Capital Markets in China and Britain, 1770 – 1860: Evidence from Grain Prices

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Online Appendix

A. Chinese grain price data

The price reports are originally from the *Gongzhong zhupi zouzhe, nongye lei, liangjia qingdan* [Grain Price Lists in the Agricultural Section of the Vermilion Rescripts in the Palace Archives], which records monthly prices on the lunar calendar. These data exist on microfilm (*Yishiguan* 1990) and in published volumes from the Daoguang reign onwards (Chinese Academy of Social Sciences 2009). Original price reports were made at the county level. However, these records no longer exist. What we have today are prices for a higher administrative unit, the prefecture. A prefectural high price and a low price are given at lunar month intervals. The high price is the highest county price within the prefecture, and the low price is the lowest county price for that period. We use the mid-point price, and map that to the location of the prefectural capital. Quantity units are in units of "*shi*", where 1 *shi* = 103 *liters*. The original monetary units are in "*liang*", or the Chinese silver *tael*.

B. Chinese weather data

The Chinese rainfall data comes from the compilation published by the State Meteorological Administration (1981) from a variety of historical sources, including local histories and gazetteers. Weather for each year for 120 "stations" throughout China, a regional designation that is equal to one or two prefectures, is tabulated in this source. A ranking of one to five is used to summarize the impact of the "wetness and dryness" of weather changes from floods, droughts, monsoons, or rainfall, as opposed to other weather phenomenon such as windstorms or temperature changes. The ranking of weather for all regions in China, however, can be seen in the annual contour maps of weather provided, and all prefectural locations were filled in by examining the weather in the closest nearby stations.

The scale of rainfall is defined as follows by the compilers as follows: “Level 1 represents years in which there have been exceptional rainfall, leading to major floods, typhoons, water related disasters, and the destruction of all crops. Level 2 encompasses cases where there is heavy rainfall, but limited in scope and/or resulting in only minor flooding. Level 3 should be interpreted as normal weather, neither very wet nor very dry, and therefore the most favorable weather for that locality. Level 4 indicates minor droughts of limited consequences, while level 5 denotes the years of greatest drought, lasting two or more seasons of the year, and leading to major harvest failures.” Over all years (1470-1979) and all regions (mainland China, Taiwan, excluding Mongolia) considered, the five categories are classified by the authors such that years and regions ranking level 1 and 5 in severity each appear with a frequency of 10 percent, ranks of level 2 and 4 each appear with a frequency between 20-30 percent, and the rank of level 3 accounts for 30-40 percent of the total distribution. In particular, the scale of rainfall is classified as follows:

Level 1: $R_i > (\overline{R} + 1.17\widetilde{\sigma})$

Level 2: $(\overline{R} + 0.33\widetilde{\sigma}) < R_i \leq (\overline{R} + 1.17\widetilde{\sigma})$

Level 3: $(\overline{R} - 0.33\widetilde{\sigma}) < R_i \leq (\overline{R} + 0.33\widetilde{\sigma})$

Level 4: $(\overline{R} - 1.17\widetilde{\sigma}) < R_i \leq (\overline{R} - 0.33\widetilde{\sigma})$

Level 5: $R_i \leq (\overline{R} - 1.17\widetilde{\sigma})$

where,

R_i = relative wetness of year *i,* between the months of 5-9.

$\overline{R}$ = average wetness between the months 5-9 over all years.

$\widetilde{\sigma}$ = standard deviation.

The weather variable used in the first stage adjustment of carry costs is the absolute value of the actual rainfall level’s deviation from the normal weather (level 3)

C. Distance

Distance calculations employ Playfair's (1965) listing of latitude and longitude measurements of prefectural cities based on their historical locations for China. The distance calculation between two points uses the Haversine Formula.

D. British wheat price data

We created the county-month wheat prices for British between 1770 and 1860 with the British government’s Corn Returns published weekly in the *London Gazette*. Before 1820, only county weighted averages of grain prices were reported. From October 1820, however, the weekly Corn Returns include prices in all market towns within each county, as well as information on quantities sold (Adrian 1977). Hence, for the period 1821-1860,

we construct the monthly prices as the weighted averages of prices across market towns, using quantities as weights.

E. British weather data

We use the precipitation reconstructions from Pauling et al. (2006) to obtain our rainfall data used for the British carry cost adjustment. Pauling et al. (2006) present seasonal precipitation reconstructions for European land areas on a 0.5·0.5 resolved grid between 1500 and 1900. We use the nearest data point to each county as the county precipitation, and aggregate the seasonal data to get the total annual precipitation. To make it comparable to the Chinese data, we normalize the British data according to the above Chinese official methodology to a 1-5 scale.

F. Interest Rate Estimation: A Summary

1. Take monthly grain price data for a specific region, *r*
2. Apply suitable time-series filter such as Butterworth (1930)
3. Compute mean of one-month differences during storage months for each calendar year t with equation (4); these are the interest rates for region *r* and year *t*
    a. Use data on harvest time and/or make assumption on storage months
    b. Adjust the mean computation for known properties of the data generation process (including missing values, high vs lower quality data)
4. Adjust these rates with observable factors that may affect grain price changes, such as climate, trade access, and harvest patterns

Table A. 1. Chinese regions

Region No.	Name	Prefecture name in pinyin	Province	Province in pinyin	Yangzi Delta	Region No.	Name	Prefecture name in pinyin	Province	Province in pinyin	Yangzi Delta
1	奉天府	Fengtian Fu	奉天	Fengtian		46	绛州	Jiangzhou Zhilizhou	山西	Shanxi	
2	錦州府	Jingzhou Fu	奉天	Fengtian		47	隰州直隶州	Xizhou Zhilizhou	山西	Shanxi	
3	承德府	Chengde Fu	热河	Rehe		48	朔平府	Shuoping Fu	山西	Shanxi	
4	济南府	Jinan Fu	山东	Shandong		49	宁武府	Ningwu Fu	山西	Shanxi	
5	兖州府	Yanzhou Fu	山东	Shandong		50	霍州直隶州	Huozhou Zhilizhou	山西	Shanxi	
6	东昌府	Dongchang Fu	山东	Shandong		51	归绥道	Guisui Dao	山西	Shanxi	
7	青州府	Qingzhou Fu	山东	Shandong		52	开封府	Kaifeng Fu	河南	Henan	
8	登州府	Dengzhou Fu	山东	Shandong		53	归德府	Guide Fu	河南	Henan	
9	莱州府	Laizhou Fu	山东	Shandong		54	彰德府	Zhangde Fu	河南	Henan	
10	泰安府	Taian Fu	山东	Shandong		55	卫辉府	Weihui Fu	河南	Henan	
11	武定府	Wuding Fu	山东	Shandong		56	怀庆府	Huaiqing Fu	河南	Henan	
12	曹州府	Caozhou Fu	山东	Shandong		57	河南府	Henan Fu	河南	Henan	
13	济宁直隶州	Jining Zhilizhou	山东	Shandong		58	南阳府	Nanyang Fu	河南	Henan	
14	沂州府	Yizhou Fu	山东	Shandong		59	汝宁府	Runing Fu	河南	Henan	
15	临清直隶州	Linqing Zhilizhou	山东	Shandong		60	汝州	Ruzhou Zhilizhou	河南	Henan	
16	顺天府	Shuntian Fu	直隶	Zhili		61	陈州府	Chenzhou Fu	河南	Henan	
17	保定府	Baoding Fu	直隶	Zhili		62	许州直隶州	Xuzhou Zhilizhou	河南	Henan	
18	永平府	Yongping Fu	直隶	Zhili		63	陕州直隶州	Shaanzhou Zhilizhou	河南	Henan	
19	河间府	Hejian Fu	直隶	Zhili		64	光州直隶州	Guangzhou Zhilizhou	河南	Henan	
20	正定府	Zhengding Fu	直隶	Zhili		65	西安府	Xi'an Fu	陕西	Shaanxi	
21	顺德府	Shunde Fu	直隶	Zhili		66	延安府	Yan'an Fu	陕西	Shaanxi	
22	广平府	Guangping Fu	直隶	Zhili		67	凤翔府	Fengxiang Fu	陕西	Shaanxi	
23	大名府	Daming Fu	直隶	Zhili		68	汉中府	Hanzhong Fu	陕西	Shaanxi	
24	冀州直隶州	Jizhou Zhilizhou	直隶	Zhili		69	兴安府	Xing'an Fu	陕西	Shaanxi	
25	赵州直隶州	Zhaozhou Zhilizhou	直隶	Zhili		70	商州	Shangzhou Zhilizhou	陕西	Shaanxi	
26	深州直隶州	Shenzhou Zhilizhou	直隶	Zhili		71	同州府	Tongzhou Fu	陕西	Shaanxi	
27	定州直隶州	Dingzhou Zhilizhou	直隶	Zhili		72	乾州厅	Qianzhou Zhilizhou	陕西	Shaanxi	
28	天津府	Tianjin Fu	直隶	Zhili		73	邠州	Binzhou Zhilizhou	陕西	Shaanxi	
29	易州直隶州	Yizhou Zhilizhou	直隶	Zhili		74	鄜州	Fuzhou Zhilizhou	陕西	Shaanxi	
30	遵化州直隶州	Zunhua Zhilizhou	直隶	Zhili		75	绥德州	Suide Zhilizhou	陕西	Shaanxi	
31	宣化府	Xuanhua Fu	直隶	Zhili		76	榆林府	Yulin Fu	陕西	Shaanxi	
32	太原府	Taiyuan Fu	山西	Shanxi		77	兰州府	Lanzhou Fu	甘肃	Gansu	
33	平阳府	Pingyang Fu	山西	Shanxi		78	平凉府	Pingliang Fu	甘肃	Gansu	
34	大同府	Datong Fu	山西	Shanxi		79	巩昌府	Gongchang Fu	甘肃	Gansu	
35	潞安府	Luan Fu	山西	Shanxi		80	庆阳府	Qingyang Fu	甘肃	Gansu	
36	汾州府	Fenzhou Fu	山西	Shanxi		81	宁夏府	Ningxia Fu	甘肃	Gansu	
37	辽州直隶州	Liaozhou Zhilizhou	山西	Shanxi		82	西宁府	Xining Fu	甘肃	Gansu	
38	沁州直隶州	Qinzhou Zhilizhou	山西	Shanxi		83	安西直隶州	Anxi Zhilizhou	甘肃	Gansu	
39	泽州府	Zezhou Fu	山西	Shanxi		84	凉州府	Liangzhou Fu	甘肃	Gansu	
40	平定州	Pingding Zhilizhou	山西	Shanxi		85	甘州府	Ganzhou Fu	甘肃	Gansu	
41	忻州直隶州	Xinzhou Zhilizhou	山西	Shanxi		86	秦州直隶州	Qinzhou Zhilizhou	甘肃	Gansu	
42	代州直隶州	Daizhou Zhilizhou	山西	Shanxi		87	阶州直隶州	Jiezhou Zhilizhou	甘肃	Gansu	
43	保德州	Baode Zhilizhou	山西	Shanxi		88	肃州直隶州	Suzhou Zhilizhou	甘肃	Gansu	
44	蒲州府	Puzhou Fu	山西	Shanxi		89	泾州直隶州	Jingzhou Zhilizhou	甘肃	Gansu	
45	解州	Jiezhou Zhilizhou	山西	Shanxi		90	江宁府	Jiangning Fu	江苏	Jiangsu	1

Region No.	Name	Prefecture name in pinyin	Province	Province in pinyin	Yangzi Delta	Region No.	Name	Prefecture name in pinyin	Province	Province in pinyin	Yangzi Delta
91	苏州府	Suzhou Fu	江苏	Jiangsu	1	136	福宁府	Funing Fu	福建	Fujian	
92	松江府	Songjiang Fu	江苏	Jiangsu	1	137	永春州	Yongchun Zhilizhou	福建	Fujian	
93	常州府	Changzhou Fu	江苏	Jiangsu	1	138	龙岩州	Longyan Zhilizhou	福建	Fujian	
94	镇江府	Zhenjiang Fu	江苏	Jiangsu	1	139	台湾府	Taiwan Fu	福建	Fujian	
95	淮安府	Huaian Fu	江苏	Jiangsu		140	武昌府	Wuchang Fu	湖北	Hubei	
96	扬州府	Yangzhou Fu	江苏	Jiangsu		141	汉阳府	Hanyang Fu	湖北	Hubei	
97	徐州府	Xuzhou Fu	江苏	Jiangsu		142	安陆府	Anlu Fu	湖北	Hubei	
98	太仓直隶州	Taicang Zhilizhou	江苏	Jiangsu	1	143	襄阳府	Xiangyang Fu	湖北	Hubei	
99	海州直隶州	Haizhou Zhilizhou	江苏	Jiangsu		144	郧阳府	Yunyang Fu	湖北	Hubei	
100	通州直隶州	Tongzhou Zhilizhou	江苏	Jiangsu	1	145	德安府	De'an Fu	湖北	Hubei	
101	安庆府	Anqing Fu	安徽	Anhui		146	黄州府	Huangzhou Fu	湖北	Hubei	
102	徽州府	Huizhou Fu	安徽	Anhui		147	荆州府	Jingzhou Fu	湖北	Hubei	
103	宁国府	Ningguo Fu	安徽	Anhui		148	宜昌府	Yichang Fu	湖北	Hubei	
104	池州府	Chizhou Fu	安徽	Anhui		149	施南府	Shinan Fu	湖北	Hubei	
105	太平府	Taiping Fu	安徽	Anhui		150	荆门直隶州	Jingmen Zhilizhou	湖北	Hubei	
106	庐州府	Luzhou Fu	安徽	Anhui		151	长沙府	Changsha Fu	湖南	Hunan	
107	凤阳府	Fengyang Fu	安徽	Anhui		152	岳州府	Yuezhou Fu	湖南	Hunan	
108	广德直隶州	Guangde Zhilizhou	安徽	Anhui		153	宝庆府	Baoqing Fu	湖南	Hunan	
109	和州直隶州	Hezhou Zhilizhou	安徽	Anhui		154	衡州府	Hengzhou Fu	湖南	Hunan	
110	滁州直隶州	Chuzhou Zhilizhou	安徽	Anhui		155	常德府	Changde Fu	湖南	Hunan	
111	六安州直隶州	Liu'an Zhilizhou	安徽	Anhui		156	辰州府	Chenzhou Fu	湖南	Hunan	
112	泗州直隶州	Sizhou Zhilizhou	安徽	Anhui		157	永州府	Yongzhou Fu	湖南	Hunan	
113	颍州府	Yingzhou Fu	安徽	Anhui		158	靖州	Jingzhou Zhilizhou	湖南	Hunan	
114	南昌府	Nanchang Fu	江西	Jiangxi		159	郴州直隶州	Chenzhou Zhilizhou	湖南	Hunan	
115	饶州府	Raozhou Fu	江西	Jiangxi		160	永顺府	Yongshun Fu	湖南	Hunan	
116	广信府	Guangxin Fu	江西	Jiangxi		161	澧州直隶州	Lizhou Zhilizhou	湖南	Hunan	
117	南康府	Nankang Fu	江西	Jiangxi		162	沅州府	Yuanzhou Fu	湖南	Hunan	
118	九江府	Jiujiang Fu	江西	Jiangxi		163	桂阳州	Guiyang Zhilizhou	湖南	Hunan	
119	建昌府	Jianchang Fu	江西	Jiangxi		164	广州府	Guangzhou Fu	广东	Guangdong	
120	抚州府	Fuzhou Fu	江西	Jiangxi		165	韶州府	Shaozhou Fu	广东	Guangdong	
121	临江府	Linjiang Fu	江西	Jiangxi		166	南雄直隶州	Nanxiong Zhilizhou	广东	Guangdong	
122	吉安府	Ji'an Fu	江西	Jiangxi		167	惠州府	Huizhou Fu	广东	Guangdong	
123	瑞州府	Ruizhou Fu	江西	Jiangxi		168	潮州府	Chaozhou Fu	广东	Guangdong	
124	袁州府	Yuanzhou Fu	江西	Jiangxi		169	肇庆府	Zhaoqing Fu	广东	Guangdong	
125	赣州府	Ganzhou Fu	江西	Jiangxi		170	高州府	Gaozhou Fu	广东	Guangdong	
126	南安府	Nan'an Fu	江西	Jiangxi		171	廉州府	Lianzhou Fu	广东	Guangdong	
127	宁都直隶州	Ningdu Zhilizhou	江西	Jiangxi		172	雷州府	Leizhou Fu	广东	Guangdong	
128	福州府	Fuzhou Fu	福建	Fujian		173	琼州府	Qiongzhou Fu	广东	Guangdong	
129	泉州府	Quanzhou Fu	福建	Fujian		174	罗定直隶州	Luoding Zhilizhou	广东	Guangdong	
130	建宁府	Jianning Fu	福建	Fujian		175	连州直隶州	Lianzhou Zhilizhou	广东	Guangdong	
131	延平府	Yanping Fu	福建	Fujian		176	嘉应直隶州	Jiaying Zhilizhou	广东	Guangdong	
132	汀州府	Tingzhou Fu	福建	Fujian		177	佛冈直隶厅	Fogang Zhiliting	广东	Guangdong	
133	兴化府	Xinghua Fu	福建	Fujian		178	连山直隶厅	Lianshan Zhiliting	广东	Guangdong	
134	邵武府	Shaowu Fu	福建	Fujian		179	桂林府	Guilin Fu	广西	Guangxi	
135	漳州府	Zhangzhou Fu	福建	Fujian		180	柳州府	Liuzhou Fu	广西	Guangxi	

Region No.	Name	Prefecture name in pinyin	Province	Province in pinyin	Yangzi Delta	Region No.	Name	Prefecture name in pinyin	Province	Province in pinyin	Yangzi Delta
182	思恩府	Si'en Fu	广西	Guangxi		218	楚雄府	Chuxiong Fu	云南	Yunan	
183	平乐府	Pingle Fu	广西	Guangxi		219	澂江府	Chengjiang Fu	云南	Yunan	
184	梧州府	Wuzhou Fu	广西	Guangxi		220	广西直隶州	Guangxi Zhilizhou	云南	Yunan	
185	浔州府	Xunzhou Fu	广西	Guangxi		221	顺宁府	Shunning Fu	云南	Yunan	
186	南宁府	Nanning Fu	广西	Guangxi		222	曲靖府	Qujing Fu	云南	Yunan	
187	太平府	Taiping Fu	广西	Guangxi		223	武定直隶州	Wuding Zhilizhou	云南	Yunan	
188	郁林直隶州	Yulin Zhilizhou	广西	Guangxi		224	永昌府	Yongchang Fu	云南	Yunan	
189	泗城府	Sicheng Fu	广西	Guangxi		225	永北直隶厅	Yongbei Zhiliting	云南	Yunan	
190	镇安府	Zhenan Fu	广西	Guangxi		226	元江直隶州	Yuanjiang Zhilizhou	云南	Yunan	
191	成都府	Chengdu Fu	四川	Sichuan		227	广南府	Guangnan Fu	云南	Yunan	
192	保宁府	Baoning Fu	四川	Sichuan		228	蒙化直隶厅	Menghua Zhiliting	云南	Yunan	
193	顺庆府	Shunqing Fu	四川	Sichuan		229	景东直隶厅	Jingdong Zhiliting	云南	Yunan	
194	叙州府	Xuzhou Fu	四川	Sichuan		230	开化府	Kaihua Fu	云南	Yunan	
195	重庆府	Zhongqing Fu	四川	Sichuan		231	丽江府	Lijiang Fu	云南	Yunan	
196	夔州府	Kuizhou Fu	四川	Sichuan		232	东川府	Dongchuan Fu	云南	Yunan	
197	龙安府	Longan Fu	四川	Sichuan		233	镇沅直隶州	Zhenyuan Zhiliting	云南	Yunan	
198	潼川府	Tongchuan Fu	四川	Sichuan		234	昭通府	Zhaotong Fu	云南	Yunan	
199	嘉定府	Jiading Fu	四川	Sichuan		235	普洱府	Puer Fu	云南	Yunan	
200	雅州府	Yazhou Fu	四川	Sichuan		236	镇雄直隶州	Zhenxiong Zhilizhou	云南	Yunan	
201	眉州	Meizhou Zhilizhou	四川	Sichuan		237	贵阳府	Guiyang Fu	贵州	Guizhou	
202	邛州	Qiongzhou Zhilizhou	四川	Sichuan		238	思州府	Sizhou Fu	贵州	Guizhou	
203	泸州直隶州	Luzhou Zhilizhou	四川	Sichuan		239	思南府	Sinan Fu	贵州	Guizhou	
204	资州	Zizhou Zhilizhou	四川	Sichuan		240	镇远府	Zhenyuan Fu	贵州	Guizhou	
205	绵州	Mianzhou Zhilizhou	四川	Sichuan		241	石阡府	Shiqian Fu	贵州	Guizhou	
206	茂州	Maozhou Zhilizhou	四川	Sichuan		242	铜仁府	Tongren Fu	贵州	Guizhou	
207	叙永厅	Xuyong Zhilizhou	四川	Sichuan		243	黎平府	Liping Fu	贵州	Guizhou	
208	绥定府	Suiding Fu	四川	Sichuan		244	安顺府	Anshun Fu	贵州	Guizhou	
209	宁远府	Ningyuan Fu	四川	Sichuan		245	都匀府	Duyun Fu	贵州	Guizhou	
210	酉阳州	Youyang Zhilizhou	四川	Sichuan		246	平越直隶州	Pingyue Zhilizhou	贵州	Guizhou	
211	忠州	Zhongzhou Zhilizhou	四川	Sichuan		247	大定府	Dading Fu	贵州	Guizhou	
212	松潘厅	Songpan Zhiliting	四川	Sichuan		248	兴义府	Xingyi Fu	贵州	Guizhou	
213	石砫厅	Shizhu Zhiliting	四川	Sichuan		249	遵义府	Zunyi Fu	贵州	Guizhou	
214	太平厅	Taiping Zhiliting	四川	Sichuan		250	仁怀直隶厅	Renhuai Zhiliting	贵州	Guizhou	
215	云南府	Yunnan Fu	云南	Yunan		251	松桃直隶厅	Songtao Zhiliting	贵州	Guizhou	
216	大理府	Dali Fu	云南	Yunan		252	普安直隶厅	Pu'an Zhiliting	贵州	Guizhou	
217	临安府	Lin'an Fu	云南	Yunan							

Table A. 2. British Regions

Region No.	County name	Region No.	County name
1	Anglesey	27	Lancashire
2	Bedfordshire	28	Leicestershire
3	Berkshire	29	Lincolnshire
4	Brecknockshire	30	Merionethshire
5	Buckinghamshire	31	Middlesex
9	Caernarfonshire	32	Monmouthshire
6	Cambridgeshire	33	Montgomeryshire
7	Cardiganshire	34	Norfolk
8	Carmarthenshire	35	Northamptonshire
10	Cheshire	36	Northumberland
11	Cornwall	37	Nottinghamshire
12	Cumberland	38	Oxfordshire
13	Denbighshire	39	Pembrokeshire
14	Derbyshire	40	Radnorshire
15	Devon	41	Rutland
16	Dorset	42	Shropshire
17	Durham	43	Somerset
18	Essex	44	Staffordshire
19	Flintshire	45	Suffolk
20	Glamorgan	46	Surrey
21	Gloucestershire	47	Sussex
22	Hampshire	48	Warwickshire
23	Herefordshire	49	Westmorland
24	Hertfordshire	50	Wiltshire
25	Huntingdonshire	51	Worcestershire
26	Kent	52	Yorkshire

Table A.3. Summary Statistics for Grain Prices

					One-month Δ non-zero
	n	Mean	Std. Dev.	Coeff. Var.	Mean
Britain					
Wheat	48,314	1.001	0.049	0.048	0.994
China					
Wheat	107,069	1.000	0.020	0.020	0.344
Millet	52,947	1.000	0.022	0.022	0.456
Rice 1st quality	74,231	1.000	0.018	0.018	0.517
Rice 2nd quality	84,374	1.000	0.020	0.020	0.464

Notes: Results are based on time-series filtered data using a Butterworth (1930) filter with a maximal period of 12 and order 2 in the first step, and maximal period 8 and order 3 in the second step. See text for description of data and sources. Last column gives the fraction for which the one-month price difference is zero in the data. Underlying raw prices for British markets are in shillings per bushel, for Chinese markets in silver *taels* per *shi*.

Table A. 4. Average monthly grain price changes, 1770 to 1860

			Monthly rate		Annualized
		n	Mean (%)	Std. dev.	(%)
Britain	Wheat	4,074	0.854	2.577	10.248
China	All grains	15,152	1.114	2.446	13.373
China	Wheat	4,930	1.124	2.577	13.488
	Millet	3,973	1.020	2.598	12.242
	Rice 1st quality	5,135	1.071	1.978	12.854
	Rice 2nd quality	5,384	1.074	2.133	12.883

Notes: Average monthly grain price changes during storage months, calculated with equation (4). Weighted by the fraction of month-to-month prices changes that are non-zero (see Table 1). Annual rates are computed as 12 times the monthly rate.

Table A.5. Grain interest rates: the influence of weather, trade, and harvest patterns

		Price Change				Interest rate	Interest rate broad
Adjustments		None	Climate	Climate & Waterway	Climate & Waterway & Harvest Patterns		Climate & Waterway & Harvest Patterns
		(1)	(2)	(3)	(4)		(5)
Britain	Mean	10.248	5.271	5.348	5.348		5.348
		(30.924)	(30.804)	(30.795)	(30.795)		(30.795)
	n	4,074	4,074	4,074	4,074		4,074
China	Mean	13.373	9.374	9.440	9.200		6.258
		(29.350)	(29.040)	(29.088)	(29.077)		(24.544)
	n	15,152	15,152	15,152	15,152		18,586
Difference		3.126	4.103	4.092	3.852		0.909
		(0.571)	(0.567)	(0.567)	(0.567)		(0.538)

Notes: Shown are statistics for average monthly grain price changes, in percent, with various adjustments; Results are based on log grain price data. Column (1) copies results from Table 2 Column (4) for comparison. Statistics for the preferred grain interest rates are shown in column (4). "Interest rate broad" is calculated using grain price gradient in all months that typically exhibit price increases. Standard deviation given in parentheses.

Table A.6. Capital market integration

	Britain	China			
	Wheat	Wheat	Rice 1st quality	Rice 2nd quality	Millet
0-100km	0.80	0.53	0.65	0.56	0.54
	(0.16)	(0.38)	(1.18)	(0.62)	(0.36)
	[n = 350]	[n = 186]	[n=196]	[n=202]	[n=152]
100-200km	0.77	0.41	0.45	0.40	0.44
	(0.16)	(0.55)	(1.37)	(0.69)	(0.38)
	[n = 788]	[n = 566]	[n=602]	[n=628]	[n=484]
200-300km	0.74	0.30	0.39	0.36	0.35
	(0.17)	(0.43)	(1.43)	(0.72)	(0.45)
	[n = 720]	[n=730]	[n=758]	[n=840]	[n=616]
300-400km	0.73	0.21	0.20	0.22	0.25
	(0.18)	(0.39)	(0.80)	(1.01)	(0.43)
	[n = 476]	[n=786]	[n=802]	[n=902]	[n=684]
400-500km	0.70	0.11	0.20	0.14	0.17
	(0.18)	(0.49)	(2.07)	(0.88)	(0.38)
	[n = 246]	[n = 886]	[n=908]	[n=1,108]	[n=568]
500-600km	0.70	0.07	0.11	0.11	0.12
	(0.19)	(0.48)	(2.04)	(1.22]	(0.27)
	[n = 64]	[n=1,002]	[n=1,018]	(n=1,184)	[n=548]

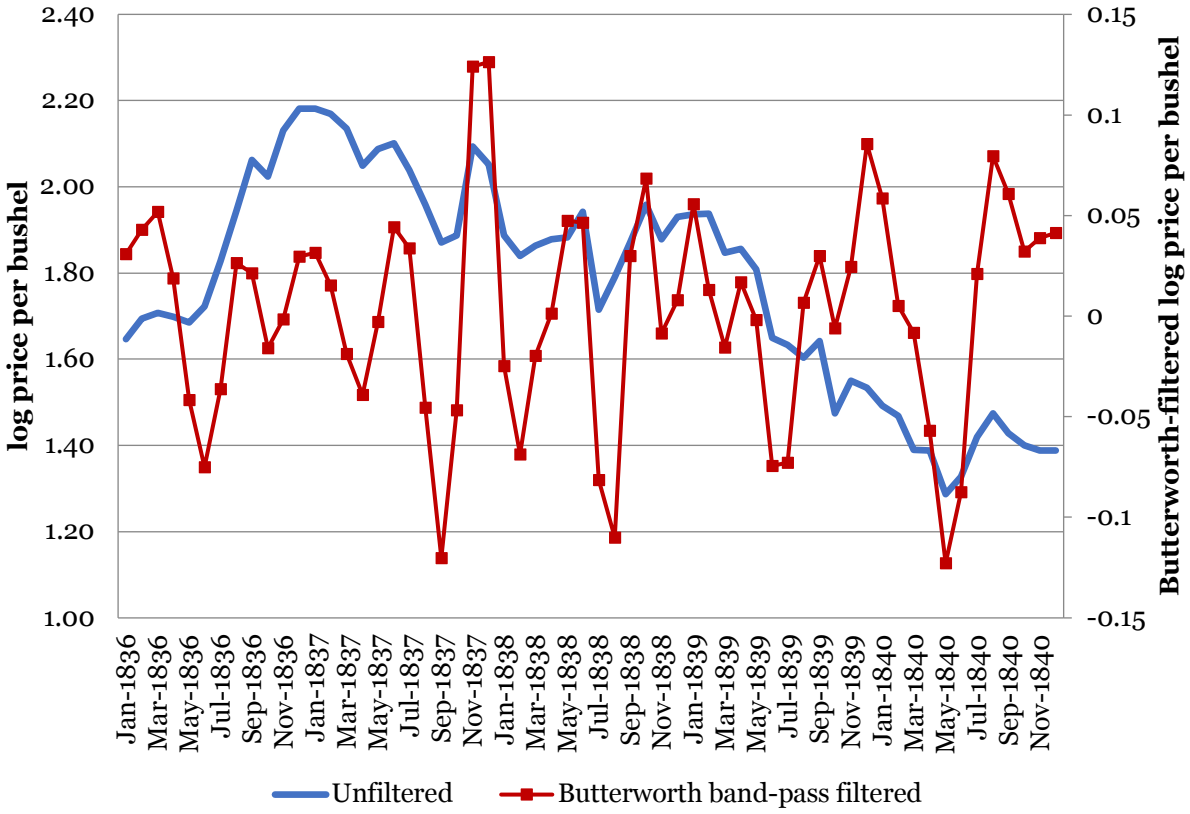
Notes: Entries are average correlations over period 1770 to 1860. Based on log grain price data. Interest rates as underlying Table A.4, column 4. Standard deviations in parentheses.

Table A. 7 Comparison of Capital Market Integration

Panel A. Difference between the bilateral correlations in Britain vs. China across distance bins				
	Wheat	Rice 1st quality	Rice 2nd quality	Millet
0-100km	0.27 (0.024)	0.15 (0.064)	0.24 (0.035)	0.26 (0.023)
100-200km	0.36 (0.021)	0.32 (0.049)	0.37 (0.026)	0.33 (0.016)
200-300km	0.44 (0.017)	0.35 (0.054)	0.38 (0.027)	0.39 (0.018)
300-400km	0.52 (0.019)	0.53 (0.037)	0.52 (0.047)	0.48 (0.021)
400-500km	0.59 (0.032)	0.49 (0.132)	0.56 (0.056)	0.53 (0.025)
500-600km	0.63 (0.061)	0.59 (0.255)	0.59 (0.153)	0.58 (0.034)
Panel B. Regression of bilateral correlations on distance				
England	0.293 (0.0223)	0.235 (0.076)	0.282 (0.043)	0.254 (0.019)
Distance	-0.082 (0.004)	-0.080 (0.012)	-0.077 (0.007)	-0.080 (0.003)
England*Distance	0.058 (0.007)	0.057 (0.025)	0.053 (0.014)	0.057 (0.006)

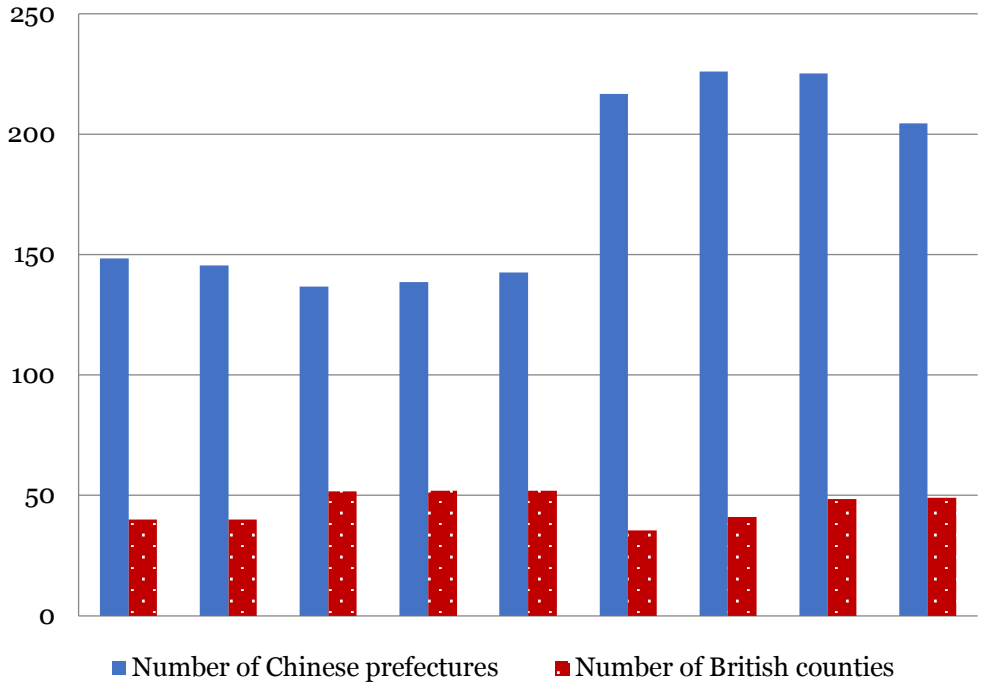
Notes: Results based on log grain price data. Figures in Panel A are obtained by regressing the bilateral correlations on the country dummy within each distance range. Panel B shows the coefficients in the regression of the bilateral correlations on the country dummy, the distance between the corresponding county-pair, and their interaction term. The coefficient of the interaction term, which is presents in the last row, indicates the heterogeneity in the impact of distance on bilateral correlations in Britain and China. Robust standard errors in parentheses.

Figure A. 1 Filtered versus unfiltered Philadelphia wheat prices, 1836-40



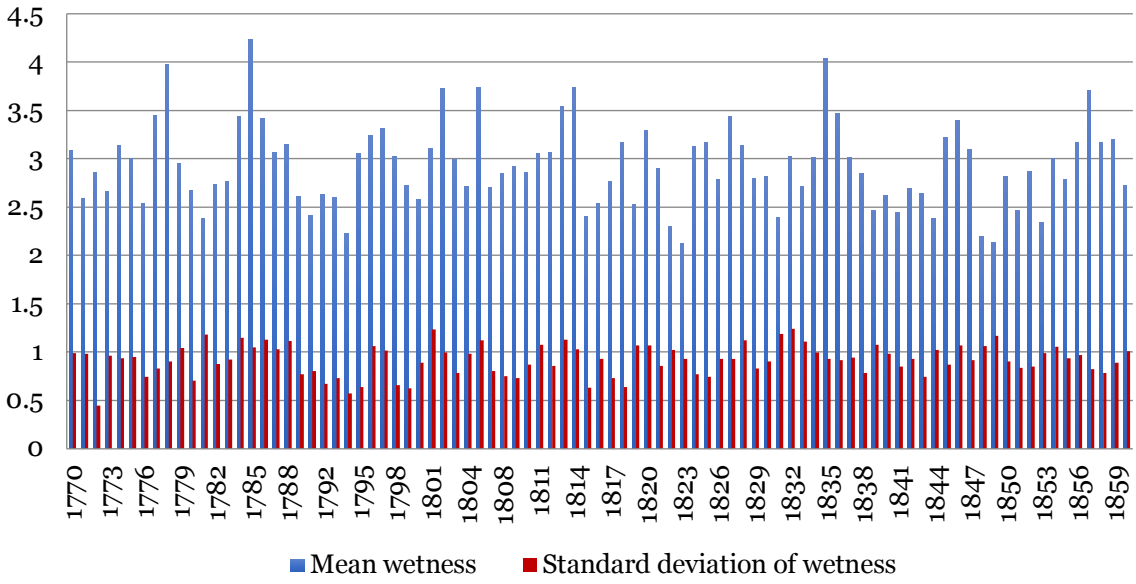
Notes: Unfiltered series is from Jacks (2006); filtered series is own calculation, see Keller, Shiue, and Wang (2018).

Figure A.2. Sample size in terms of numbers of regions



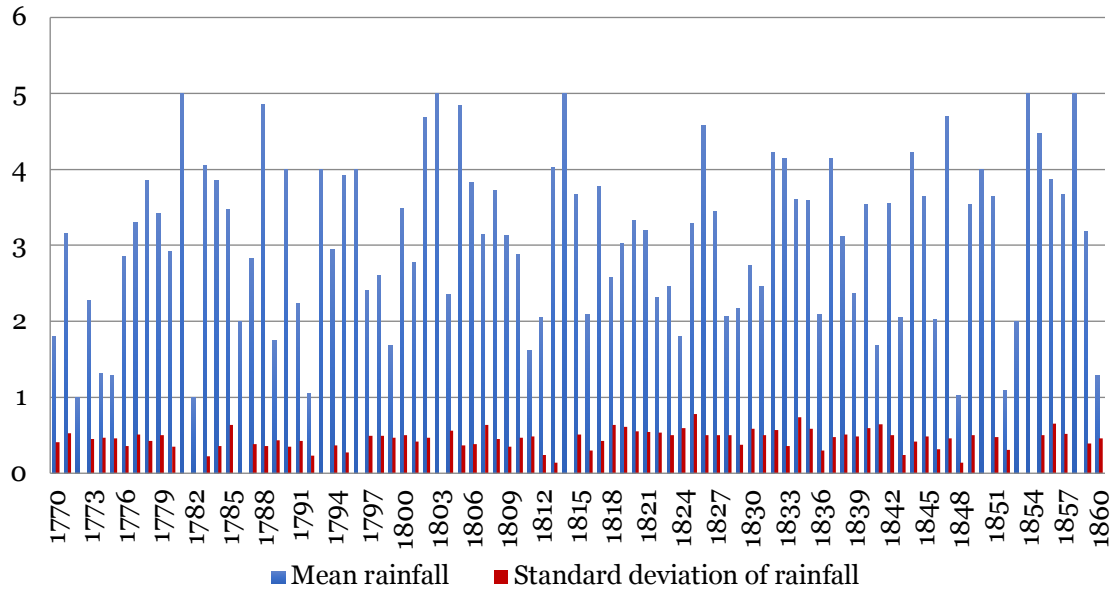
Notes: Authors' analysis, see section 3.

Figure A. 3. Climate in China: Annual wetness across regions, 1770 - 1860



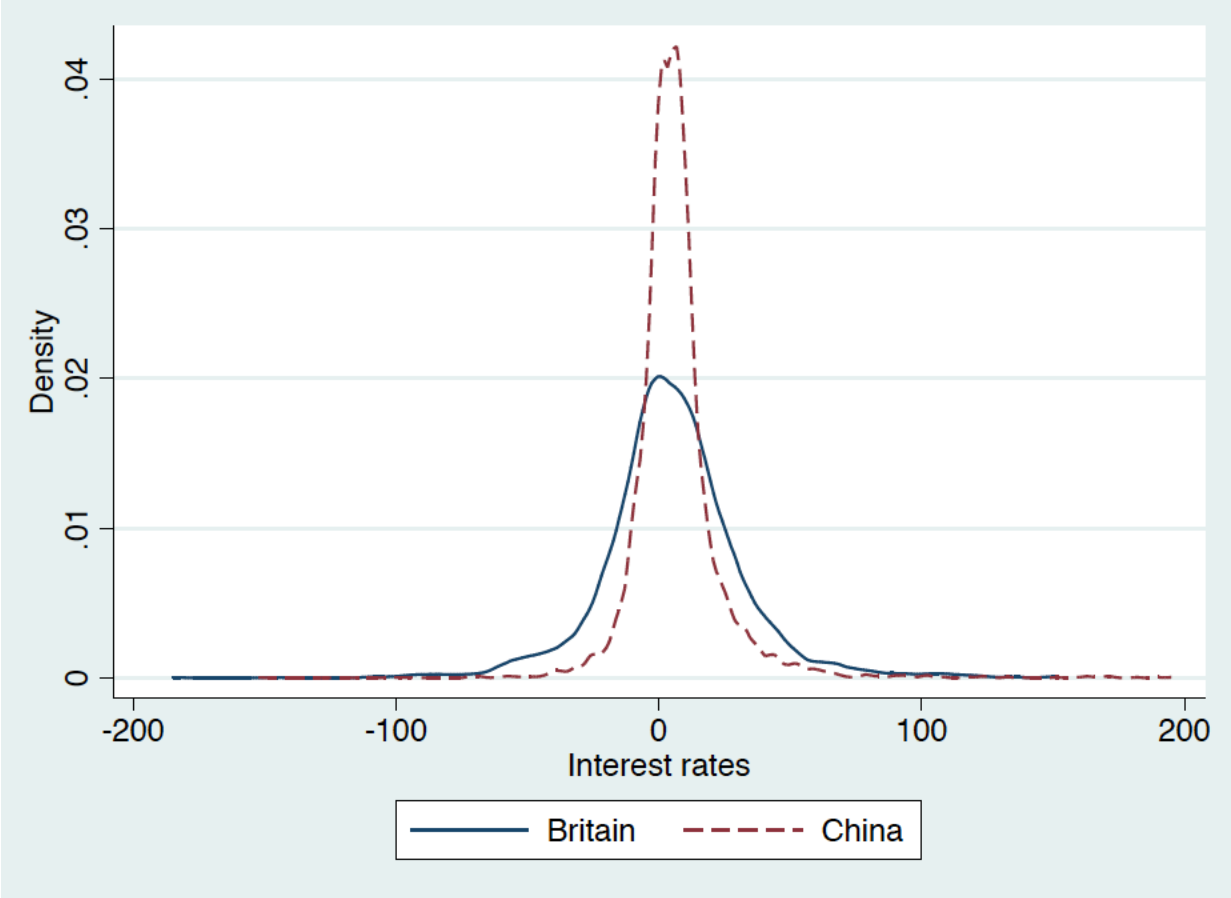
Notes: Data from State Meteorological Society (1981)

Figure A.4. Climate in Britain: Annual rainfall across regions, 1770 to 1860



Notes: Data from Pauling, Luterbacher, Casty, and Wanner (2006).

Figure A.5. The Distributions of British and Chinese Interest Rates



Notes: The graph plots the interest rates summarized in Table 3, column 4. Rates over 200 are not shown for clarity.