper tails of the WTP distributions while their WTP point estimates increased slightly as they dropped bid values in the lower tails of the WTP distributions. In simulation studies, Kanninen (1995) further offers a rule of thumb for keeping bids at the 15th to 85th percentile for single-bound discrete choice estimation WTP analyses. She offers these ranges as a guide, noting that it is perhaps more important to refrain from using obviously certified milk. Meanwhile Wu et al. (2011) found that while respectively, 53, 11.3 and 3.1 percent of respondents willing to pay were willing to pay 1-15, 16-30 and 31-50 percent more for certified greens. However only 0.5% of people were willing to pay more than 51 percent for certified greens.
excessive bids. Hanemann and Kanninen (1999) note that bid points from the tails of a distribution are generally uninformative. For the logistic distribution, this rules out bid points in the outer 12% of the distribution. Indeed both Kanninen (1995) and Boyle et al. (1998) find evidence to suggest that bias in WTP estimates are even further exacerbating the more WTP bids are clustered at the upper tail of the distribution.

Relatedly, Alberini (1995) finds for example that the more bids are included the WTP experiment, the lower the power of the subsequent statistical analysis for a fixed sample size.\textsuperscript{8} In her simulation study, Alberini (1995) recommends bid vectors between 6 and 12 for n = 960 and 8 and 12 for n = 1200 in order to ensure of the power of any subsequent analysis.

\textit{C.1.2 Lessons from the Internet survey bid design}

Taking into the account the lessons learned from the previous literature, the bid vector that I use in the internet pilot survey is: 16, 17, 18, 19, 20, 21, 25, and 30 yuan. Note that I use the same bid design for WTA questions as well. Because no previous WTA studies have been conducted on food safety attributes for pork in China, I cannot draw my derivation of the WTA bid design on previous research — information on WTP bids is the closest substitute. The lack of previous work aside, there is in fact value in using the same bid design as the WTP questions for ease of comparability.

I also take pains to assess the extent to which the bids might unwittingly signal the quality of the good being bid on. Any such signal could potentially confound the validity of this and any such WTP analysis which seeks to measure willingness to pay

\textsuperscript{8} If one thinks of an extreme sample, this intuitively makes sense. Suppose for example, that in the pilot internet survey, that 15 bid points were used but only 15 people were surveyed. As such that there was only one data point for each bid. Any subsequent analysis would be highly influenced by the particular characteristics of that one respondent, making it difficult to have much power for detecting any effect for a more general population.
for quality. For example, a respondent presented with the option of buying certified pork at 16 yuan a half kilo given that regular uncertified pork is available at 15 yuan a half kilo may decline to purchase the pork because the one yuan difference between certified and uncertified pork signals to the respondent that the certification is not to be trusted. If such respondents also systematically were less inclined to trust the certifying institution than any subsequent analysis that found a relationship between a lack of trust in that certifying institution and unwillingness to pay would not be valid. To the extent possible then, WTP should be chosen so that they do not signal one way or another the quality of the given product so as to not invalidate any subsequent analysis.

To address this possibility, in the pilot internet survey I include additional questions which ask survey respondents why they were willing or unwilling to pay for certified pork. Respondents who were unwilling to pay for certified pork (willing to accept uncertified pork) were asked the following question:

i. 你刚刚说你不愿意赔[Insert Bid Price Here]元去[Insert Institution Here]认证的猪肉。？其中哪一个原因最描述为什么你不愿意买[Insert Institution Here]认证的猪肉？
You have just stated you were unwilling to pay [Insert price from Q4 here] yuan for pork certified by the [Insert Institution Here]. Which of the following reasons most closely describes the reason why you were unwilling to pay for [Insert Institution Here] certified pork?

- 认证猪肉的价钱太高了，我付不起
  The price was too high for me to afford
- 认证猪肉的价钱太低了，我不确定中央政府认证的猪肉会这么便宜
  The price seemed too low to cover the cost of certification

9 Note that theoretically it would have been possible to include these sets of questions in the telephone survey as well. However, the advised maximum length of a telephone survey is 30 questions before willingness to respond to questions falls. With 30 questions already in the survey, I did not include these additional questions in the telephone survey to mitigate against item non-response.

10 Similar questions were asked of people who received WTA questions.
○ 我不相信中央政府认证的猪肉会维护我的利益
  I do not trust that the [Insert Institution Here] is looking after my interest when certifying pork

○ 我对中央政府认证的能力没有信心
  I do not have confidence in [Insert Institution Here]’s ability to implement the certification process

○ 其他：__________
  Other:

Meanwhile respondents who were willing to pay for certified pork (unwilling to accept uncertified pork) were asked the subsequent follow-up question:

ii. 相比于15元一斤的普通猪肉，您愿意买[Insert Bid Price Here]元一斤的[Insert Institution Here]认证猪肉，请问是由于以下那一个原因？
  You have just stated you were willing to pay [Insert price from Q4 here] yuan for pork certified by [Insert Institution Here]. Which of the following reasons most closely describes the reason why you were willing to pay for [Insert Institution Here] certified pork?

○ 我很关心食品安全问题，所以愿意多付一点钱去买中央政府认证的猪肉
  Food safety is an important concern for me and I would pay for [Insert Institution Here] certified pork at most prices

○ 我相信中央政府认证猪肉会维护我的利益
  I trust [Insert Institution Here] is looking after my interests when it certifies pork

○ 我对中央政府认证猪肉的能力有信心
  I have confidence in the [Insert Institution Here]’s ability to implement the certification process

○ 我不确定由中央政府认证的猪肉真的比较安全，但是我还是愿意买
  I am not sure how much safer this [Insert Institution Here] certified pork is, but I am willing to buy it.
The inclusion of such questions also has the benefit of not only assessing whether the bids themselves are signals of the legitimacy of the certified pork but also serve to validate whether respondents explicitly take trust into account when deciding whether to buy certified pork or not (or alternatively whether to not accept uncertified pork or not).
Table C.1: Distribution of reasons respondents cited to explain why they were unwilling to pay for certified pork or willing to accept uncertified pork

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Affordability: ‘The price was too high for me to afford’

Signal: ‘The price seemed too low to cover the cost of certification’

Benevolence: ‘I do not trust that the [Insert Institution Here] is looking after my interest when certifying pork’

Ability: ‘I do not have confidence in [Insert Institution Here]’s ability to implement the certification process’
Table C.2: Distribution of reasons respondents cited to explain why they were willing to pay for certified pork or unwilling to accept uncertified pork

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Concern: ‘Food safety is an important concern for me and I would pay for [Insert Institution Here] certified pork at most prices’

Ambivalence: ‘I am not sure how much safer this [Insert Institution Here] certified pork is, but I am willing to buy it.’

Benevolence: ‘I trust [Insert Institution Here] is looking after my interests when it certifies pork’

Ability: ‘I have confidence in the [Insert Institution Here]’s ability to implement the certification process’

From Table C.1 we can see that while it is the least likely explanation chosen by respondents who are unwilling to pay for certified pork (or willing to accept uncertified pork) the WTP price does serve as as signal for the legitimacy of the
certified pork for some respondents. Meanwhile people who were asked if they were willing to accept regular pork were more likely to say that the reason they were unwilling to accept was ‘The price seemed too low to cover the cost of certification’. However this relationship does not seem to systematically vary with price, suggesting that it would be valid to keep lower bid values in the telephone survey.

However the tendency for respondents to give certain reasons for their WTP/WTA decisions does appear to vary with price. In particular, from Table C.1 we can see that that there is a strong relationship between the number of people who cite affordability as the reason they are unwilling to pay for certified pork and the bid price. In particular, the number of people who are unwilling to pay for certified pork because ‘the price is too high’ jumps sharply when the bid price is 25 or 30 yuan, for all institutions. Meanwhile, as shown in Table C.2, price also appears to be strongly related to the propensity for people to cite ‘Food safety is an important concern for me and I would pay for [Insert institution here] certified pork at most prices’ as the predominant reason why they are unwilling to accept regular pork. In particular, the number of people unwilling to accept certified pork because ‘Food safety is an important concern for me and I would pay for [Insert Institution Here] certified pork at most prices’ increases markedly when the bid price is 25 yuan or 30 yuan for all institutions.

Finally, though there is are clear differences in the propensity for people to cite different reasons for why they were not willing to pay for certified pork as compared to why there were willing to accept regular pork and vice-versa, aside from the two cases detailed above (WTP and ‘Affordability’ in Table C.1 and WTA and ‘Concern’ in Table C.2) no other cited reason seemed to vary systematically with bid price across different institutions. That is, for example, people were much more likely to cite the bid as a signal (‘The price seemed too low to cover the cost of certification’) for the reason they were unwilling to accept regular pork versus willing to pay for certified pork but there seems to be little systematic relationship in this propensity with regards to the bid prices.

In sum, the responses from the internet survey suggests that at higher bid lev-
els, people are much more likely to cite affordability as a reason they are unwilling to pay for certified pork and concern for food safety as a reason way they are unwilling to accept regular pork. Meanwhile, the propensity for respondents to cite the benevolence or ability of the certifying institution as the predominant driver of their decision making does not appear to vary with the bid price. This raises the possibility that the inclusion of higher level bids may falsely inflate the degree to which benevolence and ability of the certifying institution affect respondent’s WTP or WTA. Given these results then in the telephone survey, I readjust the bids in the telephone survey to be 16, 17, 18, 19, 20, and 22 yuan. A maximum of 22 yuan still puts the highest WTP/WTA bid amount at 46%, well above what most previous studies have estimated. Meanwhile removing extreme bids and the reducing of the bid distribution from 7 to 6 bids should also increase the efficiency of the subsequent results, as Alberini (1995) argues.

C.2 Descriptive Statistics for Internet Survey

Survey responses were collected from 30 Chinese provinces, with the most common provinces being the respondents come from populous and relatively well developed provinces with high internet access penetration – the top 5 being Guangdong, Beijing, Jiangsu, Shandong and Zheijiang. The geographic distribution for the internet survey respondents is shown in Figure C.2.

Further demographic statistics are presented in Table C.3. Here we can see that while the sample skews male, urban, educated and young, there is good representation of women and rural hukou holders. Meanwhile such a distribution mirrors the demographics of the Chinese internet population as a whole, which also skews male, urban, educated in young. Lastly, most respondents live in a household with at least 3 or more people with a median household income of 10,000 yuan though the range and variation of this variable is quite large.
Figure C.1: Missing data plot for internet survey

Figure C.2: Plot of provincial distribution of internet survey respondents
Table C.3: Summary Statistics for Unimputed and Imputed Internet Survey

<table>
<thead>
<tr>
<th>Question</th>
<th>Unimputed Data</th>
<th>Imputed Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>(Q01) Interest in Food Safety Level</td>
<td>1.99</td>
<td>1.37</td>
</tr>
<tr>
<td>(Q02) Worry About Food Safety Level</td>
<td>2.09</td>
<td>1.01</td>
</tr>
<tr>
<td>(Q04) Perceived Benevolence of Central Govt</td>
<td>2.99</td>
<td>0.774</td>
</tr>
<tr>
<td>(Q05) Perceived Benevolence of Provincial Govt</td>
<td>2.71</td>
<td>0.722</td>
</tr>
<tr>
<td>(Q06) Perceived Benevolence of Private Indust</td>
<td>2.07</td>
<td>0.721</td>
</tr>
<tr>
<td>(Q07) Perceived Benevolence of NGO</td>
<td>2.61</td>
<td>0.784</td>
</tr>
<tr>
<td>(Q08) Perceived Ability of Central Govt</td>
<td>2.84</td>
<td>0.786</td>
</tr>
<tr>
<td>(Q09) Perceived Ability of Prov Govt</td>
<td>2.54</td>
<td>0.746</td>
</tr>
<tr>
<td>(Q10) Perceived Ability in Private Indust</td>
<td>1.99</td>
<td>0.719</td>
</tr>
<tr>
<td>(Q11) Perceived Ability in NGO</td>
<td>2.4</td>
<td>0.732</td>
</tr>
<tr>
<td>(Q12) WTP/WTA Central Govt</td>
<td>0.621</td>
<td>0.485</td>
</tr>
<tr>
<td>(Q13) Safety Level — Central Govt Pork</td>
<td>2.38</td>
<td>0.895</td>
</tr>
<tr>
<td>(Q14) WTP/WTA Provincial Govt</td>
<td>0.554</td>
<td>0.497</td>
</tr>
<tr>
<td>(Q15) Safety Level — Prov Govt Pork</td>
<td>2.53</td>
<td>0.828</td>
</tr>
<tr>
<td>(Q16) WTP/WTA Private Indust</td>
<td>0.342</td>
<td>0.474</td>
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<tr>
<td>(Q17) Safety Level — Private Indust Pork</td>
<td>2.89</td>
<td>0.783</td>
</tr>
<tr>
<td>(Q18) WTP/WTA NGO</td>
<td>0.421</td>
<td>0.494</td>
</tr>
<tr>
<td>(Q19) Safety Level — NGO Pork</td>
<td>2.77</td>
<td>0.816</td>
</tr>
<tr>
<td>(Q21) Pork Consumption Level</td>
<td>1.68</td>
<td>0.675</td>
</tr>
<tr>
<td>(Q22) Consumption of Unsafe Pork Level</td>
<td>2.65</td>
<td>0.76</td>
</tr>
<tr>
<td>(Q23) Familiarity with Certified Pork Level</td>
<td>2.22</td>
<td>0.53</td>
</tr>
<tr>
<td>(Q25) Number of Children</td>
<td>0.265</td>
<td>0.509</td>
</tr>
<tr>
<td>(Q26) Number of Family Members</td>
<td>3.43</td>
<td>1.12</td>
</tr>
<tr>
<td>(Q27) Age</td>
<td>26.2</td>
<td>6.4</td>
</tr>
<tr>
<td>(Q28) Hukou Registration Dummy</td>
<td>0.633</td>
<td>0.482</td>
</tr>
<tr>
<td>(Q30) Gender Dummy</td>
<td>0.413</td>
<td>0.493</td>
</tr>
<tr>
<td>(Q31) Income</td>
<td>1.88e+04</td>
<td>6.04e+04</td>
</tr>
</tbody>
</table>

N 1007
Table C.4: Distribution of categorical variables for unimputed and imputed data, internet survey

<table>
<thead>
<tr>
<th>(Q3) Information sources about food Safety (%)</th>
<th>Unimputed</th>
<th>Imputed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person to Person</td>
<td>0.711</td>
<td>0.711</td>
</tr>
<tr>
<td>International News</td>
<td>0.57</td>
<td>0.57</td>
</tr>
<tr>
<td>Governmental Domestic News</td>
<td>0.482</td>
<td>0.482</td>
</tr>
<tr>
<td>Other</td>
<td>0.0387</td>
<td>0.0387</td>
</tr>
<tr>
<td>Non-governmental Domestic News</td>
<td>0.701</td>
<td>0.701</td>
</tr>
<tr>
<td>Social Media</td>
<td>0.862</td>
<td>0.862</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(Q24) Responsibility for Household Food preparation(%)</th>
<th>Unimputed</th>
<th>Imputed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Me (Respondent)</td>
<td>0.239</td>
<td>0.239</td>
</tr>
<tr>
<td>My spouse or partner</td>
<td>0.101</td>
<td>0.101</td>
</tr>
<tr>
<td>My parents</td>
<td>0.372</td>
<td>0.372</td>
</tr>
<tr>
<td>My children</td>
<td>0.00795</td>
<td>0.00794</td>
</tr>
<tr>
<td>Whoever has time</td>
<td>0.28</td>
<td>0.28</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(Q32) Education Level (%)</th>
<th>Unimputed</th>
<th>Imputed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some elementary school or less</td>
<td>0.00199</td>
<td>0.00199</td>
</tr>
<tr>
<td>Elementary School</td>
<td>0.00298</td>
<td>0.00298</td>
</tr>
<tr>
<td>Middle School</td>
<td>0.00994</td>
<td>0.00993</td>
</tr>
<tr>
<td>High School</td>
<td>0.172</td>
<td>0.172</td>
</tr>
<tr>
<td>College</td>
<td>0.656</td>
<td>0.656</td>
</tr>
<tr>
<td>Graduate School</td>
<td>0.157</td>
<td>0.157</td>
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</table>

<table>
<thead>
<tr>
<th>(Q33) Occupation (%)†</th>
<th>Unimputed</th>
<th>Imputed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper level management</td>
<td>0.0129</td>
<td></td>
</tr>
<tr>
<td>Middle management</td>
<td>0.0646</td>
<td></td>
</tr>
<tr>
<td>White collar worker</td>
<td>0.307</td>
<td></td>
</tr>
<tr>
<td>Educator/Researcher</td>
<td>0.0815</td>
<td></td>
</tr>
<tr>
<td>Blue collar worker</td>
<td>0.0408</td>
<td></td>
</tr>
<tr>
<td>Service sector worker</td>
<td>0.00696</td>
<td></td>
</tr>
<tr>
<td>Agricultural/forestry worker or miner</td>
<td>0.0109</td>
<td></td>
</tr>
<tr>
<td>Professional (Lawyer, Accountant, Reporter etc.)</td>
<td>0.0606</td>
<td></td>
</tr>
<tr>
<td>Self-employed</td>
<td>0.0358</td>
<td></td>
</tr>
<tr>
<td>Unemployed (Xiangang)</td>
<td>0.000994</td>
<td></td>
</tr>
<tr>
<td>Unemployed (Wuye)</td>
<td>0.0288</td>
<td></td>
</tr>
<tr>
<td>Unemploye(Shiye)</td>
<td>0.0109</td>
<td></td>
</tr>
<tr>
<td>Student</td>
<td>0.288</td>
<td></td>
</tr>
<tr>
<td>Military</td>
<td>0.000994</td>
<td></td>
</tr>
<tr>
<td>Housewife</td>
<td>0.0149</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0.0338</td>
<td></td>
</tr>
</tbody>
</table>

† The multiple imputation model was unable to converge when occupation dummies were included. As such, these variables were not imputed.
C.3 Telephone Survey Questionnaire

Organizational overview:

- 调查介绍/ Introduction
- 基础视屏安全问题/ Baseline Food Safety Questions
- 原来的排序/ Original Question Ordering
  - 信任问题/ Questions on Trust
  - 能力问题/ Questions on Ability
  - WTP问题/ Question on Willingness to Pay
  - WTA问题/ Question on Willingness to Accept
- 相反的排序/ Reverse Question Ordering:
  - 信任问题/ Questions on Trust
  - 能力问题/ Questions on Ability
  - WTP问题/ Questions on Willingness to Pay
  - WTA问题/ Questions on Willingness to Accept
- 国际问題/ International Participation Question
- 人口学问題/ Demographic Questions
C.3.1 Introduction

Hello, I am a surveyor from the Beijing University National Research Center. We are currently doing a survey on food safety and would like to ask if you would be able to spend some time responding to some questions, is this okay?

(If the respondent says they do not have time, the enumerator should respond as follows: If everybody participates in giving their opinion on food safety, this will help us improve our knowledge of food safety regulation in the future and help improve people’s lives.)

(If the respondent has concerns, the enumerator should respond as follows: Our survey is purely for research purposes, your personal information will be kept confidential. If there is any question that you do not wish to respond to, you are in no obligation to. In addition, you may stop the survey at any time.)

(If the respondent wants to know how the enumerator got his/her telephone number, the enumerator should let the respondent know that his/her number was randomly sampled.)

C.3.2 Baseline food safety questions

1. How interested are you or not in information about food safety? Extremely interested, very interested, relatively interested, slightly interested, not interested at all?

11 Adapted from the Asian Barometer Index, Third wave and a food safety survey conducted in Huzhou, Zhejiang (湖州市食品安全调查问卷). In the Asian Barometer index the original question was: Are you interested in learning about political affairs? Completely not interested, not too interested, somewhat interested, indifferent, interested.

In the Huzhou survey, the original question wording was: Are you generally interested in news about food safety? Interested, somewhat interested, indifferent, not interested.
2. 您对食品安全问题担不担心？非常担心，很担心，比较不担心，有点担心，还是不担心？

How worried are you about food safety? Extremely worried, very worried, relatively worried, slightly worried, not worried at all?

- 非常担心(extremely worried)
- 很担心(very worried)
- 比较担心(relatively worried)
- 有点担心(slightly worried)
- 不担心(not worried)
- [不读]:拒答(No answer)

---

12 Note that the response choices are not symmetrical. Given the high degree of public interest in food safety (a 2016 Pew Research survey found that 74% of Chinese respondents thought that food safety was either a ‘very big problem’ or a ‘moderately big problem’), I framed the possible responses to skew toward interest about food safety in order to capture as much variation in the responses as possible.

13 This question is adapted from Zhang and Zhao (2007).

14 As in Question 1, note that food safety is a major political issue in China and it is likely that there are many more people who have some interest in it than people who do not have any interest in it. As such, I framed the possible responses to skew toward worry about food safety in order to capture as much variation in the responses as possible.
3. 您平时主要通过什么途径获得食品安全知识？

[不读出]访员注意：此题请先勿读出所列选，但如果被访者没有说出答案，请用下列选项提示或引导被访者。请追问三次，最多选择三个答案。]

How do you usually receive information about food safety?

[Do not read: Let the respondent respond without prompting and fill in the blanks for 3a, 3b and 3c. However, if the respondent does not give at least three answers, prompt them at least three times to elicit them.]

3A. 第一答案：

3B. 第二答案：

3C. 第三答案：

<table>
<thead>
<tr>
<th></th>
<th>第一</th>
<th>第二</th>
<th>第三</th>
</tr>
</thead>
<tbody>
<tr>
<td>i.</td>
<td> </td>
<td> </td>
<td> </td>
</tr>
<tr>
<td>ii.</td>
<td> </td>
<td> </td>
<td> </td>
</tr>
<tr>
<td>iii.</td>
<td> </td>
<td> </td>
<td> </td>
</tr>
</tbody>
</table>

i. 与他人交流（例如：面对面，通过电话，短信等）
Personal contact (e.g. one-one one, telephone conversations, etc)

ii. 自媒体，社交媒体
Social media (e.g. QQ, Weibo, online message boards, etc)

iii. 国内官方媒体（例如：新华，人民日报，CCTV；包括：报刊杂志电视广播等）
State media (e.g. Xinhua, Renminribao, CCTV, etc.)

国内非官方媒体（例如：财经，新浪；包括：报刊杂志电视广播等）
Non-state media (e.g. Caijing, Xinlang, etc.)

国际媒体（包括：报刊杂志电视广播等）
International media (e.g. international newspapers, magazines and TV broadcasts, etc)

其他：请纪录回答：

Other:

拒绝回答

Refuse to Answer
C.3.3  *Original question ordering*

Now I am going to read some statements. We would like to know your thoughts on these statements. Do you strongly agree, agree, disagree, or completely disagree:

Questions on trust

4. 我相信，关于食品安全，中央政府会照顾我的利益。\(^{15}\)

   I trust the central government to look after my interests with regards to food safety issues.

   - 非常同意 (strongly agree)
   - 比较同意 (agree)
   - 较不同意 (disagree)
   - 非常不同意 (strongly disagree)
   - [不读]: 拒答 (No answer)

5. 那省政府呢？

   [不读: 如果被访者不明白上面的问题，清读出下列：我相信，关于食品安全，省府会照顾我的利益。]

   Now how about with regards to the provincial government?

   [Do not read: If survey respondent expresses confusion, read the following prompt:

   I trust the provincial government to look after my interests with regards to food safety issues]

   - 非常同意 (strongly agree)
   - 比较同意 (agree)
   - 较不同意 (disagree)
   - 非常不同意 (strongly disagree)

---

\(^{15}\) Adapted from Shi (2001); in his survey he asked respondents the following: ‘Do you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with the following statement: The government can be trusted to do what is right without our having to constantly check on them?’ A similar statement is also used in the Asian Barometer Index: ‘You can generally trust the people who run our government to do what is right.’
6. 那私营企业呢？
   [不读: 如果被访者不明白上面的问题，清读出下列：我相信，关于食品安全，私营企业会照顾我的利益]
   Now how about with regards to the private businesses?
   [Do not read: If survey respondent expresses confusion, read the following prompt: I trust private businesses to look after my interests with regards to food safety issues.]

   ○ 非常同意(strongly agree)
   ○ 比较同意(agree)
   ○ 较不同意(disagree)
   ○ 非常不同意(strongly disagree)
   ○ [不读]:拒答(No answer)

7. 那民间组织呢？
   [不读: 如果被访者不明白上面的问题，清读出下列：我相信，关于食品安全，民间组织会照顾我的利益]
   Now how about with regards to non governmental organizations?
   [Do not read: If survey respondent expresses confusion, read the following prompt: I trust non governmental organizations to look after my interests with regards to food safety issues.]

   ○ 非常同意(strongly agree)
   ○ 比较同意(agree)
   ○ 较不同意(disagree)
   ○ 非常不同意(strongly disagree)
   ○ [不读]:拒答(No answer)
Questions on ability

Now I would like to ask you some questions about how you feel about the ability of various organizations to safeguard food safety. First I’d like to ask about the central government.

8. 有些人对中央政府保障食品安全的能力有信心。有些人对他们的能力没有信心。您呢？您对他们的能力非常有信心，比较有信心，不太有信心，还是非常没有信心？
Some people are confident in the ability of the central government to safeguard food safety. Other people are not confident in their ability. How about you? Are you very confident, confident, unconfident, or very unconfident in its ability?

- 非常有信心(very confident)
- 比较有信心(confident)
- 不太有信心(unconfident)
- 非常没有信心(very unconfident)
- [不读]: 拒答(No answer)

9. 那政府呢？
[不读：如果被访者不明白上面的问题，清读出下列：有些人对省政府保障食品安全的能力有信心。有些人对他们的能力没有信心。您呢？您对他们的能力非常有信心，有信心，没有信心，还是非常没有信心？]
Now how about with regards to the provincial government?
[Do not read: If survey respondent expresses confusion, read the following prompt: Some people are confident in the ability of the local government to safeguard food safety. Other people are not confident in their ability. How about you? Are you very confident, confident, unconfident, or very unconfident in its ability?]

- 非常有信心(very confident)
- 比较有信心(confident)
- 不太有信心(unconfident)
10. 那私营企业呢？
[不读: 如果被访者不明白上面的问题，清读出下列：有些人对私营企业保障食品安全的能力有信心。有些人对他们的能力没有信心。您呢？您对他们的能力非常有信心，有信心，没有信心，还是非常没有信心？]  
Now how about with regards to private businesses?  [Do not read: If survey respondent expresses confusion, read the following prompt: Some people are confident in the ability of the private businesses to safeguard food safety. Other people are not confident in their ability. How about you? Are you very confident, confident, unconfident, or very unconfident in its ability?] 

- 非常有信心(very confident)
- 比较有信心(confident)
- 不太有信心(unconfident)
- 非常没有信心(very unconfident)
- [不读]: 拒答(No answer)

11. 那民间组织呢？
[不读: 如果被访者不明白上面的问题，清读出下列：有些人对民间组织保障食品安全的能力有信心。有些人对他们的能力没有信心。您呢？您对他们的能力非常有信心，有信心，没有信心，还是非常没有信心？]
Now how about with regards to non governmental organizations?
[Do not read: If survey respondent expresses confusion, read the following prompt: Some people are confident in the ability of the independent non governmental organizations to safeguard food safety. Other people are not confident in their ability. How about you? Are you very confident, confident, unconfident, or very unconfident in its ability?] 

- 非常有信心(very confident)
- 比较有信心(confident)
- 不太有信心(unconfident)
Questions on willingness to pay

Now I would like to ask you some questions about certified food. Food certification is a process which validates whether a particular food product meets accepted standards of quality and safety. Certified food is found to meet quality and safety standards after a regulator conducts tests, inspections and audits of the food. Now I’d like to ask, if pork that is certified by various organizations are available for purchase, would you be willing or unwilling to pay for it? For example:

12. If regular pork was available on the market for 15 yuan a half kilo, and pork certified by the central government cost _______ yuan a half kilo, would you be willing or not willing to pay for certified pork? [Computer program to randomly select from 16, 17, 18, 19, 20, 25, or 30 yuan.]

   ○ 愿意 (Yes) [if Yes, skip to question 13a]
   ○ 不愿意 (No) [if No, skip to question 13b]

13a. Compared with regular pork which costs 15 yuan a half kilo, you are willing to pay for central government certified pork at costs [Insert price from Q12 here]. Do you then feel that your food is much more safe, relatively more safe, about the same, relatively less safe, or much less safe than before?

   ○ 非常安全 (much more safe)
   ○ 比较安全 (relatively more safe)
   ○ 差不多 (the same as before)
比 较 不 安 全 ( relatively less safe )
非 常 不 安 全 ( much less safe )
[ 不 读 ]: 拒 答 ( No answer )

13b 相 比 于 15 元 一 斤 的 普 通 猪 肉 ， 您 不 愿 意 买 [ 插 入 Q12 的 价 钱 ] 的 中 央 政 府 认 证 猪 肉 ， 那 您 觉 得 您 买 食 品 买 认 证 猪 肉 比 非 常 安 全 、 比 较 安 全 、 差 不 多 、 比 较 不 安 全 ， 还 是 非 常 不 安 全 ？
Compared with regular pork which costs 15 yuan a half kilo, you are unwilling to pay for central government certified pork at [Insert price from Q12 here]. Do you then feel that your food is much more safe, relatively more safe, about the same, relatively less safe, or much less safe than if you had bought certified pork?

○ 非 非 常 ( much more safe )
○ 比 较 ( relatively more safe )
○ 差 不 多 ( the same as before )
○ 比 较 不 安 ( relatively less safe )
○ 非 常 不 安 ( much less safe )
○ [ 不 读 ]: 拒 答 ( No answer )

14 如果 市 场 上 的 普 通 猪 肉 15 元 一 斤 ， 省 政 府 认 证 检 测 过 的 猪 肉 ______ 元 一 斤 ， 您 愿 不 意 买 认 证 过 的 猪 肉 ？ [ 电 脑 rand omly 选 16 , 17 , 18 , 19 , 20 , 25 , 或 者 30 元 ]
If regular pork was available on the market for 15 yuan a half kilo, and pork certified by the provincial government cost ______ yuan a half kilo, would you be willing or not willing to pay for certified pork? [Computer program to randomly select from 16, 17, 18, 19, 20, 25, or 30 yuan.]

○ 愿 意 ( Yes ) [ if Yes, skip to question 15a ]

○ 不 愿 意 ( No ) [ if No, skip to question 15b ]

15a 相 比 于 15 元 一 斤 的 普 通 猪 肉 ， 您 愿 意 买 [ 插 入 Q14 的 价 钱 ] 的 省 政 府 认 证 猪 肉 ， 那 您 觉 得 您 买 食 品 买 以 前 比 非 常 安 全 、 比 较 安 全 、 差 不 多 、 比 较 不 安 全 ， 还 是 非 常 不 安 全 ？
Compared with regular pork which costs 15 yuan a half kilo, you are willing to pay for provincial government certified pork at [Insert price from Q14 here]. Do you then feel that
your food is much more safe, relatively more safe, about the same, relatively less safe, or much less safe than before?

- 非常安全 (much more safe)
- 比较安全 (relatively more safe)
- 差不多 (the same as before)
- 比较不安全 (relatively less safe)
- 非常不安全 (much less safe)
- [不读]: 拒答 (No answer)

15b. Compared with regular pork which costs 15 yuan a half kilo, you are unwilling to pay for provincial government certified pork at [Insert price from Q14 here]. Do you then feel that your food is much more safe, relatively more safe, about the same, relatively less safe, or much less safe than before?

- 非常安全 (much more safe)
- 比较安全 (relatively more safe)
- 差不多 (the same as before)
- 比较不安全 (relatively less safe)
- 非常不安全 (much less safe)
- [不读]: 拒答 (No answer)

16. If regular pork was available on the market for 15 yuan a half kilo, and pork certified by a private corporation cost [randomly select from 16, 17, 18, 19, 20, 25, or 30 yuan], would you be willing or not willing to pay for certified pork? [Computer program to randomly select from 16, 17, 18, 19, 20, 25, or 30 yuan.]

- 愿意 (Yes) [if Yes, skip to question 17a]
不 愿 意 (No) [if No, skip to question 17b]

17a 相比于15元一斤的普通猪肉，您愿意买 [插入Q16的价钱] 的私营企业认证猪肉，那您觉得您买食品跟以前比非常安全 - 比较安全 - 差不多 - 比较不安全，还是非常不安全？
Compared with regular pork which costs 15 yuan a half kilo, you are willing to pay for privately certified pork at [Insert price from Q16 here]. Do you then feel that your food is much more safe, relatively more safe, about the same, relatively less safe, or much less safe than before?

○ 非常安全 (much more safe)
○ 比较安全 (relatively more safe)
○ 差不多 (the same as before)
○ 比较不安全 (relatively less safe)
○ 非常不安全 (much less safe)
○ [不读]: 拒答 (No answer)

17b 相比于15元一斤的普通猪肉，您不愿意买 [插入Q16的价钱] 的私营企业认证猪肉，那您觉得您买食品跟以前比非常安全 - 比较安全 - 差不多 - 比较不安全，还是非常不安全？
Compared with regular pork which costs 15 yuan a half kilo, you are unwilling to pay for privately certified pork at [Insert price from Q16 here]. Do you then feel that your food is much more safe, relatively more safe, about the same, relatively less safe, or much less safe than before?

○ 非常安全 (much more safe)
○ 比较安全 (relatively more safe)
○ 差不多 (the same as before)
○ 比较不安全 (relatively less safe)
○ 非常不安全 (much less safe)
○ [不读]: 拒答 (No answer)

18 如果市场上的普通猪肉15元一斤，民间组织认证检测过的猪肉 _____ 元一斤，您愿不愿意买认证过的猪肉？ [电脑randomly选16，17，18，19，20，25，或者30元]
If regular pork was available on the market for 15 yuan a half kilo, and pork certified by an NGO cost _____ yuan a half kilo, would you be willing or not willing to pay for certified pork?[Computer program to randomly select from 16, 17, 18, 19, 20, 25, or 30 yuan.]

○ 愿意 (Yes) [if Yes, skip to question 19a]
○ 不愿意 (No) [if No, skip to question 19b]

19a 相比于15元一斤的普通猪肉，您愿意买[插入Q18的价钱]的民间组织认证猪肉，那您觉得您买食品跟以前比非常安全、比较安全、差不多、比较不安全，还是非常不安全？

Compared with regular pork which costs 15 yuan a half kilo, you are willing to pay for NGO certified pork at [Insert price from Q18 here]. Do you then feel that your food is much more safe, relatively more safe, about the same, relatively less safe, or much less safe than before?

○ 非常安全 (much more safe)
○ 比较安全 (relatively more safe)
○ 差不多 (the same as before)
○ 比较不安全 (relatively less safe)
○ 非常不安全 (much less safe)
○ [不读]: 拒答 (No answer)

19b 相比于15元一斤的普通猪肉，您不愿意买[插入Q18的价钱]的民间组织认证猪肉，那您觉得您买食品跟以前比非常安全、比较安全、差不多、比较不安全，还是非常不安全

Compared with regular pork which costs 15 yuan a half kilo, you are unwilling to pay for NGO certified pork at [Insert price from Q18 here]. Do you then feel that your food is much more safe, relatively more safe, about the same, relatively less safe, or much less safe than before?

○ 非常安全 (much more safe)
○ 比较安全 (relatively more safe)
○ 差不多 (the same as before)
○ 比较不安全 (relatively less safe)
○ 非常不安全 (much less safe)
○ [不读]: 拒答 (No answer)
Questions on willingness to accept

Now I would like to ask you some questions about certified food. Food certification is process which validates whether a particular food product meets accepted standards of quality and safety. Certified food is found to meet quality and safety standards after a regulator conducts tests, inspections and audits of the food. Now I would like to ask, if pork that is certified by various organizations are available for purchase, would you or would you not be willing to accept regular pork? For example:

12 If regular pork was available on the market for 15 yuan a half kilo, and pork certified by the central government cost ______ yuan a half kilo, would you be willing or unwilling to accept the regular pork? [Computer program to randomly select from 16, 17, 18, 19, 20, 25, or 30 yuan.]

- 不愿意 (No) [if No, skip to question 13a]
- 愿意 (Yes) [if Yes, skip to question 13b]

13a Compared with [Insert price from Q12 here] yuan per half kilo of central government certified pork, you are unwilling to accept regular pork at 15 yuan. Do you then feel as if your food is a lot safer before, relatively safer, about the same, relatively less safe, or a lot less safe?

- 非常安全 (much more safe)
- 比较安全 (relatively more safe)
- 差不多 (the same as before)
- 比较不安全 (relatively less safe)
- 非常不安全 (much less safe)
13b 相比于 [插入Q12的价钱] 元一斤的中央政府认证猪肉，您愿意接受15元的普通猪肉，那您觉得您买的普通食品跟以前比非常安全、比较安全、差不多、比较不安全，还是非常不安全？

Compared with [Insert price from Q12 here] a yuan per half kilo of central government certified pork, you are willing to accept regular pork at 15 yuan. Do you then feel as if your food is a lot safer before, relatively safer, about the same, relatively less safe, or a lot less safe?

- 非常安全(much more safe)
- 比较安全(relatively more safe)
- 差不多(the same as before)
- 比较不安全(relatively less safe)
- 非常不安全(much less safe)
- [不读]拒答(No answer)

14 如果市场上的普通猪肉是15元一斤，省政府认证检测过的猪肉是_____元一斤，您愿不愿意接受普通猪肉吗？ [电脑randomly选16，17，18，19，20，25，或者30元]

If regular pork was available on the market for 15 yuan a half kilo, and pork certified by the provincial government cost_____ yuan a half kilo, would you be willing or unwilling to accept the regular pork? [Computer program to randomly select from 16, 17, 18, 19, 20, 25, or 30 yuan.]

- 不愿意(No) [if No, skip to question 15a]
- 愿意(Yes) [if Yes, skip to question 15b]

15a 相比于 [插入Q14的价钱] 元一斤的省政府认证猪肉，您不愿意接受15元的普通猪肉，那您觉得您买的普通食品跟以前比非常安全、比较安全、差不多、比较不安全，还是非常不安全？

Compared with [Insert price from Q14 here] a yuan per half kilo of provincial government certified pork, you are unwilling to accept regular pork at 15 yuan. Do you then feel as if your food is a lot safer before, relatively safer, about the same, relatively less safe, or a lot less safe?
非常安全 (much more safe)  
比较安全 (relatively more safe)  
差不多 (the same as before)  
比较不安全 (relatively less safe)  
非常不安全 (much less safe)  
[不读]: 拒答 (No answer)

15b 相比于 [插入Q14的价钱] 元一斤的省政府认证猪肉，您愿意接受15元的普通猪肉，那您觉得您买的普通食品跟以前比非常安全、比较安全、差不多、比较不安全，还是非常不安全？

Compared with [Insert price from Q14 here] a yuan per half kilo of provincial government certified pork, you are willing to accept regular pork at 15 yuan. Do you then feel as if your food is a lot safer before, relatively safer, about the same, relatively less safe, or a lot less safe?

非常安全 (much more safe)  
比较安全 (relatively more safe)  
差不多 (the same as before)  
比较不安全 (relatively less safe)  
非常不安全 (much less safe)  
[不读]: 拒答 (No answer)

16 如果市场上的普通猪肉是15元一斤，私营企业认证检测过的猪肉是______元一斤，您愿意不愿意接受普通猪肉吗？ [电脑randomly选16, 17, 18, 19, 20, 25, 或者30元]

If regular pork was available on the market for 15 yuan a half kilo, and pork certified by a private corporation cost______yuan a half kilo, would you be willing or unwilling to accept the regular pork? [Computer program to randomly select from 16, 17, 18, 19, 20, 25, or 30 yuan.]

不愿意 (No) [if No, skip to question 17a]  
愿意 (Yes) [if Yes, skip to question 17b]
17a 相比于 [插入Q16的价钱] 元一斤的私营企业认证猪肉，您不愿意接受15元的普通猪肉，那您觉得您买的普通食品跟以前比非常安全、比较安全、差不多、比较不安全，还是非常不安全？
Compared with [Insert price from Q16 here] a yuan per half kilo of privately certified pork, you are unwilling to accept regular pork at 15 yuan. Do you then feel as if your food is a lot safer before, relatively safer, about the same, relatively less safe, or a lot less safe?

- 非常安全 (much more safe)
- 比较安全 (relatively more safe)
- 差不多 (the same as before)
- 比较不安全 (relatively less safe)
- 非常不安全 (much less safe)
- [不读]: 拒答 (No answer)

17b 相比于 [插入Q16的价钱] 元一斤的私营企业认证猪肉，您愿意接受15元的普通猪肉，那您觉得您买的普通食品跟以前比非常安全、比较安全、差不多、比较不安全，还是非常不安全？
Compared with [Insert price from Q16 here] a yuan per half kilo of privately certified pork, you are willing to accept regular pork at 15 yuan. Do you then feel as if your food is a lot safer before, relatively safer, about the same, relatively less safe, or a lot less safe?

- 非常安全 (much more safe)
- 比较安全 (relatively more safe)
- 差不多 (the same as before)
- 比较不安全 (relatively less safe)
- 非常不安全 (much less safe)
- [不读]: 拒答 (No answer)

18 如果市场上的普通猪肉是15元一斤，民间组织认证检测过的猪肉是元一斤，您愿意不愿意接受普通猪肉吗？ [电脑randomly选16，17，18，19，20，25，或者30元]
If regular pork was available on the market for 15 yuan a half kilo, and pork certified by a
NGO cost ____ yuan a half kilo, would you be willing or unwilling to accept the regular pork? [Computer program to randomly select from 16, 17, 18, 19, 20, 25, or 30 yuan.]

○ 不愿意 (No) [if No, skip to question 19a]
○ 愿意 (Yes) [if Yes, skip to question 19b]

19a 相比于 [插入Q18的价钱] 元一斤的民间组织认证猪肉，您不愿意接受15元的普通猪肉，那您觉得您买的普通食品跟以前比非常安全、比较安全、差不多、比较不安全，还是非常不安全？

Compared with [Insert price from Q18 here] a yuan per half kilo of NGO certified pork, you are unwilling to accept regular pork at 15 yuan. Do you then feel as if your food is a lot safer before, relatively safer, about the same, relatively less safe, or a lot less safe?

○ 非常安全 (much more safe)
○ 比较安全 (relatively more safe)
○ 差不多 (the same as before)
○ 比较不安全 (relatively less safe)
○ 非常不安全 (much less safe)
○ [不读]:拒答 (No answer)

19b 相比于 [插入Q18的价钱] 元一斤的私营企业认证猪肉，您愿意接受15元的普通猪肉，那您觉得您买的普通食品跟以前比非常安全、比较安全、差不多、比较不安全，还是非常不安全？

Compared with [Insert price from Q18 here] a yuan per half kilo of NGO certified pork, you are willing to accept regular pork at 15 yuan. Do you then feel as if your food is a lot safer before, relatively safer, about the same, relatively less safe, or a lot less safe?

○ 非常安全 (much more safe)
○ 比较安全 (relatively more safe)
○ 差不多 (the same as before)
○ 比较不安全 (relatively less safe)
○ 非常不安全 (much less safe)
○ [不读]:拒答 (No answer)
C.3.4 Reverse question ordering

Questions on trust

4 我相信，关于食品安全，民间组织政府会照顾我的利益。

I trust an NGO to look after my interests with regards to food safety issues.

○ 非常同意(strongly agree)
○ 比较同意(agree)
○ 较不同意(disagree)
○ 非常不同意(strongly disagree)
○ [不读:拒答(No answer)]

5 那私营企业呢？

[不读: 如果被访者不明白上面的问题，读出下列：我相信，关于食品安全，私营企业会照顾我的利益]

Now how about with regards to the private businesses?

[Do not read: If survey respondent expresses confusion, read the following prompt: I trust private businesses to look after my interests with regards to food safety issues.]

○ 非常同意(strongly agree)
○ 比较同意(agree)
○ 较不同意(disagree)
○ 非常不同意(strongly disagree)
○ [不读:拒答(No answer)]

6 那省政府呢？

[不读: 如果被访者不明白上面的问题，读出下列：我相信，关于食品安全，省政府会照顾我的利益。]

Now how about with regards to the provincial government?

[Do not read: If survey respondent expresses confusion, read the following prompt: I trust the provincial government to look after my interests with regards to food safety issues.]

○ 非常同意(strongly agree)
Questions on ability

现在我想了解您对各织机构保障食品安全能力的信任程度。首先，我想问您关于民间组织：
Now I would like to ask you some questions about how you feel about the ability of various organizations to safeguard food safety. First I would like to ask you about NGOs.

有些人对民间组织保障食品安全的能力有信心。有些人对他们的能力没有信心。您呢？您对他们的能力非常有信心，比较有信心，不太有信心，还是非常没有信心？
Some people are confident in the ability of NGOs to safeguard food safety. Other people are not confident in their ability. How about you? Are you very confident, confident, unconfident, or very unconfident in its ability?

○ 非常有信心(very confident)
○ 比较有信心(confident)
9 那私营企业呢？
[不读: 如果被访者不明白上面的问题，清读出下列：有些人对私营企业保障食品安全的能力有信心。有些人对他们的能力没有信心。您呢？您对他们的能力非常有信心，有信心，没有信心，还是非常没有信心？]
Now how about with regards to private businesses? [Do not read: If survey respondent expresses confusion, read the following prompt: Some people are confident in the ability of the private businesses to safeguard food safety. Other people are not confident in their ability. How about you? Are you very confident, confident, unconfident, or very unconfident in its ability?]

○ 非常有信心(very confident)
○ 比较有信心(confident)
○ 不太有信心(unconfident)
○ 非常没有信心(very unconfident)
○ [不读]:拒答(No answer)

10 那省政府呢？
[不读: 如果被访者不明白上面的问题，清读出下列：有些人对省政府保障食品安全的能力有信心。有些人对他们的能力没有信心。您呢？您对他们的能力非常有信心，有信心，没有信心，还是非常没有信心？]
Now how about with regards to the provincial government?
[Do not read: If survey respondent expresses confusion, read the following prompt: Some people are confident in the ability of the local government to safeguard food safety. Other people are not confident in their ability. How about you? Are you very confident, confident, unconfident, or very unconfident in its ability?]

○ 非常有信心(very confident)
11 那中央政府呢？
不读]: 如果被访者不明白上面的问题，清读出下列：有些人对中央政府保障食品安全的能力有信心。有些人对他们的能力有信心。您呢？您对他们的能力非常有信心。有信心。没有信心。非常没有信心？

Now how about with regards to the central government?

[Do not read: If survey respondent expresses confusion, read the following prompt: Some people are confident in the ability of the independent non governmental organizations to safeguard food safety. Other people are not confident in their ability. How about you? Are you very confident, confident unconfident, or very unconfident in its ability?]

○ 非常有信心(very confident)
○ 比较有信心(confident)
○ 不太有信心(unconfident)
○ 非常没有信心(very unconfident)
○ [不读]:拒答(No answer)

Questions on willingness to pay

现在我想问您一些关于食品安全认证的问题。食品安全认证保障食品生产的过程是否符合质量和安全的规定和要求。为了保证食品安全，需要通过第三方的检测、检查和审核。那么现在想问，如果市场上有售各种组织认证的猪肉，您愿不愿意购买认证猪肉？比如:

Now I would like to ask you some questions about certified food. Food certification is process which validates whether a particular food product meets accepted standards of quality and safety. Certified food is found to meet quality and safety standards after a regulator conducts tests, inspections and audits of the food. Now I’d like to ask, if pork that is certified by various organizations are available for purchase, would you be willing or unwilling to pay for it? For example:
12 如果市场上的普通猪肉15元一斤，民间组织认证检测过的猪肉_____元一斤，您愿不愿意买认证过的猪肉？[电脑randomly选16，17，18，19，20，25，或者30元]
If regular pork was available on the market for 15 yuan a half kilo, and pork certified by an NGO cost _____ yuan a half kilo, would you be willing or not willing to pay for certified pork?[Computer program to randomly select from 16, 17, 18, 19, 20, 25, or 30 yuan.]

- 愿意(Yes) [if Yes, skip to question 13a]
- 不愿意(No) [if No, skip to question 13b]

13a 相比于15元一斤的普通猪肉，您愿意买[插入Q12的价钱]的民间组织认证猪肉，那您觉得您买食品跟以前比非常安全、比较安全、差不多、比较不安全，还是非常不安全？
Compared with regular pork which costs 15 yuan a half kilo, you are willing to pay for NGO certified pork at [Insert price from Q12 here]. Do you then feel that your food is much more safe, relatively more safe, about the same, relatively less safe, or much less safe than before?

- 非常安全(much more safe)
- 比较安全(relatively more safe)
- 差不多(the same as before)
- 比较不安全(relatively less safe)
- 非常不安全(much less safe)
- [不读]:拒答(No answer)

13b 相比于15元一斤的普通猪肉，您不愿意买[插入Q12的价钱]的民间组织认证猪肉，那您觉得您买食品跟以前比非常安全、比较安全、差不多、比较不安全，还是非常不安全
Compared with regular pork which costs 15 yuan a half kilo, you are unwilling to pay for NGO certified pork at [Insert price from Q12 here]. Do you then feel that your food is much more safe, relatively more safe, about the same, relatively less safe, or much less safe than before?

- 非常安全(much more safe)
- 比较安全(relatively more safe)
- 差不多(the same as before)
14 If regular pork was available on the market for 15 yuan a half kilo, and pork certified by a private corporation cost _______ yuan a half kilo, would you be willing or not willing to pay for certified pork? [Computer program to randomly select from 16, 17, 18, 19, 20, 25, or 30 yuan.]

- 愿意 (Yes) [if Yes, skip to question 15a]
- 不愿意 (No) [if No, skip to question 15b]

15a Compared with regular pork which costs 15 yuan a half kilo, you are willing to pay for privately certified pork at [Insert price from Q14 here]. Do you then feel that your food is much more safe, relatively more safe, about the same, relatively less safe, or much less safe than before?

- 非常安全 (much more safe)
- 比较安全 (relatively more safe)
- 差不多 (the same as before)
- 比较不安全 (relatively less safe)
- 非常不安全 (much less safe)
- [不读]: 拒答 (No answer)

15b Compared with regular pork which costs 15 yuan a half kilo, you are unwilling to pay for privately certified pork at [Insert price from Q14 here]. Do you then feel that your food is
much more safe, relatively more safe, about the same, relatively less safe, or much less safe than before?

- 非常安全 (much more safe)
- 比较安全 (relatively more safe)
- 差不多 (the same as before)
- 比较不安全 (relatively less safe)
- 非常不安全 (much less safe)
- [不读]: 拒答 (No answer)

16 如果市场上的普通猪肉15元一斤，省政府认证检测过的猪肉_____元一斤，您愿不愿意买认证过的猪肉？ [电脑randomly选16，17，18，19，20，25，或者30元]

If regular pork was available on the market for 15 yuan a half kilo, and pork certified by the provincial government cost _____ yuan a half kilo, would you be willing or not willing to pay for certified pork? [Computer program to randomly select from 16, 17, 18, 19, 20, 25, or 30 yuan.]

- 愿意 (Yes) [if Yes, skip to question 17a]
- 不愿意 (No) [if No, skip to question 17b]

17a 相比于15元一斤的普通猪肉，您愿意买 [插入Q16的价钱] 的省政府认证猪肉，那您觉得您买食品跟以前比非常安全、比较安全、差不多、比较不安全，还是非常不安全?

Compared with regular pork which costs 15 yuan a half kilo, you are willing to pay for provincial government certified pork at [Insert price from Q16 here]. Do you then feel that your food is much more safe, relatively more safe, about the same, relatively less safe, or much less safe than before?

- 非常安全 (much more safe)
- 比较安全 (relatively more safe)
- 差不多 (the same as before)
- 比较不安全 (relatively less safe)
- 非常不安全 (much less safe)
17b Compared with regular pork which costs 15 yuan a half kilo, you are unwilling to pay for provincial government certified pork at [Insert price from Q16 here]. Do you then feel that your food is much more safe, relatively more safe, about the same, relatively less safe, or much less safe than before?

- 非常安全 (much more safe)
- 比较安全 (relatively more safe)
- 差不多 (the same as before)
- 比较不安全 (relatively less safe)
- 非常不安全 (much less safe)
- [不读]: 拒答 (No answer)

18 If regular pork was available on the market for 15 yuan a half kilo, and pork certified by the central government cost ____________ yuan a half kilo, would you be willing or not willing to pay for certified pork? [Computer program to randomly select from 16, 17, 18, 19, 20, 25, or 30 yuan.]

- 愿意 (Yes) [if Yes, skip to question 19a]
- 不愿意 (No) [if No, skip to question 19b]

19a Compared with regular pork which costs 15 yuan a half kilo, you are willing to pay for central government certified pork at costs [Insert price from Q18 here]. Do you then feel that your food is much more safe, relatively more safe, about the same, relatively less safe, or much less safe than before?
Questions on willingness to accept

Now I would like to ask you some questions about certified food. Food certification is process which validates whether a particular food product meets accepted standards of quality and safety. Certified food is found to meet quality and safety standards after a regulator conducts tests, inspections and audits of the food. Now I would like to ask, if pork that is certified by various organizations are available for purchase, would you or would you not be willing to accept regular pork? For example:

- 非常安全 (much more safe)
- 比较安全 (relatively more safe)
- 差不多 (the same as before)
- 比较不安全 (relatively less safe)
- 非常不安全 (much less safe)
- [不读]: 拒答 (No answer)
12 如果市场上的普通猪肉是15元一斤，民间组织认证检测过的猪肉是____元一斤，您愿不愿意接受普通猪肉吗？[电脑randomly选16，17，18，19，20，25，或者30元]

If regular pork was available on the market for 15 yuan a half kilo, and pork certified by a NGO cost____ yuan a half kilo, would you be willing or unwilling to accept the regular pork? [Computer program to randomly select from 16, 17, 18, 19, 20, 25, or 30 yuan.]

- 不愿意(No)[if No, skip to question 13a]
- 愿意(Yes) [if Yes, skip to question 13b]

13a 相比于[插入Q12的价钱]元一斤的民间组织认证猪肉，您不愿意接受15元的普通猪肉，那您觉得您买的普通食品跟以前比非常安全、比较安全、差不多、比较不安全，还是非常不安全？

Compared with [Insert price from Q12 here] a yuan per half kilo of NGO certified pork, you are unwilling to accept regular pork at 15 yuan. Do you then feel as if your food is a lot safer before, relatively safer, about the same, relatively less safe, or a lot less safe?

- 非常安全(much more safe)
- 比较安全(relatively more safe)
- 差不多(the same as before)
- 比较不安全(relatively less safe)
- 非常不安全(much less safe)
- [不读]:拒答(No answer)

13b 相比于[插入Q12的价钱]元一斤的私营企业认证猪肉，您愿意接受15元的普通猪肉，那您觉得您买的普通食品跟以前比非常安全、比较安全、差不多、比较不安全，还是非常不安全？

Compared with [Insert price from Q12 here] a yuan per half kilo of NGO certified pork, you are willing to accept regular pork at 15 yuan. Do you then feel as if your food is a lot safer before, relatively safer, about the same, relatively less safe, or a lot less safe?

- 非常安全(much more safe)
- 比较安全(relatively more safe)
14 如果市场上的普通猪肉是15元一斤，私营企业认证检测过的猪肉是_____元一斤，您愿意不愿意接受普通猪肉吗？
If regular pork was available on the market for 15 yuan a half kilo, and pork certified by a private corporation cost_____ yuan a half kilo, would you be willing or unwilling to accept the regular pork? [Computer program to randomly select from 16, 17, 18, 19, 20, 25, or 30 yuan.]

- 不愿意(No) [if No, skip to question 14a]
- 愿意(Yes) [if Yes, skip to question 14b]

15a 相比于 [插入Q14的价钱] 元一斤的私营企业认证猪肉，您不愿意接受15元的普通猪肉，那您觉得您买的普通食品跟以前比非常安全、比较安全、差不多、比较不安全，还是非常不安全？
Compared with [Insert price from Q14 here] a yuan per half kilo of privately certified pork, you are unwilling to accept regular pork at 15 yuan. Do you then feel as if your food is a lot safer before, relatively safer, about the same, relatively less safe, or a lot less safe?

- 非常安全(much more safe)
- 比较安全(relatively more safe)
- 差不多(the same as before)
- 比较不安全(relatively less safe)
- 非常不安全(much less safe)
- [不读]:拒答(No answer)

15b 相比于 [插入Q14的价钱] 元一斤的私营企业认证猪肉，您愿意接受15元的普通猪肉，那您觉得您买的普通食品跟以前比非常安全、比较安全、差不多、比较不安全，还是非常不安全？
Compared with [Insert price from Q14 here] a yuan per half kilo of privately certified pork, you are willing to accept regular pork at 15 yuan. Do you then feel as if your food is a lot safer before, relatively safer, about the same, relatively less safe, or a lot less safe?

- 非常安全 (much more safe)
- 比较安全 (relatively more safe)
- 差不多 (the same as before)
- 比较不安全 (relatively less safe)
- 非常不安全 (much less safe)
- [不读]: 拒答 (No answer)

16 如果市场上的普通猪肉是15元一斤，省政府认证检测过的猪肉是 _____ 元一斤，您愿不愿意接受普通猪肉吗？ [电脑randomly选16、17、18、19、20、25, 或者30元]

If regular pork was available on the market for 15 yuan a half kilo, and pork certified by the provincial government cost _____ yuan a half kilo, would you be willing or unwilling to accept the regular pork? [Computer program to randomly select from 16, 17, 18, 19, 20, 25, or 30 yuan.]

- 不愿意 (No) [if No, skip to question 17a]
- 愿意 (Yes) [if Yes, skip to question 17b]

17a 相比于 [插入Q16的价钱] 元一斤的省府认证猪肉，您不愿意接受15元的普通猪肉，那您觉得您买的普通食品跟以前比非常安全、比较安全、差不多、比较不安全，还是非常不安全？

Compared with [Insert price from Q16 here] a yuan per half kilo of provincial government certified pork, you are unwilling to accept regular pork at 15 yuan. Do you then feel as if your food is a lot safer before, relatively safer, about the same, relatively less safe, or a lot less safe?

- 非常安全 (much more safe)
- 比较安全 (relatively more safe)
- 差不多 (the same as before)
17b 相比于 [插入Q16的价钱] 元一斤的省府认证猪肉，您愿意接受15元的普通猪肉，那您觉得您买的普通食品跟以前比非常安全、比较安全、差不多、比较不安全，还是非常不安全？
Compared with [Insert price from Q16 here] a yuan per half kilo of provincial government certified pork, you are willing to accept regular pork at 15 yuan. Do you then feel as if your food is a lot safer before, relatively safer, about the same, relatively less safe, or a lot less safe?

- 非常安全 (much more safe)
- 比较安全 (relatively more safe)
- 差不多 (the same as before)
- 比较不安全 (relatively less safe)
- 非常不安全 (much less safe)
- [不读]: 拒答 (No answer)

18 如果市场上的普通猪肉是15元一斤，中央政府认证检测过的猪肉是元一斤，您愿不愿意接受普通猪肉？ [电脑randomly选16, 17, 18, 19, 20, 25, 或者30元]
If regular pork was available on the market for 15 yuan a half kilo, and pork certified by the central government cost _____ yuan a half kilo, would you be willing or unwilling to accept the regular pork? [Computer program to randomly select from 16, 17, 18, 19, 20, 25, or 30 yuan.]

- 不愿意 (No) [if No, skip to question 19a]
- 愿意 (Yes) [if Yes, skip to question 19b]

19a 相比于 [插入Q18的价钱] 元一斤的中央政府认证猪肉，您不愿意接受15元的普通猪肉，那您觉得您买的普通食品跟以前比非常安全、比较安全、差不多、比较不安全，还是非常不安全？
Compared with [Insert price from Q18 here] a yuan per half kilo of central government certified pork, you are unwilling to accept regular pork at 15 yuan. Do you then feel as if your food is a lot safer before, relatively safer, about the same, relatively less safe, or a lot less safe?

- 非常不安全 (relatively less safe)
- 非常安全 (much more safe)
- 比较安全 (relatively more safe)
- 差不多 (the same as before)
- 比较不安全 (relatively less safe)
- 非常不安全 (much less safe)
- [不读]: 拒答 (No answer)
certified pork, you are unwilling to accept regular pork at 15 yuan. Do you then feel as if your food is a lot safer before, relatively safer, about the same, relatively less safe, or a lot less safe?

- 非常安全(much more safe)
- 比较安全(relatively more safe)
- 差不多(the same as before)
- 比较不安全(relatively less safe)
- 非常不安全(much less safe)
- [不读]:拒答(No answer)

C.3.5 International participation question

20 在过去，我国没怎么参与制定国际食品安全标准，现在正在积极参与而对这些标准有所影响。您觉得中国的参与会让老百姓的食品安全有什么样的改变，是有较大程度的改善，较小程度的改善，和原来差不多，有较小程度的退步，还是有较大程度的退步？

China has not participated much in formulating international food standards in the past but
is now trying to be much more active. How much do you think this will affect the country’s food safety? Will it have a large positive impact, a small positive impact, be the same as before, have a small negative impact or have a large negative impact?

- 有较大程度的改善(much more safe)
- 较小程度的改善(relatively more safe)
- 和原来差不多(the same as before)
- 有较小程度的退步(relatively less safe)
- 有较大程度的退步(much less safe)
- [不读]:拒答(No answer)

C.3.6 Demographic questions

为了研究不同群体的人在态度上有没有差别，我还想了解您个人的一些情况。请放心，您的资料我们只做统计分析使用，不会透露给任何人。

In order understand how differences in background may lead to different opinions, I would like to ask some additional questions about your background. Please be assured that any information that you give will be entirely confidential.

21 您吃猪肉的频率?

How often do you eat pork?

- 至少一天一次(At least once a day)
- 至少一个礼拜一次(At least once a week)
- 至少一月一次(At least once times a month)
- 至少一年一次(At least once a year)
- 不吃猪肉(I don’t eat pork)
- [不读]:拒答(No answer)

22 您以前有吃过不安全的猪肉吗?

Have you previously eaten unsafe pork?

- 肯定没有(Definitely no)
23 这个调查之前，您对食品认证有多少了解？
Before this survey, how familiar were you with the concept of food safety certification?

○ 完全不了解(Not familiar at all)
○ 听说过但是不怎么了解(Heard of it but not very familiar)
○ 相对了解(Moderately familiar)
○ 了解很多(Very familiar)
○ [不读]:拒答(No answer)

24 在您家，谁做饭？
In your home, who is primarily in charge of preparing meals?

○ 我(Me)
○ 我的爱人或伴侣(My spouse or partner)
○ 我的长辈(My elders)
○ 我的晚辈(My children)
○ 谁有时间谁负责(Whoever has time takes care of it)
○ [不读]:拒答(No answer)

25 如果您有18岁以下的孩子跟您一起住，他们多大？
How old are any children who live at home?

26 您的家庭有几人？
How many people live in your household?

○ 1
27 请问您的周岁年龄是: [记录准确周岁年龄]

Please state your age: __________

28 您的户籍是:

Where is your household registration?

- 非农业户口(urban)
- 农业户口(rural)
- [不读]:拒答(No answer)

29 请选择您居住的省或地区:

What province do you live in?

- Beijing
- Tianjin
- Hebei
- Shanxi
- Inner Mongolia
- Liaoning
- Jilin
- Heilongjiang
- Shanghai
- Jiangsu
- Zhejiang
- Anhui
您的性别是:
Where is your household registration?

- 男 (male)
- 女 (girl)

[不读]:拒答 (No answer)
31 您全家上个月总收入是多少？ __________
How much was the monthly income for your combined household last month?

32 您最高学历/教育水平是： Please state your level of education:

- 小学以下(below elementary school)
- 小学(elementary school)
- 初中(middle school)
- 高中/中专/技校(high school/technical school)
- 大学本科(undergraduate)
- 硕士及以上学历(graduate)
- [不读]:拒答(No answer)
Please answer the following question:

What is your occupation?

01. Senior managers (top management)
02. Middle managers (middle management)
03. Office workers
04. Educators and researchers
05. General workers (production, transportation, etc.)
06. Service workers
07. Agricultural, forestry, mining workers
08. Lawyers, accountants
09. Artists, writers
10. Retired workers
11. Unemployed
12. Out of work
13. Students
14. Military
15. Housewives
16. Refuse to answer

Note: Please indicate your occupation.
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Biography

Cindy Yawen Cheng was born on June 23, 1987 in Mountain View, CA. She received a B.A. in Economics and Political Economy from the University of California Berkeley in 2009, an M.A. in Political Science from Duke University in 2016.

Publications


Awards

- Rethinking Regulation Graduate Research Award, Kenan Institute for Ethics — Duke University, (2015)
- Fulbright Hayes Doctoral Dissertation Award Research Abroad Fellowship, United States Department of Education (2014)
- Dissertation Support Award, Duke Department of Political Science (2014)
- Summer Research Fellowship, Asian Pacific Studies Institute (2014)
- National Science Foundation Graduate Research Fellowships Program, Honorable Mention (2012)
- Foreign Language and Area Studies Summer Fellowship, US Department of Education (2012)
- Graduate Research Grant, DIPE, Duke University