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Abstract

This paper presents new archival evidence about amount and structure of central government disaster relief during China's devastating flood of 1823. While the flood affected 20 percent of China's counties, spending per capita was sizable and distributed between provinces depending on the intensity of flooding. However, because of its small relative size and thus limited state capacity the Chinese government had to spend about half of annual tax income on relief during 1823. We thus conclude that short-term disaster relief was prioritized by the Qing administration over long-term investments, which may have contributed to its secular economic stagnation.

JEL classification:

Keywords: Daoguang Depression, disaster relief, China, 19th century, state capacity

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Introduction

In 1823, large parts of China were drowned in one of the heaviest floods of the whole Qing dynasty (1644-1911). The Qing History Record (*Qing Shi Gao)* offers a flavor of how contemporary historians experienced the relevance of this flood: "As the Qing Dynasty was established, the country entered into a time of peace and prosperity never seen before in history […] However, this ended in 1823 because of the big flood." Here the publication cites Feng Guifen, a famous scholar in the Late Qing. Feng also wrote: "A lot of energy and strength was spent during the flood of 1823. Merchants and farmers experienced great losses, and ordinary people's lives changed from rich to poor," (Feng 1876, vol. 9). Feng's notion of the flood was later taken up by Zeng Guofan and Li Hongzhang, two powerful officials, and thus became very influential in Chinese historiography.

Despite the prominence of this catastrophe, there is a lack of comprehensive and detailed data on its impact and the government's response because the historical records have been scattered. Following a recent reorganization of China's First Historical Archives and the installment of a dedicated disaster section, however, researching particular catastrophes has become feasible for the first time. This is why we are able to provide new evidence about the flood's impact as well as the extent and composition of central government disaster relief.

This matters for Chinese history writing as well as for historical business cycle and growth research, in particular for the role of the state in the latter. Concerning Qing

dynasty history, the 1823 flood is being considered a potential reason for why China experienced the "Daoguang Depression," allegedly a prolonged period of economic stagnation during Emperor Daoguang's rein (1821-1850). This again provides the background for China's "lost century" in connection with interior and exterior security issues such as the First Opium War (1839-42), and the Taiping rebellion (1850-64). Furthermore, the wider environmental context of the flood is debated. Some scholars argue that the flood occurred in the context of climate change at the end of the 6th Little Ice Age (Chengming Wu 2001, p. 240; Bozhong Li 2007) while others argue that the flood was a consequence of the eruption of the Tambora volcano in Indonesia in 1815 (Shuji Cao, Yushang Li and Bin Yang 2012). However, our aim is not to explain the causes of the flood but to present new evidence about its consequences and the ability and willingness of the Late Qing state to deal with it.

In addition to contributing to Chinese history we also see this as a case study that connects to the growing literature on the role of the state in economic development, especially in the context of the Great Divergence-debate. The recent decade has seen a systematic investigation of state capacity both theoretically and empirically in the context of early modern Europe concluding mainly that state capacity in combination with limited government was most conducive to long run economic performance (Marc Dincecco and Gabriel Katz 2012). In the context of the Great Divergence, Prasannan Parthasarati (2011) highlights the role of the British state for example in protecting its infant industries during the eighteenth and nineteenth centuries in contrast to India and the Ottoman Empire. Focusing on public finance, in particular on

the British state's ability to issue sovereign debt, Jaume Ventura and Joachim Voth (2015) argue that in late early modern Britain a liquid market for public debt led to capital reallocation out of agriculture, strengthened urban elites and thus triggered social change; a channel closed for the Qing government that did not issue sovereign debt.

Jean-Laurent Rosenthal and Roy Bin Wong (2011) emphasize the aspect of military conflict in the relation of state and economy. They conclude that the role the state played in the diverging development of China and Europe was the unintended outcome of the respective economic and strategic settings. Initially, conditions in China with its long run stability, low taxes and low incidence of war (compared to Europe) were consistent with a benevolent ruler. However, this turned out not to be beneficial in the long run as Europe because of its frequent internal wars developed capital-intensive production and urbanization, ultimately leading to sustained growth.

This relatively well-meaning picture of the Qing state is challenged by Peer Vries (2015, 2012). Although he agrees in general with the empirical facts such as relative per-capita tax levels in Britain and China he arrives at a different interpretation: what Rosenthal and Wong (2011) describe as a benevolent state he evaluates simply as a weak and incapable state. He thus concludes – not without parallels to Partasarathi (2011) – that a strong fiscal state with high per-capita taxes played an important role in diverging from the pre-modern zero percent growth path.[1]

[1] However, note the contrasting conclusion in Vries (2002).

While differing profoundly in their assessments these authors agree that a capable *and* benevolent state would have benefited China's economic development during the eighteenth and nineteenth centuries. In contrast MyungSoo Cha (2012) presents a profoundly pessimistic view about the particular tool of state activism analyzed in this paper, disaster relief, and its impact on long run development in China. He argues that grain loans and tax exemptions lead to capital misallocation towards the agricultural sector and thus delayed industrialization. At the same time he states that agricultural subsidies *lowered* rural savings and investment, the net effect of which could only be estimated. He concludes that the visible hand of the state via dampening short-run fluctuations of rural income led to decreasing living standards during the eighteenth and nineteenth centuries in China and Korea in contrast to Britain and Japan.

Our take on disaster relief is less Malthusian in that we interpret it as a sign of benevolent rule in the first place. Furthermore, we do not hypothesize about allocative effects of state activity through disaster relief but see a more direct trade-off between short- and long-run food security via the state's annual budget limit (Jock Andersson and James Roumasset 1996). Faced with a major macroeconomic and humanitarian crisis caused by a natural catastrophe did the Qing state actually try to combat food insecurity and if so to what extent? Did this affect its ability to combat long-run food insecurity as well? We see disaster relief as a public good smoothing consumption on the one hand but on the other decreasing public investment and thus consumption possibilities in the future given its annual budget. Because of the fact that the Chinese state did not issue public debt this implicitly takes into account Ventura and Voth's

(2015) argument.

On the issue of benevolence, Carol Shiue (2004) has uttered another pessimistic view related to the inner workings of disaster relief. She argued that the system was plagued by opportunistic behavior and that disaster relief was not spent were it mattered most but were it was politically opportune. We will consider this argumentation in order to understand better the Qing state's intentions during a major crisis.

Since one of the main contributions of this paper consists in using hitherto unavailable archival resources, the paper starts with a description of the archival material and then summarizes the evidence on the 1823 flood, especially about the reports of the extent of the flooding in various provinces. After that we present the types and amounts of relief spent by the government and how it was distributed across provinces. In the third part we analyze the evidence in the light of the debates outlined above, comparing it to European cases of disaster relief in order to provide a means of assessment.

We find that in the 17 provinces for which we have data at least 20 percent of all counties were flooded, half of them very seriously. We also find that the total amount in silver per capita spent on the affected population was at a similar order of magnitude to what Britain and the Prussian Rhine Province spent during the Irish Famine (1845-49), and after the "Year Without a Summer" (1816), respectively. As a share of government size, Chinese spending in 1823 was about 15 to 20 times higher than British spending (or 44 percent to 58 percent versus 3 percent). At the same time

we show that the amount of relief was proportional to the flood intensity, which defies notions of opportunistic rationales, such as military strategic or political ones that would open up possibilities of strategic behavior on lower levels of government. Concerning the questions of state capability we thus conclude that this flood probably overburdened the Chinese state with responsibility, and that this left few resources for other public goods such as defense or transport infrastructure in a time when other states such as Britain and Prussia liberalized their economic policies, modernized their bureaucracies and built up transport infrastructure.

The 1823 flood and governmental response

In this section we summarize the extent of the flood measured by the number of counties flooded in every province, the death toll, and reactions of grain prices in four large eastern provinces. We begin by explaining the archival sources from which we produced the evidence.

Archival resources

Our article is based mainly on archival material, and relies on secondary literature only for some auxiliary comparisons. This section gives an overview over the used material including a description of the disaster report and survey system applied at the time. This will provide a deeper understanding of the material, and its reliability. We will also come back to it when discussing the relation between disaster relief and reported flooding impact.

The primary material can be divided into published and unpublished archival records. The most important published material includes research undertaken at the China Institute of Water Resources and Hydropower Research[2] as well as the Edict Records of Jiaqing and Daoguang Times (2000) published by the First Historical Archives of China.

These publications are very valuable for the understanding of the 1823 flood, since they contain reports of the provincial officials to the court in Beijing. Thus they have been widely used in the literature.[3] However, they contain only a small part of the available material. Moreover, they focus mainly on the impact of flooding and other water engineering issues. In order to provide a more comprehensive picture of the 1823 flood, one needs to access unpublished material as well, which is stored in the First Historical Archives of China (Beijing) and mainly includes Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), Junjichu Lufu Zouzhe 军机处录副奏折 (Extra Copies of the Grand Council Memorials), and Qingdai Zaizhen Shiliao Huibian 清代灾赈史料汇编 (Collection of Disaster Relief Materials).

The published archives mentioned above are a selection from these resources, but represent no more than 10 percent of them. The unpublished archives thus offer much more detail and depth. In particular, in these reports, the provincial officials reported

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[2] Compare Shuili Shuidian Kexue Yanjiuyan (1981, 1988, 1991, 1993).

[3] Li (2007) relies partially on them.

the number and level of the flooded counties in their respective province. They reported an assessment of the severity and characteristics of the flood, and they also needed to report what kind of measures they had taken and what they expected from the central government in terms of assistance. The following describes the reporting administration in detail.

The reporting system consisted of three parts: reports, surveys and relief. In general, a disaster *report* was very simple, and typically contained how many counties were flooded. In comparison, disaster *surveys* included detailed information about how many people and how much land was affected by the disaster at least down to the level of villages.

The report system was the first stage of disaster relief and strictly regulated: "The disaster must be reported as soon as possible," (Tuo 1818). In ancient China with its limited transport means, the speed of information was undoubtedly a crucial factor to control. In 1653, the government thus ordered that if the disaster happened in summer it needed to be reported before May, and if it happened in fall it would have to be reported before August.[4] At the same time, local officials were to send junior officers to check the intensity of the disaster and fill the data into a table. All the work needed to be completed within one month; otherwise they would be punished by reduced pensions, demotion or even dismissal. This rule was followed until 1728, when the period changed to 40 days for the counties and five days for the prefecture and

[4] We converted lunar to (Gregorian) solar months by reporting here the month previous to the one in the records.

provincial officials. These were reasonable limits allowing officials sufficient time and thus no incentive to omit the disaster altogether (in order to avoiding punishment for lack of detail or inaccuracies) but short enough so not to delay the relief efforts.

The second stage was the disaster survey. It was usually carried out by county officials. They recorded the names of disaster victims, where those lived and the location destroyed or otherwise affected by the disaster. At the beginning of the Qing, the survey unit was at the county level which however led often to omissions or exaggerations. Sometimes there was no disaster in one county as a whole but only in some villages who in turn might have been in a life-threatening situation. Similarly, the whole county might have been flooded however with the exception of some important villages, so in 1757 the court agreed to change the survey unit from county to village.

To omit errors and identify misreporting, the county officials were to report their results to the prefecture and province levels. After a big disaster the governor would order a repetition of the survey by himself, while prefecture officials would do the same. Finally, when the Ministry of Finance received the report, it would also send central officials to survey once more.

The third step consisted of relief itself. It was organized by issuing vouchers to

disaster victims, which could be redeemed in food rations or silver.[5] The vouchers were issued mostly by the county administration and in some cases by local elites. As a control device the voucher had a copy for the government to check the amounts issued either on county, prefecture, province or central level depending on the specific situation.

The evidence presented in this article is based on these reports and surveys. However, we also accessed historical gazetteers containing reports about counties, prefectures and provinces, and historical records such as published collections of the writings of individual officials. Finally, we also made use of some official handbooks, mainly the "Daqing Huidian Shili" (Rules and Explanations of the Qing Dynasty) and the "Daqing Huidian" (Veritable Records of the Qing Dynasty).

Summing up, this article draws in total on excerpts from the archival records about the 1823 flood of more than 150,000 Chinese characters or about 150 pages. Of course we can still not claim to have covered all available sources but we are confident that our collection includes most of the relevant written evidence available.

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[5] One food ration was 0.005 dan of rice per day for adults and 0.0025 dan for a child of at least walking age. As one dan equals about 50 kg of wheat this would be 250 grams of wheat or 875 kcal (assuming 3500 kcal for 1 kg of wheat). Typically, this would continue for one month, and in exceptional cases for several months. For example in 1823, Zhili's relief lasted between one and three months, and in Beijing from July 1823 to April 1824 (or nine months) because many flood victims sought refuge in the capital (Tuo 1818).

The extent of the flood

The territory of the Qing state was vast and enormously complex, thus in the 18th and 19th centuries serious disasters would not be uncommon at least at *some* place in China in any given year. However, the flood in 1823 was exceptionally intensive.

Counties flooded by province

We can compare the intensity of the flood in the provinces by retrieving from the archival records the number of counties flooded, and report them as a share of the respective total number of counties. According to this, the most seriously affected provinces were Zhili (89 percent of all counties affected), Jiangsu (84 percent), Anhui (66 percent) and Zhejiang (30 percent), while Hubei (24 percent), Henan (15 percent), Jiangxi (14 percent) and Shandong (13 percent) had a somewhat better situation. Finally, provinces such as Yunnan (8 percent), Guangdong and Hunan (both 7 percent), Shaanxi (3 percent), Guizhou, Sichuan, and Shanxi (all 1 percent) were only marginally affected by the flood. According to the archival material it appears that the flood was worst between June and August 1823, although in some provinces it rained even from April to August.

Zhili was the province flooded most heavily. There the flood was concentrated on mid-July and put 120 out of its 135 counties under water. Initially, however, the year began with the fear of drought as no rain fell during spring and early summer. Thus, the Emperor and the Governor carried out a ceremony to pray for rain. At the beginning of July, it began to rain in Baoding prefecture and some other places. Then,

during the middle of July, the sources say that "the rain, especially at night, was so heavy that in some low lands, all the seeds were destroyed."[6] At the same time, many riverbanks burst. The water level of Yongding River, the biggest river around Beijing, rose to dangerous levels, and the banks finally burst in July. The governor reported that the water was everywhere, and that this situation was extremely rare. Among the 135 counties, 81 counties were reported awash in August.[7] Since it was the province nearest to the capital, Zhili received the biggest attention by the Central Government but a week later, 21 counties were added to the list.[8] In the nineth month of the year, the flood continued and the total increased to 120.

The Yangtze Delta area was affected especially in Jiangsu province. Already in April heavy rain fell, and a lot of riverbanks burst. Some areas were covered with one or two meters of water. During all of May the rain did not halt and even continued to fall until the middle of June. As if this had not been enough after a short break the pouring continued from late June to mid-July almost continuously. Many riverbanks broke, and countless houses collapsed. According to one of the latest reports, after several

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[6] The First Historical Archives of China (Beijing) [Hereafter CFHA]: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-30-487-19.

[7] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0649-015.

[8] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0649-046.

months of continuous rain, 66 of the 79 counties in Jiangsu province were flooded, 47 of them seriously.[9]

The province Zhejiang also experienced abnormal amounts of rain at that time. In March a great flooding occurred, and many houses were destroyed.[10] In July, in some areas it was still raining, such that, according to the statistics, 26 of 88 counties were inundated.[11] Except of the flowed farmland, several salt mines in Jiangsu and Zhejiang were drowned. Due to the extreme rainfalls, 16 salt mines in Jiangsu stopped to work.[12]

Anhui's flood began in May, later than in Jiangsu. A large number of counties was set under water, and several rivers overflowed in Luzhou prefecture. Several people were reported dead in Nanling county due to the heavy rainfalls. From June to August, more heavy rainfalls occurred, and according to the provincial reports 45 counties were awash in Anhui.[13] One year later, the Governor of Anhui reported to the

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[9] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-35-0057-049.

[10] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0649-002.

[11] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-35-0057-047.

[12] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-05 01-35-0502-008.

[13] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange

Emperor: “The flood in 1823 was very serious not only because there was a lot of rain in Anhui, but also because of the heavy rains in Sichuan, Shaanxi, Hubei, Hu’nan and Jiangxi provinces at the same time, as Anhui is the main area for this water to the ocean. More than one million people are seriously affected by the disaster.”[14]

Shandong, Henan, Hubei, Jiangxi and Hunan were the provinces with only limited destructions. Henan experienced rain from May to July, and 11 of 116 counties were flooded.[15] The situation in Shandong was similar to Henan. From April to June, Shandong suffered sustainable rainfalls, and 15 of its 116 counties were inundated.[16] At the same time, several rivers in these provinces flowed over, including the South Canal, the Wei River, the Zhang River and the Qin River. During that time, the Wei River burst 16 times, and the Qin River three times.[17]

In Hubei province the flood occurred mainly in April and June. It rained about five to ten times in early-, mid-, and late-April, respectively. Altogether, 17 of the 72

Rescript Memorials), No. 04-01-01-0643-027.

[14] Compare Shuili shuidian kexue yanjiuyan (1991), pp. 663-664.

[15] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0643-026

[16] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-35-0057-052。

[17] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0647-069.

counties were drowned.[18] Furthermore, along the Yangtze River in Jiangxi province 13 of the 92 counties were affected by the flood.[19]

Adding to these reports, more floods were reported to the Court in other areas of China. From April to June, flooding was experienced in ten of 124 counties in Yunnan, eight of 109 counties in Guangdong, and three of 97 counties in Shaanxi. More relevant reports came from Guizhou, Sichuan, Shanxi, Gansu, and Heilongjiang provinces. In total, from February to July 1823, 348 counties, more than 20 percent of China's 1700 counties, were flooded.

Death toll

The severity of a catastrophe is usually measured by the number of human deaths. We also queried our material for this information, and searched for comparable findings in the literature. Lillian Li (2007, p. 264) summarizes the social impact of the 1823 flood in Zhili province using a compilation of gazetteers instead of the First Historical Archives probably since they were not available as explained above.[20] According to this the gazetteers often measure the number of bodies with the expression "many" or similar. In our archival sources we found this as well. However, Li's (2007, p. 264)

[18] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-35-0057-054.

[19] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0643-014.

[20] Hebei Sheng Hanlau Yubao Keti Zu (1985). See Li (2007, p. 462) for the exact reference.

figure of "a death rate of more than 1000 per day" (in connection with a cholera epidemic) that was allegedly reached in Beijing in the summer of 1823 is not consistent with our archival evidence.[21] In particular, the references cited by Li consist of gazetteers for the counties Luanxian and Wangduo stating that "a lot of people died" in 1822, and two gazetteers for the prefectures Wen'an and Youngping reporting that "many people died."[22]

In Appendix 1 we provide a detailed account of the quantitative (and to some extent also stylistic) evidence found in the provincial reports about the number of deaths. The sum of the precisely counted deaths is only 141 but we conclude that precisely quantifying the number of bodies was apparently not relevant for the official reports to reach their aim of indicating the amount of assistance needed. The reactions that the reports triggered in Beijing were significant in comparison to earlier floods, as 1823 was unique in Qing history, and even, as the next section will show, compared to early modern states in Europe. Before we turn to government assistance, though, we will take a look at the response of market prices for staple food grains after the flooding.

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[21] In passing we note that evidence on 1823 may have been falsely reported for the year 1822 in Hebei Sheng Hanlau Yubao Keti Zu (1985). This would explain inconsistencies with the flood impact reports found in the First Historical Archives underlying this article.

[22] On Luanxian and Wangduo counties see Hebei Sheng Hanlau Yubao Keti Zu (1985, p. 682), on Wen'an and Youngping prefectures see ibid. (1985, p. 685).

Grain Prices

In this section we assess the severity of the flood by looking at the price reactions of rice and wheat. For this we rely on auxiliary data from the literature.[23] Table 1 provides some evidence about these four provinces: Anhui, Shandong, Zhejiang and Jiangsu.

Table 1 about here.

In theory, price increases depend on the size of the negative supply shock and the price elasticity of demand. Interventions by the government could be accounted for by scaling down the supply shock through food provision from granaries. Our aim is to understand what price reactions tell about the size of the harvest failures by comparing them with other major food crises in early modern history. This can be done only by assuming identical elasticities of demand. The yardstick chosen here is the harvest failure in 1816 in Europe, also known as the "year without a summer" (Richard B. Stothers 1984).[24]

The Chinese data set consists of 52 monthly price series for rice and wheat from 1736-1911 but we only present the change of prices between 1822 and 1823. In each province there exist about a dozen of series at prefecture level. This allows for some

[23] We would like to thank Bas van Leeuwen for the data underlying Van Leeuwen et al (2012).

[24] European prices except Germany refer to the data set in Jacks (2005). Prices for Germany from Jacobs and Richter (1935).

insights into regional variation within and between provinces. We calculated percentage increases for both provincial averages and the prefecture with the largest price increase. We also present the change for calendar year averages and between the respective months of August in 1822 and 1823. Thus for each province there are eight percentage price changes.

The province hit hardest by the flood in our sample is Jiangsu with 84 percent of all counties flooded. It is also the one that shows on average the largest price increase with 15 percent for rice while wheat prices reacted only to a very limited extent on average. In Tong and Zhenjiang prefectures we however observe about 20 percent price increases for both rice and wheat.

Anhui was also hit hard with 66 percent drowned counties, and its grain markets reacted in a similar manner as those in Jiangsu. Some prefectures even had price increases of more than 30 percent.

Zhejiiang, of which 30 percent counties were flooded, had on average almost no price reactions, but some prefectures were hit harder than others with about 20 percent prince increases. This holds also for Shandong but to a more limited extent.

While these reactions seem to reflect the intensity of the flood in a systematic way, they are not extreme compared to the average national wheat price increases between 1816 and 1817 after the eruption of the Tambora volcano. The more meaningful comparison is with the provincial and not prefecture averages, which implies that prices in China in 1823 reacted on average less to shortages than prices in Europe in

1817. We thus conclude that the flood caused food scarcity but price reactions were comparatively limited, which might have been a result of regional variations in harvest shocks or an outcome of successful governmental disaster management or both.

Fiscal Responses

The last part of this section summarizes the fiscal expenses of the central government. We divide them in direct and indirect expenses. Direct expenses refer to payments by the government to subsidize food, clothes, and shelter to the people, including payments for water infrastructure works. Indirect expenses refer to tax shares that the government did not want or was not able to collect, including tax exemptions and decreases of the tax base due to the disaster.

Since our sources tell about public finances only we do not cover private relief activities. This however does not mean they might not have been substantial. To the contrary, there is evidence that their extent must have been large. Chinese landlords and the wealthy in general were to the best of our knowledge aware of the Confucianist ethics to help the poor. In addition, their generosity would be rewarded by the Central government with honorary titles or official positions. Also, local officials would sometimes donate private money to support people affected by a disaster. For example, the wealthy of Jiangsu province donated large amounts of grain during 1823 ranging from 20,000 to 100,000 dan in different counties.[25] At the same

[25] One dan of rice equals 50 kg approximately.

time, officials also donated money as a private initiative, and officials at different levels of government of Yangzhou prefecture in Jiangsu province donated 16,000 taels of silver from their private salaries for the flood-affected population in this year.[26] As can be seen below this compared with 1.86 million taels of direct government support and was thus a substantial addition.

Direct Payments by the Central Government

The biggest part of direct expenditures consisted of relief payments. In the period of the Daoguang Emperor (1821-1850), the process of relief distribution worked generally in the following way: The provincial officials should report the disaster within 40 days. If emergency assistance was needed, the officers of provinces should support the people in advance using local resources, such as building temporary shacks, and distributing food and clothes to the homeless as well as contributing money for funerals.[27] After the central government received the disaster reports, they would send officials for closer investigation and checking on the measures undertaken already.

The capital city itself was in dire need of relief in 1823. In June, an officer reported that it had been raining in Beijing and its surrounding areas since May, which had

[26] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0643-029.

[27] In general, there would be five taels of silver for the soldiers and one tael for civilians (Tuo 1818).

already caused "the price of food and other daily necessities to rise quickly." He suggested the government to set up measures to reduce food prices, to which the Daoguang Emperor agreed. [28] Because the areas surrounding the capital were heavily awash, "the number of poor people was twice the number of the previous years," and the measures to control prices continued until the following year. Altogether, more than 62,600 dans of rice and 7,100 taels of silver were distributed.[29]

Zhili province was the area hit hardest in this flood. Being close to the capital, it also received more attention with regards to relief.[30] When the disaster began, the local official supported the population in need by using money and food according to the traditional system.[31] Since Tianjin, a major city in Zhili was massively inundated, the local government firstly distributed 1,200 dans of rice.[32] The counties of Wuqing and Baodi were also affected seriously, and received 73,573 taels of silver.[33] In June, 21

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[28] CFHA: Junjichu Lufu Zouzhe 军机处录副奏折 (Extra Copies of the Grand Council Memorials), No. 03-9864-001.

[29] CFHA: No. 03-9854-011.

[30] See also the discussion in the next section.

[31] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0649-015.

[32] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-35-0057-050.

[33] CFHA: Junjichu Lufu Zouzhe 军机处录副奏折 (Extra Copies of the Grand Council Memorials), No. 03-9855-047.

of the 135 counties were affected by the flood, so they collectively received relief payments of 1.8 million taels of silver. Because of the lack of rice reserves, 400,000 dans of rice taken from tribute grain were delivered to Zhili,[34] in addition to a number of other miscellaneous measures.[35] In total, more than 1,685,700 taels of silver and more than 550,000 dans of rice were used to relieve the province of Zhili from the immediate flood consequences.

The relief methods in Jiangsu were similar. In June, 23 counties were flooded and the situation became very serious. The Jiangsu governor initially sent food that could support people for one month, and 200,000 taels of silver were distributed to the poor.[36] Afterwards when food prices rose, the government collected silver to buy rice from neighboring provinces.[37] According to reports from the Jiangsu governor, North Jiangsu needed one million taels of silver, and South Jiangsu needed about 360,000.[38]

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[34] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-35-0243-028.

[35] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0645-009.

[36] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0649-017.

[37] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-35-0057-049.

[38] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0643-030.

As a whole, Jiangsu used 1,820,000 taels of silver and 277,187 dans of rice for relief activities.

There are only two records about relief in Zhejiang. The first one contains that 7,000 taels of silver were sent to Jiande and Chunan counties.[39] Another is that the local government sent 300,000 taels of silver to buy rice from the neighboring provinces.[40] Since the salt mines of Jiangsu and Zhejiang suffered from the flood, they also received support from the government, however, the amount of silver being unknown.[41]

Different from Zhejiang, the records about Anhui are very detailed. In April, 8,000 taels of silver were sent to those in need.[42] In June, 1,300,000 taels of silver were used for relief.[43] In August, Anhui sent officials to buy 10,000 dans of rice collected

[39] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0649-002.

[40] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-02-0082-007.

[41] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0643-040.

[42] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0649-004.

[43] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0643-019.

in Sichuan, Hubei, Hunan and Jiangxi provinces.[44]

Hubei province also spent 138,846 taels of silver for the poor,[45] but there exists only one record about the level of relief in Shangdong, which was 26,776 taels of silver to repair military barracks destroyed by the rain.[46] The situation of Hunan, Jiangxi and other provinces were in all likelihood similar but we could not find the respective reports.

As a total, direct relief payments still recorded in the archives were 5,383,300 taels of silver and 954,287 dans of rice. However, the flood must also have affected other areas in China. We thus assume that in addition substantial payments were made in unknown areas and therefore revise the total figure upwards. The actual amount of direct payments was probably closer to 8,000,000 taels of silver, and total rice shipments probably about 1,500,000 dans.

Apart from silver payments and food shipments, river engineering was the third part of direct fiscal expenditure by the central government. From the archival records we can see that the provincial government of Zhili spent 201,972 taels of silver to repair

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[44] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0643-015.

[45] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0643-054.

[46] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-20-0010-018.

the Yongding River between May and August.[47] Zhili also spent 219,062 taels of silver on the northern Grand Canal[48] summing up to 421,034 taels.

Next, Henan province spent 196,400 taels of silver to strengthen the dams of the Qin River,[49] while Shandong province spent 36,514 taels of silver on flood control measures at the Wei River.[50] Since the Yellow River crossing Henan and Shandong provinces brought serious flooding from May to July, 1,327,266 taels of silver were spent to repair dike breaches.[51] Accounting for the respective provincial contribution between Henan and Shandong provinces, we can divide this number in two parts, such that when including their own expenses, we arrive at 860,033 taels paid in Henan and 700,347 taels paid in Shandong, respectively.

The rivers in Jiangsu province were hit by the flood at the beginning of April

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[47] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0647-056.

[48] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0648-051.

[49] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0647-039.

[50] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0648-056.

[51] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0648-024.

continuing into August, and 380,000 taels were spent on reconstructing their banks.[52] The expenditures made in Zhejiang have not been recorded very neatly, unfortunately, except one record of 20,810 taels for riverbank repairs.[53]

Finally, the total for Hubei, Jiangxi and some other places amounted to 2,528,693 taels, while for Anhui, Yunnan, Guangxi, which also had known river projects, our records remain silent. Thus we guess that the total amount spent on river engineering would rather be about 3,500,000 taels of silver in 1823.

Summing up, direct payments that we can trace back to archival records were 5,383,300 taels of silver and 954,287 dans of rice, plus 2,528,693 taels of silver for river repair works. However, we do not believe the archival records to be complete but probably missing about 30 percent of the total records as a rule of thumb. We therefore think that payments of 8 million taels in silver directly plus 3.5 million for rivers, and 1.5 million dans of rice are more realistic.

Indirect Expenditures: Tax Reductions

The second part of government expenditure consists of indirect expenditures or explicit reductions of the otherwise expected tax payments in normal times. There are four major types of payments or shipments arriving in the imperial coffers in normal

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[52] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0646-006.

[53] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0648-033.

times stemming from land tax, tribute grain, salt tax and customs duties. Since their normal annual amount was relatively stable, deviations in disaster years can be understood as indirect expenses dedicated to disaster relief.

Firstly, land tax was the main revenue source during the Daoguang reign at about 33 million taels of silver per year. Compared to total tax revenues of about 45 million taels this is a share of somewhat above 70 percent. Table 2 summarizes the reductions of the land tax quota by province.

Table 2 about here.

According to Table 2 total exemptions from land tax were 7,658,637 taels of silver or about 27 percent as a national average. Zhili received the highest exemption with 62 percent, followed by Jiangsu with 43 percent. Anhui, Henan, Guizhou and Shandong received each 36 to 37 percent, while the others received much less in relative terms.

Second, tribute grain was at the time regarded as the most important form of tribute payment and could usually not be exempt from the annual quota of about four million dans of grain. However, since the situation in this year was so serious, the government had to deviate from its usual practise. According to our records it received only 3,082,740 dans of grain, which means a reduction of roughly a quarter.[54]

The third item, salt tax, was as important for fiscal revenues as tribute grain. When the flood struck the country, Changlu in Zhili province received an exemption of 97,391

[54] Chinese Academy of Social and Science (various years).

taels of silver on the salt tax.[55] Yunnan was given an exemption of 23,222, and Zhejiang of 2,384,000 taels totalling to 2,504,613 taels of silver.[56] Unfortunately however, we were not able to find records about exemptions of the Liang Huai Salt area, the one most affected by the flood, which provided almost half of the salt tax in usual times. Thus, we guess that the total tax reduction is unlikely to have been been lower than four million taels of silver.

Finally, the flood also reduced custom duties. According to our records, this amounted to indirect expenditures of about 400,000 taels of silver (Ni 2010).

Structure and Composition of Disaster Relief

Distribution of disaster relief

In this section we aim at understanding how the central government's bureaucracy decided about how to distribute the scarce resources between provinces. According to Shiue (2004), there was an inverse relationship between the level of centrally monitored grain storage in normal times and the size of disaster relief during disaster. This is explained with moral hazard on the side of lower-level officials who would tend to embezzle funds earmarked for storing grain if they could expect short run assistance in case of disaster by the central government.

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[55] The First Historical Archives of China (2000; Vol. 28, p. 331)

[56] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-35-0502-011.

There is an important difference between our and Shiue's data: Shiue's data covers the period 1740-1820 ad tells *if* a province received disaster relief or not in a given year but not what kind or how much while our data for 1823 contains exactly this information. In consequence we concentrate on one particular argument in her paper, which actually rests on the unobserved amounts of relief. Specifically, we consider her presumption that "[…] the geographical pattern of disaster-relief funding from the center was skewed and not likely to have been determined by the random occurrence of disasters," (Shiue 2004, p. 101). We argue that in 1823, the distribution of disaster relief actually depended to a large extent on flood intensity reported by officials and confirmed by external weather data.

The data we used for this analysis are the number of counties affected by the flood, and the composition of disaster relief by type of assistance and province as well as the respective tax targets of the previous year 1822. The latter was used to calculate not only absolute tax relief as a percentage of the current year's target, but also the change of the tax relief as a percentage to the year before, as apparently some provinces there enjoyed permanent tax relief.

Our results are presented in scatter plots (Figure 1).[57] First, in the left panel absolute disaster relief (in percent of the target) is plotted against disaster intensity (share of counties flooded). Second, in the right panel absolute disaster relief is replaced by the change of the reduced target as a percentage of 1822's reduced target. On the x-axis

[57] We present regression results in Appendix 2 for completeness.

we plot again disaster intensity. Note that here we only show one type of indirect assistance, exemptions from land tax, and do not take into account the other types of direct and indirect relief. Because land tax was by far the most important tax, some data are missing in some provinces and for some types, and the results broadly stay when taking into account other kinds of assistance, we report only land tax exemptions. (Results for other types of assistance shown in the regressions in Appendix 2.)

Figure 1 about here.

The first and most important observation in Figure 1 is that land tax relief was apparently allotted proportionally to the intensity of disaster. This holds for absolute relief as well as for the increase of the tax reduction to the previous year. We however highlight two provinces that stick out from the others and help to clarify the likely mechanisms behind disaster relief further.

In the left panel Guizhou clearly is an outlier. It receives 37 percent relief from its normal tax target although only one of 74 counties was flooded. The reason why Guizhou was relieved of so much tax is maybe that it always received 1/3 to 1/2 land tax relief during the Daoguang reign (1821-1850).[58] This becomes evident when looking at the declines of tax targets relative to 1822. According to this relative measure Guizhou is not an exception anymore, because the target was already reduced in the year before. Its tax reduction is therefore not related to flood intensity.

[58] Chinese Academy of Social Sciences (various years b).

A similar case is Zhili, the province closest to Beijing. It was affected more by the flood than all other provinces with 89 percent counties under water but its absolute tax reduction of 62 percent is still out of proportion compared with the other provinces. This shows that Zhili did indeed receive a permanently higher tax reduction because it was politically and strategically more important than the other provinces.

In the disaster of 1823, however, there was no bonus for Zhili. When looking how much its tax target was reduced on top of the reduction it had already received in 1822, it lay clearly in line with the other provinces (right panel).

As a conclusion to this section we do not see evidence in 1823 that would be consistent with moral hazard at the provincial level. Disaster relief depended apparently on the relative number of counties in need in this particular year and not on political or strategic considerations. Considering the multi-level process of reports and surveys described in the previous section shirking was apparently made quite difficult. Having said that, we are aware that there might still have been scope for reporting exaggerated disasters to receive more fiscal help or by not delivering the help to the needy. We will thus show quantitatively using historical dryness and wetness data that the governor reports were consistent with actual disaster intensity.

Verifying flood intensity reports with weather data

We can check the success of the disaster reporting system by replacing our disaster intensity measure by external data. We will use the "Yearly Charts of

Dryness/Wetness in China"[59] that contains an index from 1 (very wet) to 5 (very dry) from 120 documented sites across China. It is based on meteorological descriptions in local annals and court records, among others.

As the annual charts do not exactly follow province borders it was not straightforward to translate the index into province averages, which creates an additional source of unsystematic error. This should however make it easier to refute our hypothesis of a relationship between weather data and disaster intensity reported by the governors (or statistically spoken make it easier not to reject the null hypothesis of no relationship).

Figure 2 about here.

Figure 2 shows the relationships in scatter plots, one for absolute land tax relief (left) and one for relative tax relief (right). Overall, the evidence clearly points at a confirmation of the reliability of the disaster relief reporting system, especially for tax relief relative to 1822, which controls for quasi-permanent tax relief independent of one-time events such as disasters. As can be seen in the right panel there is a clear linear relationship ranging from Anhui (wetness 1.5, 30 percent lower tax than 1822) to Fujian (wetness 3 or normal precipitation, and slightly increased taxes).[60]

The reason for the difference between our results and Shiue's (2004) most likely lies

[59] Published by the Chinese Academy of Meteorological Science (1981).

[60] The only outliers are Sichuan, Shaanxi, and Shanxi, who apparently underreported precipitation, especially Shanxi. We cannot offer an explanation for this, but this does not interfere with our conclusion that the distribution of disaster relief was strongly related to the intensity of the actual disaster.

in the fact that she could not observe the actual amount of relief.[61] We show that in 1823 the actual amount was driven by the intensity of the floods that as exogenous events are not foreseeable and thus should not allow for opportunistic behaviour. The assumption that the amount of relief can be derived from the frequency over longer horizons would not hold if the year 1823 had been typical for the Qing bureaucracy as a whole.

Comparative size of disaster relief

This final section evaluates China's central government spending of disaster relief in an international context. We are well aware of the pitfalls of international comparisons, yet we think it is valuable as it points at both the capabilities but also the limitations of Qing government.

Table 3 about here.

During the Daoguang reign, the Qing government had annual fiscal income of 45 million taels of silver but how much of this was spent as a response to the flood?[62] Table 3 summarizes spending at the national level both the actual records found and the assumed underlying national total.

[61] „Although a full account of relief expenditures is impossible to reconstruct, it is likely that the frequency of relief reports closely reflects the overall concentration of relief expenditures and the relative extent to which the center became involved in aid to a province." (Shiue 2004, p. 120).

[62] We refer to Ni (2013, p. 88-96). On the span of estimates see Vries (2015, p. 437-8).

If we apply a rice price of one dan to one tael of silver, we can add payments in kind to monetary payments and find that the relief paid in kind was about 9,500,000 taels of silver.[63] Outlays on river engineering were probably about 3,500,000 taels. Thus direct expenditures amounted to 13 million or about 29 percent of total tax revenues. As we saw above indirect expenditure (or tax exemptions) included 7,658,637 taels of silver of land tax exemptions, one million reduction on tribute grain, four million of salt tax exemptions, and a lowering of 400,000 taels on custom duties. This amounts roughly to another 13 million taels of silver. As a total, central government expenditures would be about 26 million taels of silver or about 58 percent of 1823's total fiscal revenue.

To arrive at this estimate we had to make a number of assumptions about public spending or tax exemptions for regions where no archival records could be found. While we consider our assumptions to be conservative the conclusions also hold if based on the spending actually (but incompletely) observed in the archives.

When comparing this with the literature, some inconsistencies appear. For example, Lillian Li, in her book on famines in North China writes: "In one year alone, 1766, the state spent 34.5 million taels on relief in various parts of the empire, or approximately 12 percent of its total expenditures for the year" (Li 2007, p. 248). This implies that in 1766, the spending was one third higher than in 1823, and the size of the government more than six times as large. This statement is based on an article by Li Xiangjun (Li

[63] This implies ca. 0.75 grams of silver per kilogram of wheat.

1995, pp. 71-87), which states: “The government spent the biggest amount of money on disaster relief during the Qianlong reign. The expenditure in 1766 was 34.51 million taels of silver. If we take this year as a standard, and the annual disaster relief money (4,241,300 taels) as a total that would be approximately 12 percent of its total expenditures for this year.” Thus, the disaster spending was approximately 4.2 million taels, not 34.5 million, and the size of the government 34.5 million taels, not 288 million.

Table 4 presents the resulting national totals for China, Britain’s spending on the Irish famine 1845-49, and Prussian spending in the Rhine Province 1816-17. We compare both disaster spending as a share of total public tax income and absolute spending per capita. With this we aim at providing some orientation to better understand the capabilities and limitations of the Qing central government.

Table 4 about here.

We start with figures in local currencies and then work our way through to more comparable units. Two observations can be made directly from local currency figures (section 1 in table 4). First, the British government was about ten times as big as the Chinese as a share of GNP. The Qing government share of about one percent seems to be oddly low, but one to two percent stays in line with the literature; probably even until the end of the 19th century (Perkins 1967, p. 479; Sng and Moriguchi 2014, p. 3). The comparability depends among others on the degree of monetization of state activity, and it seems plausible that a smaller share of Qing state activities was monetized which would lead to an underestimation of its size. However, the question

to what extent state activity underrecording exceeds that of the economic activity in general is impossible to answer in this article.[64]

Second, while the difference in terms of state size is already large, the differences of disaster relief spending as shares of total government income are even larger. With about 44 percent (based on the lower estimate of 20 million taels) China spent on the 1823 flood at least 15 times as much as Britain (3 percent) or at least six times as much as the Rhineland (7 percent) spent on the respective disasters.[65]

Turning to absolute figures we need to translate local currencies into comparable units (sections 2-5 in table 4). We do this in three steps: Grams of silver, grams of silver per capita, and grams of silver per affected capita.

In grams of silver China spend almost four and a half times more on the 1823 disaster than Britain did one average in the years 1845-49, and of course a multiple of the Rhineland's amount spent in 1816-17. Translating this into per capita figures reverses the picture: Per capita, about four and half times more grams of silver were spent on disaster relief in Britain and the Rhine Province than in China (section 3 in table 4).

However, not the total population was actually affected by the disaster or the crop

[64] See further Vries (2015, p. 204-210).

[65] The shares varied extensively in the Rhine Province with the wealthier cities spending higher shares than the poorer ones (Bass 1992, p. 160). For example, Düsseldorf spent 23 percent, while Elberfeld and Krefeld spent about eight percent. Wischermann (1983) estimates 35 percent for Münster/Westphalia, which is however doubted by Bass (1992, p. 160).

failure, thus we corrected for the varying shares of population affected (section 4 in table 4). We took 20 percent of the population in China according to the share of counties flooded, and the population of Ireland, about eight million before the famine. For the Rhineland the records for the people that actually received help vary between 15.9 and 23.9 percent in larger cities, thus we took 20 percent as well.[66] This again changes the perspective, as now the per capita spending gap between Britain and China is halved (9.7 and 21.2 grams of silver, respectively).

Being aware of the numerous pitfalls potentially disturbing the comparability of these figures, especially the per capita figures, we draw only two very simple conclusions from this: First, China's spending on the flood was large in absolute terms and mattered even on a per capita basis. Thus, despite its quite small government share, Beijing was capable to act even upon its enormous population in times of extreme crisis. Second, this took a much larger part of the state's resources than other disaster relief programs in these times even though per capita spending was not higher. This reveals that disaster relief had top priority for the Qing. On the downside this means that other tasks (such as transport infrastructure upkeep or expansion) were seriously neglected by the government. This further narrowed the state's capability of promoting economic development beyond its already tiny size compared to European

[66] Bass (1992). This seems to be a more precise – and thus a lower – estimate of the persons who *actually* received help which might explain the relatively high per capita spending figures in section 4 for the Rhine Province.

states.[67]

Conclusions

This paper provides a description and an analysis of Qing government spending during the 1823 flood broken down by province and type of spending. We describe the extent of the crisis as evidenced by the archival records, the amount of spending in the provinces and as a national total, and analyze the relation between distribution of resources and crisis intensity. Finally, we make a rough comparison with Britain's total spending during the Irish Famine and Prussia's Rhine Province after the Year Without a Summer 1816.

We find that about 20 percent of China's counties were severely affected by the flood. The number of deaths turns out not to be quantifiable as each precise figure is usually accompanied by a remark that implies much higher figures but without attempts of quantification. Finally, food prices rose during the flood by 20 percent to 30 percent in some prefectures, which seems to be relatively moderate in a major food crisis.

Second, we are able to relate the distribution between provinces with the share of counties affected in a proportional way, especially when controlling for the permanent tax reductions some provinces enjoyed already before the flood. We also confirm this with external measures of dryness/wetness during 1823. This does not square well

[67] Perkins (1967, p. 487) already discussed the state's limited role in promoting growth given its small size however without recurrence to how the state actually spent its income.

with the moral hazard argument of governors expecting disproportional relief payments and behaving opportunistically.

Finally, when comparing the total spending we find that as a share of government revenue the amount was enormous, about 15 to 20 times higher than in Britain during the Irish Famine, and about six times higher than in the Prussian Rhineland. Per capita of population affected expressed in silver it was less than what the British paid but still anything than negligible. Given our today's notion of Britain being overly Malthusian and the Chinese state rather paternalistic this is an interesting observation and certainly deserves closer investigation.

Taking a step back, we should not forget that the figures presented here are only about the expenditures occurring at the government level. When it comes to population loss, housing and property damaged as well as harvest failures the total economic loss of course faired much higher. This would be the necessary perspective in order to understand why the 1823 flood has left such a deep impression on Chinese history.

Appendix 1: Death toll

Here we summarize all written evidence about people dying in connection with the flood in 1823. However we can be sure they do not reflect by any means the actual death toll as this was not assessed in the governor reports. They rather indicate single events that found their way into the reports for various specific reasons.

In the archives we could not find the number of deaths in Zhili. They only written evidence is that people "died" in Shuntian, Xuanhua and six other prefectures.[68] In the middle of June, the Yongding River broke, and the ships that transported Tribute Grain to Beijing sank such that many sailors died.[69] Except Wen'an and Youngping prefectures mentioned by Li (2007, p. 264) there are also other gazetteers writing that "a lot of people were injured" in Jingxing, and "a lot of people died in the city" in Lulong county.[70]

In Jiangsu, we found a record that contained that after June due to the rain, "a lot of people and animals died" in Kunshan county.[71] Zhejiang province reported that in

[68] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0649-015.

[69] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0649-031.

[70] (Guangxu) Xuxiu Jingxing Xianzhi, Vol. 3; (Guangxu) Yongping Fuzhi, vol. 31.

[71] (Daoguang) Kunshan Xianzhi, vol.39.

March, 15 people drowned, three in Jiande county and 12 in Chun'an county.[72] In May, ten people drowned in Fengshui and Zhuji counties.[73] So in total 25 people were counted dead in Zhejiang but of course many more fell into the unquantifiable category.

Regarding Anhui, there were reports that more than ten people died in Jixi county, as well as "some people" in Xuanchen county and Wuwei prefecture.[74] In a local gazetteer, it was recorded that "a lot of people drowned" in Caoxian, Hezhou prefecture and Tongchen county.[75] Furthermore, six people drowned in Huangmei county of Hubei province in this year.[76] In Yunnan, six peopled drowned in Yongshan county in February, and two women died in Jianshui county in June,[77] so

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[72] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-01-0649-002.

[73] CFHA: Gongzhongdang Zhupi Zouzhe 宫中档朱批奏折 (Palace Midrange Rescript Memorials), No. 04-01-35-0057-047.

[74] CFHA: Junjichu Lufu Zouzhe 军机处录副奏折 (Extra Copies of the Grand Council Memorials), No. 03-169-9853-44, No.03-169-9854-17.

[75] (Daoguang) Caoxian Zhi, vol. 17; (Guangxu) Zhili Hezhou Zhi, vol. 37; (Daoguang) Xuxiu Tongcheng Xianzhi,vol. 23.

[76] CFHA: Junjichu Lufu Zouzhe 军机处录副奏折 (Extra Copies of the Grand Council Memorials), No. 03-169-9855-24.

[77] CFHA: Junjichu Lufu Zouzhe 军机处录副奏折 (Extra Copies of the Grand Council Memorials), No. 03-169-9853-20, No.03-169-9853-46.

eight altogether in Yunnan. In Sichuan, there were also eight people who drowned in Fuzhou county,[78] as well as 12 in April in Zhenghe county, Fujian province, according to the local gazetteer.[79]

Next, in Shaanxi, 12 people drowned in Zhouzhi county in June, and ten in Zhiyang county in the same month,[80] thus 22 in total in Shaanxi. In Ganshu, five soldiers drowned in Zhongwei county in May,[81] and three women in Qinzhou.[82] In Guangdong province, 27 people drowned in the floods in Lianzhou, and in addition 15 people drowned in Yangshan county in June.[83]

In sum, the quantifiable number of people who died in the flood is only 141. This however does not mean that the death toll was really that low. It may be that the reports send to Beijing signaled the severity of the famine in qualitative terms as exact figures were impossible to assess and thus would have been regarded untrustworthy.

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[78] Compare Shuili shuidian kexue yanjiuyan (1991, p. 651).

[79] (Mingguo) Zhenghe Xianzhi, vol. 3.

[80] CFHA: Junjichu Lufu Zouzhe 军机处录副奏折 (Extra Copies of the Grand Council Memorials), No. 03-169-9854-14, No.03-50-2843-18.

[81] CFHA: Junjichu Lufu Zouzhe 军机处录副奏折 (Extra Copies of the Grand Council Memorials), No. 03-169-9853-39.

[82] CFHA: Junjichu Lufu Zouzhe 军机处录副奏折 (Extra Copies of the Grand Council Memorials), No. 03-169-9854-45.

[83] CFHA: Junjichu Lufu Zouzhe 军机处录副奏折 (Extra Copies of the Grand Council Memorials), No. 03-169-9854-47.

Appendix 2: Regression results

OLS regressions on county shares

	Land Tax Only	Total Relief	Land Tax Relative
County Share	0.588***	1.595***	0.340***
	(11.45)	(10.99)	(9.83)
N	13	13	14
adj. R-sq	0.808	0.937	0.916

Robust t-statistics in parentheses * = Significant at the 5 percent level, ** = Significant at the 1 percent level, *** = Significant at the 0.1 percent level. Tax relief in (1) and (2) measured in percentage of tax target, in (3) measured in percentage of tax relief in the year before. County Share is the percentage of counties flooded in a province. Constants insignificant.

Tobit regression on county shares

	Land Tax Only	Total Relief
County Share	0.588***	1.595***
	(11.44)	(10.98)
sigma_	0.115*	0.166***
	(2.39)	(5.38)
N	13	13

Robust t-statistics in parentheses * = Significant at the 5 percent level, ** = Significant at the 1 percent level, *** = Significant at the 0.1 percent level. Relative relieve is not censored so no tobit estimation. For more notes see above.

OLS on dryness/wetness index

	Land Tax Only	Total Relief	Land Tax Relative
Dryness 1823	-0.167	-0.632**	-0.139**
	(-1.89)	(-3.31)	(-3.15)
_cons	0.563*	1.856**	-0.385**
	(2.54)	(3.62)	(-3.27)
N	14	14	15
adj. R-sq	0.199	0.467	0.497

Robust t-statistics in parentheses * = Significant at the 5 percent level, ** = Significant at the 1 percent level, *** = Significant at the 0.1 percent level. Tax relief in (1) and (2) measured in percentage of tax target, in (3) measured in percentage of tax relief in the year before. The dryness index is a decimal number between 1 (very wet) and 5 (very dry). Additional province relative to "County Share" is Shanxi.

Tobit regression on dryness/wetness index

	Land Tax Only	Total Relief
Dryness 1823	-0.163	-0.624**
	(-1.86)	(-3.29)
_cons	0.547*	1.823**
	(2.45)	(3.56)
N	14	14
sigma	0.172***	0.381***
	(5.20)	(4.99)

Robust t-statistics in parentheses * = Significant at the 5 percent level, ** = Significant at the 1 percent level, *** = Significant at the 0.1 percent level. Relative relieve is not censored so no tobit estimation. For more notes see above.

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Tables

Table 1: GRAIN PRICE BEHAVIOUR DURING AND AFTER THE 1823 FLOOD

Percentage Increase of grain prices from 1822 to 1823

	Province Averages		Prefecture with largest increase			
	Rice	**Wheat**	**Rice**	**Name**	**Wheat**	**Name**
Shandong	13% flooded					
Cal. Year Avg.	-0.01	0.02	0.02	Linqing	0.12	Dongchang
August Prices	-0.01	0.04	0.05	Jining	0.15	Wuding
Anhui	66% flooded					
Cal. Year Avg.	0.12	0.12	0.34	Taiping	0.36	Taiping
August Prices	0.15	0.11	0.30	Taiping	0.26	Chizhou
Jiangsu	84% flooded					
Cal. Year Avg.	0.15	0.02	0.18	Tong	0.20	Zhenjiang
August Prices	0.14	0.03	0.28	Tong	0.22	Zhenjiang
Zhejiang	30% flooded					
Cal. Year Avg.	0.04	0.02	0.19	Yanzhou	0.08	Quzhou
August Prices	-0.01	0.03	0.21	Yanzhou	0.11	Quzhou

Comparison for 1816/17 (unweighted national wheat price averages)						
Austria	Belgium	France	Germany	England	USA	Sweden
0.15	0.20	0.29	0.26	0.22	0.19	0.15

Sources: Chinese prices as the same as used in Van Leeuwen et al. (2012). Western prices except Germany refer to the data set in Jacks (2005). Prices for Germany from Jacobs and Richter (1935).

Table 2: LAND TAX AND LAND TAX REDUCTIONS IN 1823 (in tael of silver)

	I	II	III = I - II	III / I
	Quota = tax target	Reduced target	Tax relief	Relief ratio (%)
Zhili	2,556,866	966,439	1,590,427	62
Jiangsu	3,625,814	2,058,011	1,567,803	43
Zhejiang	2,249,330	1,995,784	253,546	11
Shandong	3,589,694	2,305,385	1,284,309	36
Henan	4,354,543	2,734,017	1,620,526	37
Anhui	1,807,563	1,143,020	664,543	37
Hubei	1,144,208	1,015,025	129,183	11
Jiangxi	2,423,720	2,249,330	174,390	7
Hunan	912,643	886,040	26,603	3
Yunnan	210,073	209,382	691	0
Guangdong	1,148,284	1,091,740	56,544	5
Shaanxi	1,333,169	1,332,535	634	0
Ganshu	283,555	267,585	15,969	6
Sichuan	768,536	768,536	0	0
Guizhou	121,667	76455	45,532	37
Guangxi	336,951	308,746	28,205	8
Fujian	1,234,192	1,034,460	199,732	16
Total	**28,100,808**	**20,442,490**	**7,658,637**	**27**

Sources: Chao Dang (Copies of the Archives), stored in the Library of Economic Institute, Chinese Academy of Social and Sciences.

Table 3: TOTAL RELIEF PAYMENTS IN CHINA 1823 (in tael of silver)

	Land Tax	Tribute Grain	Salt Tax*	Customs Duties**	Other means			Total***
	Reduction	Reduction	Reduction	Reduction	Direct payments	Infrastructure repair works****	Food provision	
Recorded Total	7,658,637	917,260	2,504,613	388,221	5,383,300	2,528,693	954,287	20,335,011
Assumed total	7,600,000	1,000,000	4,000,000	400,000	8,000,000	3,500,000	1,500,000	26,000,000

*Recorded salt tax relief 2,504,613 teals, but data missing for about 50% of the tax base.

**Customs duties reduction 388,221 taels, but some data missing.

*** Assumed price: 1 dan rice = 1 tael silver.

****Data missing for Anhui, Yunnan, and Guangxi, which also had known river projects. Thus total amount assumed to be 3,500,000 taels.

Table 4: DISASTER SPENDING IN BRITAIN (1845-49, annual average), CHINA (1823), AND PRUSSIA'S RHINE PROVINCE (1816-17).

			I	II	III	IV	V	VI
			GNP	Gov. Revenue (million)	Gov. Share	Disaster Spending per year (million)	GNP Share	Gov. Rev. Share
Local currencies								
China	1823	mn taels of silver	4000	45	1.1%	20	0.5%	44%
		pound				26	0.7%	58%
Britain	1845-49	sterling	579	55.1	9.5%	1.62	0.3%	3%
Rhineland	1816-17	Reichstaler		13.7		1		7%
Million Grams of silver								
China		g Ag	149200	1678.5		746		
						969.8		
Britain		g Ag	60574	6116.1		169.5		
Rhineland		g Ag		232.9		17.0		
Population (million)								
China	383	g Ag / capita	390	4		1.9		
						2.5		
Britain	24	g Ag / capita	2524	255		7.1		
Rhineland	1.9	g Ag / capita		123		8.9		
Affected Population (million)								
China	76.6	g Ag / capita	1948	22		9.7		
						12.7		
Britain	8	g Ag / capita	7572	765		21.2		
Rhineland	0.38	g Ag / capita		613		44.7		

Notes:

I: Vries (2012), p. 16 for China, for Britain Hills, Ryland and Dimsdale (2010):

The UK recession in context - what do three centuries of data tell us), Quarterly Bulletin (4)

II: Own calculations for China, for Britain Vries (2012), p. 39; Bass (1991), pp. 157-160.

IV: Own calc. for China, for Britain, 7 mn pounds over five years from Gray,P.: The Irish Famine, NY 199, 5.

Rhineland: Bass (1991), pp. 157-160.

Population: Statistics on World Population, GDP and Per Capita GDP, 1-2008 AD

http://www.ggdc.net/maddison/Historical_Statistics/horizontal-file_02-2010.xls; Bass (1991), p. 157.

Affected Population: 20% from own calculations for China, population of Ireland from Maddison file;

20% for Rhineland based on various counties in Bass (1991), pp. 157-160.

Figures

Figure 1: ABSOLUTE AND RELATIVE TAX RELIEF VS SHARE OF FLOODED COUNTIES

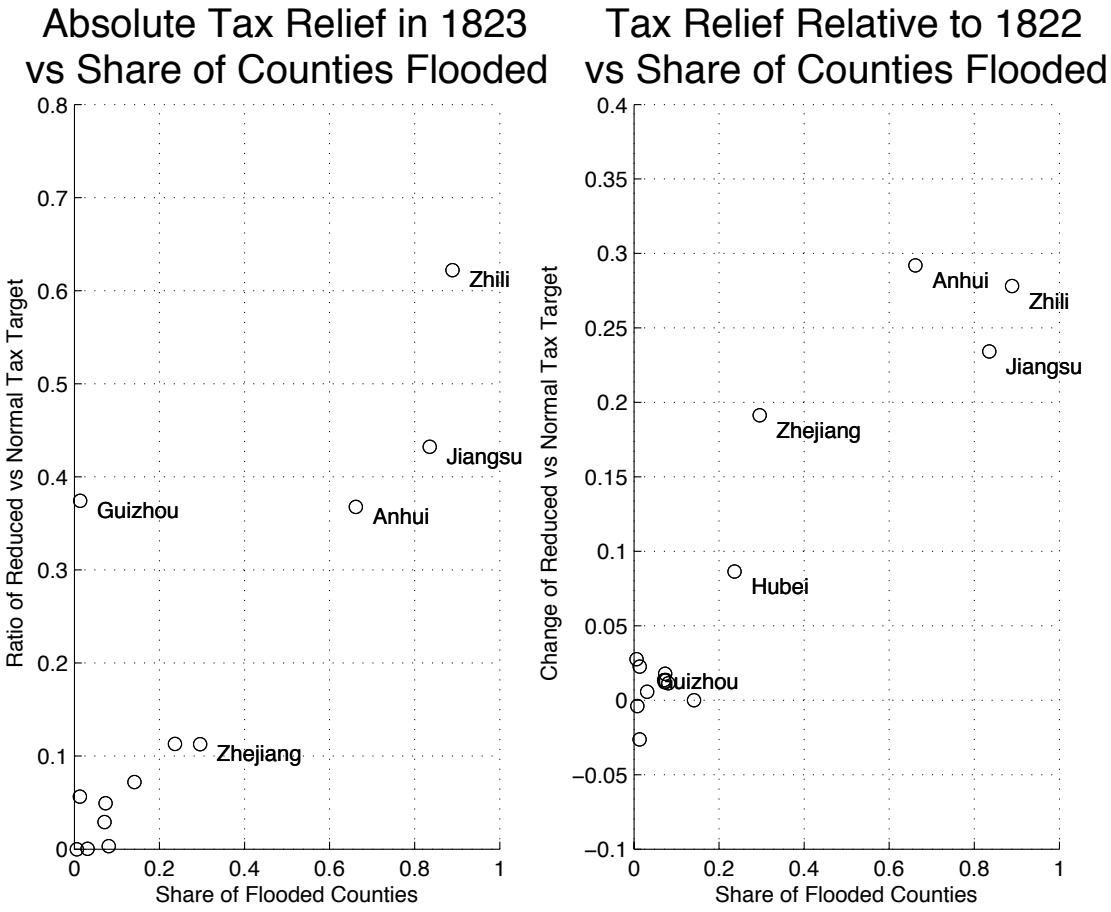
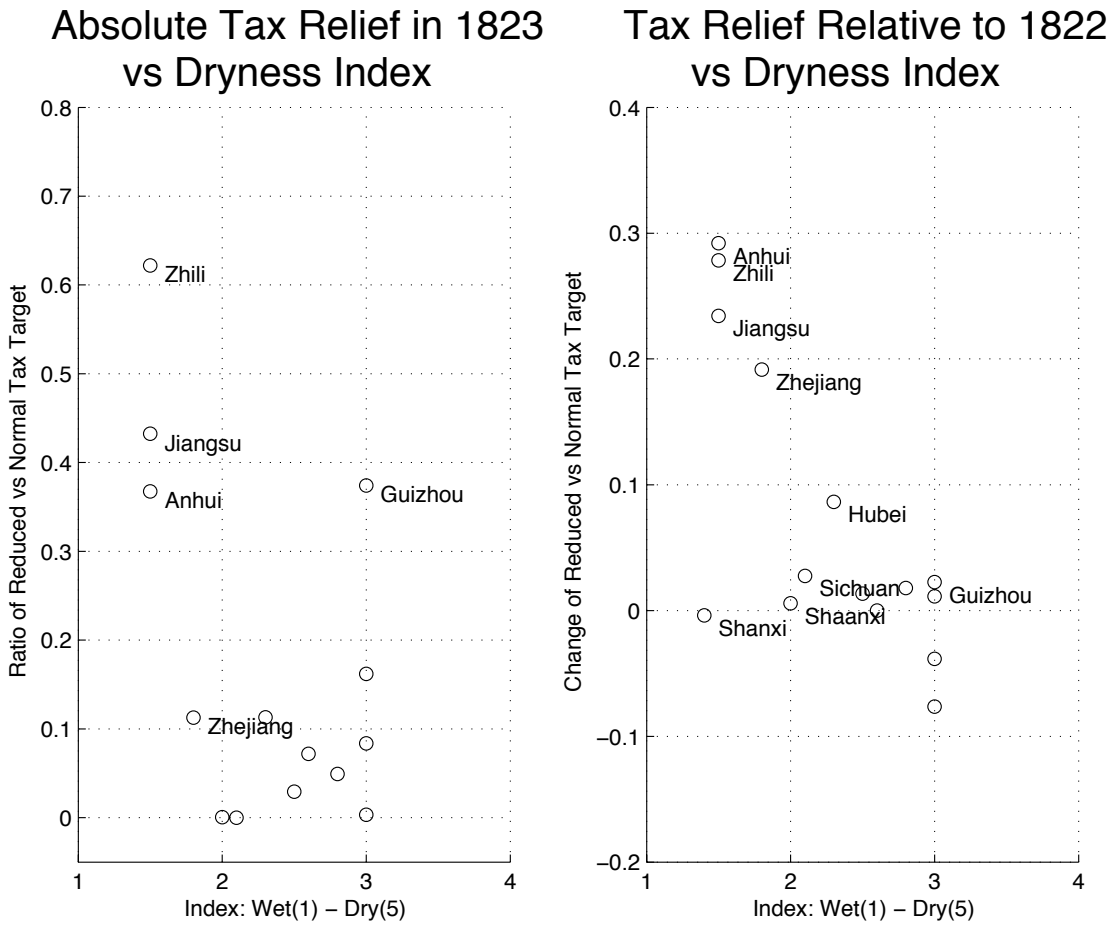


Figure 2: ABSOLUTE AND RELATIVE TAX RELIEF VS DRYNESS/WETNESS INDEX



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