

Appendix to 'Grain quality and seasonal patterns in grain prices: evidence from eighteenth-century Flanders and Northern Italy'

Wouter Ronsijn, Giulio Ongaro, and Laura Prosperi

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Appendix to ‘Grain quality and seasonal patterns in grain prices: evidence from eighteenth-century Flanders and Northern Italy’

1. Cases, data and sources

1.1 Description

The Flemish data are from Nieuwpoort, Aalst, Eeklo and Sint-Niklaas. Nieuwpoort is in coastal Flanders, where large, commercial tenant farms (> 20 ha) dominated. This was a sparsely populated region focused on large-scale grain and livestock production. Aalst is in inland Flanders, a densely populated region where larger farms (> 20 ha) co-existed with peasant smallholdings (< 5 ha). The latter coped by combining labour-intensive agricultural production with agricultural wage labour and proto-industrial linen production. Finally, Sint-Niklaas and Eeklo are both located in-between coastal and inland Flanders, with the Sint-Niklaas region particularly characterised by the predominance of medium-sized holdings (5-15 ha).¹

For Northern Italy, we use data from Milan, Romano and Udine. Milan was probably one of the largest cities in Europe in the Early Modern period.² It was the main city of the low Lombard plain, which was characterised by an agricultural structure that has been called *proto-capitalistic*, with large estates managed by *fittavoli* (tenant farmers) with a strong market-oriented character. Romano was not far from Milan but located in the Venetian province of Bergamo. This region was probably one of the most fragile in terms of food demand and supply. On the one hand, its population density remained quite high during the entire Early Modern period (around 88 inhabitants/sq. km in 1790), especially because of its advanced economic structure. On the other hand, its territory was unsuitable for agricultural production, and for survival its population depended on the import of cereals from the bordering State of Milan and, to a lesser extent, from the eastern provinces of the Republic of Venice and the Duchy of Mantua. For that reason, the grain market of Romano was an important hub, being located exactly between Bergamo, Crema, Brescia and Milan.³ Finally, Udine was located much further away, in the eastern part of the Republic of Venice, where its grain market collected almost the entire agricultural production of the large noble estates left of the Tagliamento river, in the Friuli region. The market provided supplies not only for the urban bakers and inhabitants, but also for the inhabitants of the Friulan mountains, where the agricultural production was quite poor. In other words, there was strong demand in Udine’s market, but its supply area was large enough to satisfy it.⁴

¹ Erik Thoen and Tim Soens, ‘The family or the farm: a Sophie’s choice? The late medieval crisis in Flanders’, in J. Drendel (ed.) *Crisis in the Later Middle Ages. Beyond the Postan-Duby Paradigm* (2015, Turnhout); Wouter Ronsijn, ‘Mediated and unmediated market dependence in the Flemish countryside in the nineteenth century: two paths of rural development’, *Continuity and Change*, 28 (2013)

² Luigi Faccini, *La Lombardia fra '600 e '700: riconversione economica e mutamenti sociali* (1988, Milano); Luca Mocarelli and Giulio Ongaro, *Work in Early Modern Italy, 1500–1800* (2019, London)

³ Fabrizio Costantini, *In tutto differente dalle altre città: mercato e contrabbando di grani a Bergamo in età veneta* (2016, Bergamo)

⁴ Alessio Fornasin, ‘Il mercato dei grani di Udine. Indagine per una storia dei prezzi in Friuli (secoli XVI–XVIII) (Nota di Ricerca n° 4 (1999) del Dipartimento di Scienze Statistiche dell’Università degli Studi di Udine)’, (1999); Andrea Zannini, ‘Sempre più agricola, sempre più regionale. L’economia della Repubblica di Venezia da Agnadello al Lombardo-Veneto (1509-1817)’, *Ateneo Veneto*, 9 (2010), pp. 137-171

All data are monthly observations of mean prices, except for Sint-Niklaas, for which we have weekly minimum and maximum prices, often around harvest time distinguishing between old and new grain.

1.2 Sources

Data for Flanders, Belgium:

- Eeklo, Aalst and Nieuwpoort data from STREAM (Spatio-temporal research infrastructure for early modern Flanders and Brabant), Quetelet Center, Ghent University, based on Verlinden, Craeybeckx and Scholliers.⁵
- Sint-Niklaas: data collected by Wouter Ronsijn, about the sources see Ronsijn.⁶

Data for Northern Italy:

- Milan data from Ambrosiana Library in Milan, manuscript G. 135. Data have been collected by Renzo P. Corritore and kindly made available by Luciano Maffi.
- Udine data have been collected and kindly made available by Alessio Fornasin; about the sources see Fornasin.⁷
- Romano data are in “Angelo Mai” Library, Municipal Historical Archives, section *Antico Regime-Uffici giudiziari-Giudici delle Vettovaglie*, sub-series *Calmiere dei cereali*. Romano data have been collected and kindly made available by Fabrizio Costantini; see Costantini.⁸

1.3 Transformation

To detect a seasonal pattern in grain prices, the time series first need to be detrended. We use the centred moving average of the mean log price to estimate the trend, with a span of 13 months or 53 weeks, depending on the frequency of the data. The moving average, beyond its simplicity, has the benefit that missing values can be ignored, in contrast to other methods such as the Hodrick-Prescott filter. For the monthly data, no moving averages were calculated if 1 observation was missing, but for the weekly data of Sint-Niklaas, gaps of maximum 5 weeks were ignored when calculating the moving average (in most cases, gaps were no larger than two or three weeks).

We first transformed all prices by taking their natural log. Next, these logs were detrended by subtracting from them the trend in the mean log price. This was done for all series: the minimum and maximum prices, and the old and new grain prices were all detrended using the trend in the same mean price. The result is the *deviation from trend*, showing proportionally by how much the grain price at a certain moment is above or below the trend at that time. Finally, the *first differences* were taken from the deviation from trend, showing how much the price in one month or week had dropped or risen compared to the previous month or week.

⁵ Charles Verlinden, et al. (eds), *Dokumenten voor de geschiedenis van prijzen en lonen in Vlaanderen en Brabant* (1959-1973, Brugge)

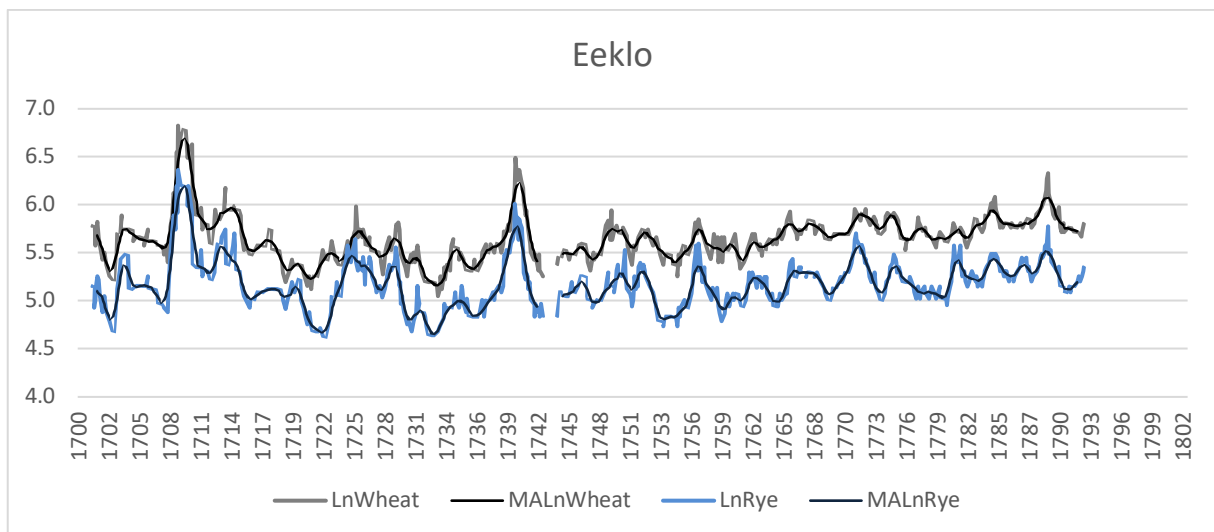
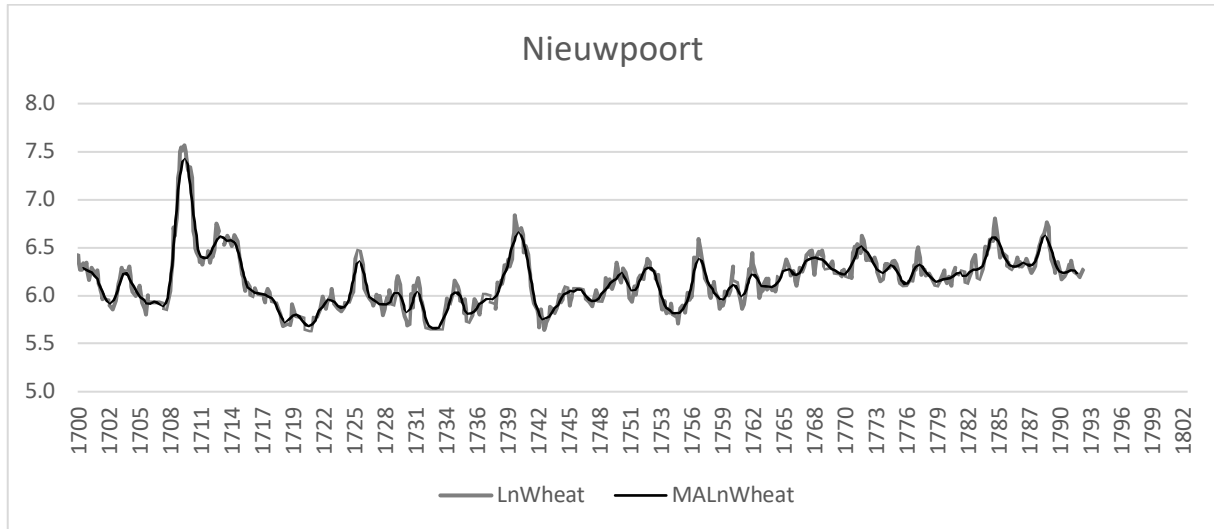
⁶ Wouter Ronsijn, ‘De donderdagmarkt van Sint-Niklaas, 1720-1900. Een reconstructie van meer dan anderhalve eeuw prijzen en handelsvolume’, *Koninklijke Oudheidkundige Kring van het Land van Waas*, 115 (2012)

⁷ Fornasin, ‘Il mercato dei grani di Udine. Indagine per una storia dei prezzi in Friuli (secoli XVI-XVIII) (Nota di Ricerca n° 4 (1999) del Dipartimento di Scienze Statistiche dell’Università degli Studi di Udine)’

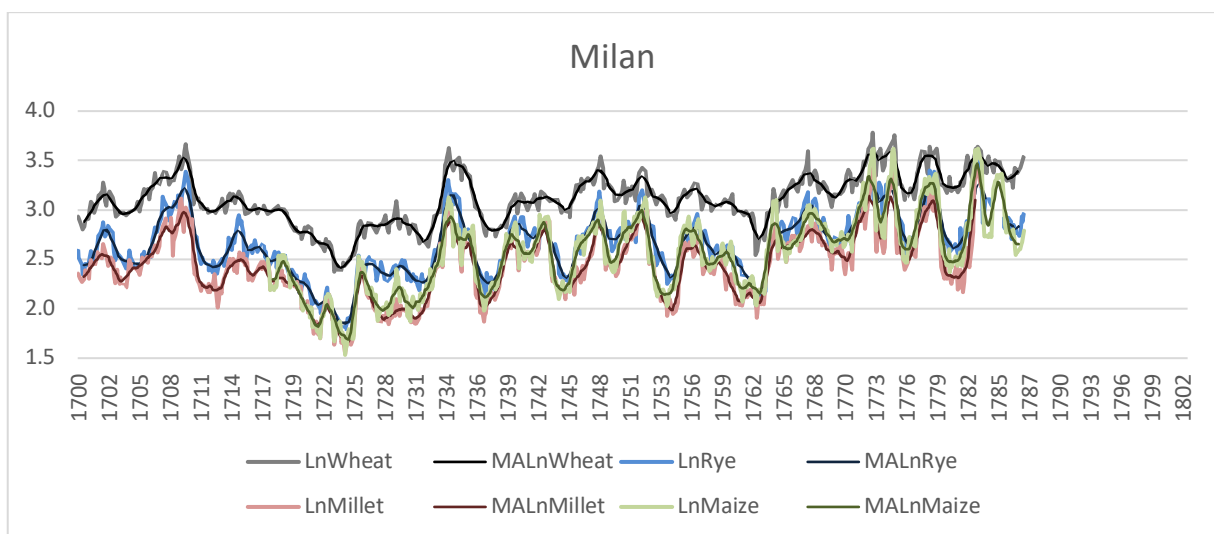
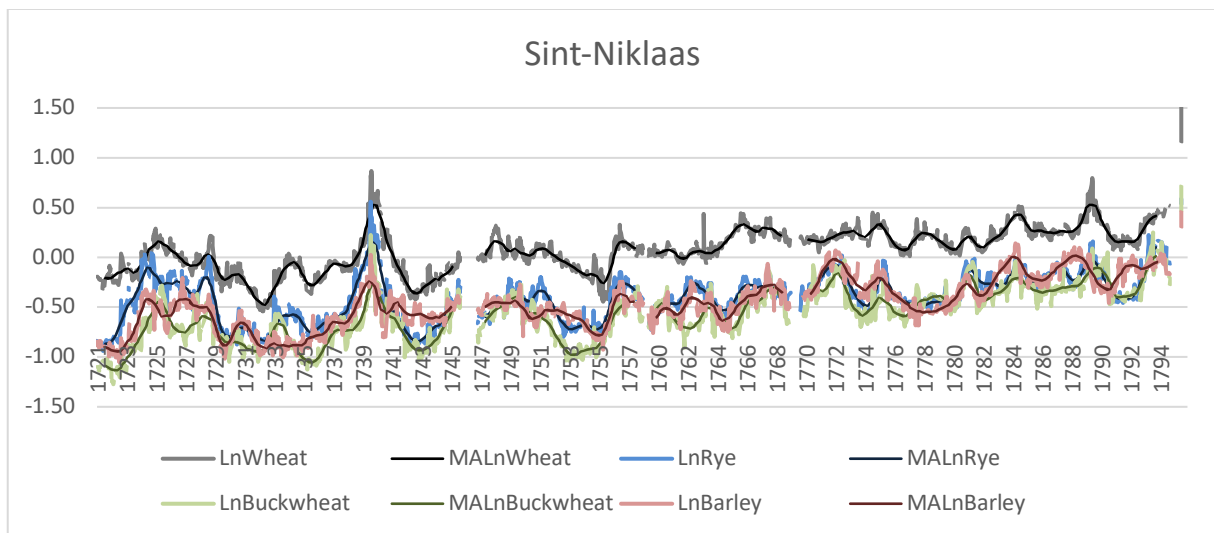
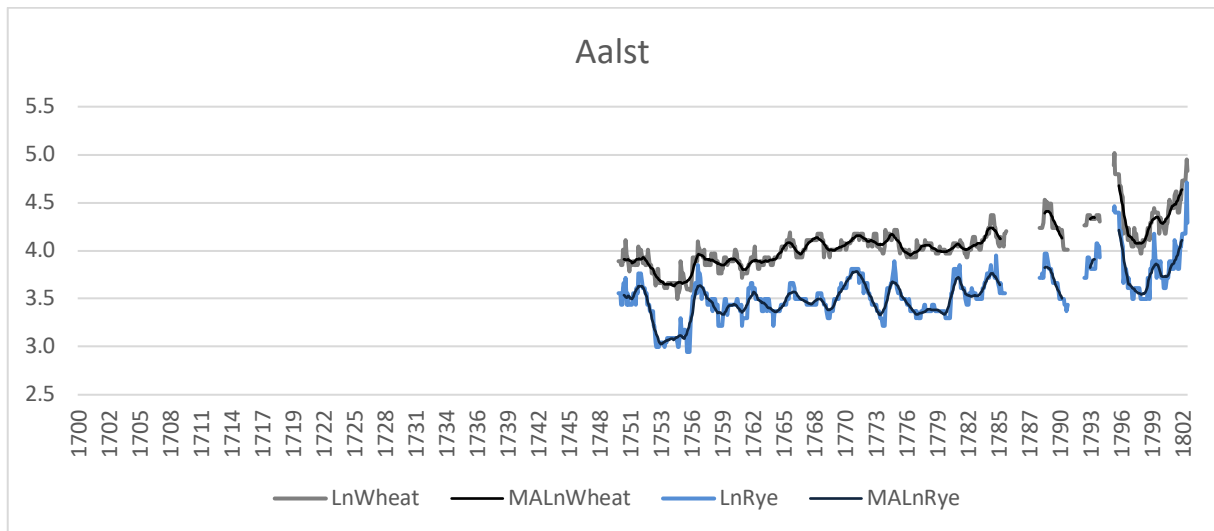
⁸ Costantini, *In tutto differente dalle altre città: mercato e contrabbando di grani a Bergamo in età veneta*

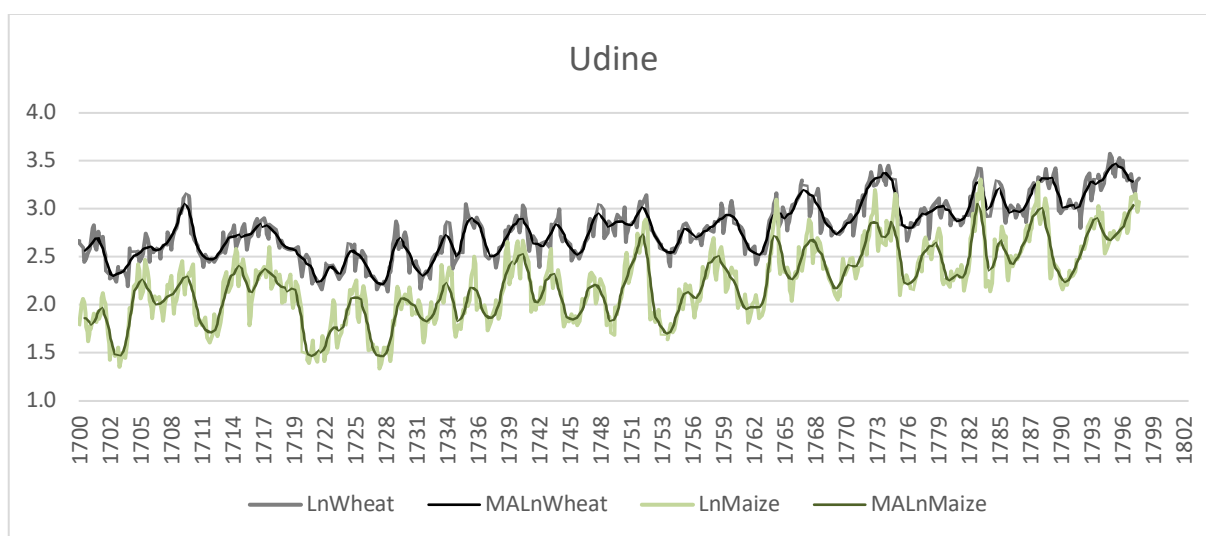
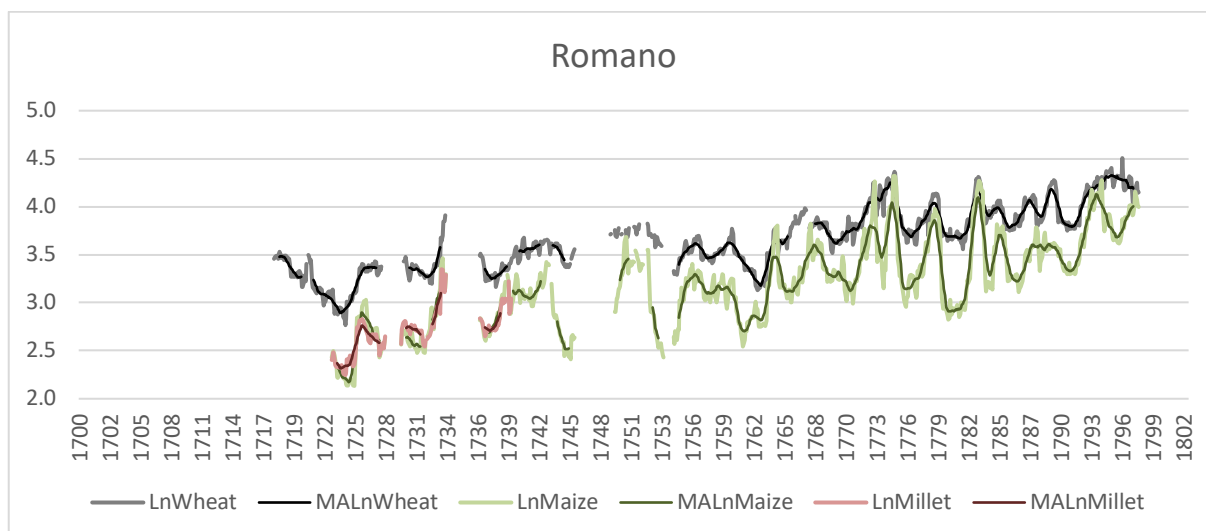
The resulting transformed time series were tested for stationarity by performing an Augmented Dickey-Fuller test. In all cases, the null hypothesis that a unit root existed in the series could be rejected. Hence we consider the transformed time series stationary.

1.4 Log-transformed prices and moving average trend



GRAIN QUALITY AND SEASONAL PATTERNS IN GRAIN PRICES





1.5 Deviation from trend: overview of cases and data

Location	Cereal	Period	Frequency	N
Nieuwpoort	Wheat	1700-1792	Monthly	1104
Eeklo	Wheat	1701-1792	Monthly	1062
	Rye	1701-1792	Monthly	1062
Aalst	Wheat	1750-1802	Monthly	516
	Rye	1750-1802	Monthly	515
Sint-Niklaas	Wheat	1722-1794	Weekly	3340
	Rye	1722-1794	Weekly	3341
	Buckwheat	1722-1794	Weekly	3325
	Barley	1722-1794	Weekly	3320
Milan	Wheat	1700-1786	Monthly	1038
	Rye	1700-1786	Monthly	1014
	Millet	1700-1782	Monthly	990
	Maize	1718-1786	Monthly	828

Romano	Wheat	1718-1797	Monthly	669
	Millet	1723-1738	Monthly	92
	Maize	1723-1797	Monthly	660
Udine	Wheat	1700-1797	Monthly	1164
	Maize	1700-1797	Monthly	1164

1.6 Deviation from trend: number of observations per month

The following tables show the number of observations per month in the deviation from trend series. Despite some series having missing values, the number of observations is distributed fairly evenly across months. Only the number of millet prices in Udine is very low.

Month	Nieuwpoort	Eeklo		Aalst	
	Wheat	Wheat	Rye	Wheat	Rye
1	92	89	89	42	42
2	92	89	89	41	41
3	92	89	89	42	42
4	92	89	89	42	41
5	92	89	89	42	42
6	92	89	89	43	43
7	92	87	87	44	44
8	92	87	87	44	44
9	92	87	87	44	44
10	92	89	89	44	44
11	92	89	89	44	44
12	92	89	89	44	44

Month	Sint-Niklaas			Rye			Buckwheat			Barley		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
1	270	258	258	271	259	259	271	259	259	271	259	259
2	252	247	247	253	247	248	253	248	248	252	247	247
3	286	281	281	286	281	281	283	278	278	283	278	278
4	292	284	284	292	284	284	288	280	280	288	280	280
5	293	286	286	292	285	285	292	285	285	292	285	285
6	277	271	271	277	271	271	274	268	268	274	268	268
7	285	280	280	285	280	280	285	280	280	284	279	279
8	288	282	283	288	282	283	285	279	280	286	279	281
9	273	264	264	273	264	264	273	264	265	272	263	263
10	294	288	288	294	288	288	292	288	288	291	287	287
11	265	258	258	265	258	258	264	258	258	263	258	258
12	265	260	260	265	260	260	265	260	260	264	259	259

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Month	Milan				Romano			Udine	
	Wheat	Rye	Millet	Maize	Wheat	Millet	Maize	Wheat	Maize
1	86	84	82	69	56	7	54	97	97
2	86	84	82	69	56	7	55	97	97
3	86	84	82	69	56	7	56	97	97
4	86	84	82	69	56	8	57	97	97
5	86	84	82	69	56	8	56	97	97
6	86	84	82	69	56	8	57	97	97
7	87	85	83	69	57	8	56	97	97
8	87	85	83	69	53	7	54	97	97
9	87	85	83	69	56	8	55	97	97
10	87	85	83	69	56	8	54	97	97
11	87	85	83	69	56	8	53	97	97
12	87	85	83	69	55	8	53	97	97

2. Seasonal patterns

2.1 Test for significance

The following tables show the regression results testing for each month whether (1) the deviations from trend and (2) the first differences of the deviations from trend are significantly different from zero:

$$P_t = c_1M_1 + c_2M_2 + \dots c_{12}M_{12} + \varepsilon_t$$

This is a regression model without constant where, for the deviation from trend, P_t is the difference between the natural log of the price at time t and the trend at time t (calculated as the 13-month or 53-week centred moving average at time t of the natural log of the mean price at time t); M_1 to M_{12} are monthly dummies; c_1 to c_{12} are the regression coefficients for each month; the error terms ε_t are heteroscedasticity and autocorrelation consistent (HAC-OLS regression). The same model is used for the first differences in the deviations from trend.

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Flanders: Wheat: Deviation from trend: HAC-OLS estimates

	Nieuwpoort			Eeklo			Aalst		
	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.
M1	-0,01139	0,00622	0,06720	-0,00430	0,00643	0,50360	-0,01254	0,00758	0,09870
M2	-0,02936	0,00545	0,00000	-0,02216	0,00618	0,00040	-0,00956	0,00613	0,11960
M3	-0,03884	0,00490	0,00000	-0,04552	0,00523	0,00000	-0,02631	0,00612	0,00000
M4	-0,03150	0,00626	0,00000	-0,02919	0,00747	0,00010	-0,01301	0,00695	0,06180
M5	-0,01426	0,00720	0,04790	-0,02212	0,00729	0,00250	-0,01266	0,01039	0,22340
M6	-0,00459	0,00918	0,61700	-0,00691	0,00903	0,44390	-0,01053	0,00948	0,26730
M7	0,01341	0,00855	0,11710	0,00882	0,00855	0,30220	0,01625	0,01014	0,10950
M8	0,02773	0,00743	0,00020	0,02565	0,00802	0,00140	0,01272	0,01165	0,27550
M9	0,01889	0,00736	0,01040	0,03650	0,00711	0,00000	0,01808	0,01000	0,07100
M10	0,05293	0,00617	0,00000	0,03873	0,00631	0,00000	0,02862	0,00890	0,00140
M11	0,02546	0,00643	0,00010	0,02318	0,00654	0,00040	0,01906	0,00795	0,01690
M12	-0,00753	0,00681	0,26940	0,00254	0,00562	0,65160	-0,01127	0,00849	0,18470
Period	1700-1792			1701-1792			1750-1802		
Frequency	Monthly			Monthly			Monthly		
N	1104			1062			516		
R-squared	0,140			0,134			0,080		

	Sint-Niklaas Mean price			Sint-Niklaas Min price			Sint-Niklaas Max price		
	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.
M1	-0,01095	0,00507	0,03100	-0,11139	0,00869	0,00000	0,07466	0,00767	0,00000
M2	-0,01288	0,00540	0,01720	-0,11086	0,00722	0,00000	0,07260	0,00763	0,00000
M3	-0,02614	0,00456	0,00000	-0,11948	0,00695	0,00000	0,05858	0,00507	0,00000
M4	-0,02409	0,00497	0,00000	-0,11204	0,00637	0,00000	0,05699	0,00457	0,00000
M5	-0,00249	0,00614	0,68460	-0,09328	0,00803	0,00000	0,07600	0,00650	0,00000
M6	0,00006	0,00837	0,99450	-0,08790	0,00926	0,00000	0,07617	0,00869	0,00000
M7	0,00774	0,00733	0,29100	-0,08443	0,00895	0,00000	0,08422	0,00741	0,00000
M8	0,02073	0,00679	0,00230	-0,07932	0,00919	0,00000	0,10427	0,00688	0,00000
M9	0,01884	0,00535	0,00040	-0,08601	0,00783	0,00000	0,10756	0,00619	0,00000
M10	0,02110	0,00490	0,00000	-0,07986	0,00609	0,00000	0,10827	0,00559	0,00000
M11	0,00870	0,00543	0,10940	-0,08620	0,00731	0,00000	0,09767	0,00537	0,00000
M12	-0,00233	0,00530	0,65970	-0,09619	0,00748	0,00000	0,08249	0,00579	0,00000
Period	1722-1794			1722-1794			1722-1794		
Frequency	Weekly			Weekly			Weekly		
N	3340			3259			3260		
R-squared	0,068			0,031			0,067		

Flanders: Rye: Deviation from trend: HAC-OLS estimates

	Nieuwpoort	Eeklo			Aalst		
		Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.
M1		0,01071	0,00696	0,12390	0,01730	0,01087	0,11220
M2		-0,01048	0,00658	0,11180	0,01539	0,00813	0,05890
M3		-0,03049	0,00612	0,00000	-0,01649	0,00924	0,07470
M4		-0,02455	0,00821	0,00290	-0,01378	0,01151	0,23150
M5		0,00816	0,00964	0,39740	-0,01185	0,01343	0,37800
M6		0,01406	0,01043	0,17770	-0,00071	0,01652	0,96570
M7		0,00699	0,00970	0,47150	-0,00629	0,01428	0,65970
M8		0,00614	0,00905	0,49770	-0,02700	0,01174	0,02190
M9		-0,01990	0,00604	0,00100	-0,01710	0,00987	0,08400
M10		0,00381	0,00624	0,54190	0,00762	0,01079	0,48080
M11		0,01852	0,00744	0,01290	0,02546	0,01060	0,01660
M12		0,01841	0,00730	0,01180	0,01860	0,00795	0,01960
Period	No data	1701-1792			1750-1802		
Frequency		Monthly			Monthly		
N		1062			515		
R-squared		0,046			0,047		

	Sint-Niklaas Mean price			Sint-Niklaas Min price			Sint-Niklaas Max price		
	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.
M1	0,00410	0,00504	0,41580	-0,03912	0,00599	0,00000	0,04366	0,00495	0,00000
M2	-0,01158	0,00499	0,02030	-0,05308	0,00578	0,00000	0,02844	0,00485	0,00000
M3	-0,02768	0,00592	0,00000	-0,06785	0,00654	0,00000	0,01234	0,00601	0,04010
M4	-0,02373	0,00600	0,00010	-0,06274	0,00651	0,00000	0,01699	0,00584	0,00370
M5	0,00668	0,00751	0,37340	-0,03328	0,00754	0,00000	0,04454	0,00789	0,00000
M6	0,01068	0,00899	0,23510	-0,02877	0,00936	0,00210	0,04877	0,00898	0,00000
M7	-0,00825	0,00717	0,24980	-0,05572	0,00788	0,00000	0,03419	0,00709	0,00000
M8	-0,00653	0,00576	0,25650	-0,06777	0,00662	0,00000	0,05194	0,00655	0,00000
M9	-0,01759	0,00506	0,00050	-0,07314	0,00579	0,00000	0,03435	0,00560	0,00000
M10	0,02364	0,00550	0,00000	-0,02348	0,00657	0,00040	0,06740	0,00549	0,00000
M11	0,03293	0,00640	0,00000	-0,00960	0,00742	0,19590	0,07529	0,00604	0,00000
M12	0,02149	0,00624	0,00060	-0,01915	0,00708	0,00690	0,06103	0,00597	0,00000
Period	1722-1794			1722-1794			1722-1794		
Frequency	Weekly			Weekly			Weekly		
N	3341			3259			3261		
R-squared	0,079			0,081			0,076		

APPENDIX

Flanders: Buckwheat: Deviation from trend: HAC-OLS estimates

	Sint-Niklaas			Sint-Niklaas			Sint-Niklaas		
	Mean price			Min price			Max price		
	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.
M1	-0,00545	0,00477	0,25390	-0,04684	0,00572	0,00000	0,03289	0,00478	0,00000
M2	0,00443	0,00462	0,33730	-0,03356	0,00550	0,00000	0,04194	0,00451	0,00000
M3	0,00668	0,00505	0,18580	-0,03194	0,00569	0,00000	0,04336	0,00505	0,00000
M4	0,01461	0,00539	0,00680	-0,02419	0,00612	0,00010	0,05077	0,00552	0,00000
M5	0,03866	0,00708	0,00000	0,00079	0,00754	0,91640	0,07457	0,00738	0,00000
M6	0,03316	0,00684	0,00000	-0,00400	0,00731	0,58400	0,06797	0,00693	0,00000
M7	0,05099	0,00711	0,00000	0,01311	0,00728	0,07170	0,08741	0,00705	0,00000
M8	0,05654	0,00890	0,00000	0,01627	0,00954	0,08810	0,09493	0,00882	0,00000
M9	-0,04577	0,00745	0,00000	-0,09894	0,00783	0,00000	0,00041	0,00795	0,95880
M10	-0,06932	0,00590	0,00000	-0,11842	0,00712	0,00000	-0,02261	0,00545	0,00000
M11	-0,05386	0,00583	0,00000	-0,10004	0,00703	0,00000	-0,00923	0,00563	0,10150
M12	-0,02564	0,00508	0,00000	-0,06933	0,00624	0,00000	0,01583	0,00506	0,00180
Period	1722-1794			1722-1794			1722-1794		
Frequency	Weekly			Weekly			Weekly		
N	3325			3247			3249		
R-squared	0,278			0,279			0,242		

Flanders: Barley: Deviation from trend: HAC-OLS estimates

	Sint-Niklaas			Sint-Niklaas			Sint-Niklaas		
	Mean price			Min price			Max price		
	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.
M1	0,00154	0,00467	0,74240	-0,06237	0,00550	0,00000	0,06104	0,00500	0,00000
M2	0,00326	0,00483	0,49960	-0,06067	0,00590	0,00000	0,06277	0,00540	0,00000
M3	-0,00628	0,00516	0,22320	-0,06876	0,00633	0,00000	0,05256	0,00559	0,00000
M4	-0,00189	0,00582	0,74530	-0,06547	0,00665	0,00000	0,05828	0,00610	0,00000
M5	0,01346	0,00742	0,06980	-0,04891	0,00827	0,00000	0,06923	0,00757	0,00000
M6	0,02429	0,00800	0,00240	-0,03784	0,00870	0,00000	0,08096	0,00830	0,00000
M7	0,00907	0,00753	0,22840	-0,05767	0,00863	0,00000	0,06775	0,00767	0,00000
M8	-0,00081	0,00681	0,90590	-0,08838	0,00810	0,00000	0,07780	0,00847	0,00000
M9	-0,02588	0,00597	0,00000	-0,10427	0,00729	0,00000	0,04579	0,00692	0,00000
M10	-0,00896	0,00526	0,08830	-0,07783	0,00639	0,00000	0,05159	0,00554	0,00000
M11	-0,00857	0,00553	0,12110	-0,07605	0,00621	0,00000	0,05259	0,00588	0,00000
M12	0,00397	0,00522	0,44670	-0,05865	0,00576	0,00000	0,06209	0,00557	0,00000
Period	1722-1794			1722-1794			1722-1794		
Frequency	Weekly			Weekly			Weekly		
N	3320			3242			3244		
R-squared	0,038			0,053			0,024		

Northern Italy: Wheat: Deviation from trend: HAC-OLS estimates

	Milan			Romano Price			Udine		
	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.
M1	0,02879	0,00404	0,00000	0,02255	0,00593	0,00020	0,03044	0,00466	0,00000
M2	0,03683	0,00436	0,00000	0,04444	0,00670	0,00000	0,03735	0,00517	0,00000
M3	0,03775	0,00469	0,00000	0,03433	0,00684	0,00000	0,04557	0,00568	0,00000
M4	0,03030	0,00543	0,00000	0,01977	0,00827	0,01710	0,04192	0,00667	0,00000
M5	0,01055	0,00727	0,14690	0,01046	0,01114	0,34790	0,02523	0,00772	0,00110
M6	-0,00256	0,00898	0,77530	0,00560	0,01190	0,63810	0,01017	0,00821	0,21580
M7	-0,02845	0,00630	0,00000	-0,04338	0,00915	0,00000	-0,10622	0,00736	0,00000
M8	-0,05694	0,00629	0,00000	-0,05467	0,00992	0,00000	-0,07172	0,00634	0,00000
M9	-0,04953	0,00623	0,00000	-0,03921	0,00810	0,00000	-0,03551	0,00674	0,00000
M10	-0,02645	0,00485	0,00000	-0,01403	0,00694	0,04360	0,00305	0,00624	0,62440
M11	0,00536	0,00403	0,18350	-0,00454	0,00600	0,44950	0,00700	0,00531	0,18750
M12	0,01524	0,00452	0,00080	0,00439	0,00638	0,49120	0,01113	0,00414	0,00730
Period	1700-1786			1718-1797			1700-1797		
Frequency	Monthly			Monthly			Monthly		
N	1038			669			1164		
R-squared	0,263			0,191			0,351		

Northern Italy: Rye: Deviation from trend: HAC-OLS estimates

	Milan			Romano	Udine
	Coefficient	Std. E.	Prob.		
M1	0,05893	0,00502	0,00000		
M2	0,06162	0,00569	0,00000		
M3	0,05697	0,00698	0,00000		
M4	0,02187	0,00795	0,00600		
M5	-0,01056	0,00957	0,27020		
M6	-0,05662	0,00929	0,00000		
M7	-0,08831	0,00901	0,00000		
M8	-0,07235	0,00679	0,00000		
M9	-0,04565	0,00695	0,00000		
M10	-0,00559	0,00661	0,39790		
M11	0,02732	0,00541	0,00000		
M12	0,05086	0,00547	0,00000		
Period	1700-1786			No data	No data
Frequency	Monthly				
N	1014				
R-squared	0,386				

APPENDIX

Northern Italy: Millet: Deviation from trend: HAC-OLS estimates

	Milan			Romano	Price		Udine
	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.	
M1	0,00884	0,00656	0,17770	0,03108	0,01539	0,04670	
M2	0,02175	0,00528	0,00000	0,01722	0,00799	0,03410	
M3	0,03030	0,00689	0,00000	0,00093	0,01711	0,95690	
M4	0,01836	0,00822	0,02570	0,00102	0,01809	0,95530	
M5	0,00166	0,01084	0,87870	-0,03329	0,03058	0,27960	
M6	-0,00785	0,01311	0,54930	-0,01712	0,02677	0,52430	
M7	0,01251	0,01258	0,32030	-0,04149	0,02164	0,05870	
M8	0,02465	0,00996	0,01350	-0,04040	0,01924	0,03890	
M9	-0,03892	0,01097	0,00040	0,00248	0,02218	0,91120	
M10	-0,05356	0,01119	0,00000	-0,02889	0,02453	0,24240	
M11	-0,02188	0,00938	0,01980	0,00559	0,01935	0,77350	
M12	0,00114	0,00840	0,89230	0,01937	0,01916	0,31500	
Period	1700-1782			1723-1738			No data
Frequency	Monthly			Monthly			
N	990			92			
R-squared	0,075			0,152			

Northern Italy: Maize: Deviation from trend: HAC-OLS estimates

	Milan			Romano	Price		Udine		
	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.
M1	0,00226	0,00662	0,73270	-0,03874	0,00778	0,00000	-0,05330	0,00699	0,00000
M2	0,02195	0,00638	0,00060	-0,01082	0,00764	0,15720	-0,02244	0,00697	0,00130
M3	0,03793	0,00753	0,00000	0,00046	0,00956	0,96190	0,02598	0,00846	0,00220
M4	0,03070	0,01200	0,01070	0,00602	0,01372	0,66080	0,03433	0,00988	0,00050
M5	0,01853	0,01482	0,21150	0,00834	0,01837	0,65000	0,06663	0,00994	0,00000
M6	0,01391	0,01675	0,40680	0,03431	0,02048	0,09430	0,09991	0,01070	0,00000
M7	0,03335	0,01554	0,03220	0,06909	0,01983	0,00050	0,12149	0,01038	0,00000
M8	0,00428	0,00960	0,65620	0,06106	0,01315	0,00000	0,10573	0,00936	0,00000
M9	-0,06048	0,01276	0,00000	0,02236	0,01312	0,08870	-0,02144	0,01014	0,03460
M10	-0,06977	0,01219	0,00000	-0,05463	0,01602	0,00070	-0,13076	0,01036	0,00000
M11	-0,02936	0,00935	0,00170	-0,06763	0,01473	0,00000	-0,13241	0,00851	0,00000
M12	-0,00585	0,00892	0,51210	-0,05114	0,01063	0,00000	-0,09612	0,00594	0,00000
Period	1718-1786			1723-1797			1700-1797		
Frequency	Monthly			Monthly			Monthly		
N	828			660			1164		
R-squared	0,114			0,138			0,485		

Flanders: Wheat: First differences of deviation from trend: HAC-OLS estimates

	Nieuwpoort			Eeklo			Aalst		
	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.
M1	-0,00387	0,00510	0,44820	-0,00684	0,00478	0,15250	0,00115	0,01123	0,91850
M2	-0,01797	0,00422	0,00000	-0,01786	0,00823	0,03030	0,00549	0,00707	0,43750
M3	-0,00948	0,00464	0,04110	-0,02336	0,00766	0,00240	-0,02026	0,00616	0,00110
M4	0,00734	0,00485	0,13060	0,01632	0,00876	0,06260	0,01330	0,00688	0,05370
M5	0,01724	0,00581	0,00310	0,00707	0,00707	0,31770	-0,00261	0,00966	0,78720
M6	0,00967	0,00636	0,12870	0,01521	0,00716	0,03390	0,00236	0,00585	0,68660
M7	0,01739	0,00531	0,00110	0,01663	0,00800	0,03790	0,02617	0,00834	0,00180
M8	0,01432	0,00632	0,02360	0,01683	0,01084	0,12070	-0,00353	0,01369	0,79660
M9	-0,00884	0,00570	0,12130	0,01085	0,00705	0,12420	0,00537	0,01148	0,64050
M10	0,03404	0,00699	0,00000	0,00107	0,00640	0,86690	0,01054	0,00979	0,28210
M11	-0,02748	0,00573	0,00000	-0,01556	0,00595	0,00910	-0,00956	0,00742	0,19800
M12	-0,03298	0,00582	0,00000	-0,02064	0,00584	0,00040	-0,03033	0,00823	0,00030
Period	1700-1792			1701-1792			1750-1802		
Frequency	Monthly			Monthly			Monthly		
N	1103			1060			512		
R-squared	0,114			0,046			0,0560		

	Sint-Niklaas Mean price			Sint-Niklaas Min price			Sint-Niklaas Max price		
	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.
M1	-0,00288	0,00165	0,08080	-0,00251	0,00208	0,22790	-0,00095	0,00261	0,71510
M2	-0,00025	0,00154	0,87080	-0,00056	0,00189	0,76650	-0,00053	0,00185	0,77370
M3	-0,00240	0,00151	0,11180	-0,00294	0,00201	0,14390	-0,00152	0,00182	0,40440
M4	0,00424	0,00192	0,02720	0,00762	0,00221	0,00060	0,00190	0,00252	0,45020
M5	0,00428	0,00193	0,02700	0,00287	0,00244	0,24000	0,00401	0,00195	0,04000
M6	-0,00224	0,00140	0,11010	-0,00229	0,00188	0,22240	-0,00274	0,00147	0,06250
M7	0,00588	0,00219	0,00730	0,00551	0,00236	0,01970	0,00544	0,00235	0,02100
M8	-0,00418	0,00205	0,04140	-0,00821	0,00299	0,00610	0,00069	0,00202	0,73450
M9	0,00378	0,00183	0,03910	0,00458	0,00267	0,08650	0,00188	0,00193	0,32780
M10	-0,00142	0,00164	0,38570	0,00040	0,00241	0,86830	-0,00126	0,00174	0,46720
M11	-0,00509	0,00173	0,00330	-0,00334	0,00215	0,12080	-0,00440	0,00180	0,01440
M12	-0,00123	0,00174	0,47770	-0,00133	0,00203	0,51310	-0,00283	0,00230	0,21860
Period	1722-1794			1722-1794			1722-1794		
Frequency	Weekly			Weekly			Weekly		
N	3218			3114			3116		
R-squared	0,009			0,008			0,004		

APPENDIX

Flanders: Rye: First differences of deviation from trend: HAC-OLS estimates

	Nieuwpoort	Eeklo			Aalst		
		Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.
M1		-0,00770	0,00592	0,19390	-0,00480	0,00903	0,59540
M2		-0,02119	0,00722	0,00340	-0,00074	0,01102	0,94640
M3		-0,02001	0,00749	0,00770	-0,03666	0,00852	0,00000
M4		0,00594	0,00657	0,36620	0,00097	0,01183	0,93480
M5		0,03271	0,00876	0,00020	-0,00197	0,01284	0,87820
M6		0,00591	0,00620	0,34090	0,00813	0,01015	0,42370
M7		-0,00651	0,00900	0,46990	-0,00738	0,00744	0,32160
M8		-0,00085	0,01125	0,93980	-0,02071	0,01789	0,24770
M9		-0,02604	0,00950	0,00630	0,00990	0,01229	0,42070
M10		0,02200	0,00547	0,00010	0,02471	0,01031	0,01690
M11		0,01472	0,00693	0,03400	0,01785	0,01086	0,10090
M12		-0,00012	0,00582	0,98420	-0,00687	0,01084	0,52660
Period	No data	1701-1792			1750-1802		
Frequency		Monthly			Monthly		
N		1060			511		
R-squared		0,053			0,044		

	Sint-Niklaas Mean price			Sint-Niklaas Min price			Sint-Niklaas Max price		
	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.
M1	-0,00548	0,00129	0,00000	-0,00581	0,00156	0,00020	-0,00482	0,00147	0,00110
M2	-0,00248	0,00159	0,11890	-0,00257	0,00187	0,16940	-0,00277	0,00167	0,09770
M3	-0,00222	0,00154	0,14960	-0,00177	0,00165	0,28200	-0,00254	0,00160	0,11080
M4	0,00223	0,00189	0,23670	0,00243	0,00200	0,22370	0,00145	0,00198	0,46320
M5	0,00923	0,00205	0,00000	0,00960	0,00221	0,00000	0,00873	0,00210	0,00000
M6	-0,00462	0,00243	0,05730	-0,00397	0,00270	0,14170	-0,00440	0,00245	0,07260
M7	0,00292	0,00257	0,25500	-0,00152	0,00256	0,55320	0,00579	0,00300	0,05360
M8	-0,00957	0,00276	0,00050	-0,00948	0,00319	0,00300	-0,00803	0,00300	0,00740
M9	0,00403	0,00193	0,03700	0,00513	0,00317	0,10520	0,00178	0,00197	0,36700
M10	0,01029	0,00210	0,00000	0,01051	0,00265	0,00010	0,00887	0,00206	0,00000
M11	-0,00352	0,00183	0,05390	-0,00188	0,00253	0,45730	-0,00447	0,00185	0,01550
M12	-0,00043	0,00188	0,81870	-0,00161	0,00234	0,49090	-0,00057	0,00183	0,75540
Period	1722-1794			1722-1794			1722-1794		
Frequency	Weekly			Weekly			Weekly		
N	3218			3112			3116		
R-squared	0,022			0,016			0,016		

Flanders: Buckwheat: First differences of deviation from trend: HAC-OLS estimates

	Sint-Niklaas: Mean price			Sint-Niklaas: Min price			Sint-Niklaas: Max price		
	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.
M1	0,00358	0,00139	0,01020	0,00160	0,00192	0,40380	0,00395	0,00147	0,00730
M2	0,00252	0,00148	0,08770	0,00371	0,00199	0,06220	0,00192	0,00147	0,19090
M3	-0,00027	0,00125	0,82980	-0,00036	0,00149	0,80910	-0,00021	0,00129	0,86970
M4	0,00439	0,00161	0,00640	0,00419	0,00179	0,01940	0,00436	0,00159	0,00630
M5	0,00478	0,00200	0,01680	0,00505	0,00218	0,02040	0,00512	0,00212	0,01560
M6	-0,00306	0,00198	0,12230	-0,00265	0,00224	0,23670	-0,00308	0,00202	0,12660
M7	0,01069	0,00277	0,00010	0,01058	0,00306	0,00060	0,01059	0,00286	0,00020
M8	-0,01171	0,00268	0,00000	-0,01397	0,00289	0,00000	-0,01007	0,00256	0,00010
M9	-0,02799	0,00390	0,00000	-0,03028	0,00447	0,00000	-0,02914	0,00413	0,00000
M10	0,00789	0,00215	0,00020	0,00900	0,00239	0,00020	0,00855	0,00212	0,00010
M11	0,00029	0,00177	0,86890	-0,00007	0,00189	0,96930	-0,00046	0,00214	0,83130
M12	0,00785	0,00163	0,00000	0,00924	0,00195	0,00000	0,00784	0,00173	0,00000
Period	1722-1794			1722-1794			1722-1794		
Frequency	Weekly			Weekly			Weekly		
N	3199			3100			3104		
R-squared	0,055			0,047			0,052		

Flanders: Barley: First differences of deviation from trend: HAC-OLS estimates

	Sint-Niklaas: Mean price			Sint-Niklaas: Min price			Sint-Niklaas: Max price		
	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.
M1	-0,00065	0,00150	0,66520	-0,00044	0,00193	0,81890	-0,00142	0,00176	0,42140
M2	0,00113	0,00147	0,44290	0,00100	0,00198	0,61430	0,00187	0,00157	0,23520
M3	-0,00186	0,00141	0,18850	-0,00142	0,00185	0,44260	-0,00216	0,00140	0,12160
M4	0,00272	0,00177	0,12370	0,00222	0,00204	0,27810	0,00261	0,00190	0,16980
M5	0,00478	0,00191	0,01250	0,00637	0,00227	0,00490	0,00445	0,00197	0,02390
M6	-0,00007	0,00183	0,96870	-0,00195	0,00220	0,37730	0,00092	0,00194	0,63660
M7	-0,00163	0,00217	0,45260	-0,00396	0,00286	0,16700	-0,00088	0,00217	0,68700
M8	-0,00633	0,00231	0,00620	-0,01261	0,00356	0,00040	-0,00214	0,00263	0,41630
M9	-0,00197	0,00235	0,40050	0,00232	0,00299	0,43730	-0,00634	0,00331	0,05570
M10	0,00275	0,00234	0,24000	0,00252	0,00287	0,38040	0,00298	0,00248	0,23060
M11	-0,00286	0,00165	0,08370	-0,00287	0,00234	0,22110	-0,00331	0,00170	0,05170
M12	0,00463	0,00147	0,00160	0,00652	0,00194	0,00080	0,00462	0,00164	0,00480
Period	1722-1794			1722-1794			1722-1794		
Frequency	Weekly			Weekly			Weekly		
N	3193			3093			3097		
R-squared	0,006			0,008			0,005		

APPENDIX

Northern Italy: Wheat: First differences of deviation from trend: HAC-OLS estimates

	Milan			Romano			Udine		
	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.
M1	0,01288	0,00347	0,00020	0,01876	0,00506	0,00020	0,01931	0,00368	0,00000
M2	0,00804	0,00322	0,01260	0,02190	0,00457	0,00000	0,00691	0,00276	0,01230
M3	0,00092	0,00327	0,77760	-0,01011	0,00586	0,08520	0,00822	0,00306	0,00740
M4	-0,00746	0,00383	0,05210	-0,01456	0,00570	0,01080	-0,00365	0,00382	0,33950
M5	-0,01975	0,00483	0,00000	-0,00931	0,00755	0,21800	-0,01669	0,00534	0,00180
M6	-0,01311	0,00543	0,01600	-0,00718	0,00937	0,44400	-0,01506	0,00498	0,00250
M7	-0,02553	0,00851	0,00280	-0,05160	0,01353	0,00010	-0,11705	0,01088	0,00000
M8	-0,02849	0,00773	0,00020	-0,01054	0,01047	0,31460	0,03450	0,00669	0,00000
M9	0,00741	0,00521	0,15500	0,01667	0,00725	0,02180	0,03622	0,00537	0,00000
M10	0,02309	0,00400	0,00000	0,02588	0,00573	0,00000	0,03856	0,00400	0,00000
M11	0,03181	0,00375	0,00000	0,00949	0,00492	0,05430	0,00395	0,00357	0,26930
M12	0,00988	0,00374	0,00830	0,00833	0,00556	0,13460	0,00413	0,00369	0,26360
Period	1700-1786			1718-1797			1700-1797		
Frequency	Monthly			Monthly			Monthly		
N	1037			660			1163		
R-squared	0,134			0,122			0,370		

Northern Italy: Rye: First differences of deviation from trend: HAC-OLS estimates

	Milan			Romano	Udine
	Coefficient	Std. E.	Prob.		
M1	0,00629	0,00467	0,17850		
M2	0,00269	0,00433	0,53430		
M3	-0,00465	0,00492	0,34490		
M4	-0,03509	0,00613	0,00000		
M5	-0,03243	0,00690	0,00000		
M6	-0,04606	0,00728	0,00000		
M7	-0,03123	0,01025	0,00240		
M8	0,01596	0,00983	0,10490		
M9	0,02670	0,00567	0,00000		
M10	0,04007	0,00597	0,00000		
M11	0,03291	0,00544	0,00000		
M12	0,02355	0,00429	0,00000		
Period	1700-1786			No data	No data
Frequency	Monthly				
N	1012				
R-squared	0,182				

Northern Italy: Millet: First differences of deviation from trend: HAC-OLS estimates

	Milan			Romano			Udine
	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.	
M1	0,01178	0,00646	0,06860	0,01360	0,01904	0,47710	
M2	0,01290	0,00603	0,03250	-0,01386	0,01243	0,26830	
M3	0,00855	0,00590	0,14760	-0,01629	0,01496	0,27940	
M4	-0,01193	0,00729	0,10200	-0,00302	0,01067	0,77840	
M5	-0,01671	0,00708	0,01850	-0,03431	0,01968	0,08530	
M6	-0,00951	0,00663	0,15170	0,01617	0,03373	0,63310	
M7	0,02146	0,00794	0,00700	-0,00615	0,00729	0,40140	
M8	0,01215	0,01066	0,25480	0,01046	0,02820	0,71170	
M9	-0,06357	0,01457	0,00000	0,04376	0,02181	0,04840	
M10	-0,01464	0,00929	0,11520	-0,03137	0,02628	0,23640	
M11	0,03168	0,00758	0,00000	0,02556	0,01765	0,15170	
M12	0,02302	0,00522	0,00000	0,01378	0,00943	0,14780	
Period	1700-1782			1723-1738			No data
Frequency	Monthly			Monthly			
N	989			88			
R-squared	0,098			0,160			

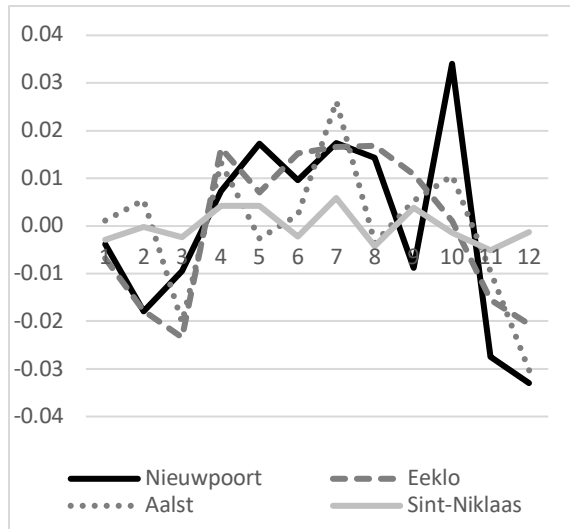
Northern Italy: Maize: First differences of deviation from trend: HAC-OLS estimates

	Milan			Romano			Udine		
	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.	Coefficient	Std. E.	Prob.
M1	0,00867	0,00596	0,14570	0,01326	0,00615	0,03150	0,04282	0,00662	0,00000
M2	0,01969	0,00559	0,00050	0,02949	0,00587	0,00000	0,03087	0,00680	0,00000
M3	0,01598	0,00592	0,00710	0,01110	0,00906	0,22100	0,04842	0,00620	0,00000
M4	-0,00723	0,00733	0,32440	0,00474	0,00784	0,54590	0,00835	0,00601	0,16520
M5	-0,01217	0,00617	0,04870	0,00063	0,00887	0,94380	0,03230	0,00612	0,00000
M6	-0,00463	0,00793	0,55980	0,02888	0,00962	0,00280	0,03329	0,00588	0,00000
M7	0,01944	0,00993	0,05070	0,03907	0,01218	0,00140	0,02096	0,00780	0,00730
M8	-0,02907	0,01559	0,06250	-0,01264	0,01792	0,48090	-0,01577	0,00853	0,06470
M9	-0,06476	0,01329	0,00000	-0,03767	0,01685	0,02570	-0,12717	0,01262	0,00000
M10	-0,00929	0,00862	0,28160	-0,07574	0,01233	0,00000	-0,10932	0,00871	0,00000
M11	0,04040	0,00777	0,00000	-0,01618	0,00863	0,06110	-0,00165	0,00669	0,80600
M12	0,02351	0,00621	0,00020	0,01649	0,00802	0,04010	0,03628	0,00625	0,00000
Period	1718-1786			1723-1797			1700-1797		
Frequency	Monthly			Monthly			Monthly		
N	827			651			1163		
R-squared	0,118			0,130			0,362		

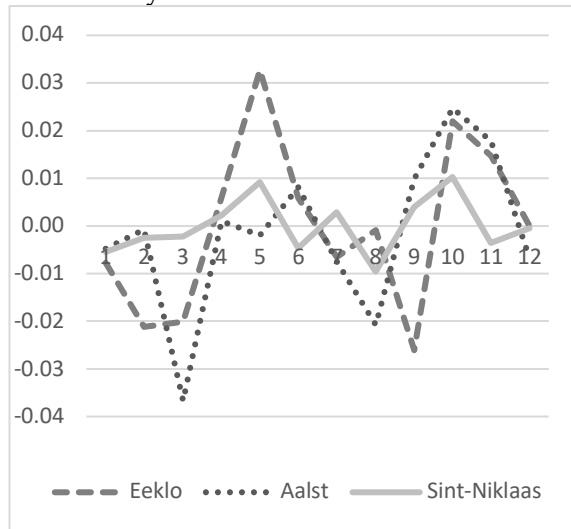
2.2 First differences: graphs

Averages of weekly first differences for Sint-Niklaas, and monthly first differences for all other locations.

Flanders: Wheat

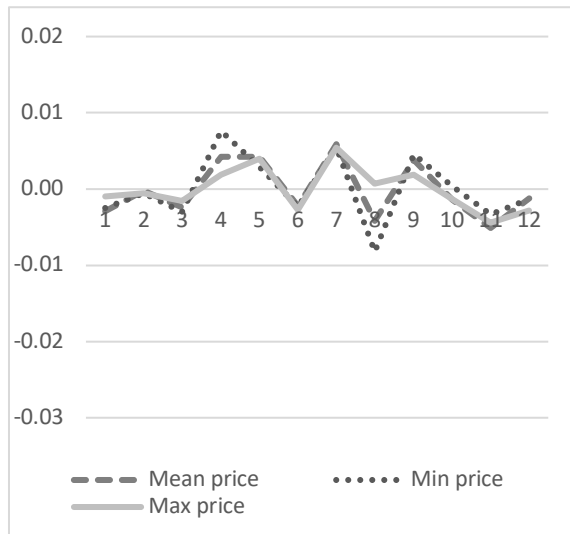


Flanders: Rye

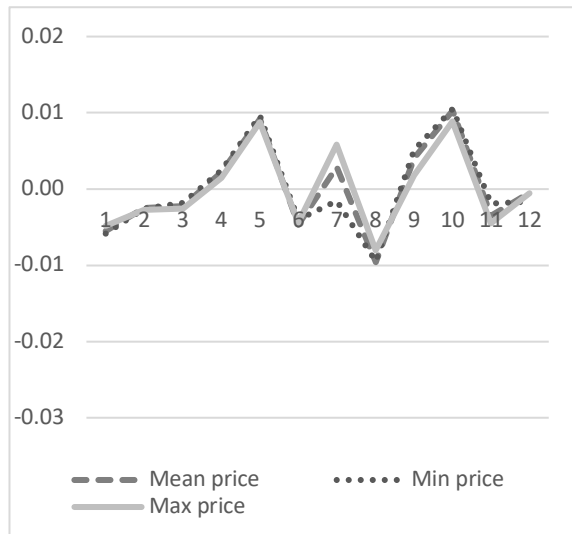


GRAIN QUALITY AND SEASONAL PATTERNS IN GRAIN PRICES

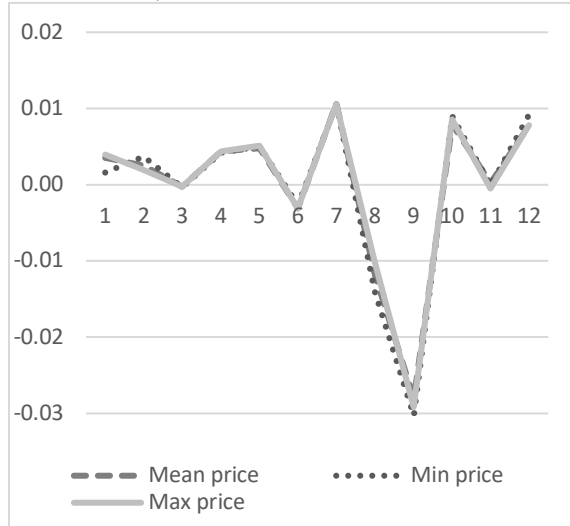
Sint-Niklaas, Flanders: Wheat



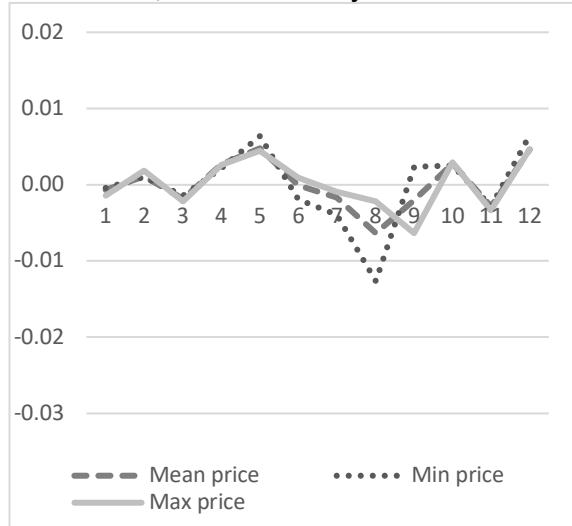
Sint-Niklaas, Flanders: Rye



Sint-Niklaas, Flanders: Buckwheat

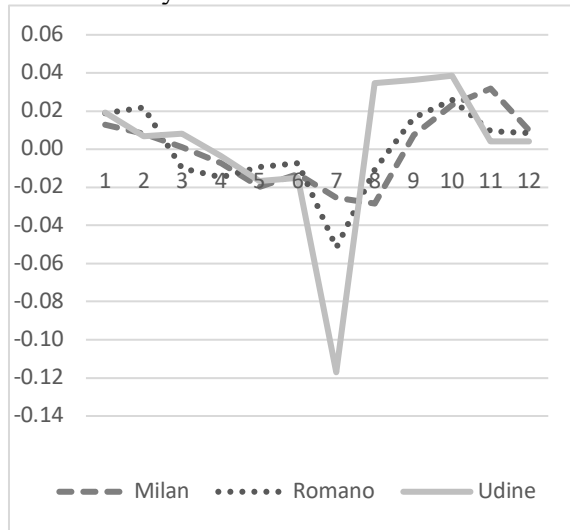


Sint-Niklaas, Flanders: Barley

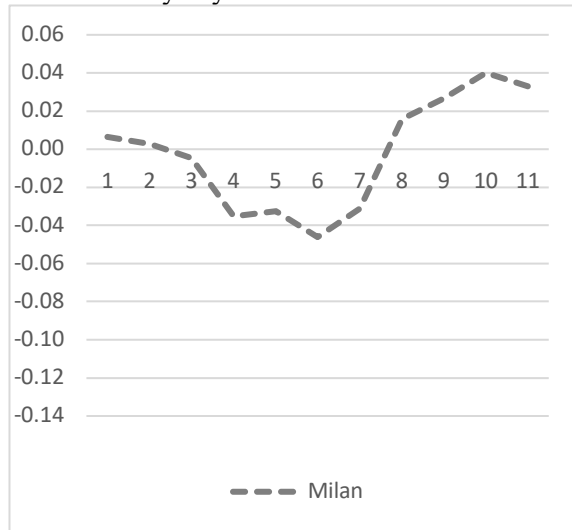


APPENDIX

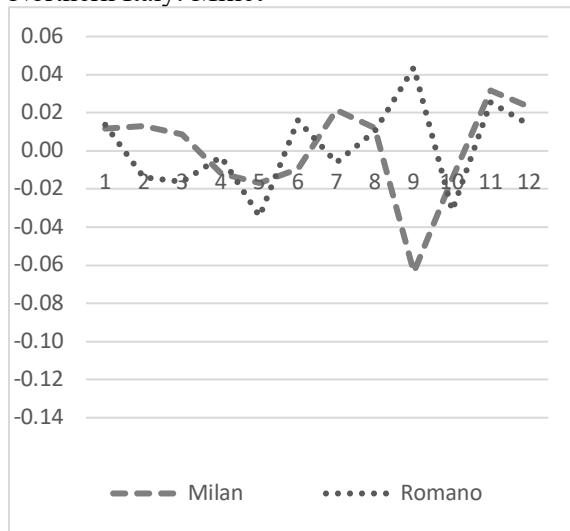
Northern Italy: Wheat



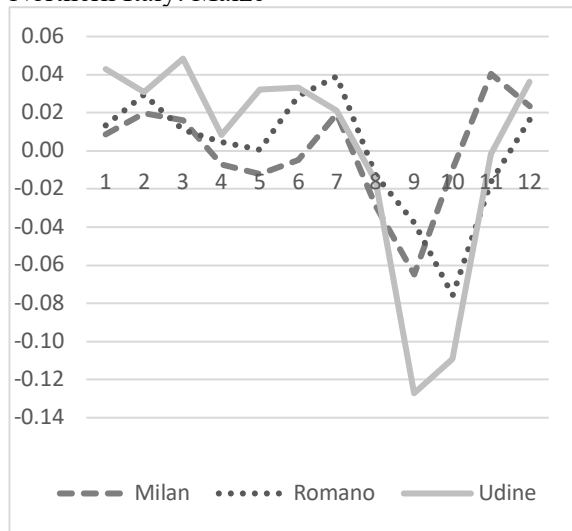
Northern Italy: Rye



Northern Italy: Millet

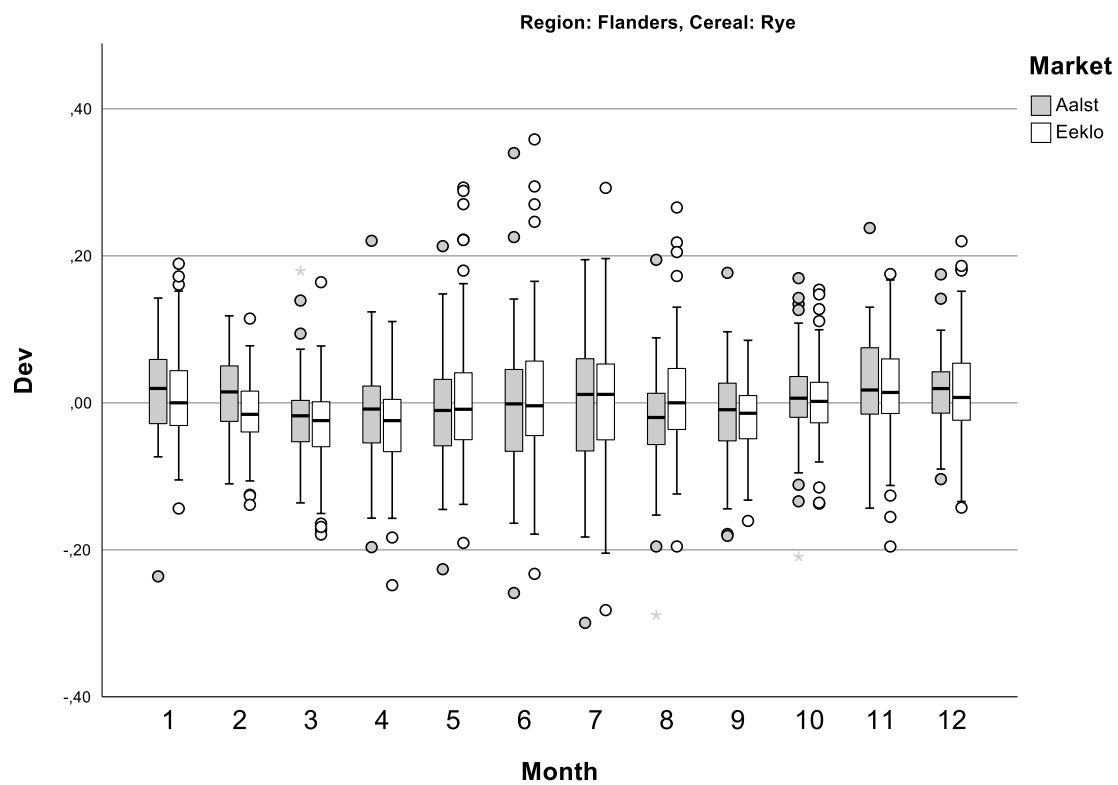
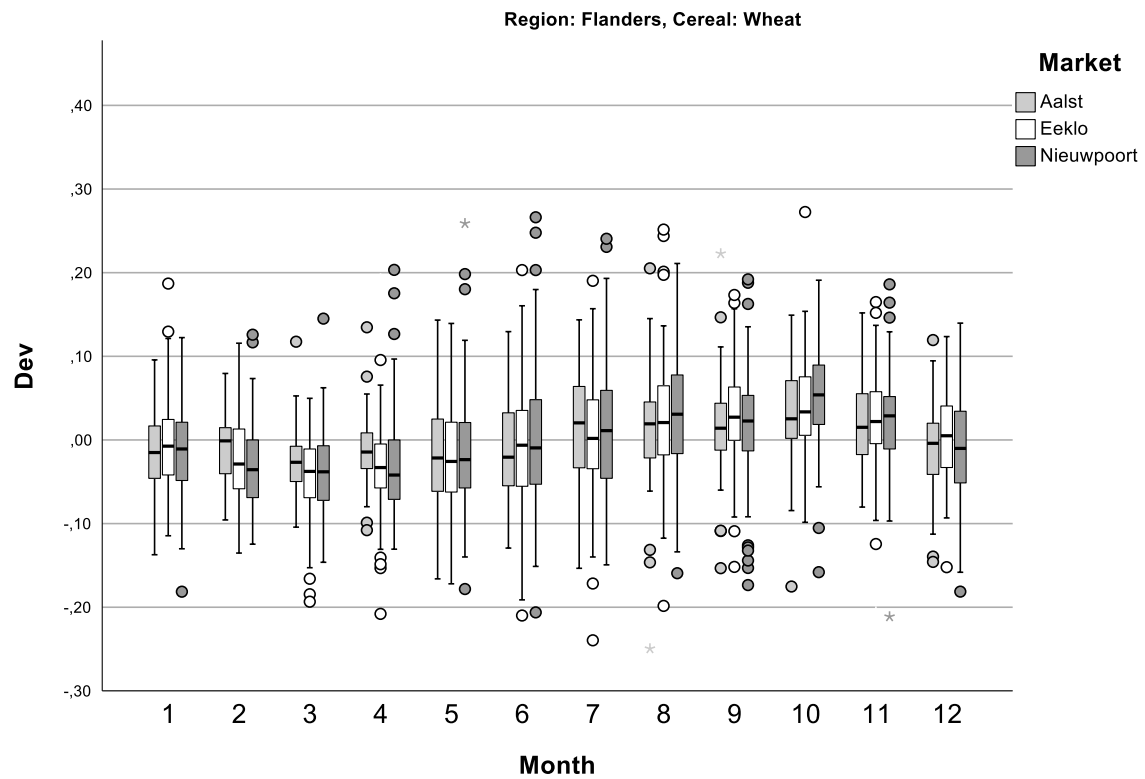


Northern Italy: Maize

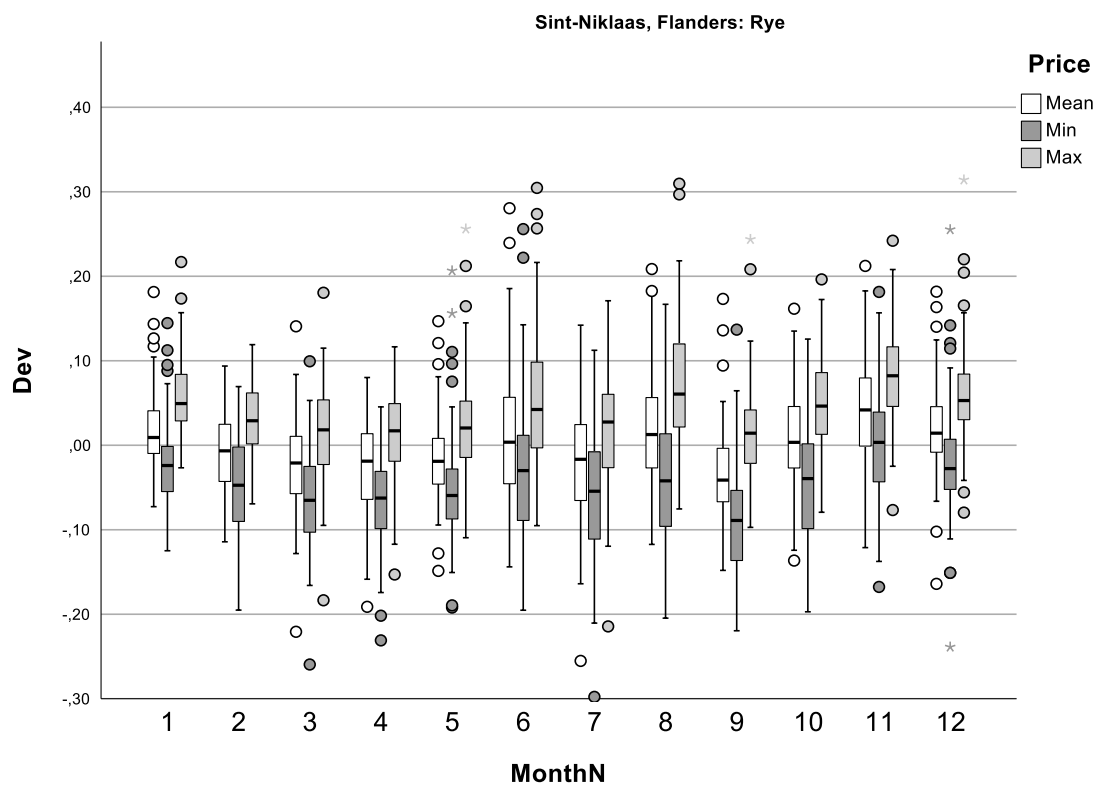
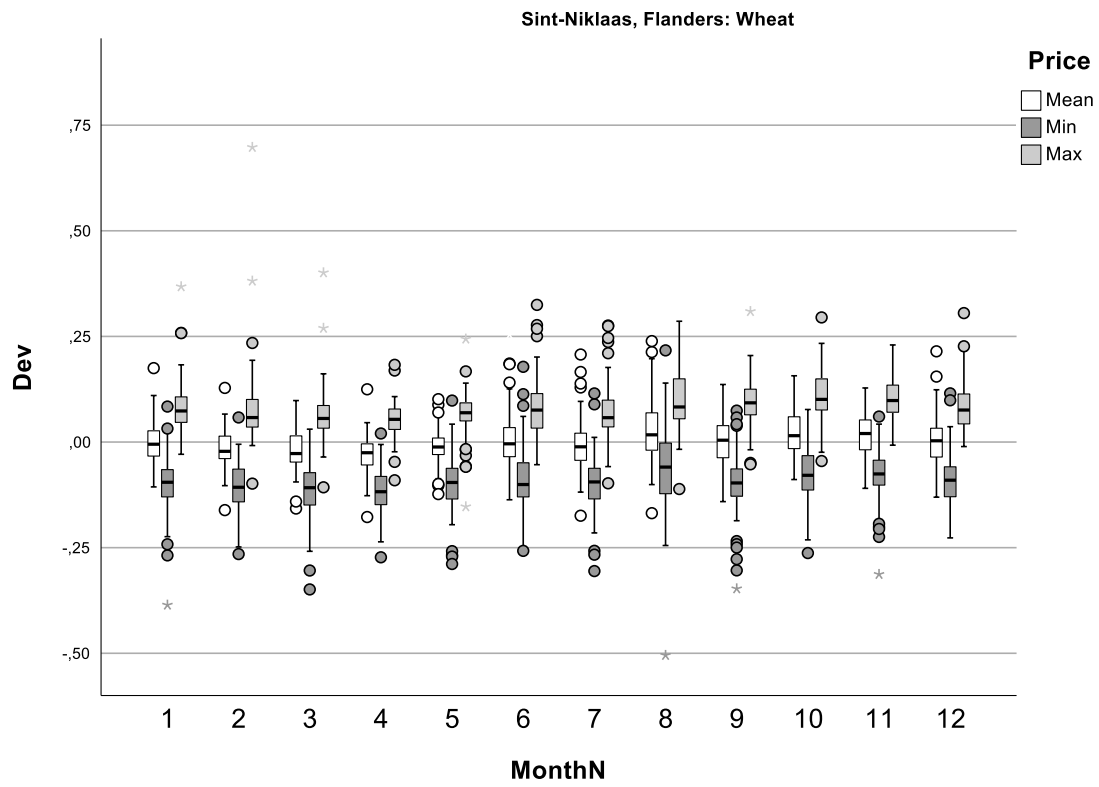


2.3 Monthly deviations from trend: boxplots

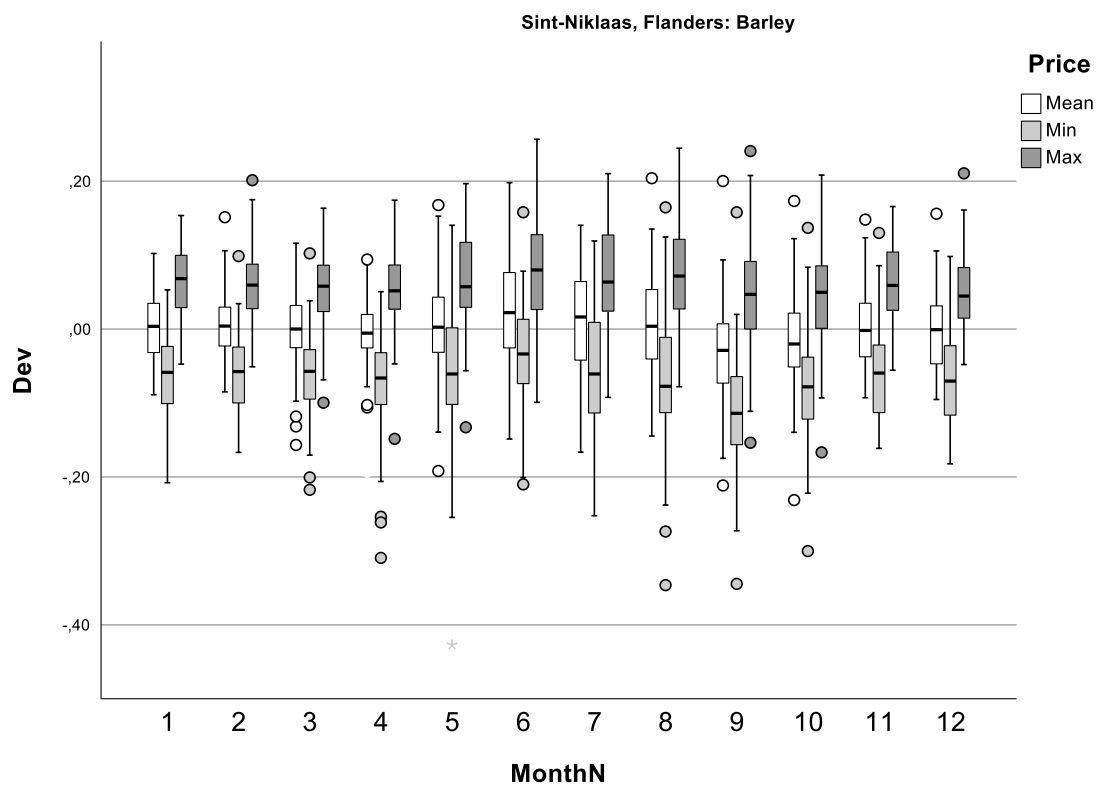
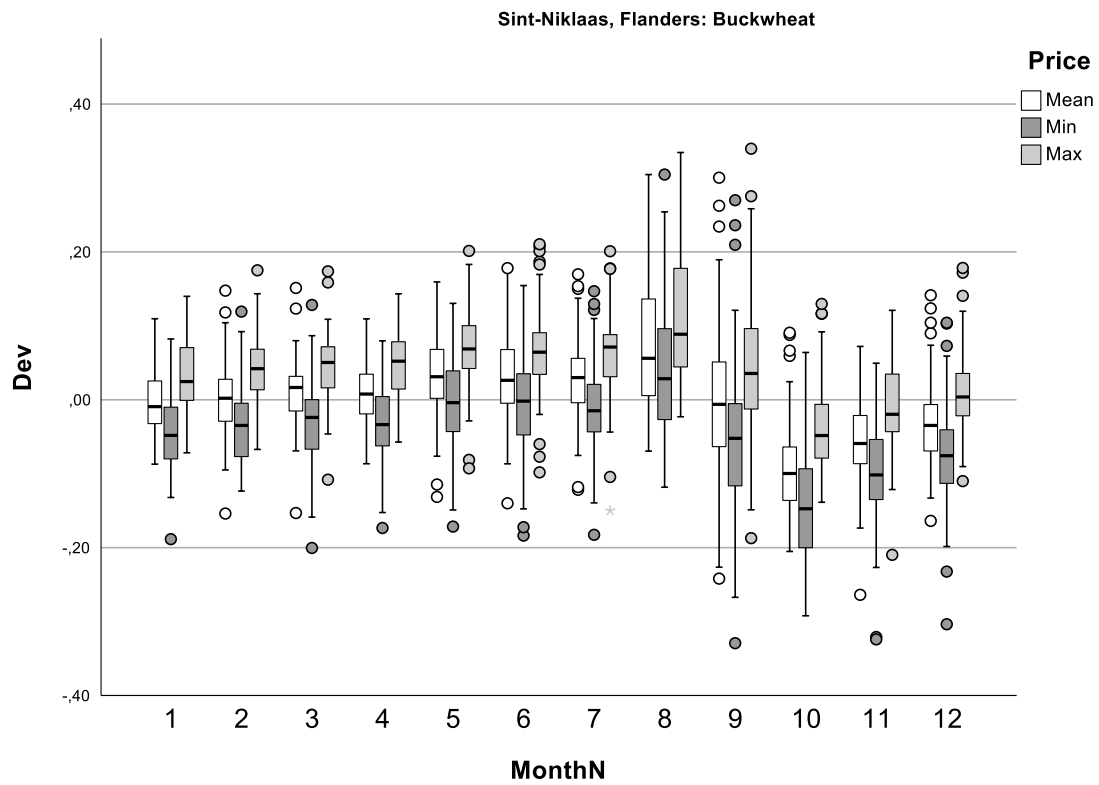
Sint-Niklaas: based on first available observation from each month.



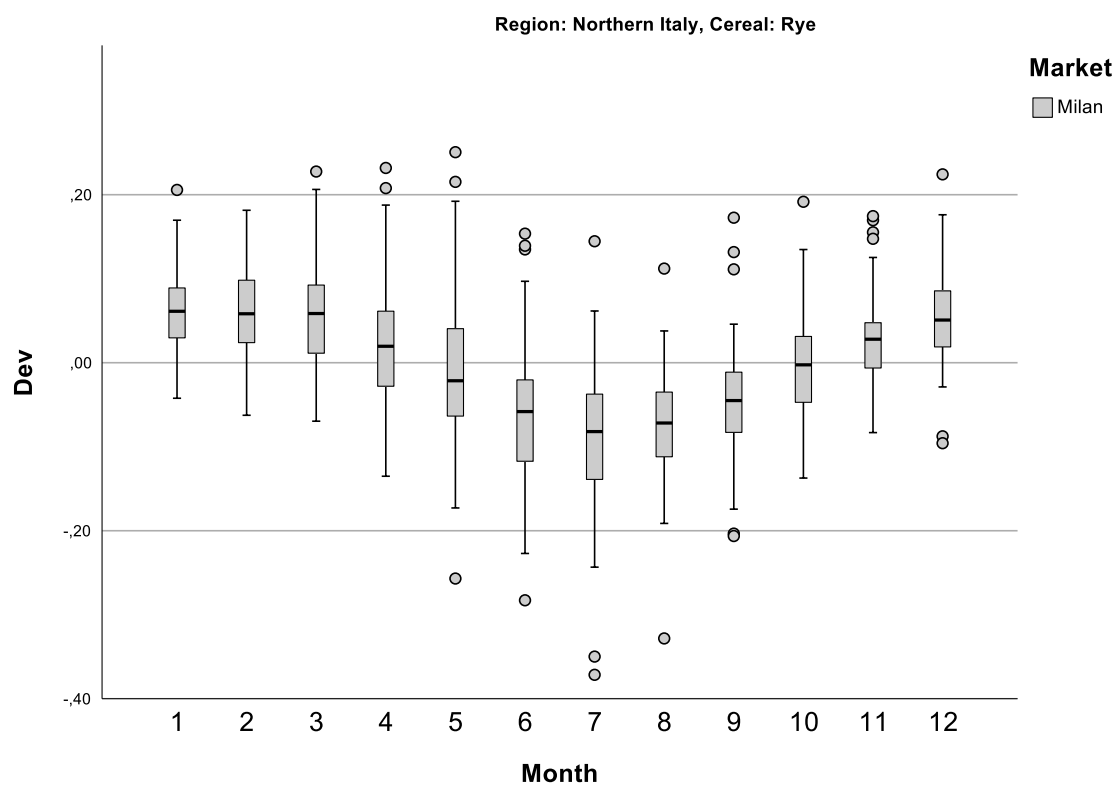
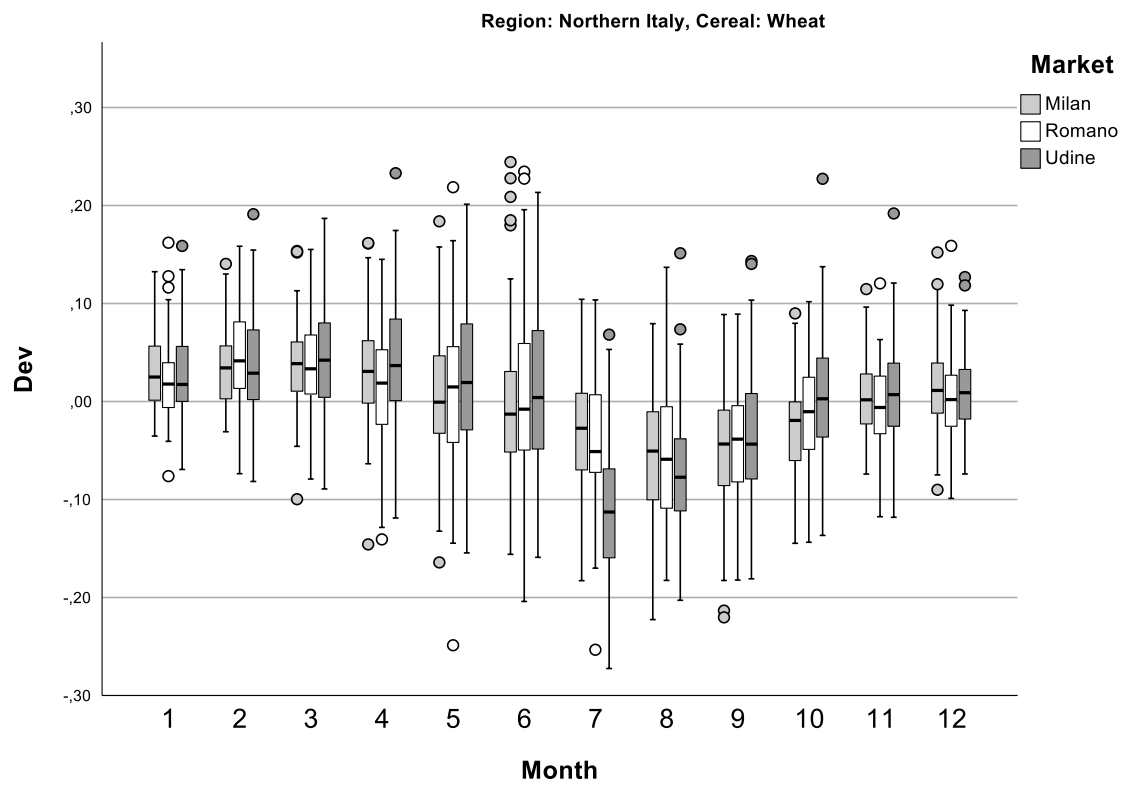
APPENDIX



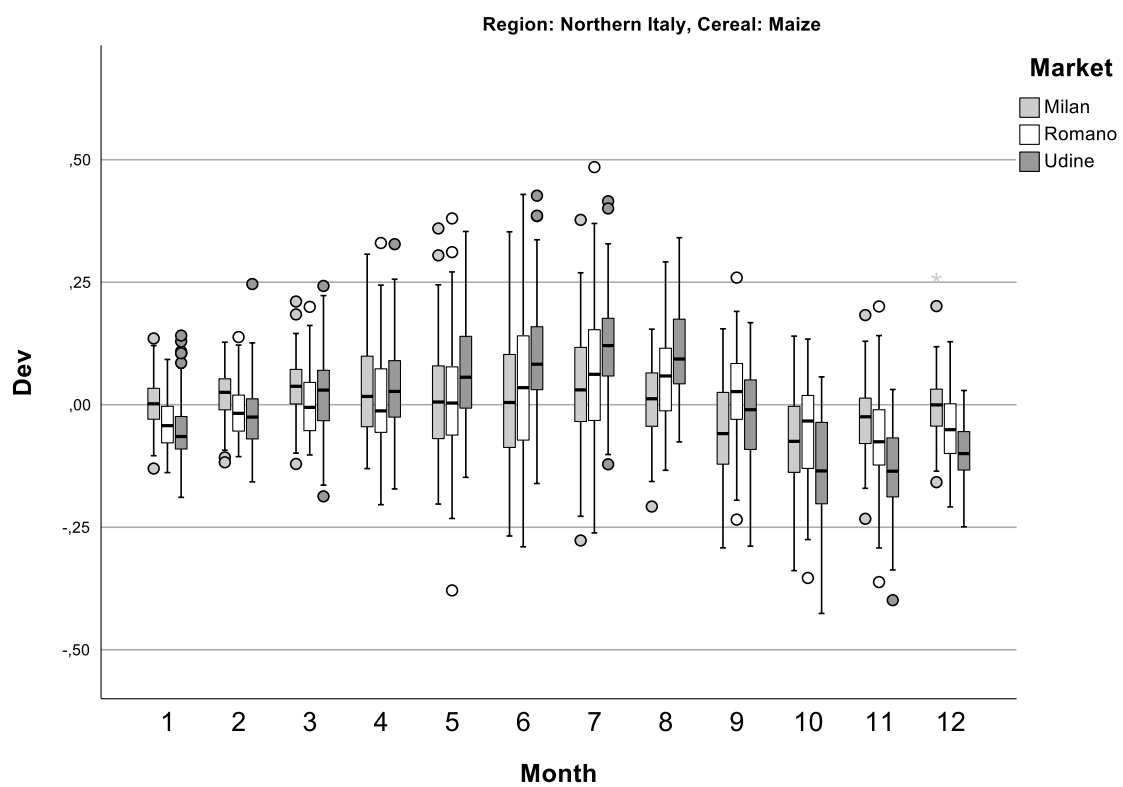
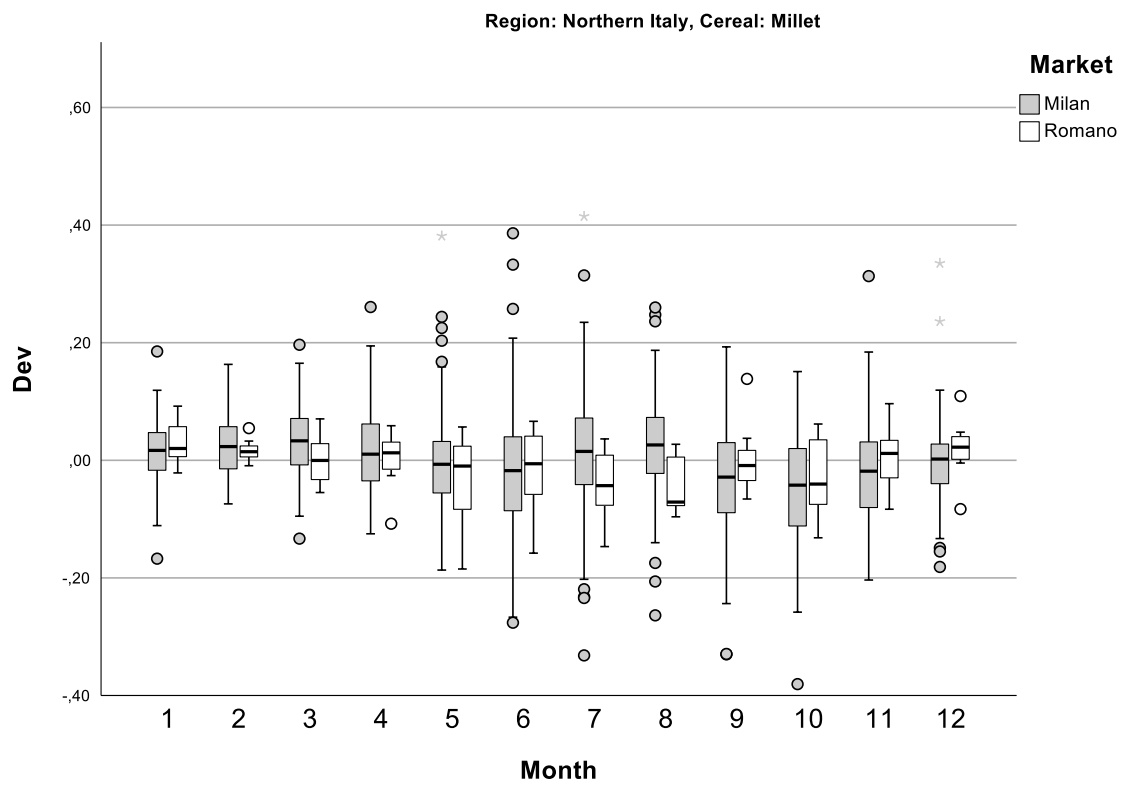
GRAIN QUALITY AND SEASONAL PATTERNS IN GRAIN PRICES



APPENDIX



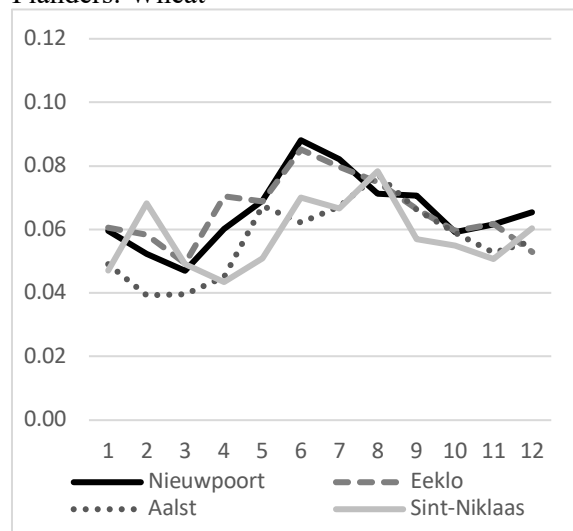
GRAIN QUALITY AND SEASONAL PATTERNS IN GRAIN PRICES



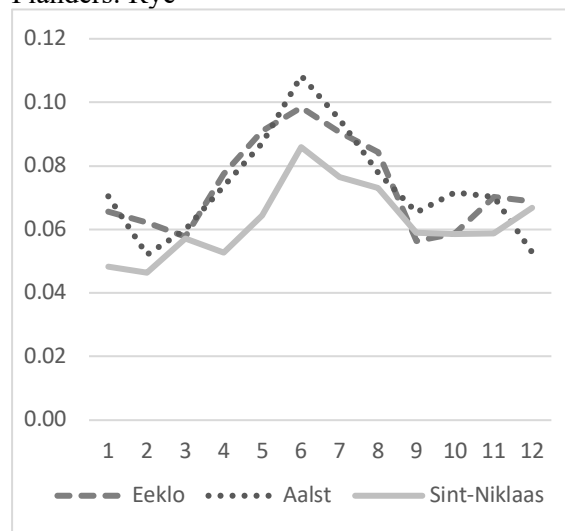
2.4 Standard deviation of monthly deviations from trend: graphs

Variation in the seasonal pattern *between* years. One observation per month for different years. For Sint-Niklaas, the first available observation from each month was used.

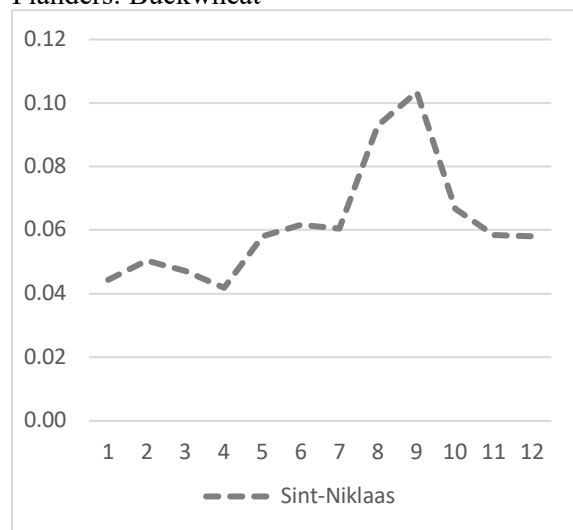
Flanders: Wheat



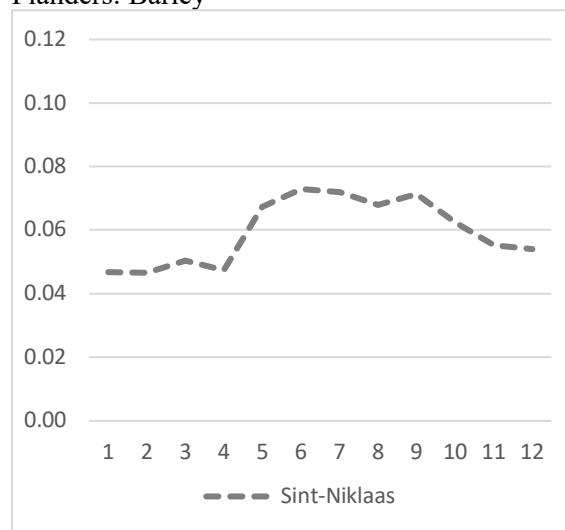
Flanders: Rye



Flanders: Buckwheat

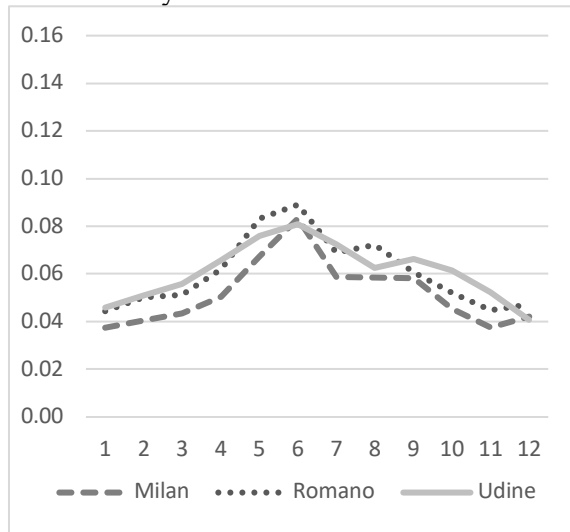


Flanders: Barley

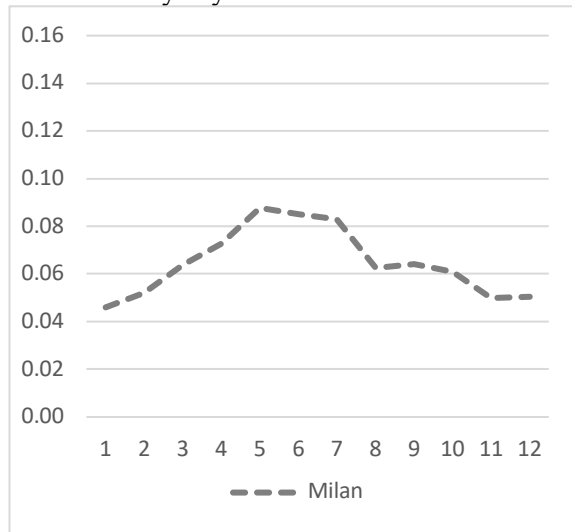


GRAIN QUALITY AND SEASONAL PATTERNS IN GRAIN PRICES

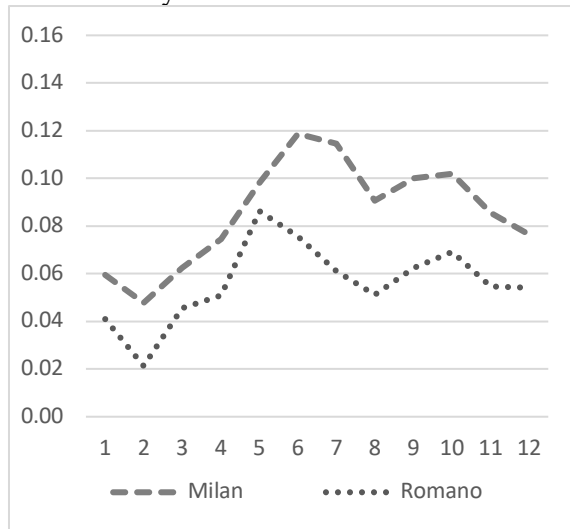
Northern Italy: Wheat



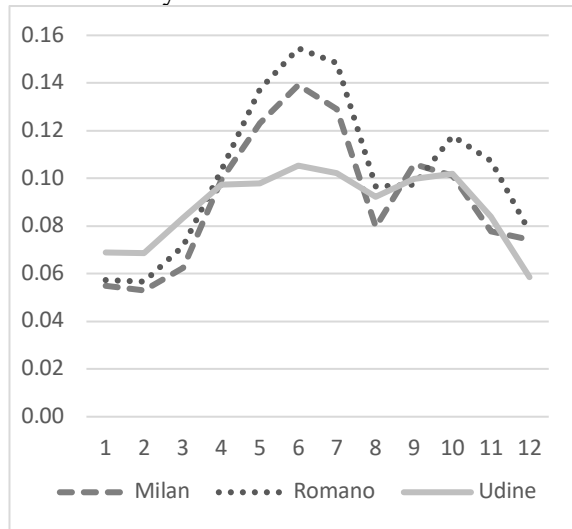
Northern Italy: Rye



Northern Italy: Millet



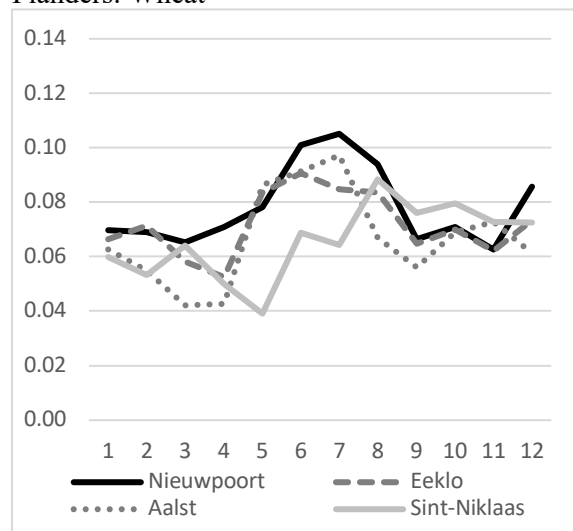
Northern Italy: Maize



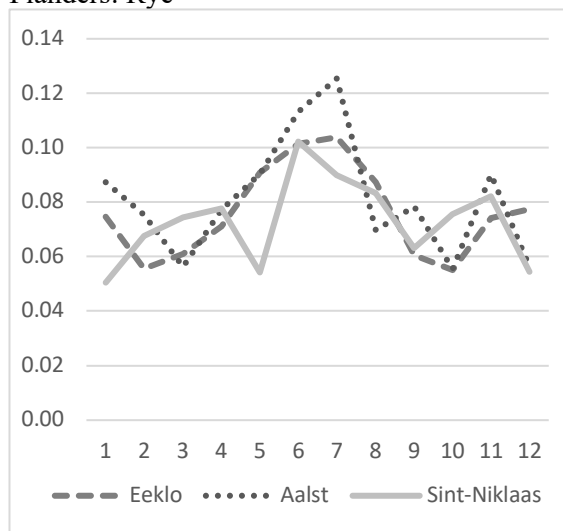
2.5 Interquartile range of monthly deviations from trend: graphs

Variation in the seasonal pattern *between* years. One observation per month for different years. For Sint-Niklaas, the first available observation from each month was used.

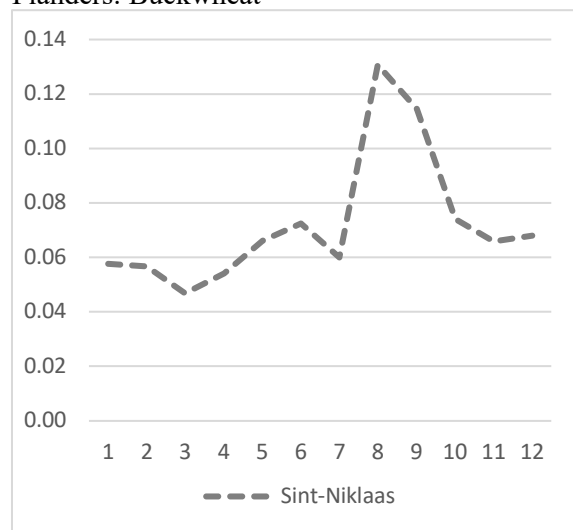
Flanders: Wheat



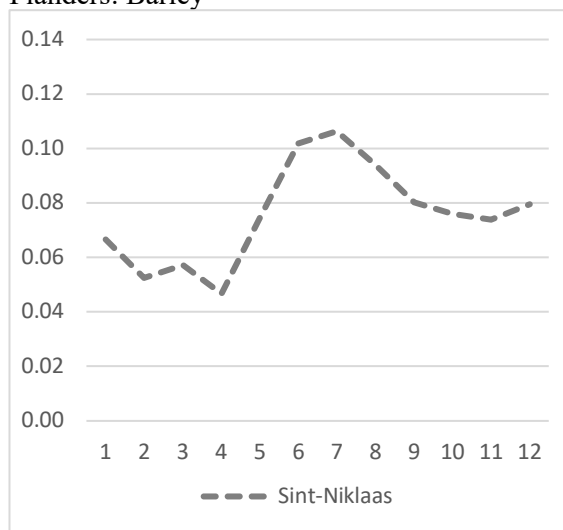
Flanders: Rye



Flanders: Buckwheat

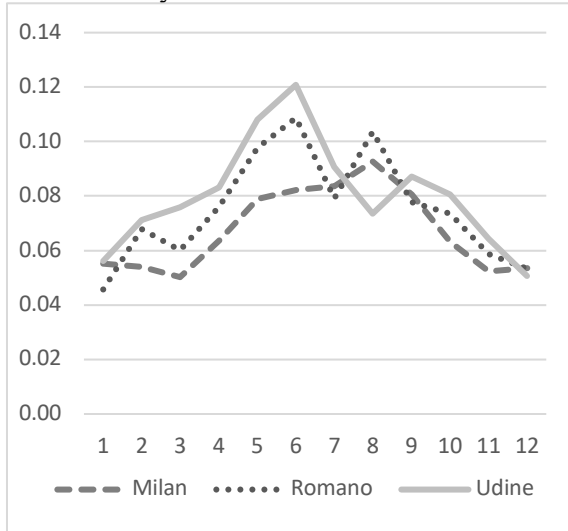


Flanders: Barley

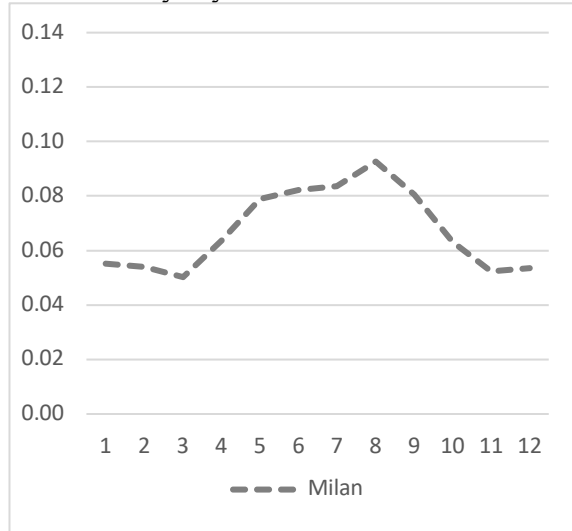


GRAIN QUALITY AND SEASONAL PATTERNS IN GRAIN PRICES

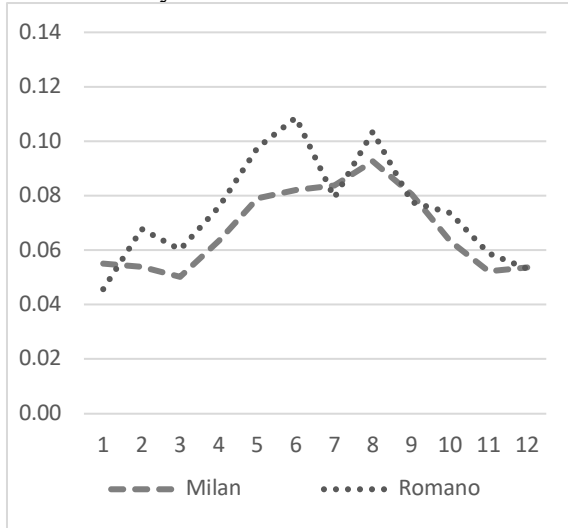
Northern Italy: Wheat



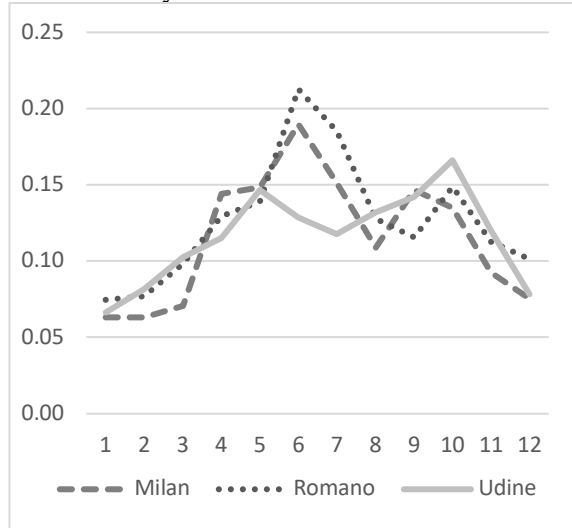
Northern Italy: Rye



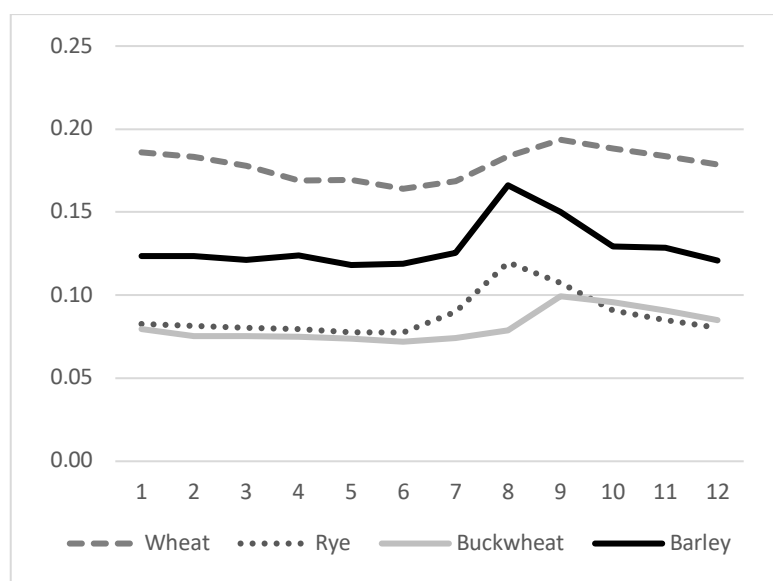
Northern Italy: Millet



Northern Italy: Maize



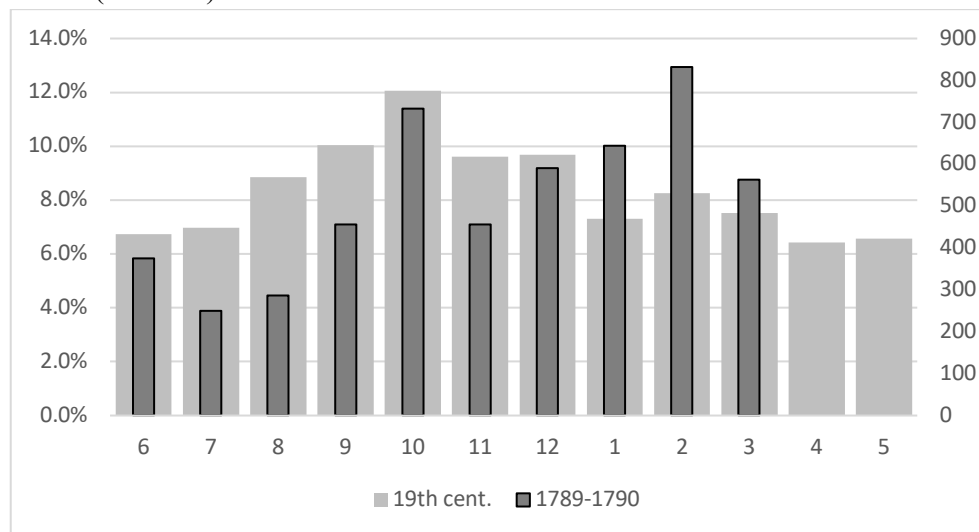
2.6 Spread between deviation from trend of minimum and maximum prices (Sint-Niklaas)



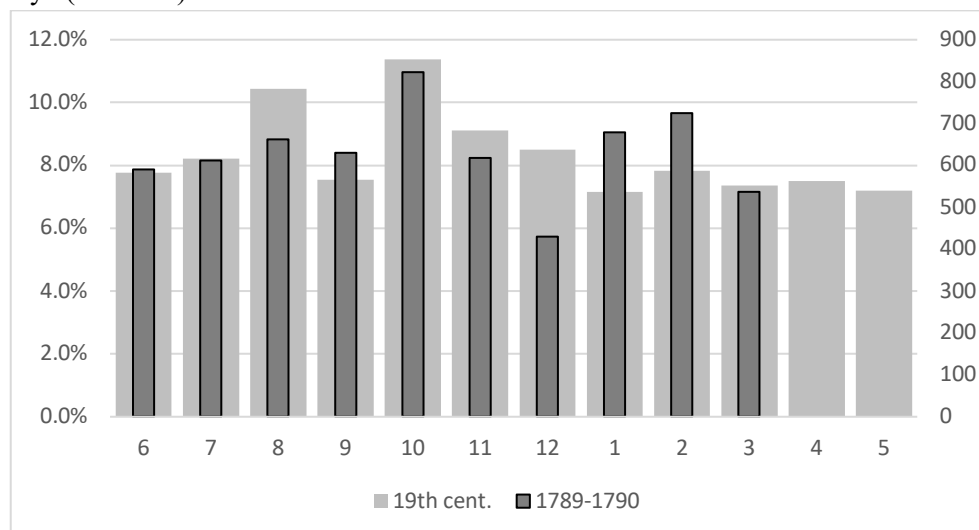
3. Sint-Niklaas trade volumes data

Eighteenth-century trade volumes data for Sint-Niklaas only exist for 10 months, from 18 June 1789 until 24 March 1790. The nineteenth-century data are the averages of the calendar years 1829, 1839 and 1849 used by Herment and Ronsijn.⁹ The following graph compares weekly trade volumes averaged per month for 1789-1790 with the nineteenth-century trade volume. Data from this one harvest year, especially the harvest year 1789-1790, can hardly be considered representative for the entire eighteenth century. Nevertheless, there is a clear association in the month-to-month ups and downs, though rather weak. The nineteenth-century averages are more smoothed out and likely correspond better to the average eighteenth-century pattern.

Wheat ($R = 0.35$)



Rye ($R = 0.46$)



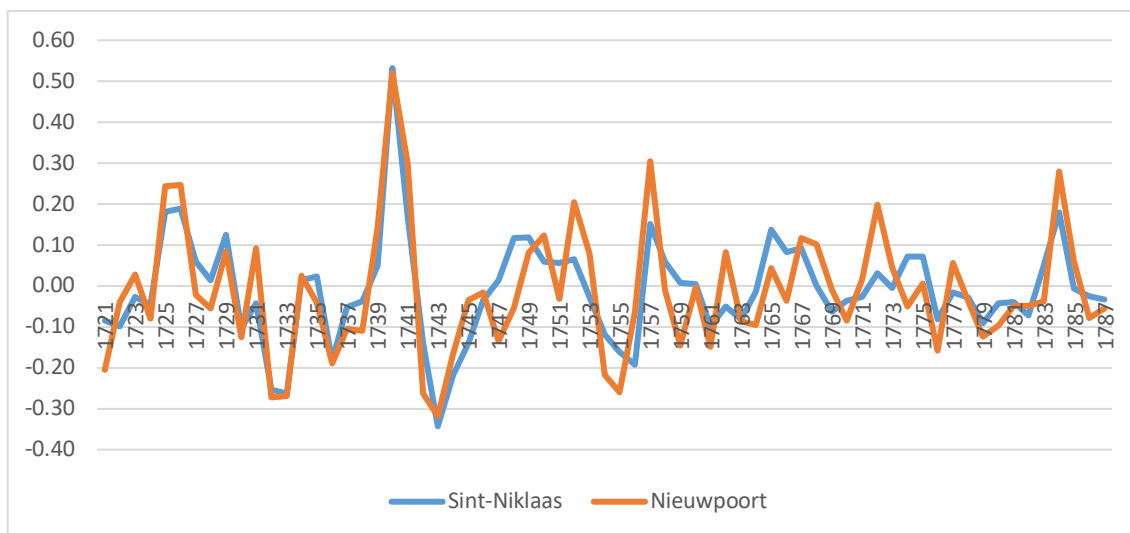
Graphs show 19th-century averages in per cent on the left axis, and the 1789-1790 pattern in hectolitres per week on the right axis.

⁹ Laurent Herment and Wouter Ronsijn, 'Seasonal patterns in food markets in north-west Europe in the second quarter of the nineteenth century: the evidence of periodic markets in France, England, and Belgium, 1820 to 1850', *Agricultural Hist. Rev.*, 63 (2015).

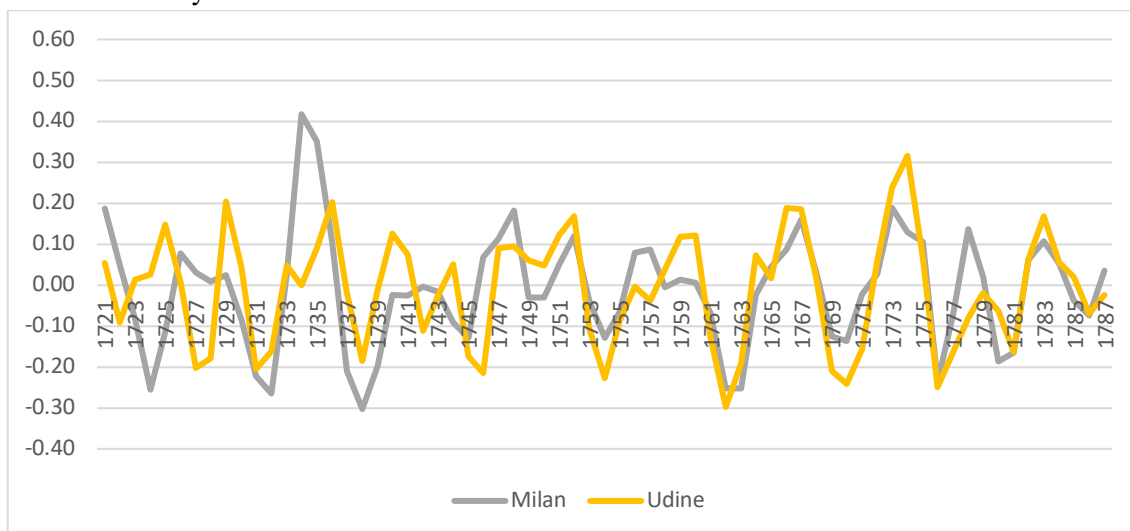
4. Market volatility

To assess market volatility, we considered differences between the natural log of the trend (hp-filtered prices) and the natural log of the price of each year. We did this for annual wheat prices in Sint-Niklaas, Nieuwpoort, Milan and Udine, which are the markets for which we have an uninterrupted series of wheat prices for all years from 1721 up to and including 1787. The result is as follows:

In Flanders:



In Northern Italy:



The results for Flanders and Northern Italy (all years for 1721-1787) have different distributions:

		Sint-Niklaas	Nieuwpoort	Milan	Udine
N	Valid	67	67	67	67
	Missing	0	0	0	0
Skewness		0,773	0,756	0,223	-0,08
Std. Error of Skewness		0,293	0,293	0,293	0,293
Minimum		-0,34	-0,32	-0,3	-0,3
Percentiles	10	-0,1655	-0,2079	-0,226	-0,2064
	20	-0,0944	-0,1294	-0,1284	-0,1633
	25	-0,0823	-0,1045	-0,0907	-0,1267
	50	-0,0257	-0,0372	-0,0037	0,0118
	75	0,0590	0,0796	0,0778	0,0746
	80	0,0715	0,0873	0,0937	0,1044
	90	0,1403	0,2116	0,1421	0,1717
Maximum		0,53	0,52	0,42	0,32
Interquartile Range		0,14	0,18	0,17	0,20
Difference percentile 20-80		0,17	0,22	0,22	0,27
Difference percentile 10-90		0,31	0,42	0,37	0,38
Difference Min-Max		0,87	0,84	0,72	0,62

5. Interest rates

Data on interest rates were obtained from different published sources.

4.1 Heritable annuities (Huang, Chilosì and Sapoznik)¹⁰

The online database of Huang, Chilosì and Sapoznik contains many observations for Northern Italy, but only few observations for Flanders (even if we include Antwerp, which is in Brabant). Most observations are of heritable annuities, so we use those. We use the raw data from 1701 onwards. This gives us the following number of observations:

For Northern Italy:

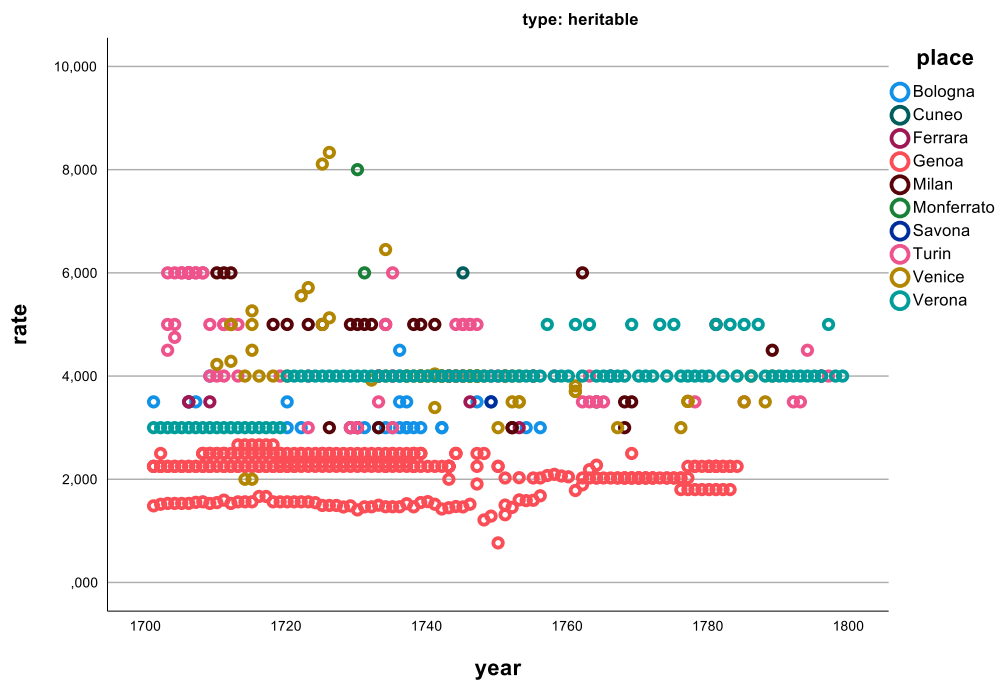
Location	N
Bologna	27
Cuneo	3
Ferrara	8
Genoa	293
Milan	29
Monferrato	2
Savona	2
Turin	79
Venice	64
Verona	177
Total	684

For Flanders (including Antwerp):

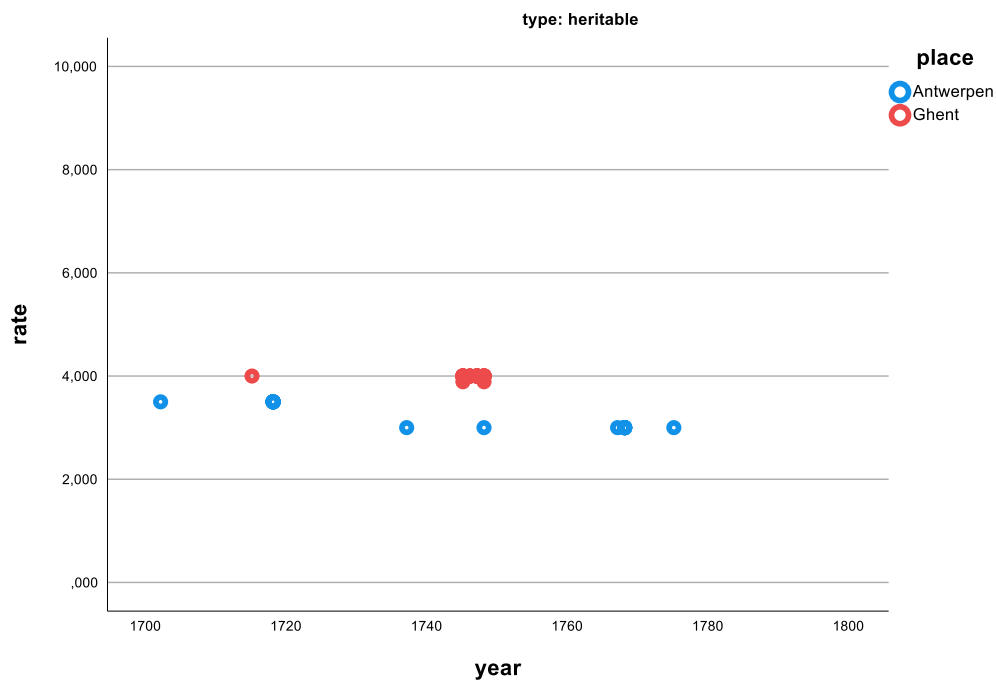
Location	N
Antwerpen	25
Ghent	40
Total	65

¹⁰ Angela Huang, et al., ‘A Source Collection on Urban Annuities, 14th–18th Centuries’, *Vierteljahrschrift für Sozial- und Wirtschaftsgeschichte* 106 (2019); Angela Huang, et al., ‘A Source Collection on Urban annuities, 14th–18th centuries. Version: 1’, *VSWG - Journal of Social and Economic History. Datasets*, (2019).

Interest rates on heritable annuities in Northern Italy (1701-1800):



Interest rates on heritable annuities in Flanders (1701-1800):



4.2 Mortgage interest rates for Flanders

Given the paucity of Flemish data in the database of Huang, Chilosì and Sapoznik, we also consider mortgage interest rates from different locations in Flanders. The first set (Lovendegem and Gavere) is from the region of Ghent, the other three (Stekene, Kruibeke, Moerbeke) are from the region of Sint-Niklaas.

Baronie van Lovendegem and Prinselijk Land van Gavere (Deprez): percent of loans by interest rate and period¹¹:

Period	Interest rate:			
	6%	5%	4%	3,5-3%
1700-09	96,4			
1710-19	71,0	24,0		
1720-29	43,2	51,8	2,4	
1730-39	23,0	65,0	8,7	
1740-49	14,1	60,8	18,4	
1750-59	2,0	59,0	36,9	
1760-69	0,8	58,5	39,0	0,4
1770-79	0,3	40,8	54,1	2,0
1780-89	1,0	45,0	49,8	1,3
1790-96	0,9	44,8	51,8	

Stekene: percent of loans by interest rate and period¹²

Period	Interest rate:					
	6.25%	5-5.99%	4.5-4.99%	4-4.49%	3.5-3.99%	3-3.49%
1700-05	100					
1710-15	46	38		15		
1720-25	50	43		7		
1730-35	30	50	10			10
1740-45	15	45	5	35		
1750-55		18	15	55	9	4
1760-65		4	14	73	4	4
1770-75		4	4	55	24	14
1780-85		11	4	66	18	
1790-95		21	21	50	4	4

¹¹ Paul Deprez, 'Hypothekaire grondrenten in Vlaanderen gedurende de 18e eeuw', *Tijdschrift voor Geschiedenis*, 79 (1966), p. 145.

¹² M.-A. Wilssens, *Bevolkingsdruk en boerenverstand: evolutie van de levensstandaard in het Waasland in de 18de eeuw* (1992, Brussel), p. 47.

Kruibeke: percent of loans by interest rate and period¹³

Period	Interest rate:					
	>5%	4.5-4.9%	4-4.5%	3.5-3.9%	3-3.4%	<3%
1710-19	27,1	14,2	32,8	8,5	17,1	
1720-29	13,0	9,7	52,1	3,2	21,7	
1730-39	4,8	4,8	31,7	18,2	37,8	2,4
1740-49	2,5	2,5	22,5	22,5	45,0	3,0
1750-59	1,7		12,5	26,7	57,1	1,7
1760-69		3,1	6,2	43,7	46,8	
1770-79	0,9		4,5	25,6	66,9	1,8
1780-89	1,2		13,2	57,8	27,7	

Moerbeke: average interest rate¹⁴

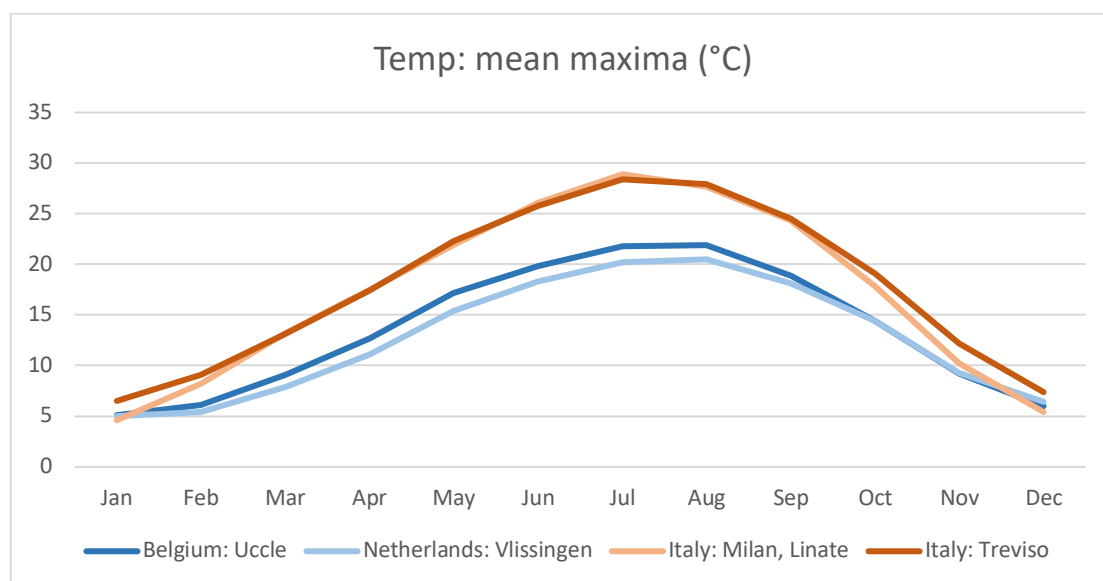
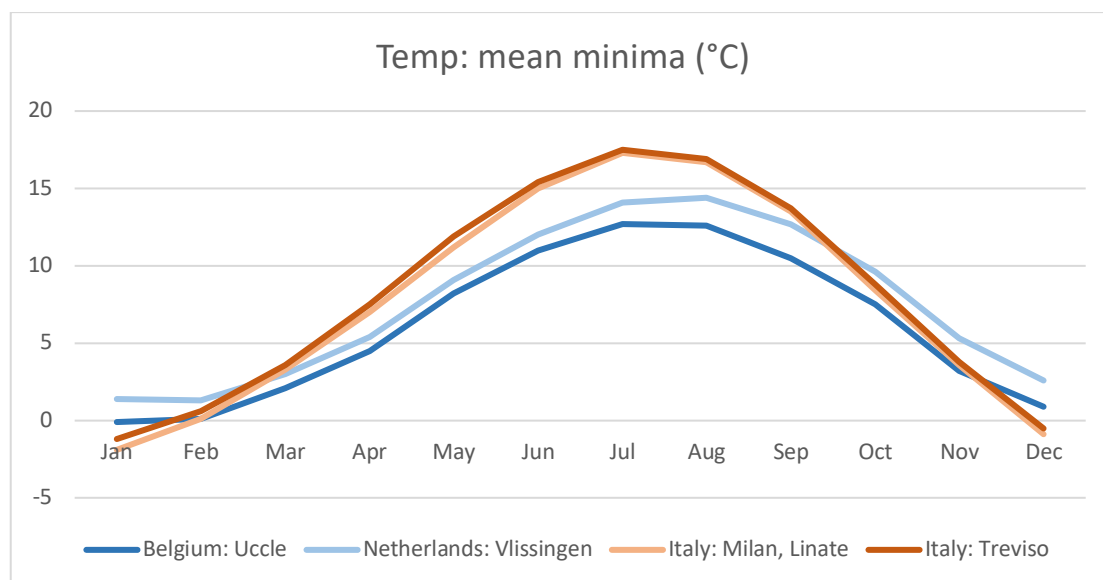
Year	Moerbeke
1698	5,00-5,99
1708	6,25
1718	4,50-4,99
1728	5,00-5,99
1738	5,00-5,99
1748	4,00-4,49
1758	4,00-4,49
1768	4,00-4,49
1778	3,50-3,99
1788	4,00-4,49

¹³ Jan Blomme, 'Bevolking, landbouw en rurale industrie in het Land van Waas (XVIIIe eeuw)', *Koninklijke Oudheidkundige Kring van het Land van Waas*, 87 (1984), p. 203.

¹⁴ John Baert, *Leefbaarheid en proletarisering van de agrarische sector in het Land van Waas: Moerbeke-Waas, 1571-1850 (onuitgegeven licentiaatsverhandeling, Universiteit Gent, Chris Vandenbroeke)* (1996, Gent), p. 244.

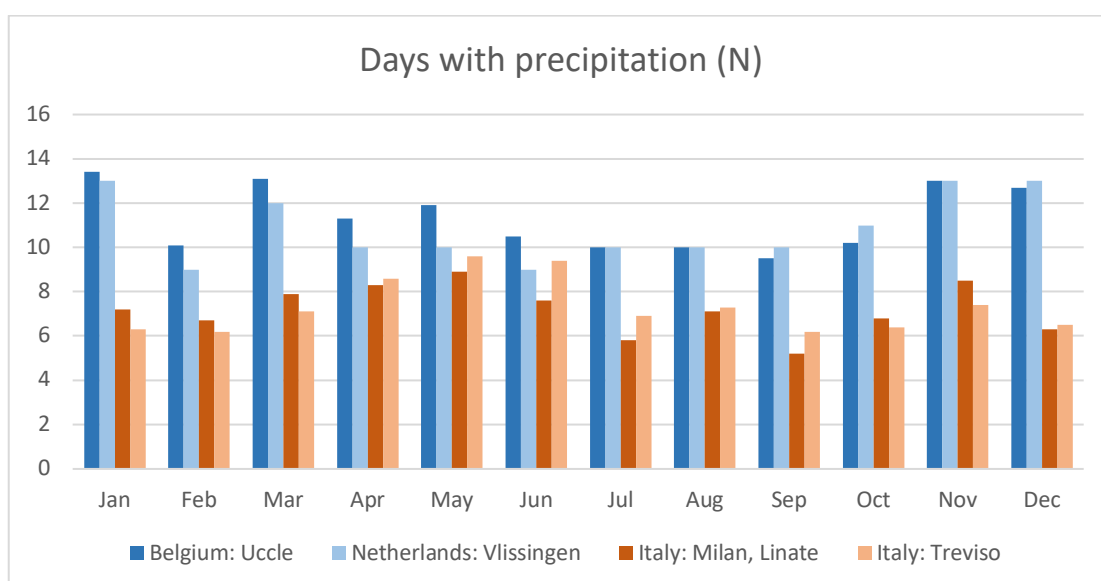
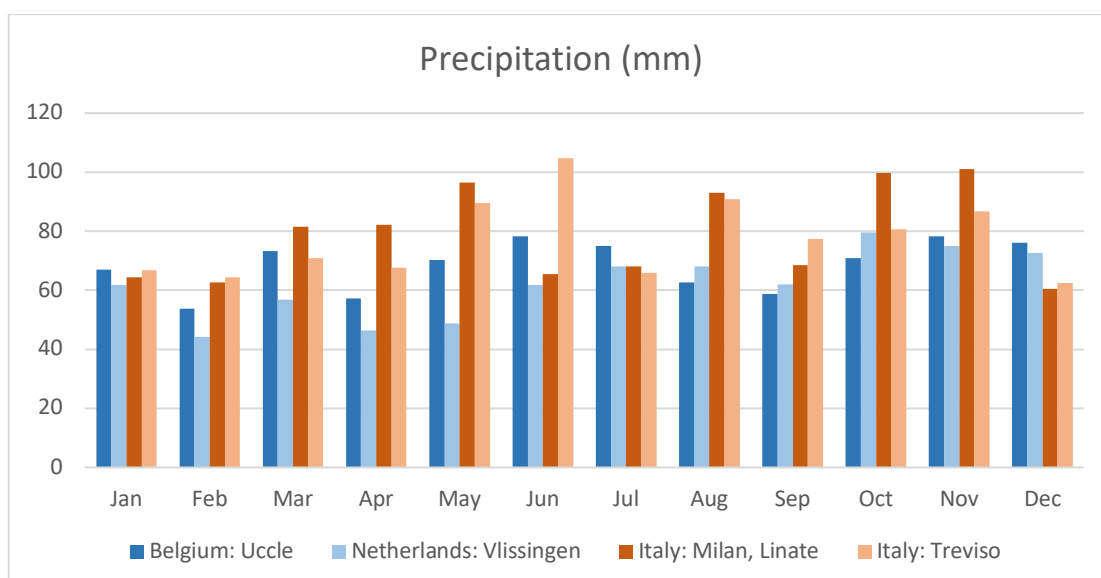
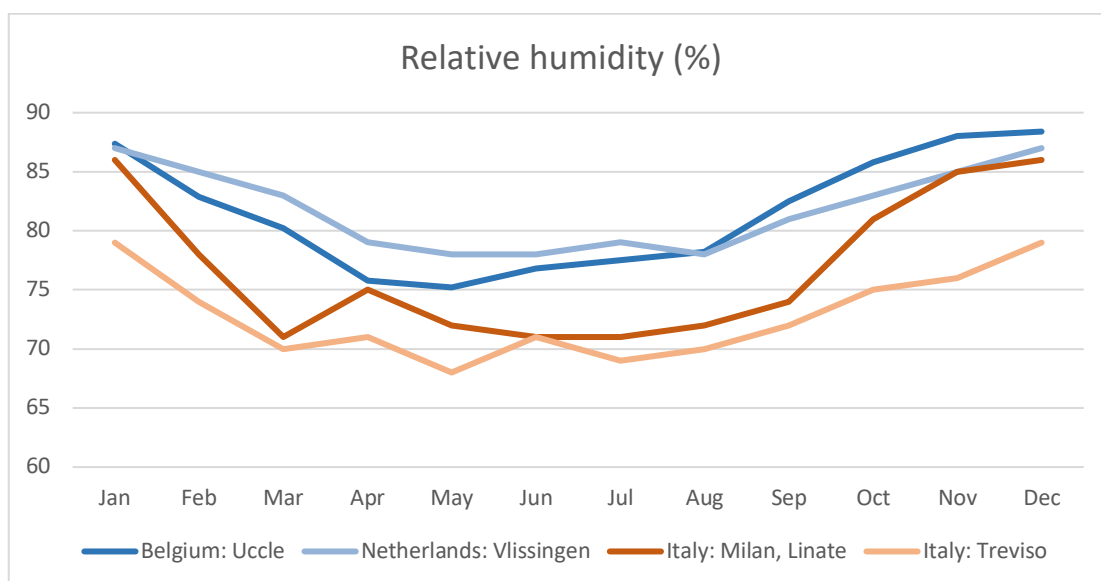
6. Weather observations

We use the World Meteorological Organisation (WMO) climate normals for 1961-1990 for four locations: Uccle in Belgium (near Brussels), Vlissingen in The Netherlands (near coastal Flanders), as well as Milan (Linate) and Treviso (near Venice) in Italy.¹⁵ Comparable data are available for temperatures (minima and maxima), precipitation, days with precipitation and relative humidity.



¹⁵ WMO Climate Normals (<https://www.ncei.noaa.gov/products/wmo-climate-normals>, consulted 27.03.2022).

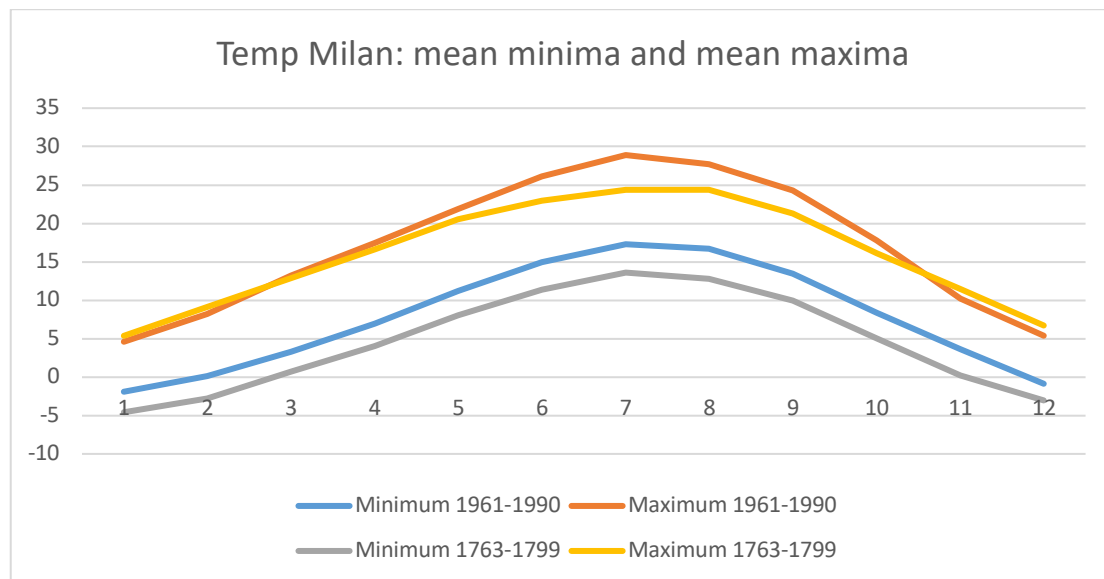
GRAIN QUALITY AND SEASONAL PATTERNS IN GRAIN PRICES



Note: Threshold for Belgium: 0.1 mm precipitation; elsewhere 1 mm.

The twentieth-century climate differs from the eighteenth-century climate. However, here we are primarily interested in the *difference* in weather patterns *between* Northern Italy and Flanders, so the question is less whether the climate changed but whether the difference between the two regions changed. For Italy, we can compare the twentieth-century observations with eighteenth-century observations.¹⁶ For Flanders, similar eighteenth-century observations are unfortunately lacking.

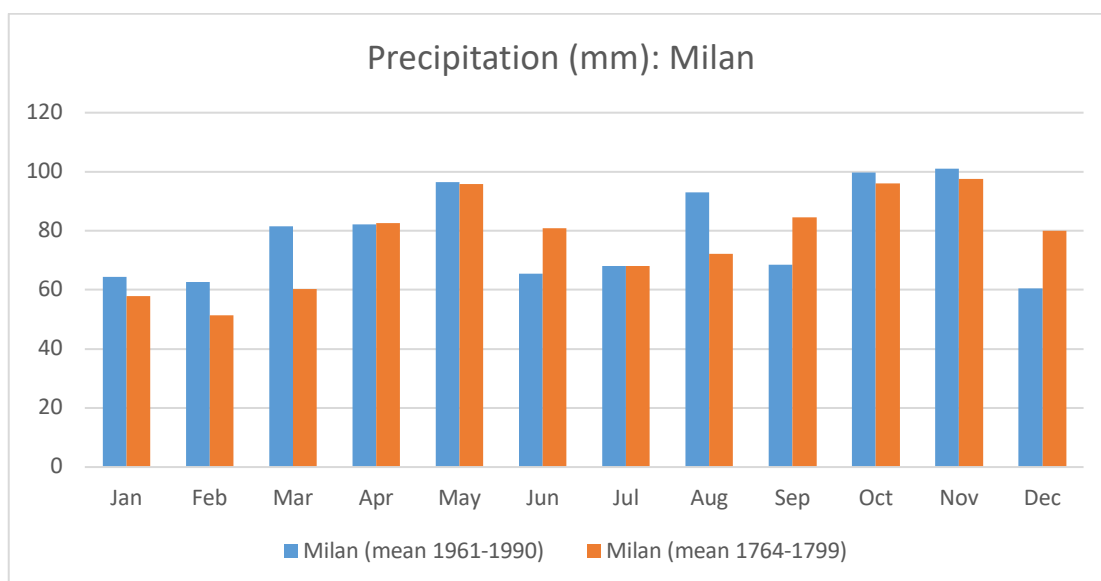
The comparison leads us to three relevant conclusions. First, in Italy seasonal patterns in temperatures and precipitation were very similar during both periods, though more so for temperatures than for precipitation. Secondly, Italian temperatures were lower in the eighteenth century than in the twentieth. It is highly likely that the same is true for Flanders. Third, precipitation in August was notably lower in the eighteenth century than in the twentieth. If August precipitation in Flanders did not change likewise, then levels of August precipitation were very similar in both areas.



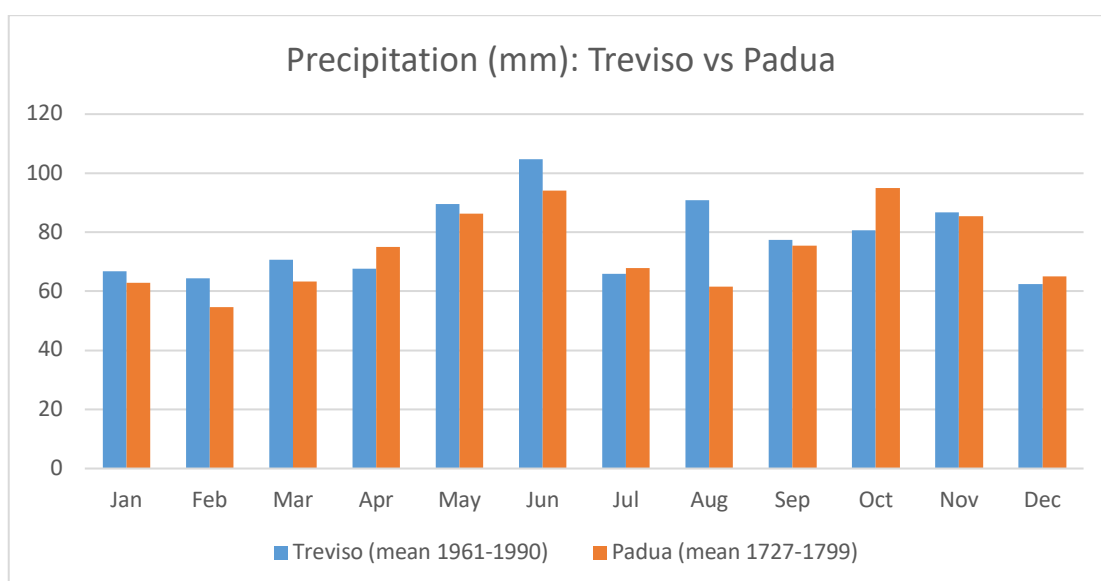
Temperatures: Correlation between mean minima: 0.999; correlation between mean maxima: 0.997.

¹⁶ Dario Camuffo, et al., 'Three centuries of daily precipitation in Padua, Italy, 1713-2018. History, relocations, gaps, homogeneity and raw data', *Climatic Change*, 162 (2020): Electronic supplementary material 18-23; Osservatorio Astronomico di Brera, *Riassunti mensili ed annuali delle osservazioni meteorologiche di Milano dal 1763 al 1840* (1841, Milan).

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Precipitation Milan: Correlation: 0.636.



Precipitation Treviso vs Padua: Correlation: 0.674.

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