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Cultural political economy of traditional Chinese medicine: implications for trade ban repeals and zoonotic spillover

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Abstract:

The reluctance of the Chinese government to enforce restrictions on trade in wildlife products prior to the SARS-CoV-2 spillover is surprising considering the risk factors incurred for public health and political stability. The spillover of SARS-COV-2 into the human sector and subsequent COVID-19 pandemic is ultimately the result of the same factors that gave rise to the SARS-COV-1 epidemic which began in 2002. As a response to the SARS-COV-1 epidemic, trade in wildlife products were banned with strict enforcement. However, this ban was lifted just three months later. Similarly, the Chinese government instituted a strict ban on wildlife trade in February of 2020 in response to the SARS-COV-2 outbreak. Notably though, this ban excluded animals that were used in Traditional Chinese Medicinal practices, including the farming of taxa of high zoonotic concern - including bats and pangolins. This thesis will explore the cultural political economy of wildlife products for medicinal purposes in Chinese markets as an explanatory factor for the Chinese government's political reluctance to enforce bans that would ultimately offer large gains to public health and be hugely cost-saving by preventing disastrous spillover events.

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Introduction

I argue that the decision of the Chinese government's seemingly irrational policies to reverse wildlife trade ban's after catastrophic market disrupting spillover events cannot be understood without taking into account the cultural value of wildlife trade within the country. Social norms that influence policy are essential to understand political behavior in these decision making processes. In this case, social norms and cultural economy associated with consumption of non-agricultural animal products encourages the continued allowance of risky trade activity. The greatest opponent to this hypothesis would be a mercantilist perspective which insists that the state encourages trade that is in its best economic interests, and so perceived economic gains of wildlife trade allowance must outweigh the perceived risks. In a mercantilist framework, not the cultural desire for consumption of international species of animals, but the economic benefits that the market provides the state would be the greatest influencing factor in the government's hesitancy to enforce bans. According to mercantilism, the trade and consumption of wildlife is valuable in the eyes of the Chinese government only so much as it contributes to economic gains and consumer activity from its continued allowance. In this thesis I will address this counter-argument by showing that the bulk of economic gains from wildlife trade within the country of China are derived from national agricultural operations and not international trade. Internal agricultural operations support a strong market, and therefore the risk they pose to human health is sensibly more tolerable within a mercantilist framework than that of international trade. I demonstrate that the subset of data that I analyze for this thesis examines a portion of trade that should be considered economically undesirable under mercantilist theory,

and therefore it's allowance is difficult to parse with the threats it poses. With all this taken into consideration, socio-cultural drivers of this trade are significant, and may explain some of the regulation hesitancy on the part of the Chinese government.

I do not argue that the cultural political economy of species consumption in China is the only factor that influences Chinese political decisions to not enforce wildlife trade bans, but rather that the seemingly irrational behavior to allow the continued trade in a product with the potential to cause catastrophic economic and social damage cannot be understood without an acknowledgment of the socio-cultural factors of wildlife consumption within China.

In this thesis, I will begin by introducing key concepts explaining the scientific background of zoonotic spillover and the contemporary history of spillover as a result of the growing human-wildlife interface. I will then offer an analysis of species trade data that shows the patterns of Chinese import behavior of species of high zoonotic risk explicitly imported for commercial purposes. Finally, I will discuss the implications of wildlife trade as a function of Chinese cultural political economy, and the risk that the growing influence of this market poses to global human health.

Literature Review

It is essential for the comprehension of my pursuing argument for the reader to be familiar with key concepts of viral spillover, biological processes that facilitate it, the varying biological threats different taxonomic groups pose to human populations, as well as Chinese cultural practices that facilitate markets for wild animals and their histories. In order to understand the counter argument to my thesis and subsequent rebuttal, it is also necessary for readers to understand economic mercantilist and neomercantilist theory as it pertains to perception of trade and value of trade in China. In my literature review I will give a thorough review of contemporary scientific research on the relationship of wildlife trade and viral spillover as well as examine texts such as the *Huangdi Neijing* which established the use of wild animals for medical practices and set the cultural precedent for wild animal consumption in China. I will also review economic mercantilist and neomercantilist theory and discuss how previous literature views the Chinese government's perception of trade and trade restrictions.

Zoonotic Spillover

Instances of zoonotic spillover have been increasing in number and severity since the latter half of the 20th century (Cunningham et al. 2017, Daszak et al. 2001). Drivers of this increase include (1) expanding land-use change, (2) range shifts of pathogens and hosts due to a changing climate, and (3) increasing movement of goods, humans, and livestock which create conduits for pathogens and hosts to travel across previous geographic and spatial barriers (Cunningham et al. 2017; Karesh & Nobel 2009; Wolfe et al. 2005; Ostfeld & Keesing, 2000). In the cases of Nipah Virus, SARS-COV-1, and MERS, wild land was increasingly converted into agricultural fields, causing humans and livestock to come into contact with wild animals. This increase of contact

between wildlife, domestic animals, and humans allowed the novel viruses to infect hosts - domestic pigs, civets, camels, etc. and later humans.

Other examples of such transmission include the Ebola Virus in Sub-saharan Africa, which made the jump from bats to humans in multiple isolated events as humans become increasingly present in wild forest areas (Baize et al. 2014; Olival and Hayman 2014; Olson et al. 2012; Leroy et al 2007) SARS-CoV-1 which is thought to have originated in colonies of horseshoe bats in eastern Asia (Wang et al. 2006; Li et al. 2005), HIV, which is believed to have first been transmitted to humans from chimpanzees in forested regions of South Central Africa (Heeney et al. 2006; Sharp and Hahn 2001), and Marburg Virus which is asymptomatically present in African fruit bats, but causes high mortality rates in infected human and non human-primates - (Bente et al. 2009; Swanepoel et al. 2007).

When these infectious diseases make the jump from wild animal populations to humans, the host human immune system has no experience with the pathogen, and the potential for a severe reaction and illness is high. Therefore, it is paramount to limit the potential for spillover events as part of a pandemic preparedness plan.

Wildlife Trade and Zoonoses

One such facet of the modern world that incorporates multiple aforementioned risks of zoonotic spillover is the wildlife trade. The wildlife trade is a global, often illicit market for wild plants and animals. The market for these products provides incentives for drivers of increased zoonotic spillover listed above. By creating a demand for wildlife products, this trade encourages

suppliers to have increased contact with wild animals, and the intercontinental shipment routes of live animals and animal parts creates new conduits for zoonoses to travel. Through the process of being trafficked and brought to market, species who do not commonly interact are housed in close containers in unsanitary conditions. Host stress is a known trigger for weakening immune systems and causing viral shedding. All of these factors combine together to create a perfect natural laboratory for diseases to mutate and jump between species.

Traditional Chinese Medicine

Demand for wildlife products in China is largely rooted in the historical use of wildlife products for Traditional Chinese Medicine. Traditional Chinese Medicine (TCM) is a practice of eastern medicine based on the 3rd century BCE written account, the *Huangdi neijing*, although records of TCM practices exist from as early as 2,000 years BCE (Kong, 2010). Practices of TCM are still widely popular in modern times and have been expanding in popularity as a consequence of growing global Chinese influence. Adherents to TCM practices utilize methods of healing including exercises such as tai chi and acupuncture, as well as traditional herbal mixtures and holistic curative compounds containing plants and animal parts (Kong, 2010; Tang et al. 2008). While there is some scientific evidence to suggest that TCM practices such as acupuncture and tai chi are useful in relieving stress and pain, evidence supporting the usefulness of herbs, plants, and animal products are lacking, and many of the ailments sought to be treated with these cures are better and more efficiently treated with modern medicine. Nonetheless, strict adherents to TCM are socially and culturally inclined to the continued use of TCM products, and often supplement, or replace expensive or regionally unavailable modern medicine with TCM practices and products. Rural users of TCM who practice out of necessity and lack of access to

western medicine are not of a great concern to associated issues of zoonotic spillover. These users often rely on local ingredients and do not facilitate international trade with multiple nodes of contact for potential biohazards. On the other hand, wealthier adherents to these practices view the more difficult to obtain “cures” as status symbols, and a way to flaunt wealth. As the income of the average Chinese citizen increases, so has the conspicuous consumption of expensive exotic animal parts (Li and Wang, 2021). Famous examples include soup made from the fetus of a pangolin in order to aid fertility (Yue 2009; Sutter 2015), and powdered rhino horn - promoted as a panacea for ailments ranging from cancer to impotence, as well as a powerful status symbol (Dang et al. 2018; Truong et al. 2016). The style of TCM practice which appeals to urban wealthy users poses a greater biohazard threat, as it does facilitate international trade in species with the potential to harbor zoonoses, and exposes them to multiple nodes of contact along a global supply chain.

As global Chinese diasporas expand, so does the influence of Chinese culture and the demand for TCM products. In this way, modern practices of TCM are variable and change frequently with demand (Brown 2017). The concept of “*ye wei*” or “*wild taste*” refers to the desire for consumption of wild species, and drives demand for the expansion of this market (Brown, 2017). Species that are charismatic or well-marketed as being charismatic are at particular risk of being traded. The Chinese Belt and Road Initiative creates easier avenues for the trade of difficult to obtain species , while also providing more entry points to make wildlife hunting more accessible (Bush et al. 2014; Espinoza et al. 2014; Farhadinia et al. 2019). Roads built in previously wild areas allow access to human hunting activities (Espinoza et al. 2014). Further, the expansion of Chinese culture in these areas creates a TCM demand for new species (Farhadinia et al. 2019,

Hinsley et al. 2020, Wong 2020,). Notably, the expansion of TCM practice to new regions facilitates the expansion of the ingredient list for cures away from those that were previously sourced within the areas where TCM was traditionally practiced. In this way, the international trade in wildlife expands to include species continents away that must be supplied through licit and illicit international trade.

However, it is important to acknowledge that culture morphs and changes with time - the notion that wildlife, and particularly exotic wildlife products, are beneficial for health and wellness exists outside of the strict confines of prescribed ancient traditional medicinal practices. Instead, what began as TCM has, in more wealthy practicing regions, transformed into a general cultural understanding and desire to consume wildlife for entertainment, luxury, or a sense of healthfulness. In this way, wildlife consumption may have its origins explained by traditional medicinal practices, but in its contemporary form it functions under a broader cultural category.

International Wildlife Trade and Zoonotic Exposure

There are two distinct groups of drivers within the market for wildlife consumption: those who consume wildlife for subsistence, and those who conspicuously consume wildlife to display prestige. As discussed in the previous section, those who consume wildlife for subsistence are often poor, rural, and rely on local bushmeat markets for necessary protein. Suppressing these markets is counterproductive, as it pushes demand underground without lessening it since people need the product for survival.

By contrast, the market for wildlife as a luxury product is driven by wealthy consumers and is

often supplied by international trade (as exotic procurements are more highly sought after). This market is more pernicious in nature, as its product demand functions inversely to the interests of biodiversity, and sustains the global movement of many species - thereby increasing the threat and possible locations of zoonotic spillover. In this market, species rarity increases demand, causing species from unsustainable populations and fragmented land to be more intensely hunted. Species in this category are more likely to be unhealthy and harbor disease, thereby increasing the chances of zoonotic spillover. Further, there is scientific consensus that the volume of internationally traded wildlife is driven more by increased wealth in purchasing countries than by poverty in source countries (World Bank 2008, IFAW 2008, Duffy 2010, Duffy and St John 2013).

While subsistence markets for wildlife protein also create the potential for zoonotic spillover, these markets are typically more localized in nature. They rely on community demand for protein which can be satiated by sustainable hunting practices. By contrast, international luxury markets (including markets responding to demand for TCM products) demand “interesting” foods and do not rely on the continued integrity of the ecosystems from which they are sourced. Further, international movements of animals facilitate novel zoonoses by increasing contact of various species en route, allowing novel virus recombination. The point of this thesis is not to suggest that all wild animal consumption is dangerous and that the allowance of it indicates a puzzling government oversight, but rather that certain types of superfluous consumption of wild animal products increase biohazard risk without offering tangible gains to society. The Chinese government allowing rural consumption of local species is rational - people depend on those animals as a protein source, and their harvesting sustains populations who do not have easy

dietary alternatives. However, by allowing the import of international wildlife products to meet demand for luxury TCM practices, the Chinese government is allowing an increase in nodes of exposure across the international and national supply chain. This, in turn, increases biohazard risk for purposes that are not essential for community resiliency.

SARS-COV-1 Wildlife Ban and Ban Reversal

The virus SARS-CoV-1 is responsible for the 2003 outbreak of SARS in Asia. This virus, which is very similar to the SARS-CoV-2 virus responsible for the current global pandemic, is believed to have originated in a population of cave-dwelling horseshoe bats in the Chinese province of Guangdong (Li et al. 2005) and vectored by various other mammalian hosts, including civets (Shi and Hu, 2008). After the outbreak of SARS-CoV-1 in 2003, China implemented a ban on the trade of 54 species of animals believed to be potential reservoirs for the virus. However, after the World Health Organization announced the virus had been cleared from the human population worldwide, these bans were reversed one year later. The actual zoonotic host of SARS-CoV-1 was not properly identified to the satisfaction of the global scientific community until years after the ban in these animal species was reversed. The decision of the Chinese government to repeal this ban under intense suspicion of wildlife reservoirs being responsible for the outbreak and without certain knowledge of which species harbored and vectored the disease suggests that wildlife trade is highly valued, even when it offers expensive health hazards to Chinese and global society.

Taxa of Zoonotic Concern

All mammalian taxa have the potential to harbor virulent pathogens which can make the jump to

human systems, but there are five particular mammalian taxa that present a greater viral zoonotic spillover threat than the rest of the order. These taxa are: Chiroptera (bats), Carnivora (carnivores, especially civets), Rodentia (rodents), Pholidota (pangolins), and Primates (Daszak et al. 2020). I chose to focus my data analysis on these five taxonomic groups because they offer the greatest risk to public health. These groups also makeup just a slight amount (~7%) of all CITES approved trade in species exports destined for China. Therefore it can be understood that the movement of these zoonotically high risk animals offer an outsized risk to Chinese public health that is not simply explainable through the fact that they satiate a large market share of imports for a lucrative domestic market. Below I will detail each taxa chosen for review and describe the characteristics that cause them to be considered "taxa of high zoonotic concern". Each group detailed below has a history of vectoring viral and/or bacterial pathogens, and being the confirmed or suspected culprit behind a spillover event that has led to localized epidemics or pandemics.

Chiroptera

Chiropterans (bats) may be the most infamous taxa for their ability to be viral zoonotic vectors. This taxa makes such an effective viral vector for three main reasons.

(1) Bats' evolutionary adaptations for flight has created an internal environment that is very favorable for harboring viruses in a way that doesn't cause damage to the host (Subudhi et al. 2019; Xie et al. 2018; Banjeree et al. 2017; O'shea et al. 2014). The high energetic costs of flight would normally create heightened oxidative stress for an organism - as mitochondria convert nutrients into energy, reactive oxygen species are also formed as byproducts (Lambert and

Brand, 2009). Left unchecked, high levels of these reactive oxygen species would cause deleterious effects to the producing organism by damaging proteins and DNA (Lambert and Brand, 2009). The efforts to constantly repair DNA would typically beget high levels of inflammation, and constantly sustaining such high levels of inflammation would threaten the well-being and life of the animal. Bats have adapted to this metabolic threat by dampening their STING (Stimulations of Interferon Genes) protein activation (Xie et al. 2018; Banjeree et al. 2017). Damaged DNA typically suggests that there is a virus present in a mammalian body (Xu 2006). STING proteins are what trigger inflammatory responses to counteract viral infections when damaged DNA is detected (Burdette et al. 2011). By dampening STING proteins, bats can avoid constant inflammation while working to repair proteins and DNA that have been damaged due to the high metabolic activity necessary for flight (Ahn et al. 2019; Xie et al. 2018). While this adaptation prevents bats from the harmful effects of inflammation, dampening their immune system leaves them susceptible to viral infections. Surprisingly, bats don't seem to fall ill from the viruses they are infected with (Ahn et al. 2019). Interferon-alpha is a component of the internal cell defense system, and it's believed that high levels of interferon-alpha may be responsible for preventing bats from falling ill from the viruses they harbor (Pamela et al. 2018; Banjeree et al. 2017). While most other mammals begin production of interferon-alpha after an infection is detected, bats seem to never cease production of the protein, and so their cells are always prepared for viral defense (Banjeree et al. 2017). Further, the production of ribonuclease L, an enzyme responsible for suppressing the spread of viral infections is more easily activated within bat cells compared to other mammalian cells (Subudhi et al. 2019; Pamela et al. 2018). Finally, it is also believed that viruses may have themselves evolved to be harbored within bat bodies (O'shea et al. 2014; Calisher et al. 2006). Viruses that persist within bats are able to

survive in a system with heavy immune viral suppression and low inflammation response (O'shea et al. 2014). Conversely, when introduced to a human system, these same viruses cause enormous runaway inflammation without facing high levels of immediate viral suppression (Drexler et al. 2012). This may explain why viral diseases such as Ebola and MERS are so deadly to humans - these viruses are accustomed to a bat system which dampens inflammation response, and so mortality in human hosts is typically achieved by activating a ruinously strong immune response.

(2) Bats tend to be gregarious and live closely together in large colonies. This style of large population clustering allows any new or introduced infectious pathogens to spread very quickly throughout a population of bats (Luis et al. 2015; Chong et al. 2009; Callisher et al. 2006). Although bat adaptations to handle the high metabolic stresses of flight and inflammation allow individuals to clear many viruses from their bodies quickly, the gregarious ecology of this taxa allows for viruses to persist in populations, as they are transmitted from one host to the next.

(3) Bats are at the forefront of the human-wildlife interface (Dobson et al. 2020). The ability for flight allows this taxa to have a high dispersion distance, and bats typically benefit from human agricultural activities conducted at the edge of human-dominated landscapes and wild areas. As such, humans and livestock are increasingly coming into sustained contact with bats, and this interface creates a perfect storm for zoonotic disease spillover into human populations (Altizer et al. 2011).

Carnivora

Carnivorans are infamous carriers of zoonotic illnesses including rabies, ringworm and external parasites, tularemia, brucellosis, leptospirosis, yersiniosis, campylobacteriosis, salmonellosis, cryptosporidiosis, giardiasis, infections with pathogenic E. coli, toxoplasmosis, echinococcosis, and cutaneous and visceral larval migrans. While typically the vectors of parasites rather than viruses, some carnivorans, including civets and ferrets are excellent viral vectors and occasionally used as human models in experiments on influenza and SARS-CoV viruses.

Pholidota:

Pangolins are the most trafficked mammals in the world. This genus contains eight species that range from Subsaharan Africa to Southeast Asia. Different species of pangolin serve different markets in East Asia, typically for the explicit purposes of use in TCM. Pangolins trafficked from Africa are more commonly sought after for their thick keratinous scales which are ground and mixed in drinks as a treatment for a variety of ailments, including the readjustment of energies and temperatures within the body. Smaller pangolin species from Southeast Asia are more commonly transported whole, and often alive, for their meat products. These distinctive looking animals are valuable as luxury items, and can fetch a higher price if they are displayed alive before consumed so that restaurant owners can prove the product's authenticity. Pangolin meat, and especially whole pangolin fetus are touted as helpful for reproductive health and fertility. Transporting live mammals offer a greater risk to public health as they are better able to transmit viral pathogens, and participate in wet market viral recombination and mixing when stored in cramped conditions with other mammalian species.

Famously, pangolins have tested positive for SARS-CoV-2, as well as other viral pathogens and

34 species of pathogenic bacteria and protozoa (Mohapatra et al. 2016). Isolation of the SARS-CoV-2 virus in Malayan pangolins have fueled debates in the scientific community as to whether pangolins could have been an intermediary host for COVID-19.

Rodentia:

Rodents and rodent parts are common ingredients in cuisine influenced by TCM. In particular, the bamboo rat is a main ingredient of a centuries old delicacy that has shot up in popularity following a social media sensation in 2017. The consumption of bamboo rats is thought to detoxify the body and boost metabolism of the stomach and spleen. Legitimate bamboo rat farms have expanded in the previous years. With their low start-up costs and increasing demand for their products, these agricultural institutions are credited with lifting many poor rural families out of poverty. The successful establishment of these and other rodent farms make it so that few desired rodents are obtained for the purposes of consumption through international trade. Unlike other taxa, rodents are easily reared and harvested in a localized agricultural setting. The threat that this taxa poses to public health is best addressed within these breeding facilities and farms as opposed to international trade policy.

Rodents are significant viral and bacterial vectors, most known for their role in harboring and transmitting Hantavirus, Hemorrhagic Fever, Lassa fever, Leptospirosis, Plague (Yersinia pestis), and Tularemia.

Primates:

Primates and primate parts are a historical ingredient in TCM. Their blood and broth made from their bones are prized as aphrodisiacs, and bezoars from certain species of Macaques are believed to be helpful in treating a wide range of ailments. It is possible to obtain bezoars from living animals and is therefore more economical to keep specimens alive in captivity for the purposes of multiple harvestings. This, of course, increases human contact with live animals and makes them a greater threat to public health through increased opportunity for viral spillover. Primates supplied to Chinese markets are often sourced from nearby regions in China, and Southeast Asia, as well as Africa and Latin America.

As phylogenetically close relatives to humans, primates harbor a variety of viral pathogens which easily make the jump to human populations. These viral pathogens famously include Simian Immunodeficiency Virus (HIV when transmitted to humans), Herpes B Virus, Marburg Virus, and Ebola Virus.

IUCN and CITES

The authority on the legality of international trade in wild animal and plant resources is the Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES). Under this 1974 international convention, only trade that does not threaten the survival of a species in the wild is permitted. At the time of print, CITES is made up of a total of 183 signatory countries, and grants protections of varying levels to over 35,000 species of wild plants and animals. The levels of protection granted under CITES are indicated by the appendix level accorded to a species. CITES is the international authority on internationally traded plants and

animals that consolidates and records trade data on all legally traded species with a transport permit.

The International Union for the Conservation of Nature (IUCN) is the international authority on species endangerment threats and conservation practices. The IUCN redlist, a living product of the IUCN, is a comprehensive inventory of global species's threats and endangerment status assessments. The IUCN redlist also documents standardized specific threats to individual species, including residential and commercial development, agriculture and aquaculture, pollution, and biological use threats (which was used in the data analysis for this project).

Mercantilism and Neomercantilist China

Mercantilism, first described by Victor de Riqueti in 1763 (Verma, 2016), is an economic system through which policy makers, merchants, and other state actors seek to increase state wealth through political action. In this paradigm, the actions that the state takes toward trade are solely for the purposes of increasing the wealth of the state. Western European countries practiced mercantilist policies from the 16th through the 19th centuries as a way of garnering and maintaining state wealth. In its original iteration, mercantilism was heavily concerned with building stores of bullion wealth (namely gold, and occasionally silver) to create stable stores of wealth buffered against the fluctuating values of the many goods states traded.

A similar theoretical paradigm to mercantilist theory has taken hold in contemporary Eastern Asia (Verma 2016). This new system, dubbed "Neomercantilism" finds its roots in mercantilist theory. Within this paradigm, countries harness economic globalization strategies to attain state wealth in the contemporary version of stable stores of "bullion" wealth, which include precious

metals as well as strong foriegn currencies.

China is certainly a country that practices neomercantilism. A global index compiled to assess mercantilist policies and practices by Foote and Ezell (2019) found that out of 60 countries practicing mercantilist policies, China is ranked the highest for the country's mercantilist economic and trade practices. Clearly, China sees the economic benefits and attainment and retainment of state wealth to be the top concern when implementing trade policies, and heavily leans on nationalist policies and technologicalism to establish favorable trade relationships.

Empirics

Research Design

To explore the impact that cultural political economy (influenced by TCM practices) has on demand for imported wildlife products, I will assess the proportion of trade that is risky for zoonotic spillover allowed by the Chinese government that corresponds with IUCN threat codes that indicate the product's end use is for consumption.

To achieve this end, I will analyze open-source import/export data from the Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES) database. The dataset that I will use for this research encompasses records of legal trade in animal species from the years 1985 to 2018, encompassing the 2002-2003 years of the SARS-CoV-1 pandemic.

I will subset this data to only include shipments declared by other countries as destined for China. Of course, this data only represents legal trade and cannot be used to assess illicit trade in

wildlife destined for China. However, political decisions made by the Chinese government only affect licit and legal trade, so this data will be sufficient for understanding the impact that culture has on influencing legal political decisions.

I will further subset this data to show imports to China of only members of the above-mentioned orders Chiroptera, Carnivora, Pholidota, Rodentia, and Primates. These orders are of particular concern for zoonotic spillover, and indicate a heightened risk assumed by China for allowing imports. This data will then be parsed to only include imports that have been reported as imported for "commercial use" on their CITES import permits - indicating that they were not imported for the purposes of scientific research or for use in zoos or theme parks.

The data from this analysis of CITES import data will be paired by genera distinction with IUCN data on species hierarchical threats classification and parsed to identify genera within the broader category of *biological use threats*. This indicates that the genera that is being traded is desirable for consumption, this animal is threatened in the wild by trade for the purposes of consumption, and fits the assumption that the animal product is being imported for the purposes of consumption.

This bulk amount of imported animal products will then be proportioned to indicate the percentage of traded specimens whose IUCN threat falls under the *biological use category*. This proportion indicates the amount of legally traded specimens accepted by China which are considered to be high risk for zoonotic spillover, and assumed to be imported for the purposes of consumption. This proportion will be taken to indicate the amount of risky trade in biological

specimens accepted by the Chinese government whose demand is explainable through cultural proclivity. I will display the resulting data graphically by taxonomically ordered categories to indicate taxonomic proportions of wildlife trade destined for China that includes 1.) dead and alive specimens categorized by genera, 2.) Only live specimens categorized by genera (which would be considered a greater threat to public health as they are most able to transmit disease), 3.) All specimens proportioned by IUCN threat categories - displaying the yearly proportions of risky zoonotic imports that for the purposes of this study indicate consumption explained by culture, and 4.) Specimens within the biological use IUCN threat category categorized by order.

Results

Analysis of CITES trade data joined with IUCN threat codes show that 33.8% of reported commercial trade in wildlife species of high zoonotic concern destined for China is threatened by biological use threats. For the purposes of this analysis, this indicates that 33.8% of animals and animal products exported to China fall under the category which can be assessed as having demand facilitated by cultural proclivities.

Temporal trends in the data show that proportions of exports to China that fit our categories for being within zoonotically high risk taxonomic groups and listed as traded for commercial purposes, have increased yearly toward being more greatly made up of genera within the Biological Use category of IUCN threats (Figure 1, c). The year with the greatest proportion of exports to China that fell under the Biological Use threat category was 2013, where 40.1% of recorded specimen exports to China were threatened by biological use.

Further examination of the data reveals that the species exported to China matching criteria for this analysis and are listed as threatened by *biological use* by the IUCN are mostly composed of carnivoran species every year of the study. Primates within these categories increased in exports to China beginning in 2003, and reached the peak of their import proportion in 2008, before decreasing. Pangolins, Rodents, and Bats were largely absent from CITES reported exports destined for China. I will discuss the possible reasons for this in the conclusion of this thesis.

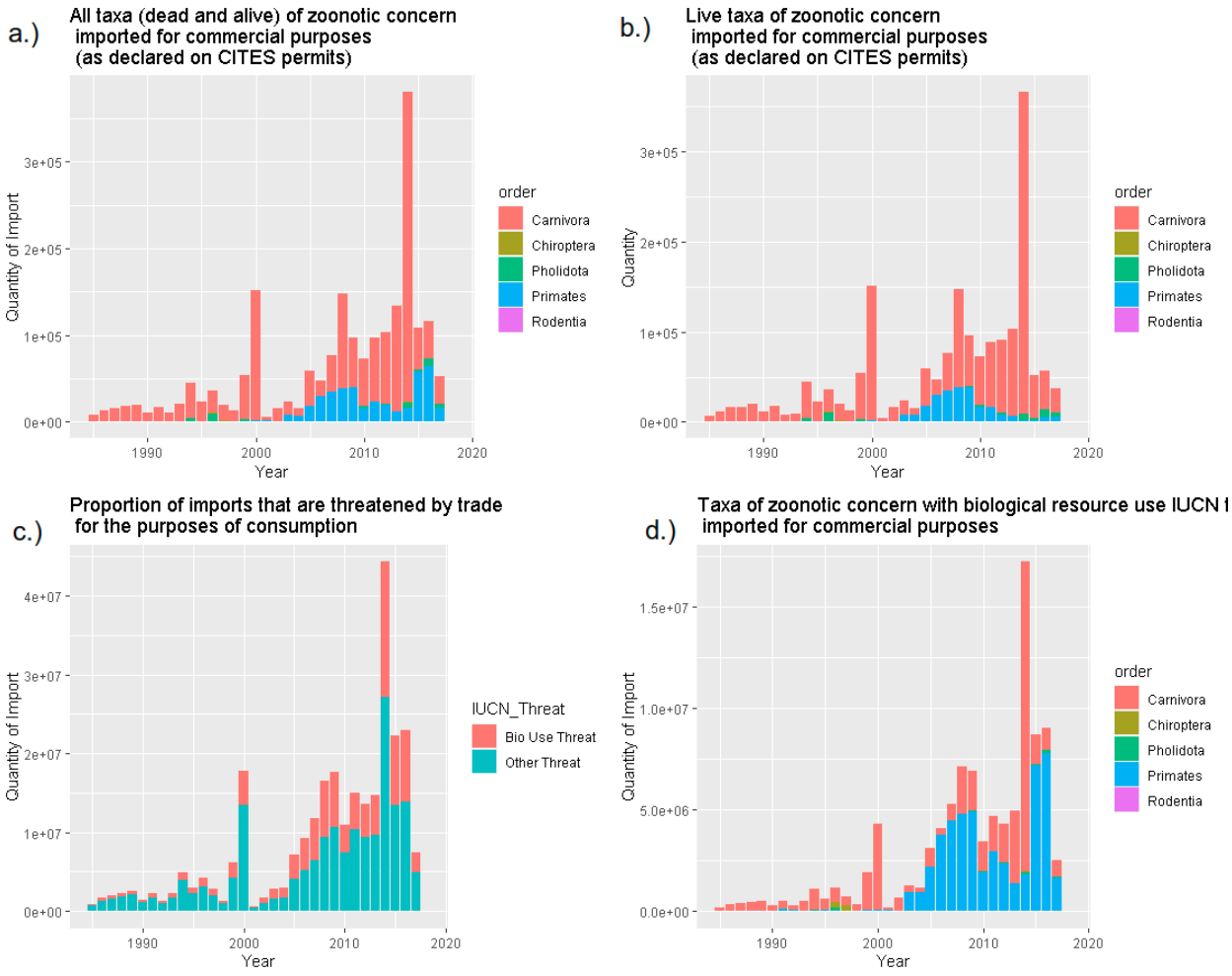

Figure 1. a.) Proportions of orders of zoonotic concern living and dead exported to China between the years of 1985 and 2016 as reported on CITES permits. b.) Proportions of only live

orders of zoonotic concern imported into China between the years of 1985 and 2018 as reported on CITES permits. c.) Proportions of exports to China of zoonotic concern whose genera is listed in the IUCN as experiencing threats from biological use. (Average proportion of exports within IUCN biological use threat category was 33.8%) d.) Proportions of orders of zoonotic concern living and dead whose genera is listed in the IUCN as experiencing threats from biological use.

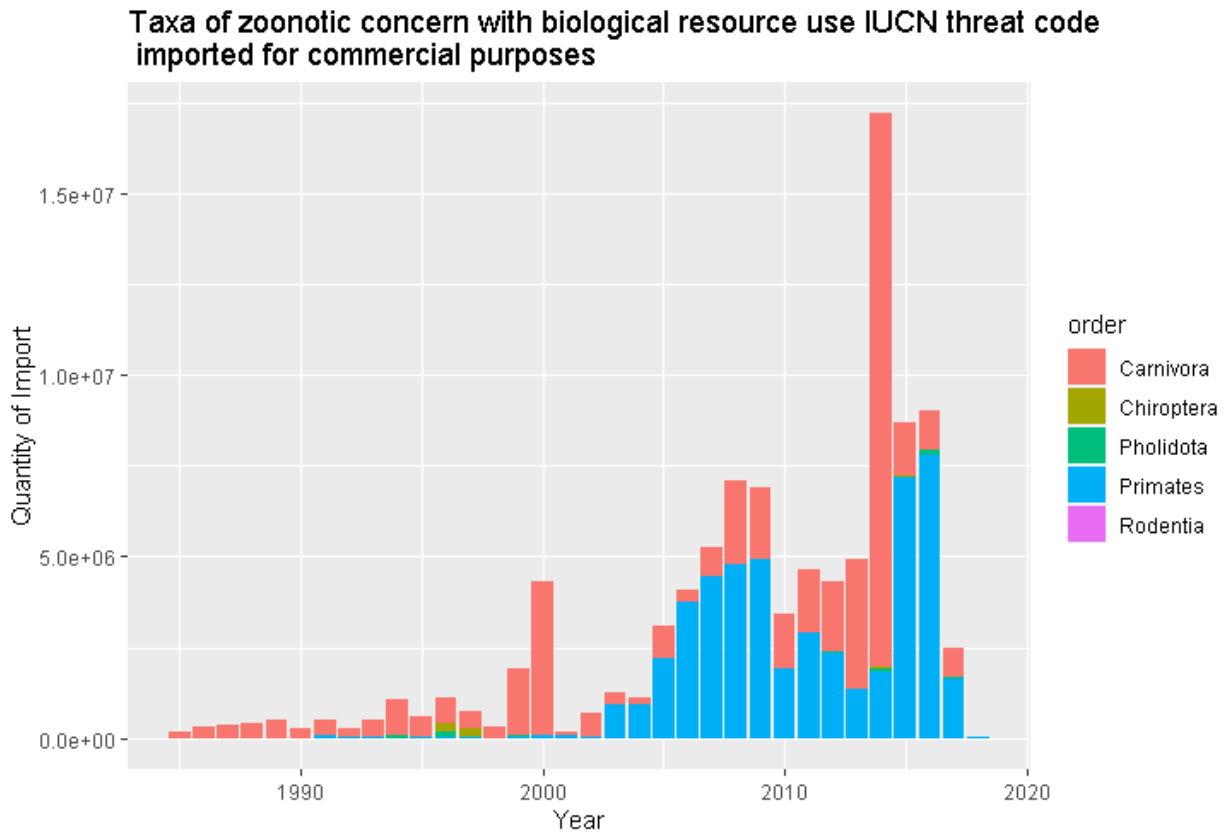

Figure 2. This figure shows the temporal trends of specimens exports destined for China that are (1) specimens that are within taxonomic orders of heightened risk for zoonotic spillover (2) imported for commercial purposes as declared on CITES permits, and (3) genera that are threatened by “Biological Resource Use” as listed on the IUCN red list (implying that the product end use is consumption)

Conclusion

As 33.8% of exported species destined for China for commercial purposes between the years of 2000 and 2016 fall under IUCN threat codes for biological use, it can be interpreted that 33.8% of the risk accepted by the Chinese government through international trade of species of zoonotic concern are due to market demand for consumption, and thereby facilitated by cultural preferences.

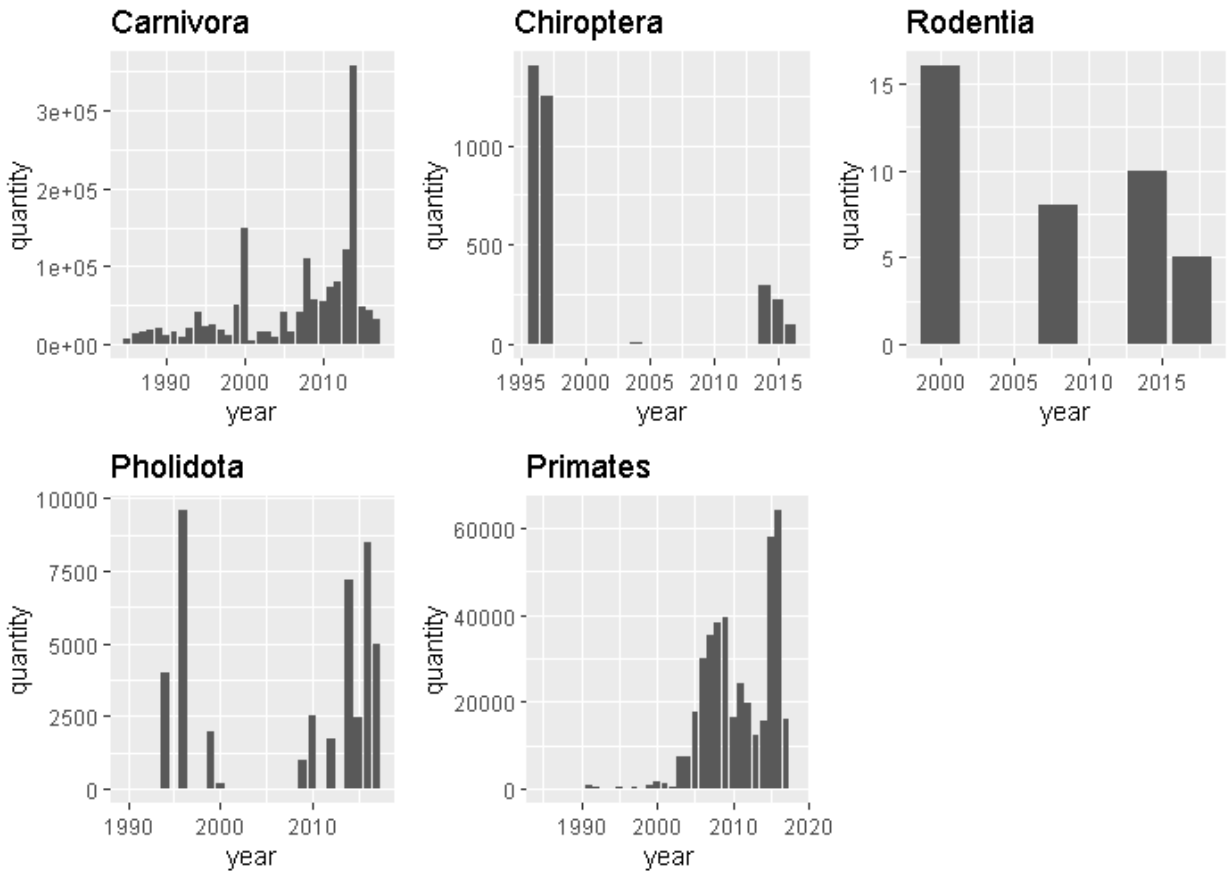

Figure 3. Exports destined for China between the years 1985 and 2016 broken down by zoonotic orders of interest to show temporal trade trends.

Pangolins did not make up a sizeable proportion of CITES reported exported specimens destined for China (Figure 3). We could expect that pangolins would not show greatly on legal export data, as all species of pangolin are restricted in trade as a CITES Appendix 1 species, and three desirable species of pangolin are either endemic to or range within China and are harvested internally. However, trade seizure data suggests that China and Hong Kong are primary destinations for illegal shipments of pangolins and pangolin products (Heinrich et al. 2016). The Order Pholidota contains eight species of Pangolin, all of which make up a substantial international illicit market. While other orders in this study also have species that are prevalent in the illegal trade in wildlife, those orders are much more specious, meaning that the import data lost from illegal trade is absorbed by that of reported legal trade.

While the Chinese government does enforce policies against illegal imports of Pangolin products, there are no standing enforceable policies against the public sale and purchasing of pangolin products within China. China does, however, strictly enforce policies against the public sale and purchasing of other illicitly imported substances such as illicit drugs and counterfeit currencies. This lack of enforcement in this area of the market within China betrays a culturally influenced double standard of threat assessment. Lax enforcement against internally traded illicit wildlife goods adds strength to my thesis argument that consumption of wild animals, and even explicitly illegally imported wild animals is given a cultural pass as a common-place occurrence. As discussed in the introduction, the culture of animal consumption for the purposes of health may not be explicitly within the realm of prescribed TCM practices, but the influence of TCM drives the values and cultural desires of many who function within Chinese society.

Similarly, the lack of data detailing exports of rodents and bats destined for China (Figure 2, Figure 3) can be explained by internal agricultural production practices as well as illicit trade filling the market for these products. Bat and rodent farming is encouraged in China through a system of lax policies around licensing and agricultural admittances that make wildlife farming a lucrative business option (Xiao et al. 2021). The system of encouraging policies for wildlife production was originally founded with the goals of encouraging economic resilience and entrepreneurship in poor, rural Chinese citizens, as well as under the supposition that supplying a market for wild products with farmed products would satiate demand with legal production and remove demand from wild ecosystems. In this way, farming was seen as a way to preserve ecosystems, cut down on demand for poaching, and introduce oversight to the supply side of the wildlife production market. Instead, the practice of wildlife farming within China has driven demand for wildlife products, and created new food markets for readily available wild species. Wildlife farms are also often used to launder illegal, wild harvested species. But in the face of this evidence the Chinese government continues to prop up this industry with encouraging policies, state-sponsored training programs, and tax remittances (Wang et al. 2019). The positive attitude of China towards agricultural markets that offer significant threats to public health and environmental security supports a mercantilist framework that argues economic and socio-political interests drive trade policies without cultural political economy being a main factor. Below I address this counter argument and offer my rebuttal.

Addressing mercantilist counter-argument

A mercantilist counter-argument to my thesis would assert that trade is encouraged on the basis that it offers economic benefits to the state and not due to cultural proclivities of nations.

According to this argument, the economic benefits of wildlife trade must outweigh the risks/incurred public health expenses if it is allowed to continue. I will address the mercantilist argument by examining the economic nature of an area of the Chinese wildlife market where it certainly holds water - interior Chinese farmed wildlife and national agricultural ventures that satiate Chinese market demand for wild animals. This area of the Chinese wildlife market offers large economic and socio-political benefits. However, similar to the international trade in wildlife species, it also presents biohazard dangers. Seemingly, and in line with mercantilist theory, this market is supported and encouraged by the Chinese government in spite of the risks it poses because the economic benefits it offers are perceived to outweigh the dangers.

The data from my thesis analysis shows a noticeable lack of Chinese imports of species that are known to be farmed within the country of China - notably bats and rodents. (Pangolins are also often sourced from within China, but illicit markets and murky supply chains prevent the collection of reliable data on trade quantities.) The risk to China from marketing these species of high zoonotic risk exists in their agricultural production just as it does in accepting their international trade. However, there is a vast difference in the amount of income and tangible social benefits generated for the Chinese government between internally farmed wildlife and internationally traded wildlife.

The mercantilist argument against my thesis would find ground in how economics incentivizes Chinese policy makers to introduce legislation that supports and sustains wildlife agricultural ventures. There is a strong economic and political incentive for the Chinese government to grow and support this market. A review conducted by the Chinese Academy of Engineering found that

in 2016, the legal wildlife market in China (supplying meat, fur, and other products) was valued at $76 billion and employed approximately 14 million people. Further, wildlife agricultural ventures in China are credited with lifting many poor rural people out of poverty (Roe and Lee, 2021). The demand for many of these farmed wildlife products is certainly grounded in culture values. Other agricultural animal products more cheaply and easily satisfy the need for protein meat. The aforementioned desire for *ye wei* or "wild taste" drives the desire for more expensive and gamey meats such as bat and bamboo rats in local markets (Brown 2017). The high regard of *ye wei* is grounded in cultural notions of TCM which laud these meats' abilities to facilitate health and wellness (Brown 2017).

The lax oversight of these farming operations certainly add a strong element of biohazard risk to the system, as animals known to vector dangerous zoonotic viruses are housed together in cramped quarters with high levels of human interface and loose, if any quarantine protocol. However, the incentives for lessened restrictions and loose policies within wildlife agriculture in China function well within the mercantilist framework - the drive for these agricultural practices are purely economic in nature. The market for these products sustains a major industry which the government taxes and profits off of. Unlike the international import of species of zoonotic concern, these agricultural practices (however problematic they may be for public health) offer stability and security to Chinese families and bring nourishing protein to market for Chinese citizens (Wang et al. 2019). The international trade in species of zoonotic concern, on the other hand, does not satiate a major foodstuffs market, generate significant tax income for the government, or provide internal stability to agrarian Chinese producers (Xiao et al. 2021). The legal trade in imported species supports a demand for international exotic products that spills

over into illicit markets, further decreasing tax income to the Chinese government through international wildlife markets. The mercantilist counter-argument to my thesis would assert that risky trade is permitted on the basis that it offers an economic benefit to the government, but with all things considered, the particular trade examined in my thesis supports a market that seemingly offers very high potential damages to public health, and very low economic benefits.

In short, there is truth to the mercantilist counter-argument that economic incentives drive trade and production policies, but the data that I chose to analyze for this thesis describes a portion of the trade that offers far more threat to public health than it offers economic incentive, and the greatest reason for its continued allowance is cultural proclivity.

Response to counter-argument through data selection

I did not choose to examine the consumption of internally produced wildlife products and instead focused my study on superfluous risk assumed through the legal international trade of zoonotically risky wildlife and wildlife products. The economic benefits of this trade are slim compared to the national agricultural wildlife market (Xiao et al. 2021), and so the risk assumed by allowing this trade can be interpreted as more heavily grounded in cultural attitudes towards wildlife consumption than the economic benefits of trade. Further, under the Mercantilist and Neomercantilist paradigm, countries seek to limit imports and maximize exports. This further confounds any argument that internationally imported products that pose risk to the national community are allowed on the basis that they offer economic gains to the state.

My data analysis found that of this economically low value portion of trade, 33.8% of imported

animal products fit the parameters of what, for the purposes of this study, indicate a product demand facilitated by culture. It can be concluded from this thesis that the decisions of Chinese policy makers to allow this trade in products that pose a risk to public health cannot be explained solely through the lens of economic gains and products' intrinsic values. Rather, the cultural political economy of these wildlife products facilitates a demand that is grounded in history and human culture that continues to contribute to ban hesitancy.

Acknowledging alternative argument on the basis of illicit trade management

Certainly there are alternative arguments that explain Chinese policy makers' ban hesitancy that do not rely solely on economic gains or cultural proclivity for wildlife products. Mainly, there is the issue of illicit trade management, where potential smuggling is strategically addressed through trade allowances that keep otherwise illicit products "above board" so that they can be more easily monitored (Brown 2017). Law enforcement supporters of this system would argue that if every pangolin brought into the country was considered illegal, there would simply be more illegal shipments of pangolin to China and law enforcement would have no indication of the trade routes facilitating this movement, the final destination of pangolin products, or the fluctuating volume of shipments. This could supposedly explain the Chinese government's wildlife ban hesitancy, but considering the known danger of zoonotic exposure to a population, one would expect the Chinese government to perform the same mitigation efforts that they do with dangerous trade in other dangerous substances such as toxic chemicals (Xiao et al. 2021). The fact that these products are not as heavily regulated as other dangerous trade items is another point to my thesis argument that it may be cultural perceptions of these products that influence lax regulation policies.

Suggested further work

Further work on this subject should seek to quantify the discrepancies between intrinsic value of wildlife products in China, perceived private consumption benefit, direct consumption benefits, and cost of potential damages. The real value of wildlife consumption within China is likely to vary by species, product location, product destination, and use practices. These figures would be useful in influencing policies aimed at pandemic preparedness efforts and biodiversity conservation.

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