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# The Role of Chinese Panda Ambassadors in International Trade

Mattia Longhi* and Caterina Morelli†‡

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**Abstract:** This paper examines the impact of China's panda diplomacy—the practice of loaning giant pandas to foreign countries—on international trade, which prior literature has shown to be responsive to soft power influences. We investigate whether hosting giant pandas strengthens a country's trade relations with China, particularly in years when a panda cub is born, as these animals serve as symbolic ambassadors that foster diplomatic and economic ties among the countries, while supporting China's commitment to giant pandas conservation. To explore this, we construct a novel dataset tracking the movement of pandas as part of Chinas diplomatic initiatives and apply an augmented gravity model of trade using both annual and monthly data from UN-Comtrade. Our analysis reveals that countries hosting giant pandas experience a significant increase in exports to China between 5.9% and 7.2% in the year when a panda cub is born. This effect is short-lived, persisting up to four months after the cubs highly publicized 100-day naming ceremony. The impact is concentrated in specific sectors, including food and live animals, crude materials, and machinery.

*Keywords: Panda Diplomacy, political relationship, international trade, China, soft power*

*JEL Classification: F14, F50, P33*

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# 1 Introduction

Tourists at the Berlin Zoo may encounter Jiao Qing and Meng Meng, two giant pandas that arrived from China in June 2017, and their two offspring. At the time of their arrival, the German Chancellor Angela Merkel introduced the new black-and-white residents as "two very pleasant diplomats" (Financial Times, 2017). Seven years later, two giant pandas were welcomed to the San Diego Zoo by California Governor Gavin Newsom and the Chinese ambassador to the United States, who declared that the pandas were sending a clear and important message as the two countries celebrated the 45$^{\text{th}}$ anniversary of their diplomatic ties (Reuters, 2024). The Chinese practice of sending giant pandas to other nations is known as panda diplomacy and is part of a broader form of soft power named animal diplomacy, implemented also by other countries around the world.[1] This practice, which consists in using live animals as diplomatic tools, has been used even in the ancient world to either signal subordination to other nations, or as a goodwill, or as a way to start diplomatic relations (Leira and Neumann, 2017), and has recently been recognized as a form of soft power in a country public diplomacy (Hartig, 2013). In an era characterized by the rise of geopolitical tensions among United States and China, and the phenomenon of "slowbalisation" (Antràs, 2020; Goldberg and Reed, 2023), new forms of soft power may assist international trade dynamics in addressing significant challenges. Despite the extensive literature on the interplay between politics and trade (Pollins, 1989; Berger et al., 2013), little is known about the role of animal diplomacy in the promotion of trade relations between countries. This paper aims to fill this gap in the literature by focusing on the Chinese panda diplomacy.

The Chinese panda diplomacy began as a gesture of friendship towards other countries, as giant pandas live exclusively in six unconnected areas of alpin bamboo forest within a few Chinese provinces (O'Brien et al., 1994), giving China a unique monopoly over them. After a long period in which pandas were used as diplomatic gifts by China, they were declared an endangered species in the 1980s. By the 1990s, the country began leasing them to other nations to safeguard the species from extinction while retaining control over their population and ensuring adherence to conservation standards.[2] Hosting countries pay substantial fees to lease a giant panda, and their zoos invest significant resources to provide a healthy, safe environment and to encourage reproduction, typically through artificial insemination. Under panda diplomacy agreements, newborn cubs remain the property of China and are returned once they mature

[1] For example, New Zeeland is famous for its kiwi diplomacy, while Australia is famous for its koala and platypus diplomacy, and India for its elephant diplomacy.

[2] It is worth noting that during the Eighties China started to lease pandas for a short period of time and on market basis. However, it is at the beginning of the Nineties that the country switched to long term loans with scientific purposes.

enough to live independently (Buckinghamn et al., 2013). While the arrival of giant pandas in partner countries may sometimes coincide with the conclusion of trade agreements, suggesting that the selection of recipient countries could be endogenous, the birth of a panda cub is independent of political relationships and trade negotiations. It may instead positively influence trade by highlighting the partner countrys role in conserving a species emblematic of China. The birth of a panda cub in a partner country is a highly celebrated event, drawing significant attention from the media, the public, and politicians alike. It becomes a source of pride and joy not only for the host country but also for China, highlighting the strong diplomatic and cultural ties between the two nations. For example, in 2013, when a newborn panda arrived to the Smithsonian's National Zoo, Cui Tiankai, China's then-ambassador to the United States, declared that "There are actually two Chinese ambassadors in Washington: me and the panda cub at the National Zoo" (The Washington Post, 2023).[3] Thus, the aim of this paper is to study whether over the past decades the panda diplomacy has contributed in improving economic relationship among China and other countries, focusing on the birth of pandas cub. To that end, we build the *Panda Diplomacy Dataset* which traces all the movements of giant pandas from China to other world countries that are identified as part of this policy, to study its effect on international trade. More precisely, we estimate an augmented gravity model of countries' exports to China using data from UN-Comtrade, to study whether a positive political shock represented by the birth of a giant panda has a positive effect on Chinese import. We find that countries hosting giant pandas experience an increase in exports to China ranging from 5.9% to 7.2% in the year a panda cub is born. Similar to other political shocks, the effects are short-lived, fading within four months after the panda's birth. This is consistent with the fact that, 100 days after birth, the panda is officially named, an event that attracts significant political attention. The sectors driving this effect include food and live animals, crude materials, manufactured goods, and machinery and transport equipment. These findings are robust to various robustness checks.

This paper primarily contributes to the literature on the political determinants of trade. Despite the effects of political variables on trade seem to be short-lived (Du et al., 2017), authors show that many forms of soft power, like an increase in a country's diplomatic service (Rose, 2007), state and official visits (Nitsch, 2007; Fan and Lu, 2021), or positive bilateral opinion and the approval of a country leadership by the importer country (Disdier and Mayer, 2007; Guiso et al., 2009; Rose, 2019), positively affect international trade. A similar effect is detected when focusing on the role of military alliances (Jackson

[3]When a panda cub was born in the Netherlands in 2020, the official Twitter account of the Chinese Embassy in the Netherlands announced that Chinese President Xi Jinping and his wife had exchanged congratulatory messages with the Dutch royal family. The birth was described as a "beautiful fruit of Sino-Dutch friendship and an important achievement in bilateral cooperation on biodiversity cooperation."

and Shepotylo, 2024; Li et al., 2024), and on a more general political influence (Berger et al., 2013). At the same time, researchers highlight that divergent political views (Michaels and Zhi, 2010; Fuchs and Klann, 2013), consumers boycott (Heilmann, 2016; Pandya and Venkatesan, 2016), and sanctions (Afesorgbor, 2019; Gutmann et al., 2023), are found to reduce bilateral trade. However, political shocks do not affect firms in the same manner, as scholars suggest that trade adjustments vary depending on firm characteristics, with state-owned enterprises often reacting more strongly (Davis et al., 2019; Lin et al., 2019). The literature further suggests that a country regime type may influence the overall level of trade. In fact, many authors detect that democratic countries are more opened to international trade than autocracies (Morrow et al., 1998; Mansfield et al., 2000), which typically import less (Aidt and Gassebner, 2010). As an autocratic country, many papers have focused on the relation between politics and trade in China (Che et al., 2015; Davis et al., 2019; Du et al., 2017; Fuchs and Klann, 2013; Lin et al., 2019), however, to the best of our knowledge, we are the first to estimate panda diplomacy's effects on international trade. Indeed, up to now, only the Financial Times (2017) has descriptively shown that the China's biggest trade partners seem to get the most giant pandas. The paper closest to ours is the one by Fuchs and Klann (2013) that investigates the consequences of countries officially receiving the Dalai Lama on their exports to China. While the authors suggest a negative "Dalai Lama effect" on exports, we show that contributing to panda conservation enhances trade relations with China.

Focusing on exports to China, we also contribute to improving the knowledge about factors that shape Chinese geopolitical relations, which span diverse areas such as foreign aid (Cruzatti et al., 2023; Dreher et al., 2019, 2021; Isaksson and Kotsadam, 2018), FDI (Stone et al., 2022), and more in general to other official capital flows (Gelpern et al., 2023; Horn et al., 2021).

Finally, our work also contributes to the literature on animal diplomacy. This literature mainly concentrates on descriptive and political standpoints, while its economic dimension is relatively limited. For example, previous works highlight how animals represent a special type of diplomatic gift and emphasize the need to seriously consider them in rethinking the diplomatic process (Leira and Neumann, 2017), as well as the key elements required for successful animal diplomacy (Hartig, 2013). While, in the specific case of China, authors describe how giant pandas have been used to promote Chinese national image and diplomacy, and the specific features of this policy (Schaller, 1994; Buckinghamn et al., 2013; Hartig, 2013; Songster, 2018). The political aspect of the panda diplomacy has also gather the attention of many international media (The Washington Post, 2014; Financial Times, 2017; The Economist, 2019; CNN, 2024), which emphasize the key role of pandas in China's public diplomacy. In relation to panda diplomacy

and economics, using a gravity model of tourism, Okafor et al. (2021) shows that the panda diplomacy promotes Chinese outbound tourism flows in countries hosting a giant panda. While, Liu et al. (2024) suggests that inbound tourism to China significantly decreased from country with panda diplomacy with respect to those without such diplomatic relations. Finally, apart for the descriptive work discussed by the Financial Times (2017) which relates pandas diplomacy and trade, no other papers have estimated the effects of this form of soft power to economic variables. We add to this literature by showing that the panda diplomacy seems to increase countries' export to China when a new cub born in one of its zoos, underlying that it could be considered as a positive political shock among two countries.

The rest of the paper is organized as follows. Section 2 provides more details on the panda diplomacy. Section 3 describes the data and the empirical strategy, while Section 4 presents the main results. Section 5 contains some robustness checks and the final Section 6 concludes.

## 2 Institutional framework

In this section, we retrace the history of animal diplomacy, starting from its origins and describing the evolution of its relevance in the anthropological and sociological field. Finally, we will describe the panda diplomacy nowadays, reporting comparisons with other animal diplomacy and in particular the role of this custom regarding the conservation of the species of giant pandas. While the focus of this paper remains economic, this section will be characterized by a multidisciplinary approach necessary to understand in depth the relevance of the panda diplomacy and the reasons why we expect it to affect the relationships between geopolitics and international trade.

### 2.1 The history of animal diplomacy around the world

The animal diplomacy refers to the practice of using live native fauna for diplomatic purposes (Cushing and Markwell, 2009), most commonly gifting them to other nations. According to Leira and Neumann (2017), this practice dates back to the ancient world, when Nubia frequently sent giraffes as tributes to Egypt. Before the Common Era, other examples included horses, cattle and sheep gifted to the Assyrian Empire, as well as camels along the Silk Road. While these offerings often served as tributes, they occasionally had the goal to circumvent trade taxes, or even establish trade relations between nations. Over time, the purpose of such animal gifts shifted. As animals for food and transport became more readily available, the focus shifted to exotic creatures, which began to symbolize the power and prestige

of the leaders who presented them. Examples of such exotic gifts include the giraffe received by Frederick II from the Sultan of Egypt (1215), the elephant gifted to Pope Leo X by the Portuguese King (1514), and the giraffe gifted to France by the Pasha of Egypt between 1826 and 1827. In the last example, the giraffe was viewed as a diplomatic ambassador between the two countries, aimed at reassuring the French regarding Egyptian military intentions. Nowadays, examples of this practice can be found in Australia, with koala (Aranceta-Reboredo, 2022) and platypus (Cushing and Markwell, 2009), in China, with giant pandas, in India, with elephants (Menon, 2019), in New Zealand, with kiwi (The New York Times, 2023), and in few other countries. However, Chinese panda diplomacy represents the most interesting case, which can be explained by the interaction of giant panda's unique characteristics and how China conducts it.

### 2.2 The uniqueness of Chinese panda diplomacy

Chinese panda diplomacy has long history, apparently dating back to the Tang Dynasty (618-907 A.D.), when Empress Wu Zetian sent two bears (which were believed to be pandas) to Japan (BBC, 2024).[4] Nowadays, panda diplomacy is still being practiced, and in the last century we can observe three periods that characterize its evolution, according to the way in which it is conducted: pandas as state gifts (1941-1983); pandas as short-term loan (1984-1993); pandas as long-term loan (1994-present). The first records of the modern era dating back to 1941 marked the beginning of "pandas as state gifts", when Madame Chiang sent two giant pandas to the USA to express gratitude for their aid during the Japanese siege of China. However, it is during the era of Mao Zedong that the use of pandas as instruments of diplomacy became more prominent. Between 1957 and 1983, China sent in total 24 pandas to 9 nations.[5] Two key changes in the practice of panda diplomacy occurred in 1984 and at the beginning of the Nineties (Buckinghamn et al., 2013). Following Deng Xiaoping's rise to power, China changed its approach in 1984 by shifting from gifting pandas to leasing them. The leasing contracts were typically short-term, required a monthly fee of $50,000 per month per panda, and were signed by recipient countries primarily to obtain pandas for exhibition.[6] For that, the aim of panda diplomacy shifted from focusing on international relations to the market, since from that date many zoos around the world begun to guest panda for a short period (Buckinghamn et al., 2013).[7] However, according to the same author, this conduct was met

[4] However, according to Songster (2018) it could be a myth.

[5] The first giant pandas where sent to the Soviet Union and the Democratic People's Republic of Korea. Subsequently, pandas flew to USA, Japan, France, UK, Mexico, Spain, and Germany.

[6] The first example of this renewed practice occurred in 1984, when China leased two giant pandas to USA, in coincidence of the Olympic games (United Press International, 1984).

[7] According to our dataset, 18 zoos in USA, Europe and Asia guest 28 pandas under short-term leasing conditions.

with criticism, as the Convention on International Trade in Endangered Species (CITES) implies that giant pandas may only be traded for scientific purposes or to promote the propagation or survival of the species. Therefore, at the beginning of the 1990s, Chinese authorities revised the policy, establishing long-term loans to support breeding, with the fees used to finance a giant panda management plan.[8] The last short-term contract that we identified dates back to 1992 with a U.S. zoo, while the first long-term contract was negotiated by Japan in May 1993, and the giant pandas arrived in September 1994 (O'Brien et al., 1994). Since that date, no other changes occurred in practicing panda diplomacy, with 77 giant pandas which were sent all over the world up to 2024.[9] It is worth noting that the goal of these changes is to put emphasis on pandas conservation, without forgetting the importance of pandas in diplomatic relations. Indeed, it is notable that the leasing contracts are signed by the highest government level, they imply a fines of $500,000 if a panda dies because of a human error, and cub born in zoos outside China belongs to China and must be returned to its home country within a few years of its birth, once it is old enough to be separated from its mother (Buckinghamn et al., 2013).[10] Overall, it is possible to conclude that while the primary goal of panda diplomacy is to strengthen geopolitical ties as a form of soft power, the commitment to the protection and conservation of the species is a crucial aspect of these agreements.

### 2.3 Why giant pandas?

According to O'Brien et al. (1994), the habitat of giant pandas is limited to six unconnected areas of alpine bamboo forest within a few Chinese provinces, granting China a unique monopoly over them. Pandas typically live in small groups that are separated from each other by nature and human settlements, making the species demographically and genetically vulnerable. Furthermore, females are fertile for only 24-72 hours per year, usually during the Winter-Spring season (Buckinghamn et al., 2013; Hartig, 2013), posing additional challenges for their breeding. Finally, their diet is based on 99% on bamboo also making pandas vulnerable to natural events.[11] Due to these factors, the International Union for the Conservation of Nature (IUCN) classified the giant panda as an endangered species in 1990, when the population amounted to only 1,114 individuals.[12]

[8] The plan was published by the WWF in 1991, and approved two years later by the Chinese Forest Administration.

[9] It is worth noting that 12 of them were still a gift.

[10] The number of years between the birth of a panda cub and its return to China varies by country but is typically no more than three or four years. Additionally, countries must pay extra fees during this period to keep the cub, as it remains the property of China.

[11] In 1978 and 1983, mass-bamboo flowering caused starvation and the 2008 Sichuan earthquake caused damages to panda habitat.

[12] According to the World Wildlife Fund (WWF), the first census of giant pandas conducted between 1974 and 1977 recorded a population of 2,459 individuals in the wild, distributed across various bamboo forest re-

The decline in the number of pandas is attributed to deforestation of their natural habitat and reduced human activity in the region. However, their breeding difficulties also play a key role and contribute to the symbolic value of the panda, which can be strategically exploited as part of animal diplomacy. Indeed, in addition to their limited fertility period, their pregnancy, which lasts approximately 95-160 days, represents a particularly delicate time for female pandas (Hartig, 2013). Zoos often face challenges in confirming a panda's pregnancy with certainty, yet any announcement of a pregnancy immediately captures public and media attention. After the panda is born, the baby is monitored for a few months while living alone with its mother, separated from the rest of the family. Thus, when the puppy reaches 100 days from birth, it receives a Chinese name, that sometimes translated into the language of the country of the zoo, and makes its public debut. The political relevance of this occasion is evident from media coverage, which highlights the presence of various political exponents. Smithsonians National Zoo & Conservation Biology Institute (2013) reports that during the 100-day celebration of the giant panda cub at the Smithsonians National Zoo—named Bao Bao—special video messages were sent from the First Lady of the United States, Michelle Obama, and the First Lady of the Peoples Republic of China, Peng Liyuan, congratulating the National Zoo on the successful birth of the cub. Two years later, both First Ladies attended in person the same celebration for Bei Bei, young sister of Bao Bao (The Washington Post, 2015). Similarly, Phys.org (2013) notes that Austria's economy minister, Reinhold Mitterlehner, and China's ambassador to Vienna, Shi Mingde, attended the official naming ceremony for the first 100 days of the giant panda Fu Bao in December 2010 in Vienna. Thus, the birth of a giant panda is expected to improve and strengthen political relations up to one or two months before its birth, when the pregnancy could be announced, and it may last around 100 days later, when politicians are involved in the ceremony for its public debut.

### 2.4 Panda diplomacy and economic relations

As stated by Fuchs and Klann (2013), the extensive influence of the Chinese government over the economy equips the country's political leaders with the necessary tools to manage trade. This approach aligns trade practices with China's political preferences, rewarding allied nations and disadvantaging those less aligned. Panda diplomacy may not be an exception, as giant pandas are a Chinese national symbol, and their connection to trade and political relations between China and other nations is strong. Anecdotal

gions. However, a subsequent survey conducted between 1985 and 1988 revealed a sharp decline, with the population estimated at just 1,114 pandas. The third survey, published in 2004, offered more hopeful findings, estimating the wild population at 1,596 individuals. Information about the survey can be found at https://wwf.panda.org/what_we_do/endangered_species/giant_panda/panda/panda_survey.

evidence suggests that countries that receive pandas are often among China's largest trade partners (Financial Times, 2017), but they often received them within a few years after the conclusion of a trade agreement between the two parties. As suggested by Buckinghamn et al. (2013), Hong Kong, Macao, Malaysia, and Singapore received a couple of pandas in a few years after they finalized a free trade agreement (FTA) with China, while Canada, France, and Scotland received them after concluding specific deals. Moreover, the arrival of pandas is often marked by celebratory events attended by political representatives, symbolizing the importance of strong ties with China and the prestige of hosting these iconic animals (Financial Times, 2017; Reuters, 2024).

We start our analysis by providing preliminary evidence that the leasing of giant pandas is positively correlated with trade, quantifying its effects in a window around the panda's arrival. This is because China tends to send pandas to countries with which it seeks to strengthen economic relations, often a few months after the conclusion of trade agreements (Buckinghamn et al., 2013). Furthermore, as the leasing conditions are negotiated between the countries, it is plausible that the conclusion of such agreements can be anticipated in advance.

Since the leasing of giant pandas is often anticipated, it is not an exogenous event in the study of its impact on trade relations. In contrast, the birth of a panda cub is largely unpredictable, with only limited advance notice, typically no more than two or three months. At the same time, it generates significant political attention and represents a unique and compelling event to examine the relationship between panda diplomacy and trade. Our main hypothesis is that the birth of a panda cub improves trade relations between China and the host country, for two main reasons. First, a new panda symbolizes the presence of a new ambassador between the two countries, reinforcing their political ties (The Washington Post, 2023). Second, given China's strong emphasis on species conservation, the birth of a cub in a partner country is viewed as a significant and joyful event, highlighting the host nation's role in conservation efforts and reflecting positively on its collaboration with China. Thus, we expect a positive effect on Chinese trade relations, as the birth of a cub represents both the strengthening of political ties through the coming of a new ambassador and the host nation's commitment to conserving a species of profound cultural and diplomatic significance of China. The next section presents the data and the methodology.

# 3 Data and methodology

## 3.1 Data

To perform the analysis we build the *Panda Diplomacy Dataset* which collects information about the Chinese panda diplomacy and we combine it with UN-Comtrade data to get information about countries' exports to China, and with other economic variables from the WDI.[13]

The *Panda Diplomacy Dataset* provides data about all movements of giant pandas in captivity from China to other countries and back, and the birth and death of pandas in partner countries' zoos, from 1941 to 2024. More precisely, we manually collect data from news and the websites of hosting zoos around the world. Since each giant panda has a name, it is possible to uniquely identify its own history, including its genealogical tree. Therefore, we are able to include the name of the giant panda, its sex, the hosting country, the zoo in which it lives, the year and month of arrival at the zoo and in which it left the hosting country to go back to China, and the reason why it was sent to the country. In addition, we are able to identify eventual cubs and their date of birth, whether it was conceived by artificial insemination or not, and whether and when the giant panda died at the hosting zoo outside China. Thanks to this information, we build the following three dummy variables: (i) *Panda* that is equal to 1 if country $c$ has at least a giant panda for some day during year t; (ii) *Panda Leasing* that is equal to 1 when China sends a giant panda to country $c$ in year $t$; (iii) *Panda Birth* that is equal to 1 when a cub is born in country $c$ in year $t$. As the political effects on trade are found to be short-lived (Du et al., 2017), we define a panda as being born in year $t$ if the birth occurred between November of year *t-1* and October of year $t$. Since the majority of panda births result from artificial insemination, the occurrence of twins is relatively common. Thus, we introduced an additional dummy variable, *Panda Birth Twin*, which indicates whether twins or a single panda were born, following the same time structure of *Panda Birth*.

The dataset provides information about 132 distinct giant pandas sent from China, 39 of them as state gift, 93 in leasing, to 26 countries and territories over the period 1941 to 2024, together with 87 pandas cub born outside China.[14] Furthermore, the number of death in zoos outside China is 44, and the number of pandas that were sent back to their home country is 114, resulting in 61 giant pandas being outside China at the end of 2024.[15] Table 1 lists all zoos involved in panda diplomacy from 1941 to 2024,

[13] Other economic variables include the partner country GDP and population, and the exchange rate of partner country's LCU with Yuan.

[14] It includes also the Chinese special administrative regions of Hong Kong and Macao, and Taiwan.

[15] Notice that we are not able to perfectly trace panda death and given back from North Korea in the 1960s-1980s as information are not available.

specifying the year the first panda arrived and the last year a panda was present. This includes both pandas given as state gifts and those leased.

However, since China changed its approach to panda diplomacy at the beginning of the 1990s, leasing the last pair of pandas under the short-term policy to the Columbus Zoo in the USA in 1992 and sending the first pair under the long-term policy in 1994, we focus on the years 1994-2019. We exclude the COVID-19 period since trade relations were dramatically affected, albeit differently across countries.

Figure 1 provides an overview of the countries participating in panda diplomacy during our sample period. Countries highlighted in blue hosted at least one giant panda between 1994 and 2019 but did not experience the birth of any cub, while those marked in green hosted pandas with at least one surviving cub.[16] During this period, there were 53 panda cubs in total, including 13 instances of twin births. When focusing on the narrower time-frame of 2002-2019, the sample includes 50 panda cubs, of which 13 couple of twins. Overall, 20 countries have been involved in panda diplomacy during our sample period, 10 of them have experienced the birth of a giant panda, of which 7 countries have also experienced the birth of at least one pair of panda twins.

Figure 2 presents a comparison of the ratio between exports to China and GDP in countries involved in panda diplomacy (green bar) and not (red bar). As can be seen, countries involved in panda diplomacy experienced a larger ratio between exports to China and GDP (2.25%) compared to countries not involved (1.13%). This evidence is coherent with the results reported by Financial Times (2017), showing that China's biggest trade partners are the ones involved in panda diplomacy. Finally, Figure 3 illustrates the ratio of exports to China to GDP in countries engaged in panda diplomacy, comparing periods when they have a panda (green bar) and when they do not (red bar). As shown, the export levels are quite similar, with panda diplomacy countries exporting 2.28% of their GDP when they have a panda and 2.21% when they do not. While the arrival of giant pandas may coincide with the conclusion of trade agreements (Buckinghamn et al., 2013), this descriptive evidence suggests that countries engaged in panda diplomacy tend to export more to China, regardless of whether they currently host a panda. Nevertheless, it is important to acknowledge the potential risk of reverse causality when studying the impact of a panda's arrival on exports to China. Therefore, examining the effect of the birth of a panda cub helps deal with this issue. The next subsection presents the methodology.

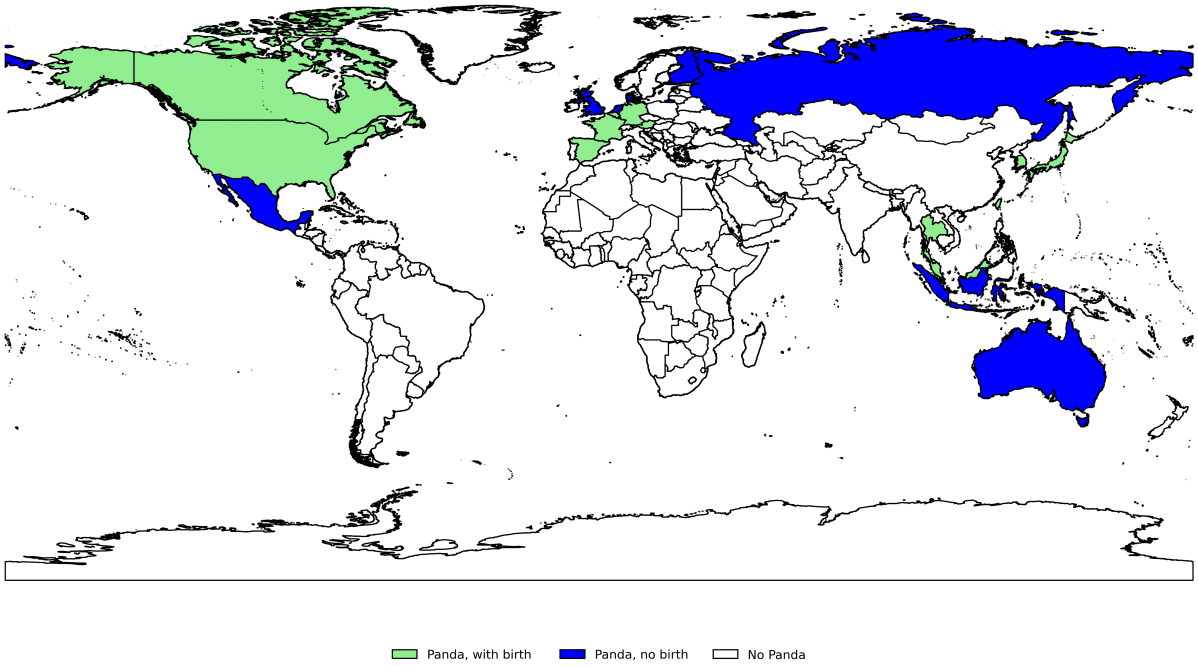
[16] During our sample period, Mexico is the only country to host pandas that are its own property, as they are the offspring of pandas gifted in 1975.

Table 1: Summary of Panda Diplomacy dataset

| Country | Zoo | Start Date | End date | Birth |
|---|---|---|---|---|
| Australia | Taronga Zoo - Melbourne Zoo | 1988 | 1988 | 0 |
| Australia | Adelaide Zoo | 2009 | 2024 | 0 |
| Austria | Schnbrunn Zoo | 2003 | ongoing | 5 |
| Belgium | Pairi Daiza | 2014 | 2024 | 3 |
| Canada | Toronto Zoo - Calgary Zoo | 1985 | 2020 | 2 |
| Denmark | Copenhagen Zoo | 2019 | ongoing | 0 |
| Finland | Ahtari Zoo | 2018 | 2024 | 0 |
| France | Zoo de Vincennes | 1973 | 2000 | 0 |
| France | ZooParc de Beauval | 2012 | ongoing | 3 |
| Germany | Berlin Zoo | 1984 | ongoing | 4 |
| Hong Kong | Ocean Park | 1999 | ongoing | 2 |
| Indonesia | Taman Safari Indonesia | 2017 | ongoing | 0 |
| Ireland | Dublin Zoo | 1986 | 1986 | 0 |
| Japan | Adventure World | 1988 | ongoing | 17 |
| Japan | Kobe Oji Zoo | 2000 | 2024 | 0 |
| Japan | Ueno Zoo | 1972 | 2024 | 5 |
| Macau | Zoo Negara | 2010 | ongoing | 2 |
| Malaysia | Zoo Negara | 2014 | ongoing | 3 |
| Mexico | Chapultepec Zoo | 1975 | ongoing | 7 |
| Netherlands | Ouwehands Dierenpark | 2017 | ongoing | 2 |
| Netherlands | Safari park Beerse Bergen | 1987 | 1987 | 0 |
| New Zealand | Auckland Zoo | 1988 | 1988 | 0 |
| North Korea* | Pyongyang zoo | 1965 | 1980 | 0 |
| Qatar | Al Khor Panda House | 2022 | ongoing | 0 |
| Russia | Moskovsky Zoopark | 2019 | ongoing | 1 |
| Singapore | River Wonders | 1990 | ongoing | 1 |
| South Korea | Everland Zootopia | 1994 | ongoing | 3 |
| Soviet Union | Moscow zoo | 1957 | 1972 | 0 |
| Spain | Zoo Aquarium de Madrid | 1978 | ongoing | 7 |
| Taiwan | Taipei Zoo | 2008 | ongoing | 2 |
| Thailand | Chiang Mai Zoo | 2003 | ongoing | 1 |
| United Kingdom | London Zoo | 1974 | 1991 | 0 |
| United Kingdom | Edinburgh Zoo | 2011 | 2023 | 0 |
| USA | Bronx Zoo - Busch Garden Florida | 1938 | 1988 | 0 |
| USA | Saint Louis | 1939 | 1952 | 0 |
| USA | Brookfield Zoo | 1938 | 1953 | 0 |
| USA | Toledo Zoo | 1988 | 1988 | 0 |
| USA | Columbus Zoo | 1992 | 1992 | 0 |
| USA | Los Angeles zoo | 1984 | 1984 | 0 |
| USA | San Diego Zoo | 1987 | 2019 | 6 |
| USA | Zoo Atalanta | 1999 | 2024 | 7 |
| USA | National Zoo in Washington | 1972 | 2023 | 4 |
| USA | Memphis Zoo | 2003 | 2023 | 0 |
| Total | | | | 87 |

*Notes:* Summary of the *Panda Diplomacy Dataset*. It reports the year when the first giant panda arrived in the zoo, the year when the last giant panda died or went back to China, and the number of cubs birth announced in each zoo. *Data about North Korea may be not complete due to lack of reliable information sources.

Figure 1: World map of panda diplomacy between 1994-2019




*Notes:* Colored countries represent those that hosted giant pandas at least once during the period 1994-2019. Green countries are the ones that experienced a birth of a panda cub, while blue ones not. In white are depicted countries that never had a panda during the sample period.

### 3.2 Methodology

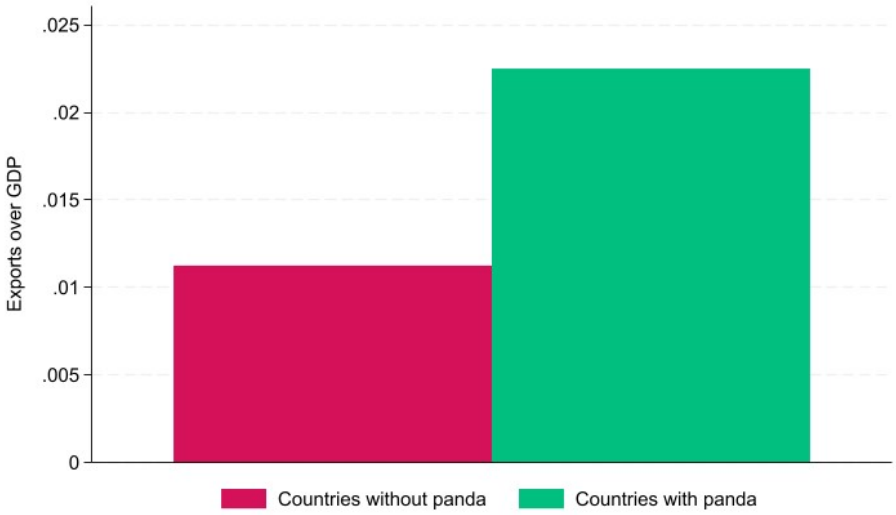
In our work, we examine the effect of panda diplomacy on international trade with China. To provide preliminary evidence that the leasing of giant pandas is positively correlated with trade, we estimate using the Poisson Pseudo-Maximum Likelihood (PPML) estimator the exports dynamics of partner country $c$ to China, in the years around the arrival of giant pandas as follows:

$$\begin{aligned} exports_{c,t} = & exp\{\beta_0 + \sum_{j=-2}^{2} \beta_{1,j} PandaLeasing_{c,t+j} + \beta_2 log(gdp_{c,t}) + \beta_3 log(pop_{c,t}) + \\ & + \beta_4 log(exchrate_{c,t}) + \beta_6 otherexp\_to\_gdp_{c,t} + \delta_c + \gamma_t + \varepsilon_{c,t}\} \end{aligned} \tag{1}$$

where $exports_{c,t}$ is the value of real exports of partner country $c$ to China at time $t$ in US dollars and the variable $PandaLeasing_{c,t+j}$ with $t = -2, ..., +2$ is a dummy variable that is equal to 1 if country $c$ at year $t+j$ hosted one giant panda or a couple of giant pandas.[17] The control variables taken from the

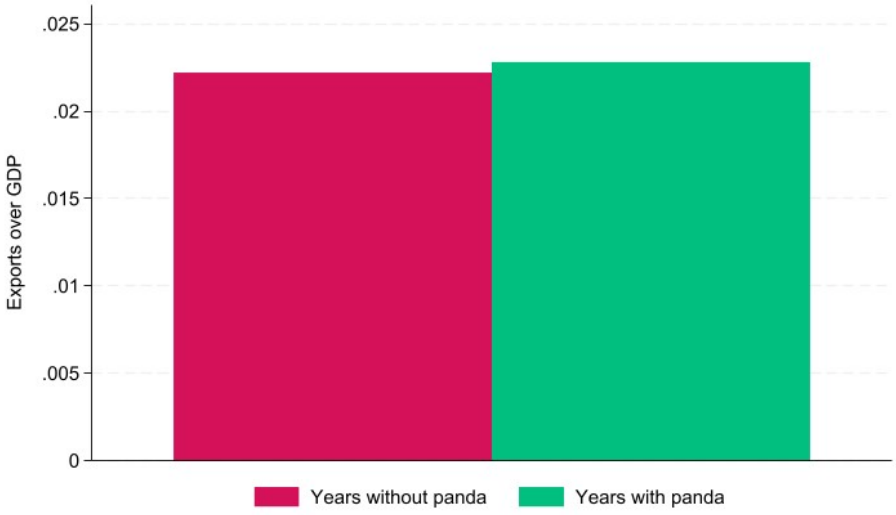
[17] Giant pandas are typically leased in pairs; however, if one becomes ill, ages, or passes away, China may choose to send

Figure 2: Exports to China and panda diplomacy, 1994-2019




*Notes:* The red bar represents average exports to China as a share of GDP for countries not involved in panda diplomacy during the period 1994-2019, while the green bar shows the same measure for countries that hosted at least one giant panda.

Figure 3: Exports to China before and after the arrival of a panda, 1994-2019




*Notes:* The red bar represents average exports to China as a share of GDP in countries involved in panda diplomacy before receiving pandas during the period 1994-2019, while the green bar shows the same measure after they received pandas.

trade gravity model literature (Rose, 2007; Fuchs and Klann, 2013) are the following: $log(gdp_{c,t})$ is the

a replacement panda or leave the position unfilled.

logarithm of partner country's real GDP in USD at time $t$, $log(pop_{c,t})$ is the logarithm of partner country's population at time $t$, $log(exchrate_{c,t})$ is the logarithm of the real exchange rate of partner country's local currency unit in Yuan, and $otherexp\_to\_gdp_{c,t}$ is the amount of exports of country $c$ towards territories different from China in year $t$, divided by its GDP. Finally, $\delta_c$ and $\gamma_t$ denote country and year fixed effects, while the standard error $\varepsilon_{c,t}$ is clustered at the country level since it is the level of treatment. As regards the choice of PPML, its use is particularly suitable when dealing with trade data for two reasons (Santos Silva and Tenreyro, 2006). First, it allows to include observations in which the value of the exports is equal to zero.[18] Furthermore, the PPML method offers consistent estimates of the model coefficients, which may not be the case when using OLS with trade gravity model.[19]

Then, we test our main hypothesis estimating a gravity-type model regression over the period 1994-2019, where exports from country $c$ to China are explained by the birth of a panda cub in a zoo located in country $c$ in year $t$. The model includes country fixed effects to control for time-invariant heterogeneity, year fixed effects to account for global shocks, and several time-varying control variables. Notably, the inclusion of partner country fixed effects absorbs factors commonly used in gravity models, such as bilateral distance, contiguity, and common language. Our analysis starts in 1994 since it is the first year of the third phase of panda diplomacy, and ends in 2019 to exclude years affected by the COVID-19 which dramatically disrupted trade among countries. However, since the Chinese inclusion in the World Trade Organization had a relevant role in shaping Chinese trading relations, we also focus only on the period 2002-2019. Thus, we estimate the following Equation 2 using a PPML estimator:

$$\begin{aligned} exports_{c,t} = & exp\{\beta_0 + \beta_1 PandaBirth_{c,t} + \beta_2 Panda_{c,t} + \beta_3 log(gdp_{c,t}) + \beta_4 log(pop_{c,t}) + \\ & + \beta_5 log(exchrate_{c,t}) + \beta_6 otherexp\_to\_gdp_{c,t} + \delta_c + \gamma_t + \varepsilon_{c,t}\} \end{aligned} \tag{2}$$

where $PandaBirth_{c,t}$ is a dummy variable equal to 1 if, in country $c$, a new panda was born between November of year *t-1* and October of year $t$.[20] As the effects of political shocks on trade are found to last in two months (Du et al., 2017), we code the births that occurred in November and December of year *t-1* as if they happened in year $t$.[21] All the other variables are estimated as in Equation 1. In this

[18] We consider partner country's exports to China equal to zero if in the same year the value of its total exports towards the rest of the world is positive. While, we consider it to be missing if the value of other exports is not available.

[19] Santos Silva and Tenreyro (2006) also clarify that, despite being a count data estimator, PPML is well-suited for regressions involving continuous data.

[20] In an additional specification, we set the variable $PandaBirth_{c,t}$ equal to 1 only if the panda cubs are twins. If exports to China increase because the partner country is contributing to the survival of the species, we would expect a larger effect when more than one cub is born.

[21] This decision is further supported by the monthly analysis presented in Section 4.

specification we also control for the dummy variable $Panda_{c,t}$ which is equal to 1 during years in which country $c$ has at least one giant panda. This is necessary to control for the fact that the birth of a panda in a country is conditioned only when pandas are living in one of their zoos. The coefficient of interest is $\beta_1$, as it captures the effect of the birth of a panda on a country's exports to China.

Despite Equation 2 allows us to estimate the effect of a panda born on country's exports to China, it does not give us any insights about the dynamics of the effect within the same year. Indeed, it is of interest to test for both parallel trend before and for the persistency of the shock. Thus, we decide to estimate the exports dynamics exploiting monthly frequency data. In this way we can mitigate the aggregation bias that annual frequency data may generate (Du et al., 2017), and we can distinguish the effects of the different phases of the birth as discussed in Section 2.3. However, this strategy comes at the cost of reducing the sample period from 2010 to 2019.[22] For these reasons, using real monthly exports data, we estimate the following equation with PPML:

$$\begin{aligned} exports_{c,m,t} = exp\{\beta_0 + \sum_{j=-6}^{6} \beta_{1,j} PandaBirth_{c,m+j,t} + \beta_2 Panda_{c,m,t} + \beta_3 log(gdp_{c,t}) + \beta_4 log(pop_{c,t}) + \\ + \beta_5 log(exchrate_{c,t}) + \beta_6 otherexp\_to\_gdp_{c,m,t} + \delta_c + \gamma_t + \varepsilon_{c,m,t}\} \end{aligned} \tag{3}$$

where $exports_{c,m,t}$ is the value of real exports of partner country $c$ to China in month $m$ of year $t$ in US dollars, and $PandaBirth_{c,m+j,t}$ is a dummy variable that equals 1 if a new panda was born in country $c$ during month $m+j$ of year $t$, with $j = -6, -5, ..., +6$, a new panda was born. The controls are as in Equation 2, apart for $otherexp\_to\_gdp$ and $Panda$ for which we have monthly observations.[23] Now, the coefficients of interest are all the $\beta_{1,j}$, with $j = -6, -5, ..., +6$.

To improve the granularity of the analysis, we then re-estimate Equation 2 distinguishing trade by Standard International Trade Classification (SITC) sections. This allows us the inclusion country-industry fixed effects to account for industry specific time-invariant factors of each country, and year-industry fixed effects to account for specific industry shocks. The next section presents the results.

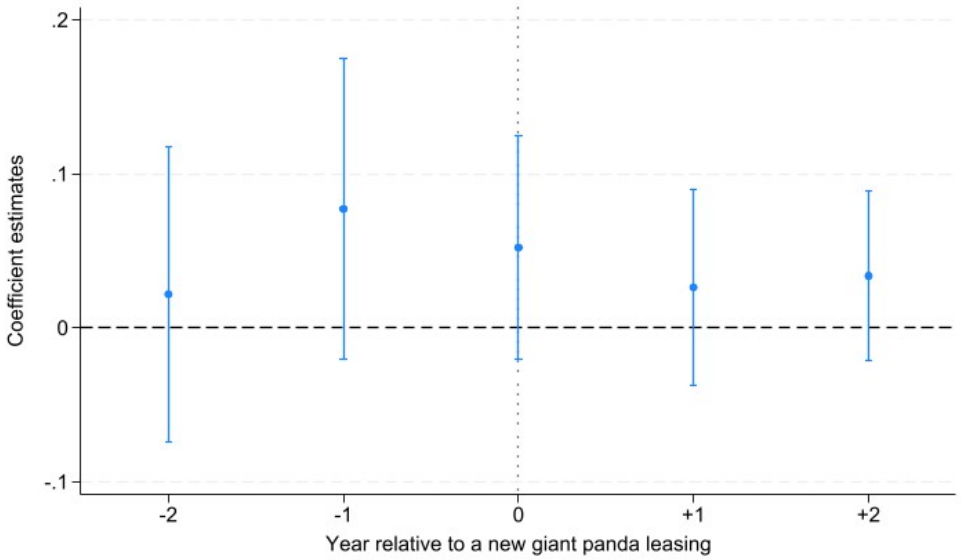
[22] Despite that, we are still considering 25 births out of 40 events, in 9 different countries.
[23] Note that monthly exports are scaled by the annual GDP, since monthly GDP data are not available.

# 4 Results

## 4.1 Baseline results

We begin our analysis by examining the relationship between exports to China and the lease of giant pandas. Figure 4 presents the percentage change in trade between China and its partner countries, covering the period from two years before to two years after they received giant pandas between 1994 and 2019. The results indicate higher exports to China during the year of the pandas' arrival (year 0) and the preceding year (year -1); however, it is not significant, with a p-value of 0.12. The small observed increase in exports hints at a connection between panda diplomacy and international trade with China, but this relationship appears weak. While receiving pandas sometimes coincides with the signing of trade agreements, it also depends significantly on the capacity of the hosting zoo to provide suitable living conditions for the pandas.

Figure 4: Export dynamics in countries that received giant pandas




*Notes:* It presents the export dynamics of countries that received a panda, from two years before to two years after its arrival. The reported 95% confidence intervals are based on standard errors clustered at the partner country level and correspond to PPML estimates that include year and country fixed effects, along with the control variables specified in Equation 2.

The results of Equation 2 are shown in Table 2. The estimates examine the relationship between the birth of a panda cub and exports to China, using four different specifications that vary by sample period, i.e., 1994-2019 (columns 1 and 3) and 2002-2019 (columns 2 and 4), and sample composition, i.e., all countries

(columns 1 and 2) and only those involved in panda diplomacy (columns 3 and 4). It is important to note that panda births occurring in November or December are shifted to the following year, as explained in the methodological section. The effect of a panda birth on exports to China is consistently positive across all specifications. However, the level of statistical significance varies. In the sample covering the entire period from 1994 to 2019 (columns 1 and 3), the estimates are not statistically significant at conventional levels, with p-values of 0.14 and 0.19, respectively. In contrast, when focusing on the period from 2002 to 2019 (columns 2 and 4), which starts after China's inclusion in the WTO, the estimated effects become significant at the 1% level. For these specifications, the birth of a panda cub is associated with an increase in exports to China of 5.5% (column 2) when focusing on the sample of all countries and 7.2% (column 4) when the sample includes panda diplomacy countries only. Compared to other political shocks examined in the literature (Rose, 2007; Nitsch, 2007; Fuchs and Klann, 2013; Fan and Lu, 2021), the effect of a panda cubs birth on international trade is relatively smaller in absolute magnitude. Overall, the findings highlight a positive association between panda births and exports to China, with stronger and statistically significant effects observed in the more recent period.

Figure 5 presents the estimated dynamic effects of panda births on exports over time. As political shocks on international trade are found to be short lived (Du et al., 2017), we study the dynamics using data on a monthly basis over the period 2010-2019.[24] As can be seen, there are not statistical significant differences in exports to China up to three months before the birth of a panda. Although, the positive effect on trade starts to materialize two months before the birth, reflecting the fact that panda pregnancy may be anticipated.[25] The effects of the shock persist for up to four months, aligning with the timing of the official naming ceremony held 100 days after birth, an event that attracts significant political attention, as discussed in Section 2.3.

### 4.2 Effects by sector

We now present the results based on country-year-sector observations. To ensure consistency with our previous findings, we replicate the analysis outlined in Equation 2, incorporating country-industry and year-industry fixed effects, alongside the other variables specified in Equation 2. Table 3 summarizes the results across the usual four specifications. As in the previous analysis, the variable *Panda Birth* remains positive and significant at least at the 5% level for the period 2002-2019, with the coefficients being smaller in absolute terms in these specifications.

[24] General results of Table 2 hold even over this stricter period of time and are available upon request.
[25] As discussed in Section 2 the pregnancy period for giant pandas is known to last between 3 and 5 months.

Table 2: Panda births and total exports to China

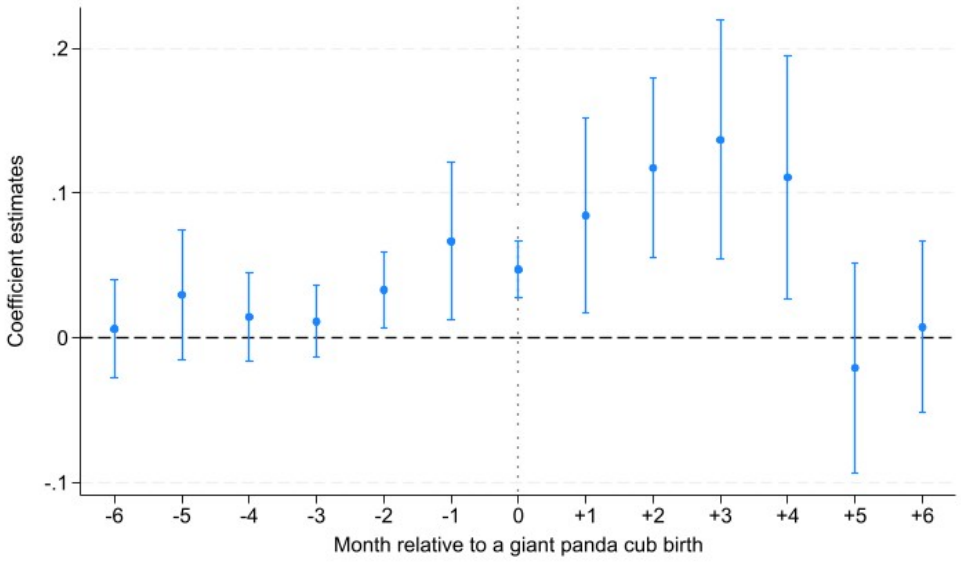
| | Exports | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Panda Birth | 0.0257 | 0.0532*** | 0.0336 | 0.0698*** |
| | (0.0173) | (0.0169) | (0.0253) | (0.0222) |
| Having panda | 0.0421 | 0.0189 | 0.0529 | 0.0340 |
| | (0.0957) | (0.0930) | (0.0874) | (0.0776) |
| (log) GDP | 1.007*** | 1.019** | 0.366 | -0.0960 |
| | (0.385) | (0.491) | (0.252) | (0.468) |
| (log) population | 0.617 | 0.194 | 2.220** | 2.924** |
| | (1.066) | (1.168) | (0.984) | (1.152) |
| (log) exchange rate | -0.00291 | -0.126 | -0.179 | -0.553*** |
| | (0.0531) | (0.143) | (0.175) | (0.212) |
| Other exports to GDP | 0.893** | 0.726* | 1.001*** | 0.997*** |
| | (0.399) | (0.421) | (0.331) | (0.346) |
| Observations | 3,659 | 2,763 | 512 | 360 |
| Country FE | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |
| Starting year | 1994 | 2002 | 1994 | 2002 |
| Only countries in panda diplomacy | | | Yes | Yes |

*Notes:* Panel with countries as observation units and PPML estimates. The dependent variable is the real amount of partner countries' exports to China in US dollar. The independent variable of interest, *Panda Birth*, is a dummy equal to 1 if in year $t$ in country $c$ a giant panda is born. Control variables are: *Having Panda*, that is a dummy equal to 1 if in year $t$ country $c$ has a giant panda, *log(GDP)*, that is the logarithm of real GDP in US dollar of the partner country, *log(Population)* which is the logarithm of partner country population, *log(Exchange rate)* that is the logarithm of the real exchange rate between partner country LCU and Yuan, and *Other exports to GDP* denotes the total amount of exports of the partner country towards territories different from China over its GDP. All columns include country and year fixed effects. Columns 1 and 3 refer to the period 1994-2019, while columns 2 and 4 to the period 2002-2019. Columns 3 and column 4 include only countries with at least one panda in the sample period. Standard errors (in parenthesis) are clustered at the country level. *** p<0.01, ** p<0.05, * p<0.1

To better understand which sector is driving our results, we re-run our preferred specification for each of the 10 SITC sector over the years 2002-2019 as our results are significant only in this period. Identifying the driving sectors is essential to shed light on the mechanism behind the propagation of the panda diplomacy effect. Results are reported in Table 4.

The results reveal that the positive effects of panda births on exports are primarily driven by four key sectors. The first is Food and Live Animals (SITC 0), where a significant and substantial positive effect of about 30% is observed. However, this sector accounts only for 2.35% of total exports, suggesting a moderate contribution to the overall trade effect. The second key sector is Crude Materials, Inedible, Except Fuels (SITC 2), which shows a significant positive increase of 15.3% of the exports to China and constitutes a sizable 13.14% of total exports. Together, these two sectors underscore the importance of essential resources and agricultural products in driving trade growth. Another important sector is

Figure 5: Export dynamics in panda diplomacy countries when experiencing the birth of a giant panda




*Notes:* It presents the export dynamics in panda diplomacy countries when experiencing a birth of giant panda in a specific month on a 13 months window. Reported 95% confidence intervals are based on standard errors clustered at the partner country level, and correspond to PPML estimates that includes year and country fixed effects, and controls as in Equation 3.

Machinery and Transport Equipment (SITC 7), which exhibits a significant increase of exports of 7% in the years and countries in which pandas are born. As the largest sector in terms of export share (42.2%), it plays a critical role in explaining the overall increase in trade with China. Lastly, Manufactured Goods (SITC 6) shows a smaller but statistically significant effect of 5.5%, representing 9.49% of exports and contributing to the positive trend. Only the sector of Animal and Vegetable Oils (SITC 4) exhibits a negative and statistically significant coefficient (-13.7%) at the 10% level. However, since it represents a very small percentage of total exports to China (0.88%), it should not be a cause for concern. Table A1 in the Appendix reports the same results when considering all countries in the sample over the period 2002-2019.

## 5 Robustness analysis

In this section, we run a number of alternative specifications to test the robustness of our results by considering different samples and definitions of the independent variable of interest. We begin by re-estimating our baseline model substituting the variable *Panda Birth* with *Panda Birth Twin*. The dependent variable is now equal to 1 if in country $c$ in year $t$ the pandas born are twins. We do that

Table 3: Panda birth and exports by sector to China

| | Exports by sector | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Panda Birth | 0.0256 | 0.0527** | 0.0252 | 0.0609** |
| | (0.0175) | (0.0244) | (0.0257) | (0.0247) |
| Having panda | 0.0126 | 0.00423 | 0.0219 | 0.0118 |
| | (0.0711) | (0.0746) | (0.0662) | (0.0653) |
| (log) GDP | 0.978*** | 0.961** | 0.331 | -0.133 |
| | (0.326) | (0.431) | (0.232) | (0.329) |
| (log) population | 0.515 | 0.257 | 2.001** | 2.953*** |
| | (0.968) | (1.148) | (0.844) | (1.063) |
| (log) exchange rate | 0.0138 | -0.0733 | -0.0822 | -0.335** |
| | (0.0361) | (0.120) | (0.131) | (0.165) |
| Other sector exports to GDP | 2.444*** | 2.427*** | 2.255*** | 2.536*** |
| | (0.764) | (0.836) | (0.454) | (0.517) |
| Observations | 34,112 | 24,854 | 5,121 | 3,591 |
| Country-industry FE | Yes | Yes | Yes | Yes |
| Year-industry FE | Yes | Yes | Yes | Yes |
| Only countries in panda diplomacy | | | Yes | Yes |
| Starting year | 1994 | 2002 | 1994 | 2002 |

*Notes:* Panel with countries-sector as observation units and PPML estimates. The dependent variable is the real amount of partner countries' exports to China in US dollar for each sector. The independent variable of interest, *Panda Birth*, is a dummy equal to 1 if in year $t$ in country $c$ a giant panda is born. Control variables are: *Having Panda*, that is a dummy equal to 1 if in year $t$ country $c$ has a giant panda, *log(GDP)*, that is the logarithm of real GDP in US dollar of the partner country, *log(Population)* which is the logarithm of partner country population, *log(Exchange rate)* that is the logarithm of the real exchange rate between partner country LCU and Yuan, and *Other sector exports to GDP* denotes the total amount of exports in a specific sector of the partner country towards territories different from China over its GDP. All columns include country-industry and year-industry fixed effects. Columns 1 and 3 refer to the period 1994-2019, while columns 2 and 4 to the period 2002-2019. Columns 3 and column 4 include only countries with at least one panda in the sample period. Standard errors (in parenthesis) are clustered at the country level. *** p<0.01, ** p<0.05, * p<0.1

because it is important for China to protect the giant panda as an endangered species, and the breeding process is both complicated and delicate. The birth of twin pandas represents an exceptional event, as it not only demonstrates the hosting zoo's success in overcoming the inherent challenges of breeding this species but also significantly enhances its contribution to panda conservation. With the arrival of two new pandas instead of one, the zoo makes an even greater impact in safeguarding the species, which is highly valued by China. Consequently, we expect to observe a higher positive effect on trade when twin pandas are born, reflecting the amplified importance of this achievement in the context of panda diplomacy. As we can observe from Table 5, the birth of panda twins has a positive effect between 10% and 13% on exports to China, in different model specifications. This effect is also significant at the 1% across all specifications.

Table 4: Panda birth and exports to China, sector heterogeneity

| | SITC description | Share of exports | Panda Birth | Std Error | Obs |
|---|---|---|---|---|---|
| 0 | Food and live animals | 2.35% | 0.2645*** | (0.0723) | 360 |
| 1 | Beverages and tobacco | 0.28% | 0.1199 | (0.0754) | 359 |
| 2 | Crude materials, inedible, except fuels | 13.14% | 0.1443*** | (0.0253) | 359 |
| 3 | Mineral fuels, lubricants and related materials | 6.99% | -0.0736 | (0.2639) | 359 |
| 4 | Animal and vegetable oils, fats and waxes | 0.88% | -0.1417* | (0.0814) | 359 |
| 5 | Chemicals and related products, n.e.s. | 13.04% | 0.0450 | (0.0294) | 359 |
| 6 | Manufactured goods | 9.49% | 0.0503* | (0.0249) | 359 |
| 7 | Machinery and transport equipment | 42.20% | 0.0661** | (0.0287) | 359 |
| 8 | Miscellaneous manufactured articles | 7.56% | -0.0052 | (0.0435) | 359 |
| 9 | Commodities and transactions, n.e.s. | 4.07% | -0.0589 | (0.0656) | 359 |

*Notes:* Panel with countries as observation units and PPML estimates from separated regression for each sector. The dependent variable is the real amount of partner countries' exports to China in US dollar for each sector. The independent variable of interest, *Panda Birth*, is a dummy equal to 1 if in year $t$ in country $c$ a giant panda is born. Control variables are: *Having Panda*, that is a dummy equal to 1 if in year $t$ country $c$ has a giant panda, the logarithm of nominal GDP in US dollar of the partner country, *log(GDP)*, the logarithm of partner country population, *log(Population)*, the logarithm of the real exchange rate between partner country LCU and Yuan, *log(Exchange rate)*, and the total amount of exports of the partner country, in the same sector, towards territories different from China over its GDP, *Other sector exports to GDP*. All regression models include country and year fixed effects, refer to the period 2002-2019, and they include only countries with at least one panda in the sample period. Standard errors (in parenthesis) are clustered at the country level. *** p<0.01, ** p<0.05, * p<0.1

Then, we present the results of the main analysis specified in Equation 2, using $PandaBirth_{c,t}$ as a dummy variable that equals 1 if a panda was born in country $c$ during year $t$, without shifting pandas born in November and December to the following year. While we consider the specification used in Table 2 to be the most accurate for identifying the effect, it is important to demonstrate that this adjustment in variable handling does not significantly alter the results. Table 6 shows that the effect remains consistently positive and significant, confirming that shifting the pandas born in November and December to the following year is not the factor driving the effects observed in the main results. However, the estimates in this specification are less pronounced and statistically weaker than those in the original model. This supports our conclusion that the initial specification is better suited to capturing the effect of panda births on exports to China, as the impact is primarily concentrated in the months following the birth.

In addition, we replace the dummy variable *Panda* with the number of female pandas a country has. This allows us to account for the fact that countries with more female pandas may have a higher probability of experiencing a panda birth. At the same time, countries that are left with only male pandas are coded as zero, since births are not possible in such cases.[26] As shown in Table 7 results are consistent with the

[26]Note that births are still possible in the absence of a male partner, as female pandas can be artificially inseminated.

Table 5: Panda births twin and total exports to China

| | Exports | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Panda Birth Twin | 0.101*** | 0.127*** | 0.0994*** | 0.118*** |
| | (0.0275) | (0.0267) | (0.0343) | (0.0342) |
| Having panda | 0.0389 | 0.0161 | 0.0513 | 0.0372 |
| | (0.0960) | (0.0934) | (0.0891) | (0.0822) |
| (log) GDP | 1.011*** | 1.015** | 0.374 | -0.0813 |
| | (0.383) | (0.482) | (0.252) | (0.456) |
| (log) population | 0.590 | 0.139 | 2.148** | 2.720** |
| | (1.055) | (1.145) | (0.990) | (1.170) |
| (log) exchange rate | -0.00414 | -0.127 | -0.181 | -0.535** |
| | (0.0542) | (0.145) | (0.176) | (0.229) |
| Other exports to GDP | 0.876** | 0.697* | 0.970*** | 0.931*** |
| | (0.395) | (0.418) | (0.323) | (0.345) |
| Observations | 3,659 | 2,763 | 512 | 360 |
| Country FE | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |
| Starting year | 1994 | 2002 | 1994 | 2002 |
| Only countries in panda diplomacy | | | Yes | Yes |

*Notes:* Panel with countries as observation units and PPML estimates. The dependent variable is the real amount of partner countries' exports to China in US dollar. The independent variable of interest, *Panda birth twin*, is equal to 1 if twins of giant pandas are born in country $c$ in year $t$. Control variables are: *Having Panda*, that is a dummy equal to 1 if in year $t$ country $c$ has a giant panda, *log(GDP)*, that is the logarithm of real GDP in US dollar of the partner country, *log(Population)* which is the logarithm of partner country population, *log(Exchange rate)* that is the logarithm of the real exchange rate between partner country LCU and Yuan and *Other exports to GDP* denotes the total amount of exports of the partner country towards territories different from China over its GDP. All columns include country and year fixed effects. Columns 1 and 3 refer to the period 1994-2019, while columns 2 and 4 to the period 2002-2019. Columns 3 and column 4 include only countries with at least one panda in the sample period. Standard errors (in parenthesis) are clustered at the country level. *** p<0.01, ** p<0.05, * p<0.1

baseline specification, and even the sample starting from 1994 is significant at the 5% level.

Finally, a potential concern is represented by the fact that a particular panda diplomacy country that experienced a birth, or a particular year, may drive our results. To address this concern, we re-estimate the specification in column 4 of Table 2 by excluding one partner country of the panda diplomacy that experienced at least one birth at a time and then excluding one year at a time among those considered. The coefficient of our variable of interest is always positive and significant. Results are available upon request.

Table 6: Panda births and total exports to China, alternative measure

| | Exports | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Panda Birth | 0.0258 | 0.0444* | 0.0317 | 0.0593** |
| | (0.0195) | (0.0260) | (0.0216) | (0.0262) |
| Having panda | 0.0422 | 0.0200 | 0.0534 | 0.0355 |
| | (0.0957) | (0.0932) | (0.0872) | (0.0780) |
| (log) GDP | 1.006*** | 1.023** | 0.366 | -0.0798 |
| | (0.385) | (0.493) | (0.252) | (0.478) |
| (log) population | 0.618 | 0.197 | 2.222** | 2.927** |
| | (1.066) | (1.170) | (0.981) | (1.148) |
| (log) exchange rate | -0.00259 | -0.124 | -0.176 | -0.537** |
| | (0.0525) | (0.142) | (0.171) | (0.213) |
| Other exports to GDP | 0.895** | 0.730* | 1.003*** | 1.003*** |
| | (0.400) | (0.423) | (0.332) | (0.352) |
| Observations | 3,659 | 2,763 | 512 | 360 |
| Country FE | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |
| Starting year | 1994 | 2002 | 1994 | 2002 |
| Only countries in panda diplomacy | | | Yes | Yes |

*Notes:* Panel with countries as observation units and PPML estimates. The dependent variable is the real amount of partner countries' exports to China in US dollar. The independent variable of interest, *Panda Birth*, is a dummy equal to 1 if in year $t$ in country $c$ a giant panda is born. Differently from all other tables, the births occurred in November and December of year *t-1* are not shifted to year $t$. Control variables are: *Having Panda*, that is a dummy equal to 1 if in year $t$ country $c$ has a giant panda, *log(GDP)*, that is the logarithm of real GDP in US dollar of the partner country, *log(Population)* which is the logarithm of partner country population, *log(Exchange rate)* that is the logarithm of the real exchange rate between partner country LCU and Yuan, and *Other exports to GDP* denotes the total amount of exports of the partner country towards territories different from China over its GDP. All columns include country and year fixed effects. Columns 1 and 3 refer to the period 1994-2019, while columns 2 and 4 to the period 2002-2019. Columns 3 and 4 include only countries with at least one panda in the sample period. Standard errors (in parenthesis) are clustered at the country level. *** p<0.01, ** p<0.05, * p<0.1

# 6 Conclusion

This study explores the relationship between panda diplomacy, a unique form of Chinese soft power, and international trade, specifically focusing on exports to China. Using comprehensive data from 1994 to 2019, our analysis investigates the dynamics of trade surrounding the birth of pandas in partner countries and examines the broader implications of this event across different economic sectors. Unlike the leasing of a panda, its birth is unanticipated and not subject to concerns about reverse causality, and serves as both a symbol of strengthened political ties through their role as diplomatic ambassadors and a recognition of the host countries' contributions to species conservation, which enhances their collaboration with China.

Our findings suggest that the birth of panda cubs is associated with a positive impact on exports,

Table 7: Panda births, female pandas, and total exports to China

| | Exports | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Panda Birth | 0.0437** | 0.0650*** | 0.0554** | 0.0823*** |
| | (0.0209) | (0.0220) | (0.0264) | (0.0272) |
| Num. of female panda | -0.0866* | -0.112 | -0.0906** | -0.0875 |
| | (0.0445) | (0.0795) | (0.0399) | (0.0758) |
| (log) GDP | 0.979** | 1.007** | 0.245 | -0.128 |
| | (0.391) | (0.464) | (0.223) | (0.366) |
| (log) population | 0.644 | 0.0748 | 2.742*** | 3.121*** |
| | (1.082) | (1.146) | (0.987) | (1.061) |
| (log) exchange rate | 0.000323 | -0.127 | -0.186 | -0.559** |
| | (0.0551) | (0.144) | (0.182) | (0.249) |
| Other exports to GDP | 0.741** | 0.565 | 0.898*** | 0.891*** |
| | (0.376) | (0.406) | (0.280) | (0.303) |
| Observations | 3,659 | 2,763 | 512 | 360 |
| Country FE | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |
| Starting year | 1994 | 2002 | 1994 | 2002 |
| Only countries in panda diplomacy | | | Yes | Yes |

*Notes:* Panel with countries as observation units and PPML estimates. The dependent variable is the real amount of partner countries' exports to China in US dollar. The independent variable of interest, *Panda birth*, is equal to 1 if a giant panda is born in country $c$ in year $t$. Control variables are: *Num. of female panda*, that is the number of female panda that country $c$ has in year $t$, *log(GDP)*, that is the logarithm of real GDP in US dollar of the partner country, *log(Population)* which is the logarithm of partner country population, *log(Exchange rate)* that is the logarithm of the real exchange rate between partner country LCU and Yuan, and *Other exports to GDP* denotes the total amount of exports of the partner country towards territories different from China over its GDP. All columns include country and year fixed effects. Columns 1 and 3 refer to the period 1994-2019, while columns 2 and 4 to the period 2002-2019. Columns 3 and 4 include only countries with at least one panda in the sample period. Standard errors (in parenthesis) are clustered at the country level. *** p<0.01, ** p<0.05, * p<0.1

particularly in the period from 2002 to 2019, following China's accession to the WTO. Panda births are associated with an increase in exports from 5.9% to 7.2%, depending on the sample and specification. The monthly data analysis complements our findings confirming that the increase in exports coincides with key events in panda diplomacy, starting two months before a panda's birth, when the pregnancy becomes known, and lasting up to four months afterward. This pattern reflects the heightened political and public attention during this period, emphasizing the short-term nature of the trade boost associated with panda diplomacy. The sectoral analysis reveals that the effects of panda diplomacy are concentrated in sectors related to agriculture (SITC 0) and industry (SITC 2 and 7). We plan to explore the mechanism through which these effects propagate, with a particular focus on the role of state-owned enterprises, which are commonly identified in the literature as the primary channels through which the Chinese government implements its foreign policies (Davis et al., 2019; Lin et al., 2019).

Our results contribute to a deeper understanding of how soft power initiatives like panda diplomacy intersect with economic interests. By fostering goodwill and symbolic partnerships, panda diplomacy may act as a catalyst for trade. Recognizing the interplay between soft power and economic priorities can help inform strategies for engaging with China's geopolitical and economic landscape. In addition, our findings suggest that animal diplomacy should be taken seriously as a component of international relations, considering that many countries are practicing it. Overall, this study highlights the nuanced role of cultural diplomacy in shaping global trade dynamics and underscores its potential as a tool for advancing strategic economic objectives.

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# 7 Appendix

## A Appendix: Additional Tables

Table A1: Panda birth and exports to China, sector heterogeneity in all countries

| | SITC description | Share of exports | Panda Birth | Std Error | Obs |
|---|---|---|---|---|---|
| 0 | Food and live animals | 3.1% | 0.3713*** | 0.1037 | 2,660 |
| 1 | Beverages and tobacco | 0.3% | 0.121* | 0.0671 | 2,319 |
| 2 | Crude materials, inedible, except fuels | 16.36% | 0.2044*** | 0.0654 | 2,616 |
| 3 | Mineral fuels, lubricants and related materials | 10.87% | -0.1239 | 0.2921 | 2,223 |
| 4 | Animal and vegetable oils, fats and waxes | 0.92% | -0.1518 | 0.1095 | 2,181 |
| 5 | Chemicals and related products, n.e.s. | 11.99% | 0.055* | 0.0311 | 2,589 |
| 6 | Manufactured goods | 10.43% | 0.0422** | 0.0199 | 2,663 |
| 7 | Machinery and transport equipment | 35.76% | 0.0601* | 0.0311 | 2,624 |
| 8 | Miscellaneous manufactured articles | 6.56% | 0.008 | 0.0427 | 2,638 |
| 9 | Commodities and transactions, n.e.s. | 3.73% | -0.0716 | 0.0798 | 2,341 |

*Notes:* Panel with countries as observation units and PPML estimates from separated regression for each sector. The dependent variable is the real amount of partner countries' exports to China in US dollar for each sector. The independent variable of interest, *Panda Birth*, is a dummy equal to 1 if in year $t$ in country $c$ a giant panda is born. Control variables are: *Having Panda*, that is a dummy equal to 1 if in year $t$ country $c$ has a giant panda, the logarithm of nominal GDP in US dollar of the partner country, *log(GDP)*, the logarithm of partner country population, *log(Population)*, the logarithm of the real exchange rate between partner country LCU and Yuan, *log(Exchange rate)*, and the total amount of exports of the partner country, in the same sector, towards territories different from China over its GDP, *Other sector exports to GDP*. All regression models include country and year fixed effects, refer to the period 2002-2019, and they include all countries. Standard errors (in parenthesis) are clustered at the country level. *** p<0.01, ** p<0.05, * p<0.1