Online Appendix:

The secular decline of market integration during Qing China's Golden Age

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(A) Spatial classification (Chinese data)

China's geography in this article is split into broad zones south and north based on widely accepted agricultural and climatic differences (Buck, 1937) or into eight trans-provincial macro-regions based on river drainage systems (Skinner, 1977). The south-north division reflects the staple grains grown, rice in the south and wheat, millet and coarse grains in the north. Skinner's macro-regions has strongly influenced the writing of cultural, economic, regional and social history. His scheme was derived from nineteenth century data on urban and trading hierarchies and personal observations in China in the late 1940s. Despite the many criticisms (see Cartier 2002), we and Shiue and Keller (2007) – among others – have found the classification useful for organising data on grain markets into regional economies at a time when water transport was the most efficient way to move baulk commodities like grain across long distances. There were eight macro-regions in the 18 provinces of China proper, and another, the Northeast or Manchuria. These are shown below.

Table A-1 Macro-regions of China

ID	Macro-region	Chinese Name	Geographical Area
10	Northeast China (Manchuria)	东北区	not reported
20	North China	华北区	746,460 km$_2$
30	Northwest China	西北区	771,300 km$_2$
	31 Wei-Fen Basins	渭汾流域分区	
	32 Upper Huang Basin	黄河上游分区	
	33 Gansu (Hexi) Corridor	河西(甘肃)走廊分区	
40	Upper Yangtze	长江上游区	423,950 km$_2$
50	Middle Yangtze	长江中游区	699,700 km$_2$
	51 Middle Yangtze proper	长江中游分区	
	52 Gan Basin	赣江流域分区	
	53 Yuan Basin	沅江流域分区	
	54 Upper Han Basin	汉江上游分区	
60	Lower Yangtze	长江下游区	192,740 km$_2$
70	Southeast Coast	东南沿海区	226,670 km$_2$
	71 Ou-Ling Basins	瓯灵流域分区	
	72 Min Basin	闽江流域分区	
	73 Zhang-Quan	漳泉分区	
	74 Han Basin	韩江流域分区	
	75 Taiwan	台湾分区	
80	Lingnan	岭南区	424,900 km$_2$
90	Yungui	云贵区	470,570 km$_2$

Source: Skinner, G. W., Henderson, M. and Yue, Z. (2013). "A note regarding the Physiographic and Socioeconomic Macroregions of China" (http://tinyurl.com/qexyu96); the geographical areas, Skinner, 1977: 213.

Figure A-2: Skinner Macro-Regions of China

Source: Skinner, G. W., Henderson, M. and Yue, Z. (2013). "A note regarding the Physiographic and Socioeconomic Macroregions of China" (http://tinyurl.com/qexyu96).

Table A-1 Prefectural Makeup of Skinner Macro-Regions (South China)

Prefecture	Pref	Pro	Province	ID	Prefecture	Pref	Pro	Province	ID
Sizhou *#	33	1	Anhui	20	Taiping *#	36	1	Anhui	60
Chuzhou *	34	1	Anhui	20	Hezhou *#	37	1	Anhui	60
Fengyang	35	1	Anhui	20	Luzhou *#	38	1	Anhui	60
Liu'an	39	1	Anhui	20	Guangde *#	41	1	Anhui	60
Yingzhou	40	1	Anhui	20	Ningguo *	42	1	Anhui	60
Haizhou *#	1	2	Jiangsu	20	Huizhou *	43	1	Anhui	60
Huai'an	2	2	Jiangsu	20	Chizhou *#	44	1	Anhui	60
Kuizhou	108	10	Sichuan	40	Anqing *#	45	1	Anhui	60
Baoning	109	10	Sichuan	40	Yangzhou *#	3	2	Jiangsu	60
Shunqing	110	10	Sichuan	40	Tongzhou *#	4	2	Jiangsu	60
Zhongqing	111	10	Sichuan	40	Taicang *#	5	2	Jiangsu	60
Long'an	112	10	Sichuan	40	Songjiang *#	6	2	Jiangsu	60
Tongchuan	113	10	Sichuan	40	Suzhou *#	7	2	Jiangsu	60
Chengdu	114	10	Sichuan	40	Changzhou *#	8	2	Jiangsu	60
Jiading	115	10	Sichuan	40	Zhenjiang *#	9	2	Jiangsu	60
Xuzhou	116	10	Sichuan	40	Jiangning *#	10	2	Jiangsu	60
Mingyuan	117	10	Sichuan	40	Ningbo	11	11	Zhejiang	60
Yazhou	118	10	Sichuan	40	Jiaxing *#	12	11	Zhejiang	60
Huangzhou #	73	8	Hubei	51	Hangzhou *	13	11	Zhejiang	60
Wuchang #	74	8	Hubei	51	Shaoxing	14	11	Zhejiang	60
Hanyang #	75	8	Hubei	51	Jinhua	15	11	Zhejiang	60
De'an	76	8	Hubei	51	Huzhou *	17	11	Zhejiang	60
Anlu	77	8	Hubei	51	Yanzhou	18	11	Zhejiang	60
Jingzhou fu	78	8	Hubei	51	Quzhou #	19	11	Zhejiang	60
Xiangyang	79	8	Hubei	51	Taizhou	16	11	Zhejiang	71
Yichang #	80	8	Hubei	51	Wenzhou	20	11	Zhejiang	71
Yunyang	81	8	Hubei	51	Funing	21	4	Fujian	72
Shinan	82	8	Hubei	51	Fuzhou	22	4	Fujian	72
Yuezhou #	83	9	Hunan	51	Jianning	26	4	Fujian	72
Changsha #	84	9	Hunan	51	Yanping	27	4	Fujian	72
Changde #	85	9	Hunan	51	Shaowu	31	4	Fujian	72
Lizhou	86	9	Hunan	51	Xinghua	23	4	Fujian	73
Hengzhou	87	9	Hunan	51	Quanzhou	24	4	Fujian	73
Baoqing	88	9	Hunan	51	Zhangzhou	25	4	Fujian	73
Chenzhou	91	9	Hunan	51	Yongchun	28	4	Fujian	73
Guiyang	92	9	Hunan	51	Longyan	29	4	Fujian	73
Yongzhou	93	9	Hunan	51	Tingzhou	30	4	Fujian	74
Raozhou	46	3	Jiangxi	52	Chaozhou	60	5	Guangdong	74
Guangxin	47	3	Jiangxi	52	Jiayingzhou	61	5	Guangdong	74
Fuzhou	48	3	Jiangxi	52	Taiwan	32	4	Fujian	75
Nanchang	49	3	Jiangxi	52	Huizhou	62	5	Guangdong	80
Nankang	50	3	Jiangxi	52	Hanxiong	63	5	Guangdong	80
Jiujiang	51	3	Jiangxi	52	Shaozhou	64	5	Guangdong	80
Jianchang	52	3	Jiangxi	52	Guangzhou	65	5	Guangdong	80
Ningdu	53	3	Jiangxi	52	Lianzhou	66	5	Guangdong	80
Ji'an	54	3	Jiangxi	52	Zhaoqing	67	5	Guangdong	80
Linjiang	55	3	Jiangxi	52	Luoding	68	5	Guangdong	80
Ruizhou	56	3	Jiangxi	52	Gaozhou	69	5	Guangdong	80
Ganzhou	57	3	Jiangxi	52	Leizhou	70	5	Guangdong	80
Nan'an	58	3	Jiangxi	52	Lianzhou fu	71	5	Guangdong	80
Yuanzhou	59	3	Jiangxi	52	Qiongzhou	72	5	Guangdong	80
Tongren	119	6	Guizhou	53	Guilin	96	7	Guangxi	80
Sizhou	122	6	Guizhou	53	Wuzhou	97	7	Guangxi	80
Zhenyuan	123	6	Guizhou	53	Pingle	98	7	Guangxi	80
Liping	124	6	Guizhou	53	Liuzhou	99	7	Guangxi	80
Duyun	125	6	Guizhou	53	Xunzhou	100	7	Guangxi	80
Pingyue	126	6	Guizhou	53	Yulin	101	7	Guangxi	80
Chenzhou fu	89	9	Hunan	53	Nanning	102	7	Guangxi	80
Yongshun	90	9	Hunan	53	Si'en	103	7	Guangxi	80
Jingzhou	94	9	Hunan	53	Qingyuan	104	7	Guangxi	80
Yuanzhou	95	9	Hunan	53	Taiping fu	105	7	Guangxi	80

Table continued overleaf

Prefecture	Pref	Pro	Province	ID	Prefecture	Pref	Pro	Province	ID
Zhen'an	106	7	Guangxi	80	Anshun	128	6	Guizhou	90
Sicheng	107	7	Guangxi	80	Xingyi	129	6	Guizhou	90
Sinan	120	6	Guizhou	90	Guiyang	130	6	Guizhou	90
Shiqian	121	6	Guizhou	90	Dading	131	6	Guizhou	90
Zunyi	127	6	Guizhou	90					

Notes: South China prefectures by Skinner macro-region (final column, marked ID; source: see Figure A-1) and province (Pro), in order of prefecture identifier (Pref). The latter is the numbering maintained in the map of our sample in Figure 1 of the main text. * marks prefectures in the Yangzi Delta and # prefectures in the Yangzi River sample, following the classification used by Shiue and Keller (2007).

Table A-2 Prefectural Makeup of Skinner Macro-Regions (North China)

Prefecture	Pref	Pro	Province	ID	Prefecture	Pref	Pro	Province	ID
Zhangde	175	12	Henan	20	Daming	138	16	Zhili	20
Weihui	176	12	Henan	20	Baoding	139	16	Zhili	20
Huaiqing	177	12	Henan	20	Dingzhou	140	16	Zhili	20
Guide	178	12	Henan	20	Zhaozhou	141	16	Zhili	20
Kaifeng	179	12	Henan	20	Shenzhou	142	16	Zhili	20
Henan fu	180	12	Henan	20	Shunde	143	16	Zhili	20
Shanzhou	181	12	Henan	20	Xuanhua	144	16	Zhili	20
Chenzhou	182	12	Henan	20	Yizhou	145	16	Zhili	20
Xuzhou	183	12	Henan	20	Zhengding	146	16	Zhili	20
Ruzhou	184	12	Henan	20	Qingyang	200	11	Gansu	31
Guangzhou	185	12	Henan	20	Pingliang	202	11	Gansu	31
Runing	186	12	Henan	20	Qinzhou	203	11	Gansu	31
Nanyang	187	12	Henan	20	Gongchang	205	11	Gansu	31
Shangzhou	193	13	Shaanxi	20	Yulin	188	13	Shaanxi	31
Xing'an	198	13	Shaanxi	20	Suide	189	13	Shaanxi	31
Dengzhou	147	14	Shandong	20	Yan'an	190	13	Shaanxi	31
Laizhou	148	14	Shandong	20	Tongzhou	191	13	Shaanxi	31
Qingzhou	149	14	Shandong	20	Fuzhou	192	13	Shaanxi	31
Wuding	150	14	Shandong	20	Xi'an	194	13	Shaanxi	31
Yizhou	151	14	Shandong	20	Qianzhou	195	13	Shaanxi	31
Jinan	152	14	Shandong	20	Binzhou	196	13	Shaanxi	31
Tai'an	153	14	Shandong	20	Fengxiang	197	13	Shaanxi	31
Yanzhou	154	14	Shandong	20	Taiyuan	165	15	Shanxi	31
Dongchang	155	14	Shandong	20	Fenzhou	168	15	Shanxi	31
Caozhou	156	14	Shandong	20	Pingyang	170	15	Shanxi	31
Datong	157	15	Shanxi	20	Xizhou	171	15	Shanxi	31
Daizhou	159	15	Shanxi	20	Jiangzhou	172	15	Shanxi	31
Liaozhou	160	15	Shanxi	20	Jiezhou	173	15	Shanxi	31
Pingding	161	15	Shanxi	20	Puzhou	174	15	Shanxi	31
Xinzhou	162	15	Shanxi	20	Ningxia	201	11	Gansu	32
Ningwu	163	15	Shanxi	20	Lanzhou	206	11	Gansu	32
Lu'an	166	15	Shanxi	20	Xining	207	11	Gansu	32
Qinzhou	167	15	Shanxi	20	Shuoping	158	15	Shanxi	32
Zezhou	169	15	Shanxi	20	Baode	164	15	Shanxi	32
Yongping	132	16	Zhili	20	Liangzhou	208	11	Gansu	33
Zunhuazhou	133	16	Zhili	20	Ganzhou	209	11	Gansu	33
Tianjin	134	16	Zhili	20	Suzhou	210	11	Gansu	33
Hejian	135	16	Zhili	20	Anxi	211	11	Gansu	33
Jizhou	136	16	Zhili	20	Jiezhou*	204	11	Gansu	40
Guangping fu	137	16	Zhili	20	Hanzhong*	199	13	Shaanxi	54

Notes: North China prefectures by Skinner macro region (final column, marked ID; source: see Figure A-1) and province (Pro), in order of prefecture identifier (Pref). Prefecture numbering corresponds with the map of our sample in Figure 1 of the main paper. * Not included in the analysis in the main section of the paper (isolated prefectures in terms of Skinner macro-region) but included in additional analysis (e.g. convergence adopting cross-section averages for the entire crop-region of North China, results available on request).

(B) Data Quality (Chinese data)

Historians widely agree the Qing period grain data are high quality and comparable across China (Chuan and Kraus, 1975; Marks, 1998; Shiue and Keller, 2007; Wang 1978 [2003]). Errors, omissions, and misreporting from incompetence, laxness or even manipulation of prefecture officials cannot be ruled out on occasions. This is evident in prices that remain unchanged for several months. In most markets prices for grain would change from month to month through the year. The share of prices in any month that had changed compared with the previous month is reported in Tables B-1 for South China and B-2 for North China.

Over the full sample period 1740-1820, the average month-to-month change (column 1 of both tables) was the lowest in the winter months December to February, in the range 55-62 percent. The most frequent change in South China occurs over the summer and early autumn, with September averaging 79 percent. In North China, the most frequent change occurs mid-summer in which July averaged 81 percent. The frequency of change in any particular month was higher in the earlier years of the sample – 66-86 percent for rice and 77-93 percent for wheat – compared with the late eighteenth century, from 47-77 percent and 44-75 percent respectively.

We have selected 1820 as our sample end-year since we have reasons to believe the valid concerns over data quality are *much less significant before this date*. Looking at periods of unchanged grain prices in the Southern (Northern) data, in 1740-79 there are only 5 (8) occasions of *periods without changes longer than 12 months* with the longest lasting 25 (18) months, and for 1781-1820 there are 17 (28) occasions, with a maximum period of 21 (23) months. In contrast, for 1821-1860 there are 202 (158) occasions (53 of 25 months or more), with a maximum period of 72 (105) months.

Table B-3 provides detailed statistics for the distribution of periods without price changes for South and North China over three time spans (to reiterate, 1821-1860 is not part of our sample). These figures highlight the clear step-change in the data from 1820. Around 95% of all Southern Chinese rice prices would have changed in 1 to 4 months in 1740-80 and 1 to 5 months in 1781-1820, but in 1 to 9 months in 1821-1860. For Northern Chinese wheat prices, the equivalent figures are 1 to 5 months, 1 to 7 months, and 1 to 12 months.

Table B-1 Price Change Frequency (South China)

		(1) **1740-1820**	(2) **1740-1759**	(3) **1760-1779**	(4) **1780-1799**	(5) **1800-1820**
Jan	MC	0.554	*0.662*	0.573	0.488	0.468
	Obs.	7,465	1,973	2,174	1,743	1,575
Feb	MC	*0.546*	0.688	*0.549*	*0.472*	*0.443*
	Obs.	7,418	1,955	2,208	1,660	1,595
Mar	MC	0.647	0.760	0.683	0.548	0.562
	Obs.	7,574	1,998	2,262	1,641	1,673
Apr	MC	0.741	0.822	0.767	0.670	0.669
	Obs.	7,453	2,015	2,266	1,499	1,673
May	MC	0.751	0.829	0.770	0.712	0.682
	Obs.	7,375	1,982	2,222	1,512	1,659
Jun	MC	0.721	0.811	0.725	0.625	**0.692**
	Obs.	7,311	2,013	2,187	1,527	1,584
Jul	MC	0.699	0.782	0.723	0.587	0.658
	Obs.	7,263	2,041	2,207	1,410	1,605
Aug	MC	0.762	0.842	0.816	0.725	0.619
	Obs.	7,160	2,028	2,212	1,322	1,598
Sep	MC	**0.794**	**0.857**	**0.836**	**0.773**	0.676
	Obs.	7,226	1,997	2,180	1,434	1,615
Oct	MC	0.751	0.831	0.786	0.709	0.649
	Obs.	7,341	2,045	2,106	1,494	1,696
Nov	MC	0.684	0.788	0.734	0.583	0.591
	Obs.	7,479	2,104	2,088	1,648	1,639
Dec	MC	0.618	0.732	0.635	0.524	0.547
	Obs.	7,639	2,128	2,164	1,810	1,537

Notes: MC is the percentage of prefectures that experienced a price change in a given month; Obs is the number of monthly observations. Column (1) presents the results for the full 81 -ear time period, columns (2) to (5) for 20/21-year subsample periods. The month with the highest proportion of price changes over the previous month is in bold.

Table B-2 Price Change Frequency (North China)

		(1) 1740-1820	(2) 1740-1759	(3) 1760-1779	(4) 1780-1799	(5) 1800-1820
Jan	MC	0.597	0.789	0.670	0.445	0.471
	Obs.	4,774	1,111	1,426	1,218	939
Feb	MC	0.605	0.766	0.630	0.539	0.493
	Obs.	4,909	1,122	1,414	1,227	1,066
Mar	MC	0.671	0.805	0.714	0.570	0.608
	Obs.	4,957	1,141	1,432	1,225	1,079
Apr	MC	0.704	0.815	0.737	0.626	0.644
	Obs.	5,090	1,211	1,436	1,197	1,166
May	MC	0.695	0.829	0.713	0.624	0.615
	Obs.	5,047	1,187	1,483	1,124	1,173
Jun	MC	0.772	0.886	0.803	0.687	0.724
	Obs.	4,852	1,123	1,480	1,098	1,071
Jul	MC	**0.806**	**0.934**	**0.868**	**0.750**	**0.669**
	Obs.	4,750	1,101	1,456	1,019	1,094
Aug	MC	0.749	0.905	0.822	0.610	0.621
	Obs.	4,679	1,145	1,459	934	1,061
Sep	MC	0.668	0.812	0.754	0.514	0.554
	Obs.	4,730	1,148	1,470	945	1,087
Oct	MC	0.627	0.830	0.701	0.496	0.469
	Obs.	4,826	1,130	1,436	1,012	1,168
Nov	MC	0.612	0.789	0.687	0.433	0.522
	Obs.	4,868	1,123	1,465	1,068	1,132
Dec	MC	0.595	0.788	0.657	0.444	0.485
	Obs.	4,981	1,191	1,452	1,183	1,075

Notes: MC is the percentage of prefectures that experienced a price change in a given month; Obs is the number of monthly observations. Column (1) presents the results for the full 81-year time period, columns (2) to (5) for 20/21-year subsample periods. The month with the highest proportion of price changes over the previous month is in bold.

Table B-3 Length of Periods without Price Changes

Panel (a) South China

	1740-1780			1781-1820			1821-1860		
Period length (months)	**Count**	**Share**	**Cum**	**Count**	**Share**	**Cum**	**Count**	**Share**	**Cum**
1	3,841	57.2%	57.2%	4,496	54.0%	54.0%	3,462	45.1%	45.1%
2	1,450	21.6%	78.8%	1,780	21.4%	75.4%	1,539	20.1%	65.2%
3	715	10.6%	89.4%	963	11.6%	87.0%	796	10.4%	75.6%
4	324	4.8%	94.2%	477	5.7%	92.7%	449	5.9%	81.4%
5	201	3.0%	97.2%	290	3.5%	96.2%	336	4.4%	85.8%
6	79	1.2%	98.4%	146	1.8%	97.9%	249	3.2%	89.1%

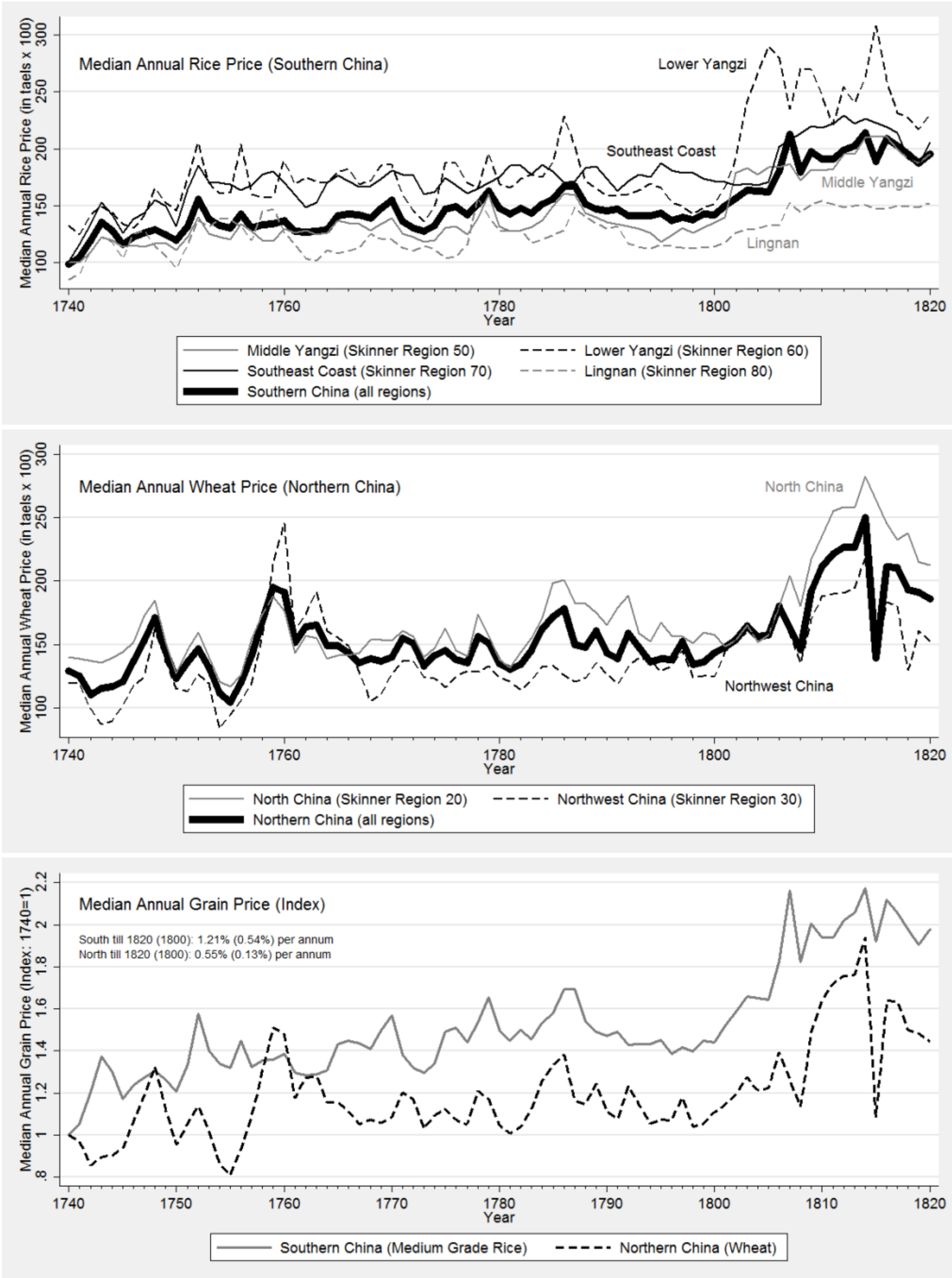
Panel (b) North China

	1740-1780			1781-1820			1821-1860		
Period length (months)	**Count**	**Share**	**Cum**	**Count**	**Share**	**Cum**	**Count**	**Share**	**Cum**
1	1,919	58.1%	58.1%	1,926	46.4%	46.4%	1,144	34.9%	34.9%
2	641	19.4%	77.5%	849	20.5%	66.9%	590	18.0%	52.9%
3	309	9.4%	86.8%	425	10.2%	77.2%	415	12.7%	65.6%
4	166	5.0%	91.9%	313	7.5%	84.7%	261	8.0%	73.6%
5	98	3.0%	94.8%	186	4.5%	89.2%	191	5.8%	79.4%
6	66	2.0%	96.8%	163	3.9%	93.1%	142	4.3%	83.7%

Notes: The table reports the frequency distribution of periods or incidences without price changes in three 40-year time spans. The period length shows how long a price stayed the same, e.g. for South China in 1740-80 3,841 prices changed from one month to the next (around 57% of all price observations in that 40-year period), 1,450 prices changed within two months (22%), and so on. Cumulatively, 90% of prices changed within 1 to 3 months during the 1740-80 and 1780-1820 periods, whereas the same cumulative share was only reached for price changes within 1 to 6 months in the 1820-60 period.

(C) Price Evolution (Chinese data)

Figure C-1: Median Price Movement for South and North China



Notes**:** A. The medium prices in the top and middle panels are taels *x 100*. B. The bottom panel presents the indices for the median grain price with a base year 1740=1.

(D) Western European Markets: Data Description and Background

The English Corn Returns

The analysis of market integration in England used the *English Corn Returns* (published in the *London Gazette*, the official government newspaper, between 1700 and 1914), specifically the weekly wheat prices from 1770 to 1820 collected and digitized by Liam Brunt and Edmund Cannon (henceforth BC). These are available from the History Data division of the UK Data Service. A detailed discussion of the *Returns* is in Brunt and Cannon (2013, 2014, and the respective supplementary appendices). Below we provide a brief overview of this resource.[1]

The British government compiled the *English Corn Returns* to monitor grain trade in England, Wales and Scotland to give effect to the Corn Laws, designed to regulate domestic grain prices from the 1690s until 1846. In the first 20 years of the *Returns* local Justices of the Peace (JPs) collected prices from between two and six market towns in their jurisdictions and each week sent these to the Treasury in London. The identity of market towns from which these prices were drawn was not stipulated and most likely differed between weekly *Returns*. From 1789 onwards a system in place for London since 1781 was extended across the nation whereby Inspectors of Corn Returns were appointed in each designated market town to collect sworn records of 'all sales' of domestic produce (including wholesale and re-sale of grain which had already been traded in the market) and each week to forward (weighted) averages of these prices to the Receiver of Corn Returns in London. The identity of the monitored market towns was now fixed[2] and their number by county varied between two in Rutland and 12 in Norfolk. The Treasury-based Receiver calculated the county averages that were published in the *London Gazette*. This feature of the English grain price data is similar to our Chinese price series: spatial aggregation leads to an average price being recorded that we use in our empirical analysis. For English counties, the average is computed from a number of market towns, for Chinese prefectures from the highest and lowest price recorded at the prefecture level.

The recorded data for the 1770-1820 period are county average prices per (Winchester) bushel of grain in shillings and pence (converted to pence for analysis). We exclude London prices. Wheat was the staple food grain for the majority of English and Welsh consumers at the time. Although grain trade volumes are widely thought to have been under-reported in the *Returns*, BC argue that monitored and non-monitored grains were identical (in terms of quality and other attributes) and likely traded at the same price. Due to a high level of on-farm storage

1 Unless indicated, all of the statements below are based on the discussion in these articles and supplements.
2 For instance, in Nottinghamshire prices were collected in Mansfield, Newark-on-Trent, Nottingham, Retford and Worksop.

trade *volumes* for wheat – and hence prices – varied little throughout the year. Figure I-1 below show that despite storage the English wheat price series still display significant seasonal patterns.[3]

Data coverage for wheat prices in the 1770-1820 subsample is 99.7% (i.e. only 0.3% of county averages are missing). Potential causes for missing records are discussed in the Supplemental Appendix of BC (2013) and issues of data accuracy in BC (2013).

BC (2013) conclude the *Returns* constitute high quality data, despite several concerns about the level, trend and fluctuation of the price series covered. Two of these concerns, the underestimation of price fluctuations over time due to quality heterogeneity, and the absence of imported grain prices (again, related to grain quality), are relevant for but unlikely to impact our analysis of price convergence significantly. Changes in grain quality are not isolated to individual markets but are common across wider regions, so our empirical approach that accounts for cross-section dependence will capture the common shocks regardless of their magnitudes. The latter concern is relevant for the study of grain consumption but not the analysis of market integration.

In contrast to what we have argued for China, the period 1770-1820 witnessed substantial infrastructure improvements in English counties, including the expansion of the canal network and improvements to the road network (BC, 2013: 112). The counties in the sample are listed in Table D-1 below. The average distance between market pairs for the English counties is 202km. This compares with 213km in the Lower Yangzi, 429km in the Middle Yangzi, 260km in the Southeast Coast and 366km in the Lingnan macroregions.

Wheat prices in the Austrian Low Countries

From the middle of the 18th century onward the central government of the Austrian Low Countries implemented a program to closely monitor local grain prices. Like in the Chinese and English cases, this effort was intended to organize an efficient food supply and move away from the past *ad hoc* management of food crises (Buyst, Dercon and Van Campenhout, 2006). Between 1765 and 1794, customs officials recorded the prevailing market prices for various agricultural products in a standardized fashion, which were reported weekly to specialized civil servants who oversaw the data collation process and compared the figures with those obtained from city governments. Although data collection was standardized, different cities used

[3] In our empirical implementation we include time (monthly) dummies to capture seasonal patterns.

different measurement systems, so the specialized civil servants converted the data to a common unit – Brabantine *stuivers* per *razier* from Brussels (49 litres).

The wheat prices used in our analysis are those observed on the first market day of the month for all markets considered, as collated and recorded in Vandenbroeke (1973). The dataset comprises 20 markets with data available for almost all of the 360 months between 1765 and 1794. Buyst et al (2006: 188) report the markets covered "compose a representative sample of all large and medium-sized grain markets in the Austrian Low Countries" at the time. The markets are listed in Table D-2 below. Following Buyst et al, we prefer wheat over rye prices, which are also available in 18 markets for the same time period, due to wheat's higher value-to-weight ratio and thus higher incentives to profit from trade and arbitrage across markets. Road infrastructure during the sample period was improved between major towns from the mid-1750s onwards such that the Austrian Low Countries had "the highest paved road density in Europe" by the early 1790s (Buyst et al, 2006: 193).

Table D-1 List of English and (one) Welsh Counties in the *English Corn Returns*

Bedfordshire	Lincolnshire
Berkshire	Middlesex
Buckinghamshire	Monmouthshire (Wales)
Cambridgeshire	Norfolk
Cheshire	Northampton
Cornwall	Northumberland
Cumberland	Nottingham
Derbyshire	Oxford
Devon	Rutland
Dorsetshire	Salop (Shropshire)
Durham	Somerset
Essex	Stafford
Gloucestershire	Suffolk
Hampshire	Surrey
Herefordshire	Sussex
Hertfordshire	Warwick
Huntingdonshire	Westmorland
Kent	Wilts
Lancashire	Worcester
Leicestershire	York

Notes: These are the 39 English and 1 Welsh counties for which data covers 1770-1820. Our sample excludes London.
Source: Note to 'History Data Service, SN 4383 Weekly British Grain Prices from the London Gazette, 1770-1820'.

Table D-2 List of Markets in the Austrian Low Countries data

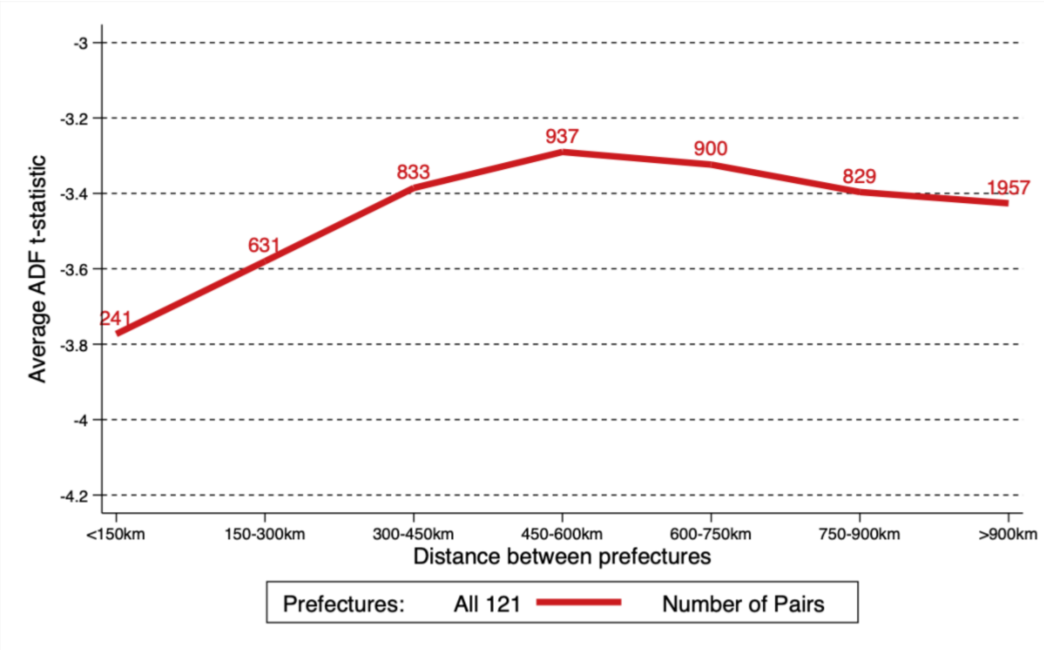
Antwerp	Lier
Ath	Mechelen
Binche	Mons (Bergen)
Bruges	Namur (Namen)
Brussels	Nieuwpoort
Charleroi	Oostende
Ghent	St. Niklaas
Ieper (Ypres)	Tienen
Kortrijk	Tournai (Doornik)
Leuven	Veurne

Notes: The 20 market locations covered in the analysis of the Austrian Low Countries. This sample includes the 18 markets analysed in Buyst, Dercon and Van Campenhout (2006) and additionally Oostende and Nieuwpoort.
Source: Vandenbroeke (1973).

(E) Market integration in South China: Cointegration (Static)

Figure E-1 presents the average ADF t-statistics from pairwise cointegration regressions for a sample of 121 South China prefectures as a function of distance intervals. Our sample is the same as the Shiue and Keller (2007) sample and we use the same distance interval classes. The results are qualitatively similar to the 'All China' results reported in Figure 4 of the Shiue and Keller paper and the interpretation is the same. Generally, the lowest (largest negative) average ADF t-statistic is found for the shortest distances, 0-150 km, which is what one would expect. The small differences in the absolute ADF t-statistics between our and the Shiue and Keller results are primarily a consequence of different data frequency.[4]

Figure E-1 – Market Integration in South China: Cointegration (Static)



***Notes*:** This plot shows the (unweighted) average ADF t-statistics for 1740-1795 for South China. We follow the Shiue and Keller (2007: Figures 3, 4 and 5) methodology for the same sample of 121 prefectures and with their distance classes. The numbers are the count of prefecture pairs which comprise each average.

[4] We used monthly price data with four lags in the ADF regression whereas Shiue and Keller used semi-annual prices and presumably fewer lags. The Shiue and Keller 'All-China' sample is the same as the 121 prefectures for South China we use for the results in Figure 1. Our full South China sample used in the rolling window implementation in the main part of the paper includes an additional 10 prefectures in Sichuan Province in the Upper Yangzi. Finally, we adopt the same outlier detection strategy as Shiue and Keller and exclude the intercept term in the Engel-Granger equation.

(F) Intuition for the Common Correlated Effects Estimation specification

We can provide the intuition for the Pesaran (2006) CCE approach in three simple steps, assuming for illustration a single factor f_t and the absence of serial correlation (a simplified version of equation (1) in the maintext):

$$\Delta\tilde{p}_{it} = \beta_i \tilde{p}_{i,t-1} + \gamma_i f_t + \varepsilon_{it}, \qquad (3')$$

First, at each point in time we take the cross-section average of equation (3'): $\Delta\bar{\tilde{p}}_t = \bar{\beta}\bar{\tilde{p}}_{t-1} + \bar{\gamma} f_t$, with $\bar{\varepsilon}_t = 0$ since ε_{it} is white noise. Next, we solve the resulting equation for the common factor: $f_t = (1/\bar{\gamma})[\Delta\bar{\tilde{p}}_t - \bar{\beta}\bar{\tilde{p}}_{t-1}]$. Finally, we plug this back into equation (3') to yield:

$$\begin{aligned} \Delta\tilde{p}_{it} &= \beta_i \tilde{p}_{i,t-1} + (\gamma_i/\bar{\gamma})\left[\Delta\bar{\tilde{p}}_t - \bar{\beta}\bar{\tilde{p}}_{t-1}\right] + \varepsilon_{it} \\ \Leftrightarrow \Delta\tilde{p}_{it} &= \beta_i \tilde{p}_{i,t-1} + \phi_i \Delta\bar{\tilde{p}}_t + \varphi_i \bar{\tilde{p}}_{t-1} + \varepsilon_{it}. \end{aligned} \qquad (3'')$$

It can be easily seen that we were able to account for the unobservable common factor $f_t$with heterogeneous factor loadings γ_i by a combination of cross-section averages of observable variables $[\Delta\bar{\tilde{p}}_t, \bar{\tilde{p}}_{t-1}]$, and heterogeneous parameters ϕ_i and φ_i.

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