Driven by crises : price integration on the grain market in late medieval Flanders

Title: Driven by crises: Price integration on the grain market in late medieval Flanders.

Author: Stef Espeel

Affiliation: Centre of Urban History, University of Antwerp

Abstract: At the centre of the debate on pre-industrial economic growth is the study of market integration, a topic that has increasingly been the focus of intense scientific interest in recent decades. However, this has remained limited to the early modern and modern periods, mainly due to the availability of relevant data. New grain price series have been constructed for several Flemish cities dating back to the early fourteenth century. As one of the most populated regions in the late Middle Ages, the case of Flanders shows that the extraordinary sequence of price shocks in the mid-fourteenth century had a positive impact on the degree of price integration in the grain market. The Flemish grain market functioned better in times of crisis, but caused prices to rise steadily across the entire integrated system during the prolonged crisis period. Whereas many studies have labelled the late Middle Ages – particularly the fifteenth century – as an age of economic contraction with more isolated trade networks, this study shows that Flanders remained a highly economically integrated region.

Keywords: Price integration, grain markets, late Middle Ages, Flanders, grain price series, price crises

Acknowledgements: I want to thank the three anonymous reviewers for their suggestions and for giving expert feedback on this paper, as well as Giovanni Federico for his comments and guidance through the submission process. I also want to thank Tim Soens and Alexis Wilkin for their valuable aid during this research, as well as the members of the jury of my doctoral dissertation, as this article is a revised version of one of its chapters. For some of the statistical tests, the advice and help of Jacob Denolf proved to be invaluable. The research was financially supported by the Flemish Research Foundation (FWO) Grant ‘Shock Cities? Food prices and access to food in Flemish cities in an age of crises (1280–1370)’. Additional financial support was provided by the Antwerp Interdisciplinary Platform for Research into Inequality (AIPRIL).

Driven by crises. Price integration on the grain market in late medieval Flanders.

I. Introduction

In the eighteenth and nineteenth centuries, economic luminaries such as Adam Smith, Thomas Malthus, and Mountifort Longfield adamantly argued that the market played a major role in reducing the general damage wrought by a dearth or famine caused by a harvest failure. Grain merchants minimized these inconveniences through interregional and intertemporal arbitrage.[1] Within their claim that the market produced the optimal spatial and intertemporal allocation mechanism, market integration played an unmistakable role in ensuring that different regions pursued their comparative advantage, increasing steady-state aggregate output and income and reducing the vulnerability of the economy as a whole to any given harvest shortfall.[2]

For a long time, there was a lack of research on the functioning of the market during crisis periods, but the subject has received more attention in recent years. Works on the famines of the late twentieth century in Asia (e.g. Bengal and Bangladesh) and Africa (e.g. Sudan and Ethiopia) – most notably Amartya Sen's research – have emphasized the role of the failing markets and the lack of spatial integration as exacerbating factors.[3] However, studies on two major nineteenth-century famines, the Great Irish Famine (1845-50) and the Great Finnish Famine (1867-68) have argued that no market disintegration or large-scale hoarding occurred.[4] During the Great French Famines of 1693-4 and 1709-10, public interference in the rather disintegrated French grain market did not lead to grave mortality. The market was too thin and too slow to reduce price gaps between regions; however, to the limited extent that grain was being moved from more plentiful areas to less, grain markets probably alleviated hunger.[5] In the case of England during the Great Famine of 1315-7, Philip Slavin has argued that the

[1] Smith, *An inquiry into the nature and causes of the wealth of nations*, pp. 526–34; Malthus, *An investigation of the cause of the present high price of provisions*, pp. 12–14; Longfield, *Lectures on political economy*, pp. 52–58.
[2] Ó Gráda and Chevet, 'Famine and market in Ancien Régime France', pp. 706–8.
[3] Sen, *Poverty and famines*; Ravallion, *Markets and famines*, pp. 1219–21; von Braun, Teklu, and Webb, *Famine in Africa: causes, responses, and prevention*, chap. 6.
[4] Disastrous production shortfalls overwhelmed functioning markets causing grave famine conditions. Ó Gráda, *Black '47 and beyond*; Ó Gráda, 'Market and famine'.
[5] Ó Gráda and Chevet, 'Famine and market in Ancien Régime France', pp. 726–28.

functioning of the grain market did indeed fail, but he notes that this was an extraordinary event that had no equivalent in any subsequent harvest failures.[6] These examples show that different crises did not have a similar impact on the (dis)integration of markets, and price shocks could have acted as movers of the economic system itself.

Late medieval Flanders, a region with a high population density and early dependence on grain imports, offers an excellent opportunity to observe how late medieval grain markets reacted to severe disruption of both production and demand. The newly constructed Flemish market price series for grain makes it possible to study the effect of price shocks on the varying degree of integration of the Flemish grain market over time, at least from 1320 onwards. For this region in particular, a high degree of market integration has already been suggested by several authors, but it is still unclear when and how it emerged and, equally important, how and why it evolved over time.[7] This article stresses the relevance of price shocks, as opposed to determinants usually cited such as a technical change in transportation, and information and trade policies. Shocks and crises tend to decrease price dispersion due to transportation costs remaining constant, or at least increasing to a lesser extent than prices, even without any changes in market integration. Additionally, grain price spikes can be reduced by market integration if they attract grain from non-crisis-affected locations. Otherwise, new commercial links established during crisis periods to create a new or additional flow of grain influx could subsequently become permanent and foster long-term integration. However, the latter mechanism stands in contrast to Bruce Campbell's perspective on the economic contraction of the fifteenth century, a period characterized by the breakdown of longer-distance trade and commercial isolation.[8]

Flanders witnessed a succession of severe price shocks in the grain market, which were related to harvest failures, warfare, and from 1349 onwards, recurrent outbreaks of plague, all examples of exogenous

[6] Slavin, 'Market failure'; Slavin, *Experiencing famine*.
[7] Van der Wee, *The growth of the Antwerp market*; Tits-Dieuaide, *La formation des prix céréaliers*; Tits-Dieuaide, 'The Baltic grain trade'; Unger, 'Feeding Low Countries towns'.
[8] Campbell, *The Great Transition*.

shocks that generated a widespread production shortfall.[9] The back-to-back harvest failure of 1315-7 caused the Great Famine of the early fourteenth century and was the most disastrous event of the late Middle Ages.[10] Several episodes of social and political strife took place, disturbing trade networks and agricultural infrastructure. At the start of the fourteenth century, Flanders clashed with France during the Franco-Flemish wars (1297-1305/1314).[11] In the early years of the 1320s, a revolt in coastal Flanders broke out against Count Louis I of Flanders. Well-to-do peasants and part of the middling groups were profoundly dissatisfied with his autocratic and pro-French policy, and the heavy fiscal burden imposed on them.[12] At the start of the Hundred Years War and during the 1380s, other rebellions broke out led by the city of Ghent, with the key figures of Jacob and Philip van Artevelde taking up the leading role.[13] Another episode of urban conflict was the Bruges revolt of 1436-8 against Philip the Good.[14] All these episodes of political conflict could have been the cause of disrupted information and trade networks, strengthened entitlements of food for certain social groups and the destruction of grain stocks or standing grain in the fields. Besides harvest shortfalls and warfare, major episodes of plague and epidemics ravaged Flanders in 1348-9, 1361, 1369-70, 1399-1401 and 1438.[15] The emergence of this endemic disease could distort the supply and distribution of grain, especially if it occurred simultaneously with a harvest failure.[16]

In this article, I focus on the degree of price integration in the Flemish grain market in the late Middle Ages and how it changed over time in a period during which various price shocks affected the market. After a short survey of the literature on premodern market integration and a discussion on the case study

[9] In section IV an overview is added of the grain price increases during these periods.
[10] Lucas, 'The great European famine'; Kershaw, 'The great famine'; Geens, 'The great famine'; Jordan, *The great famine*; Slavin, 'Market failure'; Slavin, *Experiencing famine*.
[11] More information on this conflict can be found in Verbruggen, *Vlaanderen na de Guldensporenslag*; Nicholas, *Medieval Flanders*, pp. 196–97; Verbruggen, DeVries, and Ferguson, *The Battle of the Golden Spurs*; Boone, 'Een verstedelijkte samenleving', pp. 72–76; Prevenier, 'Leliaards en Klauwaards', pp. 145–50; Speecke, '"Isti ponerentur in officio scabinatus"', pp. 25–27.
[12] Tebrake, *A plague of insurrection*; Sabbe, 'De opstand van Brugge'; Sabbe, *Vlaanderen in opstand*.
[13] Nicholas, *The van Arteveldes of Ghent*; Rogghé, *Vlaanderen en het zevenjarig beleid*; Demuynck, 'De Gentse oorlog 1379-1385'.
[14] Dumolyn, *De Brugse opstand*.
[15] An overview of the emergence of the Black Death and its echo-epidemics in the Low Countries can be found in Roosen and Curtis, 'The "light touch"', pp. 37–46; Roosen, *The Black Death and recurring plague*, pp. 92–97.
[16] Stone, 'The Black Death'.

of Flanders in section II, I present the methodology and processed data in section III. I address the evolving degree of price integration throughout the late Middle Ages in section IV, and finish with some concluding remarks in section V.

II. Premodern market integration and the case of Flanders

A high degree of market integration in staple foods is often considered to be one of the characteristics that distinguished Europe from other parts of the world well before 1800.[17] But how far back in time should this high level of price integration in Europe be traced, and how did it evolve? In his study of the European grain market, Karl Gunnar Persson argues that there was a substantial increase in integration in the nineteenth century.[18] This was not a linear evolution, as shown by Victoria Bateman, who denies that the early modern period brought improvements to the degree of European integration due to the many episodes of warfare in the sixteenth and seventeenth centuries.[19] Nonetheless, Giovanni Federico et al. have recently shown that the process of increasing price convergence was largely a premodern phenomenon in Europe, which, according to their used dataset, started as early as the fifteenth century.[20] This convergence reached its first peak in the seventeenth century at a level that was not surpassed until the nineteenth century.

By solely looking at continent-wide integration, we overlook the importance of regional market systems, especially during the premodern period when markets tended to be located at relatively short distances, with geography being a more decisive factor than political borders.[21] Coastal markets, for example, were generally larger and showed greater scope for advancement than landlocked markets thanks to lower transportation costs, especially for bulky goods. This geographical feature contributed to advanced

[17] However, critics have argued that the degree of integration in China was at the same level as that of Europe on the eve of the nineteenth century and the Industrial Revolution. Moreover, integration in Europe only rapidly increased during the first half of the nineteenth century, which shows that it appears to have been a consequence of economic growth rather than a pre-condition for it. The Chinese region studied is the Yangtze Delta area. Shiue and Keller, 'Markets in China and Europe'.
[18] Persson, *Grain markets in Europe*.
[19] Bateman, 'The evolution of markets in early modern Europe'.
[20] The absence of earlier reliable and continuous price series meant that this study could only start in the mid-fifteenth century. Federico, Schulze, and Volckart, 'European goods market integration'.
[21] Chilosi et al., 'Europe's many integrations'.

market integration in north-western Europe from the sixteenth century onwards.[22] In England, the level of market integration was already high from the early fourteenth century, and Gregory Clark even assumes that a relatively strong integration of a 'national' English market emerged as early as the thirteenth century.[23] James Galloway, who considers the English case to be exceptional, states that this early high degree of integration was the result of a strong institutional framework, with an influential central government that ensured a stable currency, established national standards for weights and measures, removed any fiscal or political barriers to trade, and implemented a legal framework for contract enforcement, thereby ensuring reduced information and transaction costs across regions.[24] However, as I argue here, the English case was perhaps not as exceptional as Galloway maintains, since the Flemish grain prices were equally well-integrated from the early fourteenth century onwards.

Several authors have already addressed the economic development of certain regions with a focus on the late Middle Ages. Johan Söderberg argues that there was already a considerable degree of integration between different cities in north-western Europe.[25] Richard Unger, on the other hand, puts forward a more pessimistic view on the late medieval economic integration of north-western Europe, stating that most of the cereals consumed in the city originated in the surrounding area, and that cities only transported large volumes of grain from more distant regions during dearth periods. This implies weak integration in the North Sea region, at least in the fourteenth and fifteenth centuries. According to Unger, market integration only became progressively stronger during the sixteenth century, while for the Low Countries, he argues that a well-integrated regional market system had begun to develop in the preceding period.[26] On this point, he follows the conclusions offered by Herman Van der Wee and Marie-Jeanne Tits-Dieuaide on the strong regional integration of the Brabantine and Flemish grain markets in the

[22] This is in line with the notion of the Little Divergence between the advancing Northwest and the rest of the European continent from the seventeenth century. Federico, Schulze, and Volckart, 'European goods market integration', pp. 307–8; Chilosi et al., 'Europe's many integrations', pp. 58–62.
[23] Clark, 'Markets and economic growth'.
[24] Galloway, 'One market or many?'
[25] He compares this integration with that of the Near East, and his conclusions were focused on the entire period between 1260 and 1512. Söderberg only uses one coefficient over the entire period and does not look at the changing degree of integration over the course of his study period. Söderberg, 'Prices in the medieval Near East and Europe', pp. 9–11.
[26] Unger, 'Feeding Low Countries towns'; Unger, 'Thresholds for market integration'.

fifteenth century.[27] In her analysis of quite fragmentary price material, Jessica Dijkman adds the Holland region to this system, at least for the first half of the fifteenth century. Dijkman maintains that Holland's high degree of integration along with other areas on the North Sea coast was due to its close connections to the interregional marine-based trade networks, the absence of restrictive trade regulations, and the high demand for bread grains caused by a production system affected by subsiding peatlands.[28]

Flanders was a pivotal region in the economic system of north-western Europe throughout the Middle Ages. Its major cities had a high need for a sufficient grain influx, and relied on their hinterland as a primary supply chain. Erik Thoen stated that by 1300 this hinterland – while extremely productive – was scarcely producing enough grain to meet demand.[29] Cities in the northern part of the county turned to their southern counterparts and the neighbouring, grain-exporting regions, such as Artois, Hainaut, the Cambrésis, and Picardy.[30] Wilhelm Naudé mentioned in his late nineteenth-century study that shipments from Normandy brought grain to Flanders in the fourteenth century and even mentions one case dating back to the thirteenth.[31] The river Scheldt and its tributaries allowed the southern Flemish and northern French regions to maintain close contact with the more populous northern Flemish cities, although land transport was also possible thanks to the relative proximity of these cities. For the cities of Ghent and Douai, the Scheldt grain trade was vital in shaping their provisioning policies, and over the course of the medieval period they began to control the trade through their respective grain staples.[32] These staples crystallized, giving citizens of these cities the preferential right to buy grain traded via the

[27] Van der Wee, *The growth of the Antwerp market*, pp. 23–24; Tits-Dieuaide, *La formation des prix céréaliers*, p. 44.
[28] Dijkman, *Shaping medieval markets*, pp. 275–312.
[29] Thoen, 'The birth of "the Flemish husbandry"'.
[30] Such interregional economic ties were already mentioned for Ghent in Bigwood, 'Gand et la circulation des grains en Flandre, du XIVe au XVIIIe siècle', pp. 445–51. It was not until the fifteenth and especially sixteenth century, that Flanders and the other principalities of the Low Countries looked to the Baltic region for frequent or sometimes continuous grain imports. Tits-Dieuaide, 'The Baltic grain trade'; van Tielhof, *De Hollandse graanhandel*; van Tielhof, 'Grain provision in Holland'; van Tielhof, *The 'mother of all trades'*; Dijkman, *Shaping medieval markets*; van Tielhof, 'The rise and decline'.
[31] Naudé, *Die Getreidehandelspolitik der Europäischen Staaten*, p. 220.
[32] Both cities were well placed to control the grain trade, as the Scarpe river flows through Douai, which was situated in some of northern France's most productive regions, and on which navigation north and east was possible. The Scarpe then flows into the Scheldt, joined by the Lys in Ghent, connected to Bruges through various waterways and east to Antwerp and the North Sea.

Scheldt river basin. Before any transit to other markets was allowed, the grain had to be unloaded and offered for sale at the local market. The first mention of both Ghent and Douai being the centres of the Flemish grain trade dates back to 1187, but Martha Howell and Marc Boone have stated that the regulatory stipulations (for Ghent) mainly date back to the mid-fourteenth century, more precisely between 1337 and 1366.[33] Grain staples provided the inhabitants of the city with some protection from the volatility of the grain markets because supply was more secure, which guaranteed local employment and created possibilities for economic and political success. Given the enormous financial importance of the grain trade, the skippers in Ghent were a hugely influential guild, and in Douai, grain merchants rose to political prominence.

Many market integration studies focus primarily on the degree of integration in the (very) long term. Some cases include the changing degree of market integration (both integration and disintegration) but rather neglect the *movers* of that integration. Why and how was the economic trading system affected, and what was the outcome? This article establishes the crises as the focal point, with the late medieval county of Flanders as a fitting case, accompanied by a new dataset of grain prices dating back to the early decades of the fourteenth century.

III. Measuring price integration: data and methodology

In an effort to uncover the when and how of premodern market integration, economic historians have repeatedly turned to the relatively abundant and easily quantifiable price data of cereals. The agricultural market played an important role, as it improved the allocation of a wide range of farinaceous products, among others.[34] The market for cereals, as a basic foodstuff with a high calorie-to-price ratio, was also more developed and regulated in the premodern era.[35] Additionally, it has been on the agenda of famine

[33] Verhulst and Gysseling, *Le compte général de 1187*, p. 84-5, 143, 156; Howell and Boone, 'Becoming early modern', p. 312. The origin of the grain staple right in Douai is even more obscure, but Howell and Boone state that this privilege also took its form in the same century. For a discussion on the Douai staple, see Espinas, *La vie urbaine*, II, p. 210-12; Rouche, *L'histoire de Douai*, p. 76; Mestayer, 'Le marché au blé de Douai', p. 47; Derville, 'Le grenier des Pays-Bas', p. 273-4.
[34] Federico, Schulze, and Volckart, 'European goods market integration', p. 276.
[35] Van der Wee, 'De crisissen van het Ancien Régime', p. 417.

studies, as lower price volatility of cereals led to increased food security and mitigated the link between income and death rates, which was presumed to play a role in hunger crises.

The data used in this study is mainly drawn from the accounts of large ecclesiastical landlords situated in the Flemish 'shock cities' of Bruges, Ghent, Lille and Douai.[36] Urban hospitals, abbeys and collegiate churches played a significant role as large agricultural producers, distributors and consumers of grain (see Appendix B). They owned a vast landed patrimony which they either cultivated themselves or leased out to tenants.[37] These tenants produced grain and, in some cases, were required to pay the landlord in kind, ensuring an enormous amount of grain income (mainly wheat for this region) which they mostly consumed or sold. Their annual accounts structurally indicate the quantities of grain income and expenses, and, in the case of wheat sales, these were even broken down per transaction. The transactions include a great deal of side information in addition to the quantity and the price, such as the date of the sale, and the buyers' name and sometimes origin. Unfortunately, such detailed contextual information is not present in the accounts of the landlords from Bruges and Ghent; however it is available for the landlords in southern Flanders. By bringing together published prices and processed archival material, I constructed new price series for the fourteenth century.[38] For the fifteenth century, I used additional published price series.[39] For 1381 onwards, I enlarged the data sample with rent prices from the *spicaria* of the count from Bergues, Veurne and Ypres/Diksmuide.[40] Strictly speaking, these are not market prices but rent prices used for conversions based on the local price courses. They give an added

[36] These cities are labelled as 'shock cities' not only in Asa Briggs' classic definition as cities having gone through a period of extremely rapid growth and structural transformation (which happened throughout the urban expansion of the twelfth and thirteenth centuries) but also because of the potential vulnerability to food shocks which resulted from this expansion. See Briggs, *Victorian cities*.

[37] For a recent discussion on the estate management of these landlords in the fourteenth century, see Espeel, 'Demesne or leasehold?'.

[38] For the methodology of constructing the price series, see Appendix A.

[39] For the references of the sources and secondary literature including price data, see Appendix C.

[40] The *spicaria* was the office responsible for the collection of grain income in the administration of the Count of Flanders. Four different prices for wheat were included in the Flemish *spicaria*: one for Bruges, Ghent, Kortrijk, Aalst, and Rupelmonde; a second for Veurne; a third for Bergues; and a fourth for Ypres and Diksmuide. The rent price for Bruges is practically equal to the rent prices recorded by St Donatian's Cathedral, which is why the *spicaria* prices for Bruges are disregarded here. All of these prices have been published in Van Houtte, *Documents*.

value to the analysis since a larger region is covered, but the four-cities sample and seven-cities sample are studied separately.[41]

Investigating late medieval grain price series and evolutions can be challenging, as several factors can hinder the analysis.[42] The availability of the sources is the first obstacle, as they become scarcer as we go further back in time. The newly constructed series for Flanders is the earliest for the region to date, only surpassed by several series for England, which date back to the thirteenth century.[43] Second, the range of products is determined by those available sources. For most premodern studies this is limited to cereals, which are regarded as intermediate goods: on the one hand, they have a high value-to-bulk ratio, and on the other, they are commodities of a heavily regulated market.[44] An additional hindrance is present in the series for Ghent. Almost no continuous accounting series has survived the test of time, and the majority of the grain prices found in those that did survive are for rye. For the other cities, wheat prices constitute the main body of data, which poses a problem, as it is not advisable to compare two different commodities (i.e. different qualities of grain) when studying price integration. Judging from the price of wheat and rye in the accounts of the landlords from Bruges, these different grain types had a parallel price course over the late Middle Ages.[45] The correlation coefficient of their price evolution in the accounts of St John's Hospital amounts to a staggering 0.99, and in the rent price list of St Donatian's Cathedral it has an equally high coefficient of 0.96. The prices for barley and even oats follow the same evolution, albeit with a weaker coefficient: respectively 0.90 and 0.86 in the accounts of St John's Hospital and 0.64 for those of St Donatian's Cathedral. A strong link clearly exists between the price evolution of wheat and that of rye. Between wheat and oats, the link is weaker, which is not surprising due to the general absence of oats in the human diet, making its price more elastic. In addition to rye being a suitable proxy for wheat, there is also the prominent economic and political role of Ghent

[41] Changing a sample from four series to seven in the middle of the studied period could seriously skewer the results.
[42] This paragraph is based on Federico, 'How much do we know', pp. 485–88.
[43] Rogers and Rogers, *A history of agriculture and prices*; Beveridge, 'A statistical crime'; Munro, 'Builders' wages'.
[44] Federico, 'When did European markets integrate?', p. 94.
[45] This is also shown in VandenBorre, *Prijzen, lonen en levensstandaard in Brugge*, pp. 63–66.

as the largest city in the county of Flanders, justifying the addition of its rye prices. Coupled with the fact that we are rather looking at how the level of price integration shifted rather than the actual level of these prices throughout the late Middle Ages, I have chosen to include the rye series in the analysis.

Third, the number and geographical reach of the locations for which integration is studied are important. Generally speaking, the more locations the better. Unfortunately, in this case, only four series are available for the fourteenth century (Bruges, Ghent, Lille, and Douai), which can be supplemented with an additional three for the fifteenth century. A fourth obstacle involves the timing or frequency of the price series, especially with regard to the empirical tests for market efficiency. The estimates of the speed of adjustment are biased upwards if the frequency of the data does not match the actual time of adjustment.[46] On the other hand, a time series also needs a minimum number of observations. In the data set for this paper, an annual frequency is used due to the absence of more continuous monthly data, which are generally hard to find for the late Middle Ages. Finally, a fifth challenge is posed by errors in the data, but inaccuracy only becomes a serious problem if there is a systematic bias in the series. As a general rule, posited by Federico, non-market sources are more likely to contain bias due to political and economic decisions made by large landlords, who could have a level of market power or simply exploit economies of scale in transactions.[47] He maintains that such a series should be omitted from the dataset. However, for the late Middle Ages, other more trustworthy sources are simply non-existent for this region. The source material for late medieval Flanders is unsurprisingly not continuous, especially not for the earliest decades. Even though annual prices are certainly available for the first two decades (see Appendix C), the empirical analysis can only start from 1320 onwards.[48] The problem of missing observations after 1320 can be tackled through interpolation, but this would only strengthen the series with a few percentages.[49] Additionally, any missing observations which would be interpolated are based

[46] Taylor, 'Potential pitfalls'; Brunt and Cannon, 'Measuring integration'.
[47] Federico, 'When did European markets integrate?', p. 97.
[48] For Bruges, there are even prices from 1277 onwards, see VandenBorre, *Prijzen, lonen en levensstandaard in Brugge*, pt. 2.
[49] As proposed by Federico, 'When did European markets integrate?', pp. 106–7. This procedure, however, was designed for a long-term analysis. For Bruges, 2 extra prices out of a total of 181 potential price data could be

on the straddling observations, which smooth peaks and are less suitable for the shorter-term analysis of price peaks.

Many studies on market integration use only the correlation of price series over an entire period to assess the level of integration. Such studies primarily focus on the parallel course of prices and attribute a certain value to that integration, without considering its possible dynamism within that period.[50] In this article, I am using a three-way empirical methodology, for which continuous price series are preferred but not mandatory, even though data bias and hiatuses in the series can result in a slight distortion of the results.[51] This methodology is based on the following definition of market integration: "In conditions of *perfect* integration, certain goods' prices must be at equilibrium and they must return to that equilibrium quickly when a price shock occurs."[52] The first prerequisite concerns the Law of One Price (LOP), which states that in a perfectly integrated market, the same prices are used for the same commodity, with an exception for additional transportation costs.[53] The second prerequisite focuses on the efficiency of the market. Information sharing and arbitrage (making a profit by buying and selling at different market prices over different locations) imply that whenever prices move away from the equilibrium, they swiftly adjust to that equilibrium again. This efficiency can be measured by the speed of adjustment and the increase in stable linear developments.

added (from 93 to 94 per cent coverage). For Ghent, 11 extra prices could be added (from 86 to 92 per cent coverage); for Lille 6 extra prices (from 96 to 99 per cent coverage); and for Douai, 1 extra price (97 per cent coverage remains the same). I have performed the analysis carried out in section IV with the interpolated series as well, and this does not radically change the outcome, which is why I opt for the non-interpolated sample. The comparison between these results can be consulted in the online Excel appendix.

[50] This methodology was for instance used by (among others) Tits-Dieuaide, *La formation des prix céréaliers*; Unger, 'Feeding Low Countries towns'; Söderberg, 'Prices in the medieval Near East and Europe'.

[51] Based on the methodology of Federico, Schulze, and Volckart, 'European goods market integration'; Chilosi et al., 'Europe's many integrations'.

[52] A definition of market integration was already formulated in the nineteenth century by Augustin Cournot, who stated that a region with an integrated market is '*an entire territory of which the parts are so united by the relations of unrestricted commerce that prices take the same level throughout with ease and rapidity*'. See Cournot, *Mathematical principles*, pp. 51–52. This definition has been revived and restudied in Federico, 'How much do we know', p. 474.

[53] Anderson and Van Wincoop, 'Trade costs'.

I study the LOP by analysing the price convergence over time, using the cross-sectional coefficient of variation (CV).[54] To assess the evolution of this CV and the presence of any breaks therein, I use a Bai-Perron test rather than rely on any visual demarcations.[55] I test the operational efficiency of the fourteenth-century Flemish grain market system using two different measures. It is not possible to pinpoint the speed of adjustment because, in an integrated market, prices would undoubtedly adjust within a year, whereas in this analysis only annual averages can be used due to the prevalence of the source material and the character of the price data.[56] Therefore, the measures we are required to use are the average rolling coefficient of correlation (CC) and the average rolling standard deviation (SD).[57] The first measure examines the presence (or absence) of a (stable) parallel relationship between markets. Highly correlated prices would signal ongoing trade between different *loci*.[58] Following the method of Chilosi et al., I use a roll of 21 years on the average of the different coefficients of correlations between the price in each city and the average price of all cities.[59] I thus look at the co-movement of those prices relative to each other. Low price volatility in individual localities is another important feature of good market integration. Efficient markets imply better protection from local shocks, which lead to more stable prices over time. It is also important to note that market integration only reduces price volatility if shocks differ between areas and when arbitrage ensures that areas with a relative deficit are supplied by those with a relative surplus. In a small area like Flanders, this may have not been the case, so it is important to look at the type of shocks as well. This volatility is frequently measured using the coefficient of variation, but here I opt to use only the rolling standard deviation as it is important to

[54] The coefficient of variation is computed as the standard deviation divided by the mean in the arithmetic scale. The advantages of a cross-sectional coefficient of variation are explained in Federico, 'When did European markets integrate?', pp. 95–98.
[55] Bai and Perron, 'Computation and analysis of multiple structural change models'. This test was also used in Federico, Schulze, and Volckart, 'European Goods Market Integration', and is frequently used to look for structural breaks in time series, attempts to compute multiple well-fitting regressions over a certain period with an optimization towards as few as possible different periods. I am grateful to Dr Jacob Denolf for sharing his knowledge on the possibilities of measuring market integration with the available data and for his help in processing this test.
[56] Federico, 'How much do we know', p. 477.
[57] These two measures are used in Chilosi et al., 'Europe's many integrations'.
[58] Studer, 'India and the Great Divergence', p. 401.
[59] Chilosi et al., 'Europe's many integrations', pp. 48–52.

include the general price evolution as well.[60] The roll on the SD is set for 11 years to analyse the change over the entire period. This roll is shorter than that used for measuring correlation, since the latter is more demanding in terms of sample size. Given that rolling averages are used for studying the two aspects of market efficiency, it is not feasible to perform a Bai-Perron test to unravel any structural breaks. Nonetheless, the evolution of these measures can be compared visually with the segments of price convergence.

Coefficients signalling a stronger degree of integration might reflect the influence of other factors at play rather than just an advancing market integration. Shocks impacting an entire region could provide a potential explanation for price convergence, especially in the case of weather anomalies. This problem has not been fully addressed in studies on integration, except very recently for early modern Germany, where the standard deviation of real seven-year mean prices proves to be more robust to weather anomalies and climate change.[61] On the correlation between temperatures and grain prices, Chantal Camenisch has shown that the conditions of the summer season affected rye and oats prices in the fifteenth-century Burgundian Low Countries: falling temperatures resulted in higher cereal prices. Gregory Clark has shown that in late medieval England, manorial yields – highly susceptible to harmful weather conditions – only show a weak correlation with the price course, but English prices tended to conform to a national trend.[62] More than a swing in temperatures, heavy short-term anomalies, such as very dry or wet summers, were more prone to cause a grave death of grain supplies. Acute shortages were brought on in particular by disastrous harvest conditions occurring back-to-back.[63] In a region affected in this way, prices in different areas would all soar, accounting for some convergence and

[60] Whereas the coefficient of variation 'deflates' the standard deviation using the arithmetic mean of the time series. Therefore, price peaks during a period of high average prices would show as less volatile when using the coefficient of variation.
[61] Albers and Pfister, 'Climate change, weather shocks, and price convergence'. A methodology of measuring price convergence robust to weather shocks has been used in this paper by employing the standard deviation instead of the coefficient of variation of five-year averages of real grain prices. This methodology proves to be robust to spatially symmetric and asymmetric weather shocks.
[62] High yields and the threat of low prices would cause the majority of the stock to be repelled to more expensive regions while low yields and accompanying increasing prices would ensure grain inflow. Clark, 'Markets and economic growth', pp. 9–19.
[63] Campbell, 'Nature as historical protagonist', pp. 287–93.

correlation of prices, even if those areas had few or no economic ties. The rate and height of the increase would vary locally according to supply and demand. Flattening the variation between localities demonstrates a stronger integration, which makes both the coefficients of variation and correlation still viable to use here, albeit cautiously.

IV. Flanders and its price integration in the late Middle Ages

The four new annual price series include several peaks that play an important role in this analysis. These short-term price peaks are identified by the threshold of an increase of more than 100 per cent over the 'normal' price (see Table 1).[64] Specialized (historical) research on food crises defines price spikes as increases with the potential to lead to a shortage, and it is imperative to compare a certain price year with the preceding period rather than with its straddling data. The first price extreme occurred during the period of the Great Famine (1315-17), followed by a second one between 1339 and 1343, especially in the two southern Flemish cities of Lille and Douai. The third period of price increases occurred during and after the Black Death ravaged Europe (1349-52). The next peak developed in 1360 when another wave of the plague hit the region. Yet another crisis broke out in the late 1360s, instigated by a third plague outbreak, but the peak did not reach the required threshold due to a prolonged period of high prices (see Appendix C). In the fifteenth century, price crises occurred in 1408, 1416, 1438, 1455-7, the late 1470s and early 1480s, and 1488.[65] All of these price peaks can be linked to the presence of a particular 'price shock' (harvest failure, warfare, and/or epidemic) given in the overview in part I.

Table 1 around here

[64] The 'normal' price is defined as the average price in the ninth to the second year before the crisis, leaving out the highest and lowest value. Curtis et al., 'Low Countries', pp. 123–25.

[65] More information on the food crises of the fifteenth century and the reaction of urban governments in the Southern Low Countries can be found in Tits-Dieuaide, *La formation des prix céréaliers*; Curtis et al., 'Low Countries'; Barla, *Pour la necessitet du povre peuple*.

The process of price convergence is shown in Figure 1. A Bai-Perron test suggests structural breaks in the cross-sectional CV in 1347, 1376, and 1418 for the sample of four cities (1320-1500).[66] Performing the same test on the sample of seven cities (1381-1500) results in a single break in 1421, confirming the presence of this break.[67] The addition of three extra price series from 1381 onwards does not change the results significantly, confirming the validity of both samples.

Figure 1 around here

Table 2 around here

The first break is situated at the start of the outbreak of the Black Death in the Low Countries. In the period beforehand, from 1320 to 1347, the average CV amounts to 0.29 and shows a mildly declining linear trend, which signifies slowly converging prices. During the second period, marking the year from 1348 to 1376, the average CV dropped to 0.21. Within this period, the linear trend again shows a slightly decreasing slope. In the third phase, from 1377 to 1418, a higher average CV than the previous period is present (0.29), paired again with a slightly decreasing slope, indicating a gentle converging of wheat prices. The fourth and final phase, which spans the rest of the period studied, is characterized by an almost similar average CV to the third period and a very stable linear trend. Prices in the early fourteenth century show that a converging trend was already occurring before the Black Death, but it reached its highest level during the extraordinary sequence of price spikes in the mid-fourteenth century. However, regional commercial links between the southern and northern Flemish cities were nothing new in the mid-fourteenth century, as grain imports northwards were already occurring from the late thirteenth century onwards. Improved price integration cannot, therefore, be attributed to the fact that new temporary commercial contacts created during the crisis years were becoming permanent. An important factor was the relative stability of transportation costs in comparison to the price of grain, accounting

[66] These structural breaks are identified by a Bai-Perron test on the Hodrick-Prescott filtered series of the four-city sample. When the series of the cross-sectional CV is not filtered, no breaks are identified by the Bai-Perron test. The intervals in which the three breaks occur with 95 per cent certainty are respectively 1343-50, 1373-9 and 1404-1427.

[67] The structural break in 1421 is from a Bai-Perron test on the non-filtered series of this seven-cities sample, whereas the break in 1420 is from the Hodrick-Prescott filtered series.

for a part of the mechanism of price dispersion during crises. In addition, the importing of grain from non-affected cities or regions also comes into play. Judging from the annual prices in Appendix C and the overview of the price crises in Table 1, many of the crises did not reach their absolute peak in the exact same year. The timing of the pinnacles of the shocks causing price peaks is not parallel over the entire county. The crises occur in all the cities during the same prolonged period, but numerous local differences remain on an annual basis, which is hugely advantageous for arbitrage and the price integration process.

The analysis of the parallel movement between the price series, which is measured through the rolling coefficient of correlation (Figure 2), is the first test of market efficiency.[68] More integrated markets are expected to have prices that move similarly, and the rolling CC shows that co-movement. At the beginning of the fourteenth century, the average rolling CC was high (around 0.90), dropping drastically to about 0.60 during the 1330s. From the second half of the 1330s onwards, the average coefficient started to increase, reaching 0.90 again. Around 1380, the coefficient dropped again to a level of 0.75, which was maintained throughout the last two decades of the century. This stable lower coefficient is present for the four- as well as the seven-cities sample. The last decades of the fourteenth century show a peculiar divergence for the Ghent series, which is caused by the absence of a high number of annual prices during that period, especially during the higher price years. After these years with relatively few prices, the series for Ghent quickly recovered to the level of the other cities.[69]

Figure 2 around here

[68] The rolling coefficient of correlation is calculated between the price series of a city and the average price level of the entire sample, so these numbers cannot be used for any comparison with other studies and cities.

[69] To verify that the discrepancy between the series for Ghent and the other cities in Figure 2 is not caused by using the rye series, I have performed a robustness check by comparing the convergence of the price series without the Ghent prices. The determination coefficient (R^2) between the cross-sectional coefficients of variation of the four-cities sample (1320-1500) with and without Ghent equals 0.683 ($p<0.001$). When performing this check with the seven-cities sample (1381-1500), the R^2 equals 0.860 ($p<0.001$). In combination with the correlation coefficients mentioned in section III, these tests show that the use of the Ghent rye series is justified.

For the fifteenth century, we can see a slight divergence between two different samples. The sample in which only the four cities of Bruges, Ghent, Lille and Douai are studied displays a higher coefficient than the sample with seven included series. A slight break can be observed for both samples, followed by an increase around the 1430s. Between 1430 and 1480, a period of exceptionally low prices for the late Middle Ages, the co-movement is as strong again as it was in the period following the Black Death. To summarize, while the evolution of grain prices in the early fourteenth century was not entirely parallel for each city, this changed rapidly after the Black Death, and that parallel evolution remained very strong, with only slight fluctuations, during the rest of the late Middle Ages. The breaks in the price convergence discussed above are visible in the co-movement of prices as well, with a U-shaped evolution during the first period (1320-47), a high correlation during the second (1348-76), followed by a slightly lower correlation during the third (1377-1418) and a stable correlation during the last phase.

The other factor relating to market efficiency concerns price volatility, measured by the average rolling standard deviation for each city (figure 3), as explained above. The lower the deviation, the less volatile the set of series. Price volatility is linked to the occurrence, frequency, length, and severity of price extremes, which should be lower in a more integrated market system due to the quick movement of goods.

Figure 3 around here

First of all, there is almost no difference between the four- and seven-cities samples, again confirming their validity. The high starting value around 1320 is mainly due to the lack of price values available for Bruges, Ghent and Douai during the Great Famine (1315-17). During the 1320s and 1330s, the rolling SD drops to a value of slightly below 10 g Ag per hl., after which it increases again towards the period around 1340. This increase is mainly due to the price peaks that are most pronounced in southern Flanders. Afterwards, the volatility drops quite steadily up to 1380 with the average rolling SD reaching a low of about 3.8 g Ag per hl. Small jolts do occur just before 1360 and after 1370. From 1380 to 1420, the SD increases slightly to 8-9 g Ag per hl. For the rest of the fifteenth century, the long-term evolution

of the SD remains stable at around 6-7 g Ag per hl. There is still fluctuation present, with even higher amplitudes than in the fourteenth century, but this is caused by the average annual price being low and stable with the presence of several price peaks, pushing the SD up for some episodes. The price crisis of 1438 and those occurring at the end of the century count as the harshest ones. Confronting the evolution of the grain market price volatility in Flemish cities with the breaks in price convergence shows that during the first segment, before 1348, volatility was relatively high but constant. During the second phase (1348-76), volatility started to decline, followed by a slight increase in the third phase (1377-1418), and a stable evolution in the last phase (1419-1500). In the longer term, price volatility dropped slightly over time, but the high degree of price integration seemingly failed to temper the major price crises of the late Middle Ages. However, it is possible that the peaks would have been more extreme if integration had been lower.

Each of the three integration measures addresses a different aspect of the functioning of the market. Nonetheless, these three measures do not necessarily have to be in accordance with each other to result in a more integrated or disintegrated market. Between the two measures of efficiency, co-movement and price volatility, a discrepancy could exist as a result of different factors. Unfavourable weather conditions, for instance, could have a disruptive effect. At the end of the 'Little Ice Age' (1400-1700), events such as the Thirty Years War (1618-48) and several food crises in the second half of the seventeenth century caused spikes in the price volatility for the southern German region.[70] However, this increase in price volatility, suggesting a lower price integration, is not followed by a drop in the co-movement of prices, by virtue of the intensification of trade and better climatic conditions. The same seems to be true for fifteenth-century Flanders: the small number of high price peaks cause jumps in price volatility, while the parallel price evolution remains strong.

Figure 4 around here

[70] Albers and Pfister, 'Climate change, weather shocks, and price convergence'; Chilosi et al., 'Europe's many integrations', p. 52.

In Figure 4, the three integration measures for late medieval Flanders are combined to show their interplay. In general, the Flemish grain market seems strongly integrated over the entire period, and that integration dates to at least the early 1300s. The several segments divided by the breaks in price convergence (1347, 1376 and 1418) are more or less discernible for the other measures as well. The decades after the Black Death (1347-76) are of particular interest, characterized by high average prices and several spikes, when all the measures show stronger price integration, reaching its highest level during the late Middle Ages. During more dire times, with higher overall prices, grain merchants (and city authorities, at least during the particularly serious crises) were driven into their neighbouring regions in search of food and substantial profit-making.[71] In contrast, abundance at home would not motivate the more common traders to frequent more distant markets in search of grain, as it was easily obtained in their home city and its hinterland. The expanded interregional search for food benefitted the information flow and caused prices to readjust, leading to a more integrated market between these regions in the mid-fourteenth century.

V. Concluding remarks

In this article, I have examined the performance of the late medieval grain market in Flanders, in particular how its performance varied under the influence of price shocks. Applying a three-way methodology for assessing several aspects of price integration – price convergence, co-movement and volatility – shows that Flemish price integration was at a fairly high level at the onset of the fourteenth century and further intensified during the mid-fourteenth-century price shocks. That early high degree of integration is not surprising, as the cities of Flanders had grown and thrived in the eleventh, twelfth and thirteenth centuries towards a commercial dynamism unmatched in Europe, except for the mercantile Italian city-states.[72] Flanders had ceased to be self-sufficient in essential foodstuffs and industrial goods and raw materials, for which it needed strong commercial contacts and market systems,

[71] Or they were driven towards more distant regions specialized in grain production, such as the Baltics in the sixteenth century and later.
[72] Nicholas, *Medieval Flanders*; van Bavel, *Manors and markets*, pp. 280–81; Campbell, *The Great Transition*, p. 151.

much to the benefit and profit of Flemish shippers and carriers.[73] The high level of price integration after the Black Death was not seen again in the late Middle Ages. These conclusions stand in contrast to earlier studies, which have dated the origin of strong Flemish integration to the fifteenth century, probably partly because of the lack of data for the fourteenth century and earlier.[74]

Wilhelm Abel has already hinted at the co-movement of grain prices from the early fourteenth century onwards in France, Germany, northern Italy and England, as a prelude to the unified grain market that stretched from Spain far into the Russo-Polish East in the sixteenth century.[75] Marie-Jeanne Tits-Dieuaide confirms that cereals were imported into Flanders during times of shortage as early as the thirteenth century from nearby Holland, Artois, Picardy and Normandy, but also England.[76] Richard Unger states that until 1500 much of the supply of cereals required for Flemish towns came from nearby regions, and cities accepted the need for high prices during shortages as they attracted supplies; they also brought about a widening of the grain market, with foodstuffs being shipped over greater distances to meet rising urban demand.[77] The new data presented here prove that economic ties across the county and with the southern grain-exporting regions were already strong from the early fourteenth century onwards. These ties suggest that a broader network and stronger intensity of grain trade routes were in place than Unger suggests.

The weaker price integration observed around the turn of the fifteenth century shows that market integration was far from being a linear, self-reinforcing process. For instance, during the sixteenth and seventeenth centuries, warfare on the European continent was the main cause of periods of decreasing market integration.[78] No other study has ever looked at this process for a period as early as the fourteenth and fifteenth centuries, mainly because of the poor quality of the available data. Philip Slavin argues

[73] Thoen, 'The birth of "the flemish husbandry"'.
[74] Van der Wee, *The growth of the Antwerp market*; Tits-Dieuaide, *La formation des prix céréaliers*; Unger, 'Feeding Low Countries towns'.
[75] Abel, *Agrarkrisen und Agrarkonjunktur*, pp. 20, 106–9, 116.
[76] Tits-Dieuaide, 'The Baltic grain trade', pp. 11–19.
[77] Unger, 'Feeding Low Countries towns', pp. 343–44.
[78] Bateman, 'The evolution of markets in early modern Europe'; Federico, Schulze, and Volckart, 'European goods market integration', pp. 288–90.

that during the Great Famine of the early fourteenth century, grain markets in England disintegrated, but he does not focus on the long-term development of market integration. For late medieval Flanders, fluctuations in integration levels are also observed. In contrast to the European market disintegration that occurred during the crises of the second half of the seventeenth century, grain price integration in Flanders in the late Middle Ages seems to have benefited from the extraordinary sequence of shocks in the middle of the fourteenth century (1340-70). However, in this study, I have focused on a regional economy rather than a continent-wide economic system. Additionally, a socioeconomic crisis such as the Black Death and the subsequent plague episodes in the decades thereafter can hardly be compared with the seventeenth-century conditions. The extended mid-fourteenth century stands out as the most catastrophic mortality crisis in history, and it had severe economic consequences. Economically, the period from 1340 to 1370 was characterized by high average grain prices in the mid to long term as well as severe peaks in the short term. That specific price evolution was observed in all the cities studied here. Price integration in Flanders seems to have received a boost from the rapid succession of price shocks, which suggests that the medieval Flemish grain market functioned 'better' in times of crisis and scarcity. Even though the Black Death was a continent-wide phenomenon that brought universal social and economic disruption, its impact and that of the following plague outbreaks in the decades thereafter varied greatly on a local scale. In the region of Flanders, which already had a fairly high degree of economic integration, it still led to parallel price crisis periods over the entire integrated region. As a result, grain-exporting regions such as Douai experienced similar price spikes to major grain-importing cities, with the absence of supply problems. Nonetheless, despite these parallel crisis periods, annual local price differences still ensured that grain was transported across the county from non-affected regions to those with shortages, strengthening integration between the regions.

The price shocks and the crises in the grain market claim a central role in this study, as they appear to be the instigators of changing market integrations. Nonetheless, defining which type of shock was most decisive remains difficult: plague outbreaks, war conflicts, or extreme weather anomalies causing harvest to fail miserably. In fact, the extraordinary occurrence of a sequence of price shocks in the middle

of the fourteenth century seems to have been the prime mover. The fifteenth-century shocks – which caused a serious price increase but occurred isolated in time – did not have the same structural impact on the price convergence. With regard to market regulations, the changing degree of market integration does not provide any conclusive evidence for dating the development and crystallization of an institution as important as the grain staple in Ghent and Douai. The presence of a staple had very little impact on the price, but the inhabitants of these cities undoubtedly benefited from more secure supply channels of grain.

Bruce Campbell has argued that the societal and demographic collapse of the fourteenth century caused a fifteenth-century recession and contraction of commercial activities.[79] Traded volumes shrank drastically, and the geographical orbit of European trade narrowed. This contraction reduced major trading hubs like Marseille to the status of modest regional markets.[80] The lack of reliable late medieval grain price series for a wide range of European cities and regions hinders an extensive data-driven analysis of market integration in north-western Europe, as has been performed here for Flanders.[81] However, Campbell also states that the economies that fared best were those that successfully captured a larger share of intra-European trade and maintained a positive trade balance.[82] Thanks to the geographical and economic position of major trading centres like Bruges, which engaged, for instance, in the important English wool trade in order to supply the substantial Flemish cloth industry, Flanders remained at the centre of north-western Europe's economy. Long- and very long-distance trade partly disintegrated, but the interregional commercial ties remained strong. Over the plague-dominated period between 1340 and 1370, each wave caused a devastating decline in the urban population. However, it recovered relatively quickly in Flanders, partly thanks to the influx of migrants from the countryside, which ensured that the grain output stabilized at a fairly high level, even though there was still a need

[79] Campbell, *The Great Transition*, pp. 355–72.
[80] Day, *The medieval market economy*, p. 208.
[81] Besides price data for cereals for England and the Southern Low Countries, most quasi-continuous price series of Europe only start well into the fifteenth century. An overview of these published price series can be found in Federico, Schulze, and Volckart, 'European goods market integration'.
[82] Campbell, *The Great Transition*, p. 368.

to import grain from further away.[83] On average, European towns had significantly fewer people to feed, and enough provisions could be brought in from the surrounding hinterlands. Flanders was an exception, needing extra imports of grain from the southern Flemish and northern French regions, strengthening the integration of its grain market at a time when the economic conjuncture was, on aggregate, negative.

[83] Van der Wee, 'The agricultural development'.

Footnote References here

Appendix A here

Appendix B here

Appendix C here

Footnote references

Abel, W., *Agrarkrisen und Agrarkonjunktur: eine Geschichte der Land- und Ernährungswirtschaft Mitteleuropas seit dem hohen Mittelalter*, 3rd ed. (Hamburg, 1978).

Albers, H. and Pfister, U., 'Climate change, weather shocks, and price convergence in pre-industrial Germany', *European Review of Economic History* 25 (2021), pp. 467–89.

Anderson, J. E. and Van Wincoop, E., 'Trade costs', *Journal of Economic Literature* 42 (2004), pp. 691–751.

Bai, J. and Perron, P., 'Computation and analysis of multiple structural change models', *Journal of Applied Econometrics* 18 (2003), pp. 1–22.

Barla, N., *Pour la necessitet du povre peuple. La gestion des crises alimentaires à Lille et Mons au XVe siècle* (Brussels, 2022).

Bateman, V. N., 'The evolution of markets in early modern Europe, 1350-1800: a study of wheat prices', *Economic History Review* 64 (2011), pp. 447–71.

van Bavel, B. J. P., *Manors and Markets: economy and society in the Low Countries, 500-1600* (Oxford, 2010).

Beveridge, W. H., 'A statistical crime of the seventeenth century', *Journal of Economic and Business History* 1 (1929), pp. 502–33.

Bigwood, G., 'Gand et la circulation des grains en Flandre, du XIVe au XVIIIe siècle', *Vierteljahrschrift für Sozial- und Wirtschaftsgeschichte* 4 (1906), pp. 397-460.

Boone, M., 'Een verstedelijkte samenleving onder spanning. Het graafschap Vlaanderen omstreeks 1302', in R. Van Caenegem, ed., *1302. Feiten en mythen van de Guldensporenslag* (Antwerp, 2002), pp. 26–77.

von Braun, J., Teklu, T., and Webb, P., *Famine in Africa: causes, responses, and prevention* (Baltimore, 1999).

Briggs, A., *Victorian cities* (New York, 1965).

Brunt, L. and Cannon, E., 'Measuring integration in the English wheat market, 1770–1820: new methods, new answers', *Explorations in Economic History* 52 (2014), pp. 111–30.

Callewaert, K., ‘Les origines de la collégiale Saint-Donatien à Bruges. Deux chartres inédites du XIe siècle’, *Handelingen van het Genootschap voor Geschiedenis* 56 (1906), p. 395-401.

Campbell, B. M. S., ‘Nature as historical protagonist: environment and society in pre-industrial England’, *Economic History Review* 63 (2010), pp. 281–314.

Campbell, B. M. S., *The Great Transition. Climate, disease and society in the late-medieval world* (Cambridge, 2016).

Chilosi, D., Murphy, T. E., Studer, R., and Tunçer, A. C., ‘Europe’s many integrations: geography and grain markets, 1620-1913’, *Explorations in Economic History* 50 (2013), pp. 46–68.

Clark, G., ‘Markets and economic growth: the grain market of medieval England’, *Cliometrica* 9 (2015), pp. 265–87.

Cournot, A., *Mathematical principles of the theory of wealth* (New York, 1971).

Curtis, D. R., Dijkman, J., Lambrecht, T., and Vanhaute, E., ‘Low Countries’, in G. Alfani and C. O’Grada, eds., *Famine in European history* (Cambridge, 2017), pp. 119–40.

Day, J., *The medieval market economy* (New York, 1987).

Deblonde-Cottenier, K., Van Damme-De Mey, L. and Prevenier, W., ‘Prijzen en lonen in de domeinen der Gentse abdijen (St. Pieters en St. Baafs)’, in C. Verlinden, ed., *Dokumenten voor de geschiedenis van prijzen en lonen in Vlaanderen en Brabant* (Bruges, 1973), 4:pp. 230–325.

Decavele, J., Van Doorne, G., Hoste, M., De Block, J. and Jan Bral, G., *De Sint-Niklaaskerk te Gent: geschiedenis en restauratie* (Ghent, 1996).

Demuynck, R., ‘De Gentse oorlog 1379-1385. Oorzaken en karakter’, *Handelingen der Maatschappij voor Geschiedenis en Oudheidkunde te Gent* 5 (1951), pp. 304–18.

Deregnaucourt, J.-P., ‘Les béguines de l’hôpital des Wetz de Douai de 1350 à 1372’, *Revue du Nord* 82 (2000), pp. 35–52.

Derville, A., *L’agriculture du Nord au Moyen Âge: Artois, Cambrésis, Flandre wallone* (Villeneuve-d’Ascq, 1999).

Derville, A., ‘Le grenier des Pays-Bas médiévaux’, *Revue du Nord* 69 (1987), pp. 267–80.

Derville, A., ‘Le marché lillois du blé à l’époque bourguignonne’, *Revue du Nord* 59 (1977), pp. 45–62.

Dijkman, J., *Shaping medieval markets. The organisation of commodity markets in Holland, c. 1200-c. 1450* (Leiden, 2011).

Dumolyn, J., *De Brugse opstand van 1436-1438* (Heule, 1997).

Espeel, S., 'Demesne or leasehold? Estate management in southern Flanders during the price shocks of the fourteenth century', *Revue belge de Philologie et d'Histoire / Belgisch Tijdschrift voor Filologie en Geschiedenis* 100 (2022), pp. 275–304.

Espinas, G., *La vie urbaine de Douai au Moyen Âge* (Paris, 1913).

Federico, G., 'How much do we know about market integration in Europe?' *Economic History Review* 65 (2012), pp. 470–97.

Federico, G., 'When did European markets integrate?' *European Review of Economic History* 15 (2011), pp. 93–126.

Federico, G., Schulze, M.-S., and Volckart, O., 'European goods market integration in the very long run: from the Black Death to the First World War', *The Journal of Economic History* 81 (2021), pp. 276–308.

Galloway, J. A., 'One market or many? London and the grain trade of England', in J. A. Galloway, ed., *Trade, Urban Hinterland and Market Integration, c. 1300–1600*, CMH Working Paper Series 3 (London, 2000), pp. 23–42.

Geens, S., 'The great famine in the County of Flanders (1315–17): the complex interaction between weather, warfare, and property rights', *Economic History Review* 71 (2018), pp. 1048–72.

Howell, M. and Boone, M., 'Becoming early modern in the late medieval Low Countries', *Urban History* 23 (1996), pp. 300–24.

Jordan, W. C., *The great famine: northern Europe in the early fourteenth century* (Princeton, 1996).

Kershaw, I., 'The Great Famine and agrarian crisis in England 1315-1322', *Past & Present* (1973), pp. 3–50.

Longfield, M., *Lectures on political economy* (London, 1834).

Lucas, H. S., 'The great European famine of 1315, 1316 and 1317', *Speculum* 5 (1930), pp. 343–77.

Malthus, T., *An investigation of the cause of the present high price of provisions* (London, 1800).

Maréchal, G., 'Geschiedenis van het hospitaal van Onze Lieve Vrouw van de Potterie te Brugge in de middeleeuwen' (unpub. M.A. thesis, Ghent University, 1965).

Mertens, J., *De laat-middeleeuwse landbouweconomie in enkele gemeenten van het Brugse platteland* (Brussels, 1970).

Mestayer, M., 'Le marché au blé de Douai au XVe siècle réglementation, fonctionnement et entraves', in J.-M. Cauchies, ed., *Rencontres de Douai (25 au 28 septembre 1986): aspects de la vie économique des pays bourguignons (1384-1559): dépression ou prospérité?* (1987), pp. 47–62.

Mestayer, M., 'Le mode de vie du peuple des "bonnes maisons" de Douai dans la première moitié du XIVe siècle', in P. Guignet, ed., *Le peuple des villes dans l'Europe du Nord-Ouest (Fin du Moyen Âge - 1945)*. II (Villeneuve-d'Ascq, 2003), pp. 351–64.

Mestayer, M., 'Les prix du blé et de l'avoine de 1329 à 1793', *Revue du Nord* 178 (1963), pp. 157–76.

Munro, J. H., 'Builders' wages in Southern England and the Southern Low Countries, 1346-1500: a comparative study of trends in and levels of real incomes', in S. Cavaciocchi, ed., *L'Edilizia prima della rivoluzione industriale, secoli XIII-XVIII* (Florence, 2005), pp. 1013–76.

Munro, J. H., 'Values of English and Flemish Coins', 2012. https://www.economics.utoronto.ca/munro5/EngFlemGSval.xls (accessed on 16 June 2023).

Naudé, W., *Die Getreidehandelspolitik der Europäischen Staaten vom 13. bis zum 18. Jahrhundert: als Einleitung in die Preußische Getreidehandelspolitik* (Berlin, 1896).

Nicholas, D., *Medieval Flanders* (London, 1992).

Nicholas, D., *The van Arteveldes of Ghent: the varieties of vendetta and the hero in history* (Leiden, 1988).

Ó Gráda, C., *Black '47 and beyond: the Great Irish Famine in history, economy, and memory* (Princeton, NJ, 1999).

Ó Gráda, C., 'Market and famine in pre-industrial Europe', *Journal of Interdisciplinary History* 36 (2005), pp. 143–66.

Ó Gráda, C. and Chevet, J.-M., 'Famine and market in Ancien Régime France', *The Journal of Economic History* 62 (2002), pp. 706–33.

Persson, K. G., *Grain markets in Europe, 1500-1900: integration and deregulation* (Cambridge, 1999).

Prevenier, W., ‘Leliaards en Klauwaards vóór en na 1302. Loyaliteit, collaboratie en opportunisme’, in P. Trio, D. Heirbaut, and D. van den Auweele, eds., *Omtrent 1302* (Leuven, 2002), pp. 137–60.

Ravallion, M., *Markets and famines* (Oxford, 1987).

Rogers, J. E. T. and Rogers, A. G. L., *A history of agriculture and prices in England: from the year after the Oxford Parliament (1259) to the commencement of the Continental War (1793)* (Oxford, 1902).

Rogghé, P., *Vlaanderen en het zevenjarig beleid van Jacob van Artevelde 1338-1345: een critisch-historische studie*, 2nd ed. (Eeklo, 1950).

Roosen, J., ‘The Black Death and recurring plague during the late Middle Ages in the County of Hainaut: differential impact and diverging recovery’ (unpub. Ph.D. thesis, Utrecht University, 2020).

Roosen, J. and Curtis, D. R., ‘The “Light Touch” of the Black Death in the Southern Netherlands: an urban trick?’ *Economic History Review* 72 (2019), pp. 32–56.

Rouche, M., ed., *L’histoire de Douai* (Dunkerque, 1985).

Sabbe, J., ‘De opstand van Brugge tegen graaf Robrecht van Bethune en zijn zoon Robrecht van Kassel in 1321-1322. Het laatste politieke optreden van de volksleiders Pieter de Coninc en Jan Breidel’, *Handelingen van het Genootschap voor Geschiedenis* 107 (1970), pp. 217–49.

Sabbe, J., *Vlaanderen in opstand 1323-1328: Nikolaas Zannekin, Zeger Janszone en Willem de Deken* (Brugge, 1992).

Sen, A., *Poverty and famines. An essay on entitlement and deprivation* (Oxford, 1981).

Shiue, C. H. and Keller, W., ‘Markets in China and Europe on the eve of the Industrial Revolution’, *The American Economic Review* 97 (2007), pp. 1189–1216.

Slavin, P., *Experiencing famine in fourteenth-century Britain* (Turnhout, 2019).

Slavin, P., ‘Market failure during the great famine in England and Wales (1315-1317)’, *Past & Present* 222 (2014), pp. 9–49.

Smith, A., *An inquiry into the nature and causes of the wealth of nations* (London, 1776).

Söderberg, J., ‘Prices in the medieval Near East and Europe’, Paper presented at the GEHN-conference ‘Towards a Global History of Prices and Wages’ (Utrecht, 2004), available from:

http://www.cgeh.nl/sites/default/files/towards-a-global-history-of-prices-and-wages/soderberg.pdf (accessed 16 June 2023).

Soens, T., 'Waterbeheer in een veranderende samenleving. Een ecologische, sociaal-economische en politiek-institutionele studie van de wateringen in het Vlaamse kustgebied tijdens de overgang van de middeleeuwen naar de moderne tijden. Testregio: het Brugse Vrije' (unpub. Ph.D. thesis, Ghent University, 2006).

Speecke, M., '"Isti ponerentur in officio scabinatus": Brugge en het stadsbestuur onder graaf Robrecht van Béthune (1305-1322)', *Handelingen van het Genootschap voor Geschiedenis* 156 (2019), pp. 3–49.

Stone, D., 'The Black Death and its immediate aftermath: crisis and change in the Fenland economy, 1346-1353', in M. Bailey and S. H. Rigby, eds., *Town and countryside in the age of the Black Death. Essays in honour of John Hatcher* (Turnhout, 2012), pp. 213-44.

Studer, R., 'India and the Great Divergence: assessing the efficiency of grain markets in eighteenth- and nineteenth-century India', *The Journal of Economic History* 68 (2008), pp. 393–437.

Taylor, A. M., 'Potential pitfalls for the purchasing-power-parity puzzle? Sampling and specification biases in mean-reversion tests of the Law of One Price', *Econometrica* 69 (2001), pp. 473–98.

Tebrake, W., *A plague of insurrection: popular politics and peasant revolt in Flanders, 1323-1328* (Philadelphia, 1993).

Thoen, E., 'The birth of "the flemish husbandry": agricultural technology in medieval Flanders', in G. G. Astill and J. Langdon, eds., *Medieval farming and technology: the impact of agricultural change in Northwest Europe* (Leiden, 1997), pp. 69–88.

van Tielhof, M., *De Hollandse graanhandel, 1470-1570. Koren op de Amsterdamse molen* (The Hague, 1995).

van Tielhof, M., 'Grain provision in Holland, ca. 1490-1570', in P. Hoppenbrouwers and J. L. Van Zanden, eds., *Peasants into farmers? the transformation of rural economy and society in the Low Countries (Middle Ages – 19th Century) in light of the Brenner debate* (Turnhout, 2001), pp. 202–19.

van Tielhof, M., *The 'mother of all trades'. The Baltic grain trade in Amsterdam from the late 16th to the early 19th century* (Leiden, 2002).

van Tielhof, M., 'The rise and decline of the Amsterdam grain trade', in P. Van Cruyningen and E. Thoen, eds., *Food supply, demand and trade. Aspects of the economic relationship between town and countryside (Middle Ages - nineteenth century)* (Turnhout, 2014), pp. 85–99.

Tits-Dieuaide, M.-J., *La formation des prix céréaliers en Brabant et en Flandre au XVe siècle* (Brussels, 1975).

Tits-Dieuaide, M.-J., 'The Baltic grain trade and cereal prices in Flanders at the end of the Middle Ages: some remarks', in W. Minchinton, ed., *The Baltic grain trade: five essays* (Exeter, 1985), pp. 11–20.

Unger, R. W., 'Feeding Low Countries towns: the grain trade in the fifteenth century', *Revue belge de Philologie et d'Histoire / Belgisch Tijdschrift voor Filologie en Geschiedenis* 77 (1999), pp. 329–58.

Unger, R. W., 'Thresholds for market integration in the Low Countries and England in the fifteenth century', in L. Armstrong, I. Elbl, and M. Elbl, eds., *Money, markets and trade in late medieval Europe: essays in honour of John H. A. Munro* (Leiden, 2007), pp. 349–80.

Van der Wee, H., 'De crisissen van het Ancien Régime als spiegel voor de studie der hongersnoodcycli in de onderontwikkelde gebieden', *Tijdschrift voor economie* 6 (1961), pp. 415–36.

Van der Wee, H., 'The agricultural development of the Low Countries as revealed by the tithe and rent statistics, 1250-1800', in H. Van Der Wee and E. Van Cauwenberghe, eds., *Productivity of land and agricultural innovation in the Low Countries (1250-1800)* (Leuven, 1978), pp. 1–24.

Van der Wee, H., *The growth of the Antwerp market and the European economy (14th-16th Centuries)* (The Hague, 1963).

Van Houtte, H., *Documents pour servir à l'histoire des prix de 1381 à 1794* (Brussels, 1902).

VandenBorre, C., 'Prijzen, lonen en levensstandaard in Brugge en omgeving tijdens de 14de en het begin van de 15de eeuw' (unpub. M.A. thesis, Ghent University, 1999).

Verbruggen, J. F., *Vlaanderen na de Guldensporenslag. De vrijheidsstrijd van het graafschap Vlaanderen 1303-1305* (Bruges, 1991).

Verbruggen, J. F., DeVries, K., and Ferguson, D. R., *The Battle of the Golden Spurs (Courtrai, 11 July 1302): a contribution to the history of Flanders' war of liberation, 1297-1305* (Woodbridge, 2002).

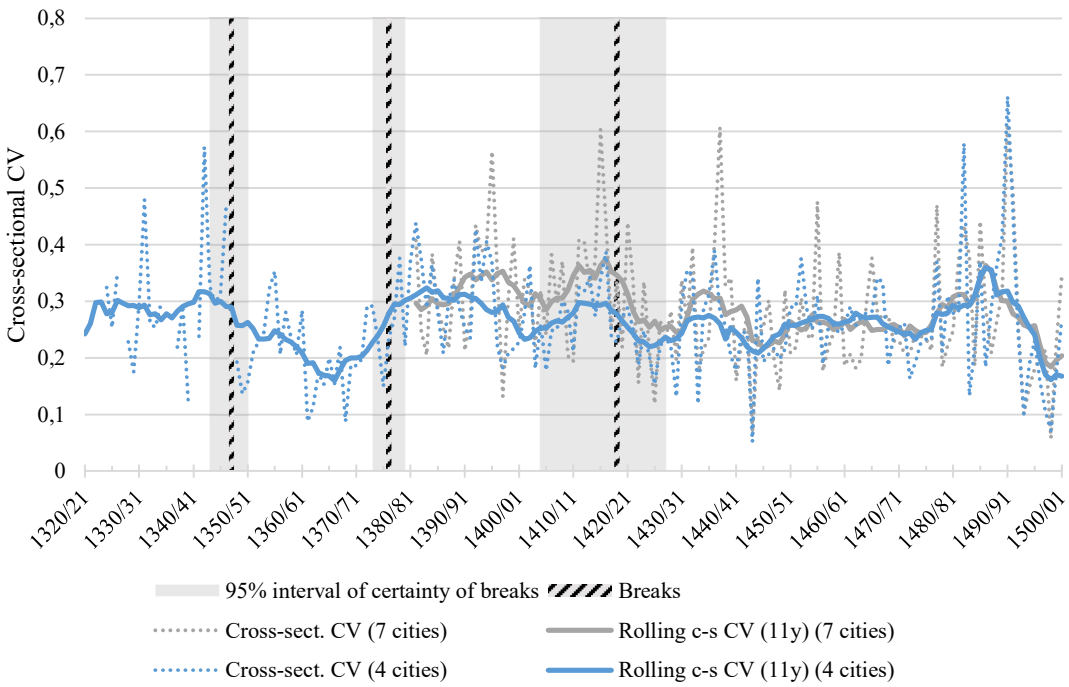
Verhulst, A., 'Prijzen van granen, boter en kaas te Brugge volgens de "slag" van het Sint-Donatiaanskapittel (1348-1801)', in C. Verlinden e.a., eds., *Dokumenten voor de geschiedenis van prijzen en lonen in Vlaanderen en Brabant* (Bruges, 1965), volume 2, pp. 3–70.

Verhulst, A. and Gysseling, M., *Le compte général de 1187, connu sou le nom de 'Gros Brief' et les institutions financières du comté de Flandre au XIIe siècle* (Brussels, 1962).

Vervaet, L., 'Goederenbeheer in een veranderende samenleving. Het Sint-Janshospitaal van Brugge ca. 1275 - ca. 1575' (unpub. Ph.D. thesis, Ghent University, 2015).

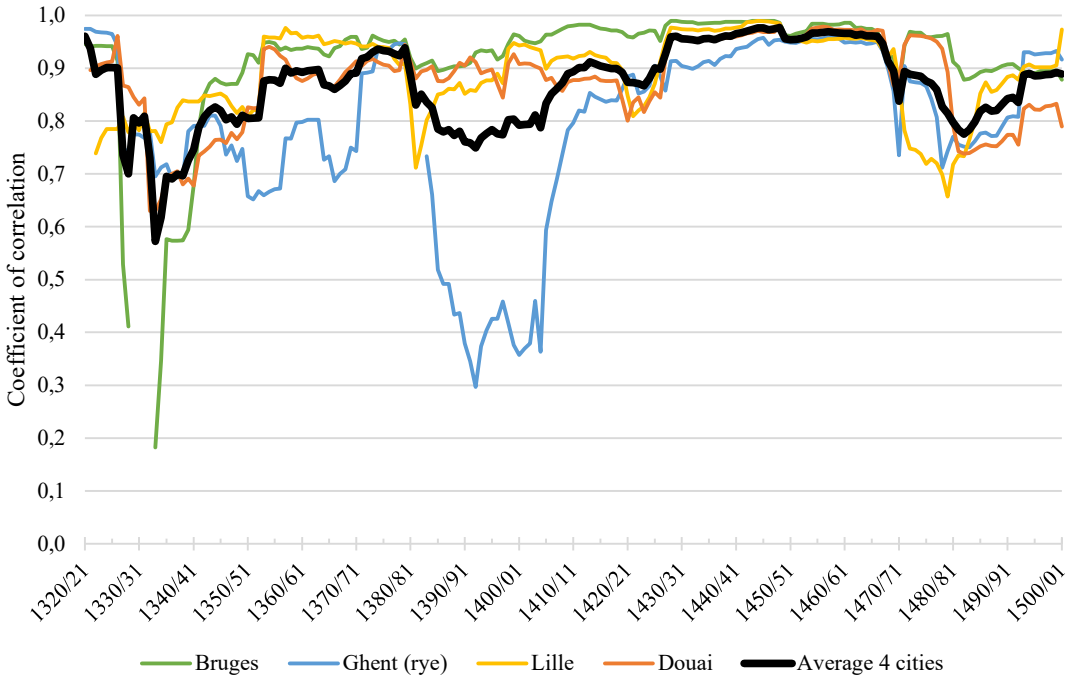
Wyffels, A., 'De prijzen van de grafelijke spijker in Vlaanderen. Reëel of misvormd beeld?', *Bijdragen tot de prijzengeschiedenis* 2 (1957), pp. 49–55.

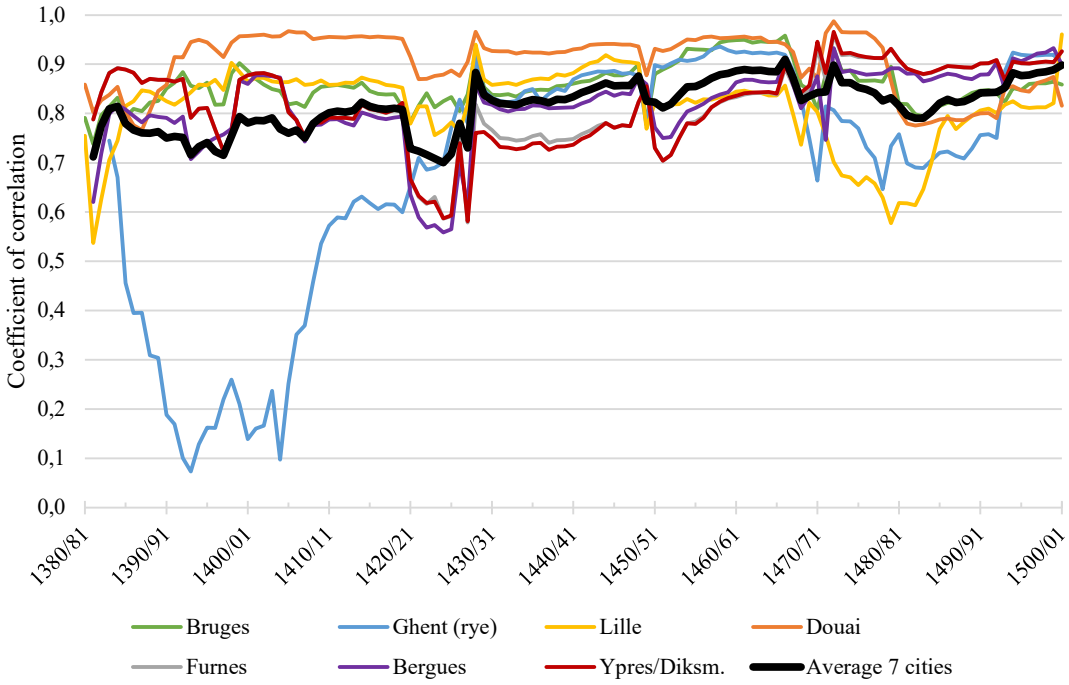
	Relative price increase vs. 'normal' price (%)			
Year	Bruges	Ghent (rye)	Lille	Douai
1315/16	**199.64**			
1316/17	82.63	**405.79**		**238.46**
1339/40		85.86	**121.06**	**113.92**
1340/41			**104.98**	30.46
1341/42		6.25	**131.25**	**108.58**
1342/43	23.34	47.81	**160.02**	-25.96
1349/50	45.53		45.73	**102.81**
1351/52	84.58		**110.89**	**144.06**
1360/61	84.13	59.05	76.98	**138.63**
1408/09	70.63	34.15	**104.65**	80.72
(1416/17)	98.59	33.33	99.84	48.62
1438/39	**144.19**	88.89	**180.05**	**190.05**
1455/56	81.41	67.27	**126.48**	83.36
1456/57	78.44	**125.45**	92.45	**103.70**
1457/58	78.44	72.73	61.94	**106.28**
1478/79	67.14	49.26	32.99	**143.58**
1479/80	53.19	5.37	26.23	**138.52**
1481/82	**159.26**	**163.55**	30.85	**186.08**
1482/83	**143.75**	**112.09**	22.33	**433.28**
1488/89	12.82	**146.14**	-3.59	-18.36


Cross-sectional CV
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
1320/21
1330/31
1340/41
1350/51
1360/61
1370/71
1380/81
1390/91
1400/01
1410/11
1420/21
1430/31
1440/41
1450/51
1460/61
1470/71
1480/81
1490/91
1500/01
95% interval of certainty of breaks
Breaks
Cross-sect. CV (7 cities)
Rolling c-s CV (11y) (7 cities)
Cross-sect. CV (4 cities)
Rolling c-s CV (11y) (4 cities)

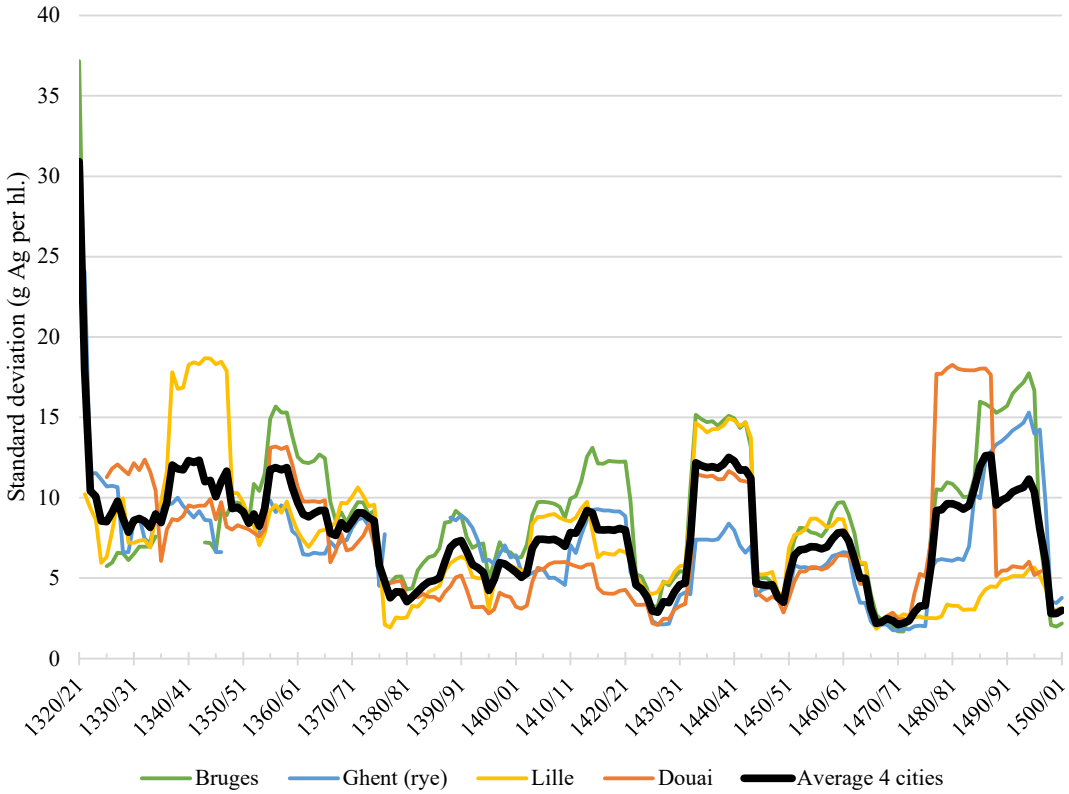
Period	Number of years	Average CV***	Slope (Annual change)
	Four-cities sample		
1320-1500	181	0.26	-0.00000335
1320-1347	28	0.29	-0.00001591
1348-1376	29	0.21	-0.00001404
1377-1418	42	0.29	-0.00003517
1419-1500	82	0.25	0.00000001
Pairwise-sign. average CV	1320-1347	1348-1376	1377-1418
1348-1376	0.0002 (***)	-	-
1377-1418	0.9846	0.000041 (***)	-
1419-1500	0.0289 (*)	0.0289 (*)	0.0158 (*)
	Seven-cities sample		
1381-1500	120	0.29	-0.0000017
1381-1421	40	0.33	0.00000269
1422-1500	80	0.14	0.00000029
Pairwise-sign. average CV	0.002046 (**)		

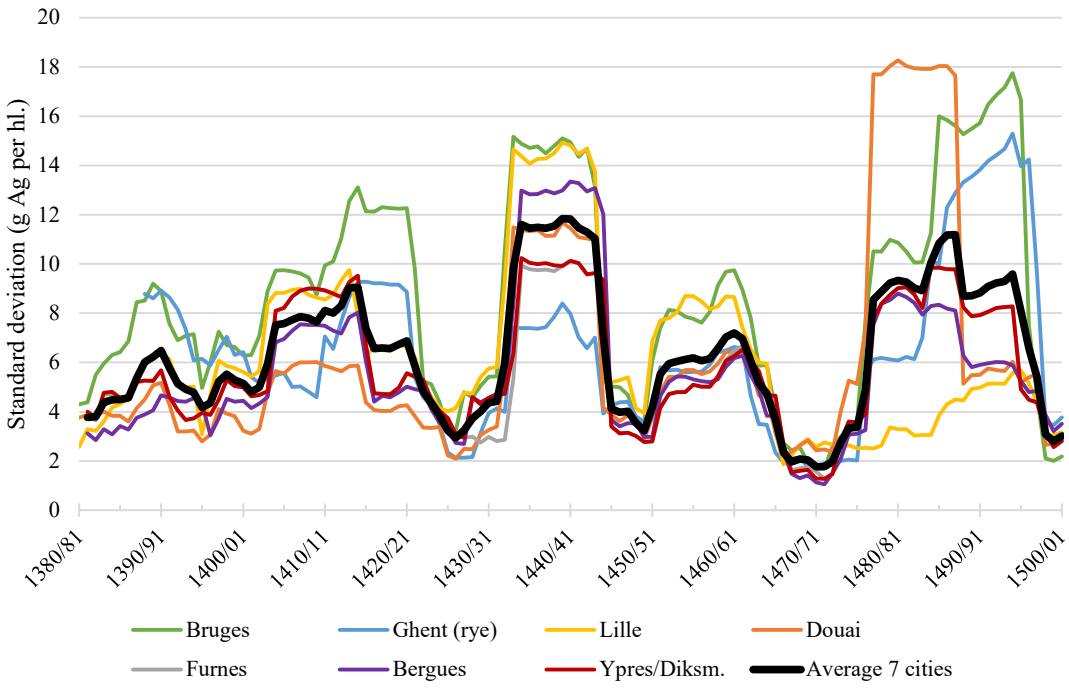
Note: test-significance: * <0.05; ** <0.01; *** <0.001. These are the results for the Hodrick-Prescott-smoothed series. The significance of the total average CV (column 3) implies the rejection of all averages equal and confirms the differences between the periods. The t-test for the pairwise significance of the average CV is carried out with the Holm procedure.



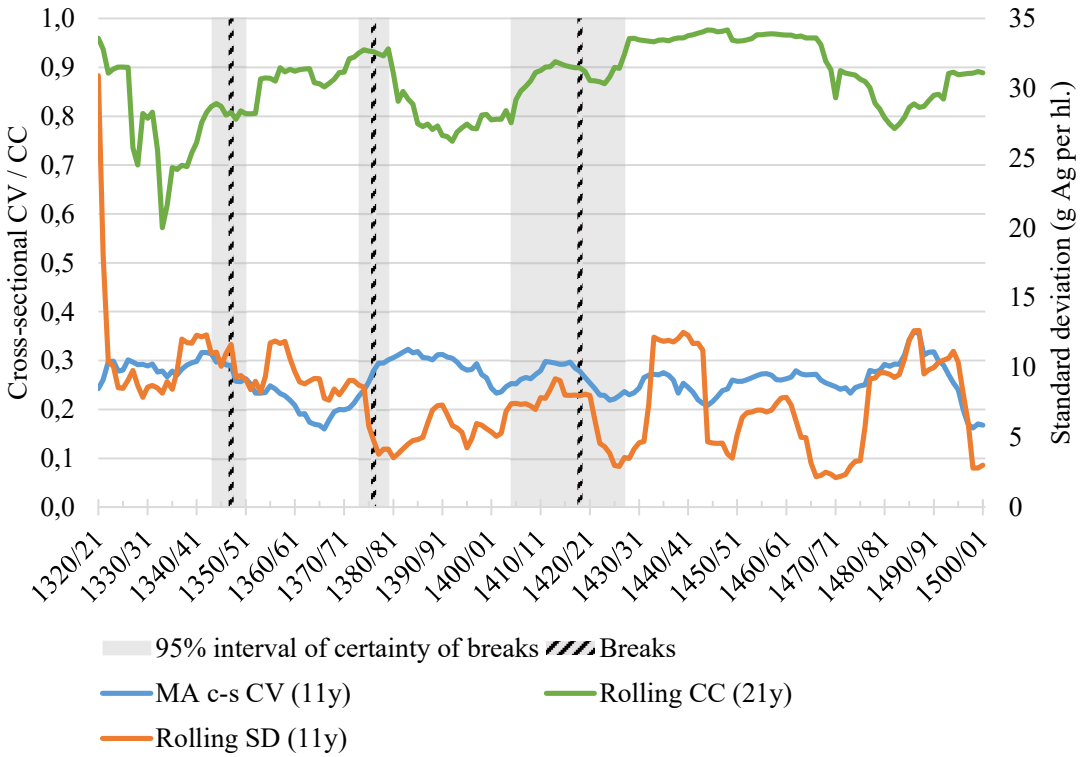


Note: the rolling CC for the four-cities sample is shown above, for the seven-cities sample below.





Note: the rolling SD for the four-cities sample is shown above, for the seven-cities sample below.



Note: the cross-sectional CV and rolling CC are plotted on the primary Y-axis (left), whereas the rolling SD is plotted on the secondary Y-axis (right).

Appendix A: constructing grain market prices in late medieval Flanders

This appendix presents the data used to construct the market price series for wheat in the selected Flemish cities. The terminology of a 'market price' series implies that these are all prices gathered from sources with a connection to the market. However, such sources are not available for the late Middle Ages, and so we have to rely primarily on the accounting material of large landlords, such as urban hospitals, abbeys, and collegiate churches. Additionally, prices from sales and purchases of grain are also scarce. These are supplemented with so-called 'rent prices', which are rates of payments in-kind of tenant leases that are prematurely converted to cash, which enabled these tenants to hold on to the grain and saved the landlords the extra effort of selling their surplus on the local market.[1] In the accounts of the landlords of southern Flanders, these converted in-kind leases were listed in between the actual sales on the market, and sometimes even as a dated transaction. This grain never reached the granaries of the landlords as it stayed with the tenant farmers, but such transactions were recorded as 'resales'.[2]

In addition to the prices of these 'resales', accounting conversions of the leases and rents in-kind into species could make use of 'rent price lists' that were established at a fixed moment of the year. This was done at the request of either urban or princely authorities or at the request of a large landlord, once, twice, or several times a year. In Douai, one such rent price list has been preserved, on which the prices of wheat, oats, and capons were noted once a year (1 October), while in Bruges, the '*slag*' (or 'stroke') of St Donatian's Cathedral was established three times over the course of an accounting year (St Martin's Day, Candlemas, and Ascension Day).[3] Depending on the objectives of the authorities or landlords fixing such rent prices, the deviation from the actual market prices could be higher or lower.[4] For Bruges at the end of the fourteenth and during the fifteenth century, Adriaan Verhulst has shown

[1] Derville, 'Le marché lillois du blé', p. 47.
[2] In the accounts, they are mentioned as "*revendu"* in middle French or "*revenditi*" in Latin instead of respectively "*vendu*" or "*vendito*" in the case of actual market sales.
[3] For Douai, see Mestayer, 'Les prix du blé et de l'avoine'. The *slag* of the church St Donatian in Bruges gathered price of wheat, rye, barley, hard oats, soft oats, butter, and cheese. These have been published in Verhulst, 'Prijzen van granen, boter en kaas'.
[4] This has been studied for the period around the Dutch Revolt at the end of the sixteenth century when the rent price of wheat of the Bruges' *spicaria* – the office responsible for the collection of grain income in the administration of the count of Flanders – was kept constant while market price knew an exponential rise. Wyffels, 'De prijzen van de grafelijke spijker', pp. 52–53.

that the rent prices from St Donatian's Cathedral and the prices of the *spicaria* were very close, but slightly lower than the market prices extracted from the purchases of wheat by St John's Hospital.[5] When rent prices were being logged on a more regular basis, as was the case for those of St Donatian's, they should have approximated the market situation better. In contrast, for Douai, the rent price list was only established once a year (St Remigius), when new (or lacking) stocks of the previous harvest were hitting the market and the established price could have been representative for the following months. Even though these prices are not market prices, discarding them would result in eliminating a large body of data which can still be useful to construct as detailed market price series as possible.

To construct an annual market price for each city in question, I use both the dated and undated selling, purchasing, and rent prices in decreasing order of reliability. Since the timing of the transactions is paramount, it is imperative to start with meticulously detailed and dated market prices as the most reliable source of information. The main body of data for this first step is found in the dated sales by the southern Flemish landlords, with which monthly price series are built. Secondly, the dated rent prices are used, mainly from the same landlords, which can supplement prices for months for which no selling prices are available. However, these rent prices cannot simply be used as market prices, but have to be converted using a simple regression analysis. If the coefficient of determination between the series of the dated selling prices and the dated rent prices is high enough, it is acceptable to construct additional market prices using the rent prices.[6] Months with missing data in between months for which prices are known can be added to the series through interpolation, to give an idea of the price evolution over that period. However, a distinction must be made between the prices based on actual price data and the interpolated prices.[7] If needed, an annual price average can be constructed using these monthly averages based on the harvest year (September to August). The mean must be given priority over the median because any smoothing of the price curve, especially during years of high prices, is by no means desirable.

---

[5] Verhulst, 'Prijzen van granen, boter en kaas', p. 9; Van Houtte, *Documents*.
[6] The coefficients of determination and the equation of the regression analysis can be consulted in the Excel document to be found as an online appendix to this article.
[7] Added in Appendix C between parentheses.

When no dated prices are available, we have to turn to sales for which no extra detailed information is included concerning its precise or approximate date. For such undated prices, the rates from the actual sales and purchases, defined as market prices, again have priority over rent prices. Rent prices are thus discarded when actual market prices are available. These prices make up annual averages according to their corresponding accounts' start and end dates, which coincided more or less with the harvest year.[8] When there are no undated market prices either, the last resort is found in the undated rent prices. Again, the rate of the rent prices cannot simply be used as market prices, and regression analysis is again needed to convert these rent prices to additional market prices.

To summarize, the process of constructing a market price series for each city includes four types of prices, and for each of them, the weighted average between all transactions of a certain month (if prices are dated) or year (if they are undated) is required to use them properly. The prices are also weighted according to the volume that was traded. The methodology is based on using the prices in a declining degree of reliability: from dated selling prices to dated rent prices to undated selling prices to undated rent prices. This approach yields market price series as 'hygienic' as possible with the available data from late medieval accounts.

[8] The start and end dates regularly fell at the end of June or at the end of July for most of the accounts used in this study. See Appendix B for the exact dates for each account.

Appendix B: the late medieval Flemish landlords and their sources

All the prices have been collected by the author, and references to the accounts used to compile these series, as well as a brief overview of the nature of these documents and the type of information they record, are listed below:

1. Bruges

    a. St John's Hospital (*Sint-Janshospitaal*)

The exact year in which this hospital was founded is not known, but it is thought to have been around the middle of the twelfth century. As well as carrying out charitable work, which consisted in welcoming all kinds of sick people, passers-by, and pilgrims, the landlord owned a considerable amount of immovable property. These properties were mainly situated in the outskirts of the city and the Franc of Bruges, the largest castellany of the county. The hospital sources contain all types of income and expenses both in cash and in kind, as well as the debts and arrears owed to the hospital, and dues that the hospital owed. The prices and wages detailed in these accounts have already been studied by Chris VandenBorre.[1] The series was further developed by Tim Soens, who corrected the monetary conversions, especially for the decades between 1280 and 1319.[2] I went back to the sources, checking each year for the correct quantities and valuations and information on the estate management of the hospital, which continued demesne farming throughout the later Middle Ages. Its estate management has already been the subject of research by Jacques Mertens and (very recently) by Lies Vervaet.[3]

Reference: Bruges, City Archives Bruges, OCMW-Archief, Sint-Janshospitaal, Rekeningen, register 1-83.

    b. Potterie Hospital (*Potteriehospitaal*)

[1] VandenBorre, *Prijzen, lonen en levensstandaard in Brugge*.
[2] Soens, *Waterbeheer in een veranderende samenleving*, app. 1.
[3] Mertens, *De laat-middeleeuwse landbouweconomie*; Vervaet, *Goederenbeheer*.

The *Onze-Lieve-Vrouw ter Potterie* hospital is another hospital whose prices are preserved for the late medieval period. The Potterie Hospital was founded no later than 1269 along the *Potterierei* in the north of the city, where a large number of potters practised their trade and gave the hospital its name.[4] This hospital was smaller, especially in comparison with St John's. Less extra information was included in its sources regarding the agricultural practices on its estates, but prices for grain were included nonetheless. Otherwise, the sources follow the same pattern as that of St John's, with income, expenses, debts, and arrears of both cash and grains.

Reference: Bruges, City Archives Bruges, OCMW-Archief, Potteriehospitaal, Rekeningen, register 87-89.

c. St Donatian's Cathedral (*Sint-Donaaskathedraal*)

St Donatian's Cathedral, located in the central square (Burg) in Bruges before its destruction after the French Revolution, was the largest church in Bruges and one of the court churches of the counts of Flanders. Its early foundations date to the middle of the tenth century when Count Arnulf I ordered a chapel to be built in the likeness of the Aachen Cathedral.[5] As one of the largest secular collegiate churches in the Low Countries, its canons held an important position in the administration of the late medieval county of Flanders. Grain prices from this landlord can be found in the *Acta Capituli*, or the 'Book of Acts', along with other deeds carried out by the chapter. These rent prices were processed and published by Adriaan Verhulst.[6] Unfortunately there is a lack of other accounts for this landlord that might have been relevant for analysing grain prices for the late medieval period.

Reference: Bruges, Episcopal Archives Bruges, Acta Capituli, A 47-57.

2. Ghent

[4] Maréchal, *Geschiedenis van het hospitaal*.
[5] Callewaert, 'Les origines de la collégiale Saint-Donatien à Bruges', p. 60.
[6] Verhulst, 'Prijzen van granen, boter en kaas'.

For fourteenth-century Ghent, price material is rather scarce. The two largest landowners of the city – and probably of the entire county – were St Bavo's and St Peter's, two early medieval Benedictine abbeys. However, they only left scattered financial records for the fourteenth century. Of that source material, specific accounts mentioning the price of grain have already been studied by Walter Prevenier in the case of St Bavo's Abbey and by Kristin Deblonde-Cottenier and Lieve Van Damme-De Mey in the case of St Peter's Abbey.[7] The administration of these abbeys was managed by different offices each responsible for a particular task, for which they each kept separate accounts.

a. Poor table of the Holy Spirit of St Nicholas Church (*armentafel van de Heilige Geest van de kerk Sint-Niklaas*)

Apart from the two large abbeys of Ghent, the accounts from the poor table of St Nicholas' Church contain useful price information on cereals. The first Romanesque church on this site was built on the initiative of St Peter's Abbey around 1100. Later, after the church had been damaged in numerous fires, a new and bigger church was built, better reflecting the city's wealth and importance.[8] The accounts of the poor table of this church make frequent reference to prices and values of grain. The price types included are sales, purchases, hereditary rents, and commutation prices. It bought grain on a fixed pattern throughout the year: on Christmas Day, Shrove Tuesday, during Lent, at Easter, and sometimes on Pentecost.

Reference: Ghent, State Archives Ghent, Sint-Niklaaskerk & Sint-Veerlekapittel, K87, n° 496-522; PAR90, n° 119-138, 157, 169-72.

3. <u>Lille</u>

a. St Sauveur Hospital (*l'hôpital Saint-Sauveur*)

The St Sauveur Hospital was founded in 1214 as the Saint-Jean-l'Evangéliste Hospital between the church and the St Sauveur city gate, which gave it its name. Originally it assisted poor people passing

[7] Deblonde-Cottenier, Van Damme-De Mey, and Prevenier, 'Prijzen en lonen'.
[8] Decavele et al., *De Sint-Niklaaskerk te Gent*.

through the city but soon began to focus on caring for the sick. Prices and quantities of commodities collected, sold, or purchased were enlisted in great detail, including the exact date, at least for the period before 1370. Alain Derville has already processed these accounts in his studies on the medieval agriculture of the Département du Nord.[9] However, he only used annual averages and did not focus on the price evolution within the year. In detail, these accounts include the cash income through rents and sales of diverse products and weekly expenses in cash for the kitchen, common purchases, purchases of cloth and linen for the beds of the hospital, public works on or around the hospital buildings or farms, miscellaneous expenses, the costs for the August harvest, the costs for the threshing of the grain, the servants' salaries, expenses incurred by the repayment of older debts, and expenses for rents owed. The accounts end with the balance between the income and the expenses and its annual audit by the bailiff.

Reference: Lille, Archives Départementales du Nord, Archives Hospitalières, VI, E, n° 7-14.

b. St Peter's Collegiate Church (*chapitre Saint-Pierre*)

St Peter's was founded in 1066 by Baldwin V, Count of Flanders. During the first decades of its existence, it began to accumulate gifts and bequests, and over the years this church became one of the largest and most powerful landlords in the region. Unfortunately, general accounts have not been preserved for the period studied here, but cereal prices were found in the accounts of several offices. In particular, the church fabric, the vicars' accounts, and those of the *office de l'éparse* and the *office de la redîme* yielded important results.

Reference: Lille, Archives Départementales du Nord, série 16 G, n° 1315-31, 1384-8, 1423-30, 1443-4, 1463-86, 1704-30, 1753-78, 1818-39.

4. Douai

a. St Amé Collegiate Church (*chapitre Saint-Amé*)

[9] Derville, *L'agriculture du Nord*.

St Amé Collegiate Church was the oldest church in Douai, founded around the middle of the tenth century by Count Arnulf I, who transferred the relics of Saint Amé (*Amatus*, bishop of Sion) from Soissons and gave them to the church. It played a key role in the early centuries of urban growth.[10] The accounts of St Amé have not previously been used in studies of grain prices. A vast number of accounts have been preserved for the fourteenth century, from at least six different offices. It was not until after the Black Death that a quasi-continuous series was recorded for wheat. Most of the prices and valuations have been collected from the accounts of the vicar's office and from 1377 onwards from the general receiver. Transactions are usually dated to construct monthly averages and annual averages based on harvest years. Strikingly, these accounts sometimes even mention the quality of the wheat. These are the only accounts to do so in this database.

Reference: Lille, Archives Départementales du Nord, série 1 G, n° 813, 816-30, 1282-7, 1287, 1288-34, 2141-97.

b. Notre-Dame des Prés Abbey

The Notre-Dame des Prés Cistercian abbey was founded in 1218 on the outskirts of the city on land owned by St Albin's parish church.[11] Although it emerged later than other religious orders, the abbey quickly assembled a vast amount of landed property located in no fewer than 117 localities in the regions of Walloon-Flanders, Ostrevent, Cambrésis, Artois, and Picardy.[12] For the late Middle Ages, no general accounts have survived the test of time, but one grain account for the period 1328-1381 still exists. This grain account mentions all the income and expenses of several types of grain, with consumption and commercialization as the main channels, as well as the rent prices of wheat, oats, and capons. Additionally, the granary sold small quantities of wheat to ensure and finance the continuation of their

[10] Rouche, *L'histoire de Douai*, p. 61.
[11] Rouche, p. 66.
[12] Derville, *L'agriculture du Nord*, p. 133.

daily operations. The rent prices have been published by Monique Mestayer and have been double-checked using the original sources, but she did not publish the prices from small-scale 'retail' sales.[13]

Reference: Lille, Archives Départementales du Nord, série 30 H, n° 363.

c. Wetz Hospital (*l'hôpital des Wetz*)

Wetz Hospital, attached to a beguinage, was founded in 1245 by Gervais de le Vile, who bequeathed his house on the corner of *rue des Wetz* and *rue du Béguinage*, located near the tanners by the river Scarpe.[14] Just like the other ecclesiastical landlords, Wetz Hospital owned and collected a considerable patrimony through gifts and inheritances, of which a large part was directly exploited by the beguines. Like the hospital accounts discussed above, these accounts provide detailed information on all the channels of income and expenses, supplemented with the landlord's debts and arrears. No prior publication has used these sources to study grain prices.[15]

Reference: Douai, Archives Municipales de Douai, série 2 NC, n° 1296-7, 1336-8.

d. des Chartriers Hospital (*l'hôpital des Chartriers*)

The des Chartriers hospital has left just over a dozen accounts for the years between 1326 and 1371. This hospital catered mostly for the crippled and to a lesser degree for the elderly, both men and women. According to Monique Mestayer, the hospital diet resembled that of healthy individuals.[16] The name *des Chartriers* refers to the 'carts' to which these people were tied, as they could not walk alone. Their accounts are meticulously detailed, with three documents drawn up on an annual basis: (1) an account of cash income and expenses, (2) an account of grain income and expenses, and (3) an overview of the hospital's possessions, with a focus on the arrears. The hospital was relatively prosperous around the

[13] Mestayer, 'Les prix du blé et de l'avoine'.
[14] The *wetz* were crossing points of the river Scarpe. The word is a Picard form of the French "gués", which translates to a "ford", as a shallow place with good footing where one could cross or wade in a river or stream. See Dictionnaire du Moyen Français (1330-1500) (DMF): http://www.atilf.fr/dmf/definition/gué.
[15] Jean-Pierre Deregnaucourt used these accounts to study the beguines that lived and managed the hospital. Deregnaucourt, 'Les béguines de l'hôpital des Wetz'.
[16] Mestayer, 'Le mode de vie'.

1330s but experienced increasing difficulty in recovering outstanding arrears, up to the point that almost half of the theoretical income never materialized.

Reference: Douai, Archives Municipales de Douai, série 1 NC, n° 1594, 1602; 2 NC, n° 129.

Appendix C: market prices in late medieval Flanders

The prices for the period 1300 to 1400 for Bruges, Ghent, Lille and Douai have been constructed with the process explained in Appendix A with original price material gathered from the sources mentioned in Appendix B and have been checked and/or supplemented with price material from several existing publications.[1] Both the nominal prices (in Flemish *groot* per hl.) and silver prices (grams per hl.) are included.[2]

Table A. *Market prices for grain in late medieval Flanders (1300-1500)*

Harvest year	Bruges (wheat)		Ghent (rye)		Lille (wheat)		Douai (wheat)		Veurne (w)		Bergues (w)		Ypres/Dixm. (w)	
	Fl. gr. / hl.	g Ag / hl.	Fl. gr. / hl.	g Ag / hl.	Fl. gr. / hl.	g Ag / hl.	Fl. gr. / hl.	g Ag / hl.	Fl. gr. / hl.	g Ag / hl.	Fl. gr. / hl.	g Ag / hl.	Fl. gr. / hl.	g Ag / hl.
1300/01	7.09	26.90												
1301/02														
1302/03	13.20	50.08												
1303/04	7.56	28.68			9.39	35.65								
1304/05					9.59	36.38								
1305/06	7.33	27.83			9.60	36.44								
1306/07	10.95	41.56			14.28	54.19								
1307/08		(44.06)												
1308/09	11.50	43.64												
1309/10	12.71	48.24												
1310/11	15.56	59.04												
1311/12		(46.78)	4.75	18.03										
1312/13	9.20	34.92	5.09	19.30										
1313/14		(72.10)												
1314/15	12.67	48.08					7.72	29.29						

[1] For the fifteenth century, only published data have been used. The Excel document in the online appendix meticulously lists all the sources and publications and where and when they have been used for the construction of the market price series.

[2] For the conversion of the Flemish *groot* to values of silver, the ratios published online by John Munro have been used. See Munro, 'Values of English and Flemish Coins'.

1315/16	35.12	133.27					19.60	74.36
1316/17	22.45	85.20	24.88	94.39			26.13	99.14
1317/18	13.32	50.55	8.50	32.25			10.69	40.56
1318/19	8.32	31.57			6.12	23.22		
1319/20				(47.40)				
1320/21	8.88	33.68	5.46	20.72	11.08	42.04		
1321/22			9.33	35.39	11.83	44.89		
1322/23			14.30	54.26				
1323/24			7.95	30.15	14.28	54.19		
1324/25	11.55	43.83	6.01	22.82		(42.50)	8.21	31.17
1325/26	10.40	39.47	6.29	23.87	9.93	37.68		
1326/27			4.91	18.63	9.89	37.52	6.66	25.27
1327/28		(42.50)		(27.53)	10.07	38.20	11.48	43.56
1328/29	10.75	40.80	6.84	25.96	10.61	40.26	12.27	46.54
1329/30	9.97	37.83	9.88	37.49		(32.92)	13.28	50.39
1330/31	13.32	50.55	9.60	36.44	8.77	33.28	6.50	24.68
1331/32	14.49	52.16			7.63	27.47	6.01	21.65
1332/33	9.84	34.30	8.37	29.16	5.96	20.78	5.80	20.21
1333/34	10.35	36.06		(30.68)	7.01	24.42	6.66	23.22
1334/35	11.71	40.80	6.98	24.32	7.29	25.41	6.53	22.76
1335/36			12.65	44.06		(25.63)		(20.90)
1336/37			11.50	40.09		(31.06)	6.57	22.90
1337/38			9.13	26.56	7.64	22.20	5.84	16.97
1338/39			9.43	27.43	12.15	35.32	6.65	19.35
1339/40			17.41	50.63	16.49	47.96	13.58	39.50
1340/41				(36.11)	15.29	44.47	8.31	24.17
1341/42			10.65	30.97	17.26	50.19	13.74	39.94
1342/43	13.60	39.56	15.47	44.99	25.72	74.79	4.91	14.27
1343/44	18.13	42.96		(34.85)	13.68	32.40	9.21	21.82
1344/45	12.77	30.26	13.26	31.41		(35.63)	7.35	17.42

1345/46	10.08	23.87	11.38	26.96	7.02	16.63	5.53	13.10
1346/47	16.77	38.07	17.58	39.92	8.80	19.99	6.12	13.89
1347/48		(35.73)			9.57	19.77	8.64	17.86
1348/49	19.38	40.06	15.96	32.98		(29.81)	13.17	27.22
1349/50	20.93	43.26			18.72	38.69	15.89	32.84
1350/51	18.80	38.85			17.69	36.57	13.79	28.50
1351/52	29.84	57.45			24.51	47.18	19.52	37.57
1352/53	17.25	33.20			16.27	31.32	10.96	21.09
1353/54	14.53	26.66	9.05	16.60	12.71	23.31	8.92	16.36
1354/55	17.44	30.47			15.12	26.41	8.84	15.45
1355/56	23.64	41.30	10.98	19.17	16.36	28.58	12.68	22.16
1356/57	25.19	44.01	15.80	27.60	18.33	32.03	18.58	32.45
1357/58	34.88	60.94	21.30	37.21	22.62	39.52	19.80	34.58
1358/59	26.94	47.06	15.45	26.99	20.08	35.08	19.12	33.41
1359/60	34.88	58.44	25.47	42.67	28.16	47.17	21.42	35.89
1360/61	44.96	75.33	22.39	37.51	30.70	51.44	37.30	62.49
1361/62	17.83	29.04	19.24	31.34	17.03	27.74	15.59	25.39
1362/63	24.03	39.14	26.16	42.61	26.08	42.49	20.38	33.19
1363/64	37.98	57.11	25.32	38.07	32.05	48.19	28.63	43.04
1364/65	32.36	48.66	27.91	41.96	24.71	37.15	22.96	34.52
1365/66	33.91	46.52	28.30	38.81	26.77	36.72	20.61	28.27
1366/67	36.43	49.98	34.59	47.45	33.18	45.52	25.10	34.43
1367/68	41.47	56.89	35.82	49.13	32.92	45.16	23.89	32.77
1368/69	30.23	38.88	26.89	34.57	25.59	32.90	30.62	39.37
1369/70	49.42	60.72	43.50	53.45	43.04	52.88	30.77	37.81
1370/71	41.86	49.09	35.29	41.39	41.28	48.41	27.30	32.02
1371/72	31.59	37.05	25.81	30.27	26.21	30.74	19.18	22.50
1372/73	31.40	36.82		(38.79)	22.01	25.81	17.83	20.91
1373/74	29.46	34.55			21.06	24.70	16.61	19.48
1374/75	41.86	46.65	33.58	37.43	25.39	28.30	27.46	30.60

1375/76	30.23	33.69	28.17	31.40	24.60	27.41	21.38	23.82						
1376/77	29.84	33.26			22.39	24.96	19.00	21.18						
1377/78	32.17	35.85	27.87	31.06	27.46	30.61	15.93	17.75						
1378/79	27.13	30.24			25.62	28.56	12.32	13.73						
1379/80	29.46	32.83	28.22	31.45	24.93	27.78	17.22	19.19						
1380/81	29.65	29.98			25.85	26.14	13.36	13.51						
1381/82	38.76	39.19	14.30	14.46	29.00	29.32	18.41	18.61	17.30	17.49	16.89	17.08	17.49	17.68
1382/83	37.98	38.40			24.93	25.21	18.12	18.31	25.97	26.25	23.84	24.10	26.55	26.84
1383/84	29.84	28.92			22.16	21.47	16.70	16.18	22.00	21.31	18.70	18.12	22.19	21.50
1384/85	31.01	36.37			22.16	25.99	14.56	17.07	14.63	17.16	12.69	14.89	14.83	17.39
1385/86	36.43	42.73			24.93	29.24	21.75	25.51	21.71	25.46	16.30	19.11	21.90	25.68
1386/87	37.21	37.73			33.24	33.71	24.34	24.68	23.21	23.53	19.82	20.09	23.40	23.73
1387/88	28.29	24.01	15.67	13.30	30.47	25.86	19.38	16.45	23.35	19.82	21.80	18.50	23.55	19.98
1388/89	33.72	26.33	16.27	12.71	27.01	21.09	18.41	14.37	15.89	12.41	17.05	13.32	16.09	12.56
1389/90	40.70	41.43	26.20	26.67	33.24	33.84	20.65	21.02	14.83	15.09	18.41	18.74	15.02	15.29
1390/91	29.84	30.38		(20.24)	23.08	23.50	17.92	18.24	18.27	18.59	23.50	23.92	18.46	18.79
1391/92	25.00	25.19	27.99	28.20	22.16	22.33	15.52	15.64	14.73	14.84	17.15	17.28	14.92	15.03
1392/93	15.50	15.78	29.15	29.68	15.33	15.61	11.77	11.98	10.56	10.75	12.26	12.48	10.76	10.95
1393/94	22.09	22.49	10.73	10.92	17.31	17.63	12.11	12.33	8.77	8.93	10.17	10.36	8.96	9.12
1394/95	18.31	18.64	27.99	28.49	18.01	18.33	9.64	9.81	11.97	12.18	12.60	12.82	12.16	12.38
1395/96	25.97	26.44	32.18	32.76	18.26	18.59	13.41	13.65	8.72	8.88	8.67	8.83	8.91	9.08
1396/97	29.65	30.19	29.09	29.62	25.62	26.09	17.47	17.79	14.44	14.70	13.71	13.96	14.63	14.90
1397/98	20.35	20.72	22.22	22.63	20.78	21.15	14.25	14.51	19.91	20.27	18.22	18.55	20.11	20.47
1398/99	19.77	20.12	22.39	22.79	19.39	19.74	13.20	13.44	11.29	11.49	11.77	11.99	11.48	11.69
1399/00	27.91	28.41	24.49	24.93	23.08	23.50	16.11	16.40	10.90	11.10	10.76	10.95	11.09	11.30
1400/01	27.52	28.02	27.99	28.49	19.39	19.74	17.94	18.27	17.59	17.90	15.21	15.49	17.78	18.10
1401/02	36.05	36.70	22.65	23.06	31.86	32.44	19.69	20.05	17.68	18.00	15.79	16.08	17.88	18.20
1402/03	37.60	38.27	15.43	15.71	33.54	34.14	23.48	23.90	20.69	21.06	21.03	21.41	20.88	21.26
1403/04	20.16	20.52	13.04	13.28	17.42	17.74	15.57	15.85	24.03	24.46	22.29	22.69	24.22	24.66
1404/05	24.03	24.46	15.75	16.03	18.61	18.94	13.18	13.42	11.14	11.34	11.53	11.74	11.34	11.54

1405/06	21.71	22.10	15.78	16.06	20.35	20.72	15.24	15.52	12.89	13.12	11.87	12.08	13.08	13.32
1406/07	28.68	29.20	22.01	22.41	22.44	22.85	15.24	15.52	11.87	12.08	11.34	11.54	12.06	12.28
1407/08	34.50	38.09	25.20	27.83	26.21	28.95	18.58	20.52	17.01	18.78	17.73	19.58	17.20	18.99
1408/09	47.29	48.14	25.35	25.80	43.79	44.58	28.63	29.14	21.41	21.80	21.08	21.46	21.61	22.00
1409/10	41.09	48.57	21.71	25.66	31.86	37.67	25.54	30.19	33.16	39.20	28.39	33.57	33.33	39.41
1410/11	23.64	27.95	13.98	16.52	19.81	23.42	18.33	21.67	24.95	29.50	23.11	27.32	25.15	29.73
1411/12	24.81	29.33	15.84	18.73	15.64	18.49	11.78	13.93	9.30	11.00	9.50	11.23	9.50	11.23
1412/13	27.91	32.99	19.88	23.51	17.11	20.23	13.27	15.68	11.09	13.12	10.22	12.09	11.29	13.35
1413/14	27.13	32.08	17.22	20.36	16.90	19.98	12.15	14.37	13.08	15.47	13.52	15.98	12.89	15.24
1414/15	23.84	28.18	23.32	27.57	16.38	19.36	13.18	15.59	10.90	12.89	10.76	12.72	11.09	13.12
1415/16	43.80	51.78	35.03	41.41	26.37	31.17	19.36	22.89	10.22	12.09	10.32	12.20	10.42	12.31
1416/17	54.65	52.36	27.73	26.57	36.88	35.34	23.48	22.50	20.98	20.10	18.80	18.01	21.17	20.29
1417/18	22.29	21.35	12.30	11.78	16.79	16.09	17.96	17.21	25.48	24.42	24.71	23.68	25.68	24.60
1418/19	20.35	17.29	11.73	9.97	19.93	16.94	17.82	15.14	10.32	8.77	9.74	8.28	10.51	8.93
1419/20	18.22	15.48	12.58	10.69	17.84	15.16	10.09	8.58	12.60	10.71	12.55	10.66	12.82	10.90
1420/21	28.68	24.38	17.85	15.17	26.35	22.39	15.57	13.23	10.51	8.93	11.00	9.35	10.71	9.10
1421/22	36.05	30.63	23.75	20.18	33.19	28.20	21.21	18.03	16.62	14.12	17.93	15.23	16.81	14.29
1422/23	27.52	23.39	22.07	18.76	24.33	20.67	17.30	14.70	19.53	16.59	22.63	19.23	19.72	16.76
1423/24	35.47	30.14	25.27	21.47	27.61	23.46	19.36	16.45	16.18	13.75	15.79	13.42	16.38	13.92
1424/25	36.05	30.63	24.98	21.23	35.00	29.75	24.84	21.11	23.06	19.60	22.38	19.02	23.28	19.78
1425/26	31.40	26.68	24.51	20.83	29.98	25.48	22.78	19.36	27.52	23.39	24.08	20.46	27.71	23.55
1426/27	34.11	28.99	25.97	22.07	30.71	26.10	20.02	17.01	19.23	16.35	18.22	15.48	19.43	16.51
1427/28	29.46	25.03	20.11	17.09	32.49	27.61	21.05	17.89	20.88	17.75	18.41	15.65	21.08	17.91
1428/29	32.56	24.37	21.69	16.24	29.14	21.81	20.91	15.65	17.54	13.13	16.04	12.00	17.73	13.27
1429/30	33.72	25.24	28.10	21.03	29.09	21.77	24.51	18.35	20.74	15.52	21.03	15.74	20.95	15.69
1430/31	44.19	33.08	27.62	20.67	45.01	33.70	25.02	18.73	23.16	17.34	21.75	16.28	23.35	17.48
1431/32	33.33	24.95	22.09	16.54	40.86	30.59	18.66	13.97	27.13	20.31	26.45	19.80	27.33	20.46
1432/33	52.71	39.46	25.00	18.71	45.71	34.21	29.14	21.82	23.21	17.37	21.56	16.14	23.40	17.52
1433/34	32.36	26.36	25.87	21.07	25.62	20.87	26.05	21.22	24.13	19.65	35.66	29.04	35.95	29.28
1434/35	25.97	21.15	14.53	11.84	22.03	17.94	15.04	12.25	23.98	19.53	20.98	17.09	24.18	19.69

1435/36	24.81	20.20	12.50	10.18	22.44	18.28	15.24	12.41	17.05	13.89	16.57	13.49	17.25	14.05
1436/37	33.33	27.15	15.12	12.31	27.75	22.60	15.90	12.95	14.34	11.68	14.34	11.68	14.53	11.84
1437/38	69.77	56.82		(18.78)	59.91	48.79	38.93	31.70	18.31	14.92	19.67	16.02	18.51	15.07
1438/39	81.40	66.29	44.48	36.22	79.58	64.81	62.61	50.99	38.52	31.37	48.74	39.70	38.71	31.53
1439/40	40.31	32.83	25.87	21.07	37.51	30.55	29.45	23.99	56.98	46.40	65.41	53.27	57.17	46.56
1440/41	35.66	29.04	25.87	21.07	35.00	28.51	25.95	21.14	27.23	22.18	24.27	19.77	27.42	22.33
1441/42	36.05	29.36	22.97	18.70	29.09	23.69	21.30	17.34	22.67	18.47	19.77	16.10	22.87	18.62
1442/43	39.92	32.51	27.91	22.73	36.01	29.33	22.78	18.55	23.35	19.02	19.72	16.06	23.55	19.18
1443/44	27.91	22.73		(20.46)	26.32	21.43	25.17	20.50	23.84	19.41	23.47	19.12	24.03	19.57
1444/45	26.36	21.47		(19.22)	18.68	15.21	13.18	10.74	18.02	14.68	16.33	13.30	18.22	14.84
1445/46	28.88	23.52	19.77	16.10	24.01	19.56	19.36	15.77	17.44	14.21	12.98	10.57	17.64	14.36
1446/47	39.15	31.88	29.07	23.68	30.12	24.53	23.99	19.54	19.19	15.63	17.93	14.60	19.38	15.78
1447/48	26.74	21.78	18.31	14.92	23.70	19.30	16.79	13.67	28.25	23.00	25.10	20.44	28.44	23.16
1448/49	21.32	17.36	14.53	11.84	18.36	14.96	14.21	11.58	17.44	14.21	16.13	13.14	17.64	14.36
1449/50	28.68	23.36	20.93	17.05	28.10	22.88	18.33	14.93	16.28	13.26	11.34	9.23	16.47	13.42
1450/51	24.81	20.20	15.41	12.55	17.31	14.10	12.98	10.57	18.31	14.92	16.28	13.26	18.51	15.07
1451/52	24.81	20.20	15.12	12.31	14.75	12.01	14.54	11.84	16.72	13.61	14.64	11.93	16.91	13.77
1452/53	27.91	22.73	16.57	13.49	16.62	13.54	11.78	9.60	16.67	13.57	12.94	10.54	16.86	13.73
1453/54	25.39	20.68	14.53	11.84	20.98	17.09	14.21	11.58	17.05	13.89	13.81	11.25	17.25	14.05
1454/55	26.74	21.78	17.44	14.21	21.12	17.20	15.24	12.41	16.38	13.34	14.63	11.92	16.57	13.49
1455/56	47.29	38.51	26.74	21.78	44.55	36.28	26.36	21.47	16.60	13.52	16.09	13.10	16.80	13.68
1456/57	46.51	37.88	36.05	29.36	37.86	30.83	29.29	23.85	30.81	25.10	30.67	24.98	31.01	25.25
1457/58	46.51	37.88	27.62	22.49	31.86	25.94	29.66	24.15	28.49	23.20	26.89	21.90	28.68	23.36
1458/59	27.91	22.73	17.44	14.21	16.97	13.82	18.33	14.93	29.07	23.68	27.30	22.23	29.26	23.83
1459/60	41.09	33.46	25.29	20.60	40.02	32.60	27.76	22.61	17.73	14.44	17.01	13.85	17.93	14.60
1460/61	34.50	28.09	19.77	16.10	28.72	23.39	21.75	17.71	29.07	23.68	25.44	20.72	29.26	23.83
1461/62	27.13	22.10	15.12	12.31	21.19	17.26	15.24	12.41	22.09	17.99	20.06	16.34	22.29	18.15
1462/63	20.16	16.41	11.92	9.71	18.68	15.21	12.98	10.57	16.57	13.49	15.41	12.55	16.76	13.65
1463/64	15.70	12.78	10.17	8.29	15.24	12.41	9.06	7.38	12.21	9.94	11.63	9.47	12.40	10.10
1464/65	18.02	14.68	13.08	10.65	15.12	12.31	8.86	7.21	9.88	8.05	8.72	7.10	10.08	8.21

1465/66	25.19	20.52	14.24	11.60	22.16	18.05	14.97	12.20	10.76	8.76	10.17	8.29		(10.75)
1466/67	27.52	19.35	14.24	10.02	19.74	13.88	13.70	9.63	15.26	10.73	15.70	11.04	15.46	10.87
1467/68	28.49	19.28	15.41	10.42	21.12	14.29	14.01	9.48	16.57	11.21	16.67	11.28	16.76	11.34
1468/69	29.65	20.06	19.19	12.98	24.93	16.87	22.08	14.94	15.12	10.23	15.55	10.52	15.31	10.36
1469/70	27.03	18.29	20.35	13.77	21.47	14.53	14.97	10.13	15.99	10.82	16.28	11.01	16.18	10.95
1470/71	27.13	18.36	21.51	14.55	20.78	14.06	14.21	9.62	18.02	12.19	14.73	9.97	18.22	12.33
1471/72	24.42	16.52	14.53	9.83	22.03	14.90	15.04	10.17	18.10	12.24	15.21	10.29	18.27	12.36
1472/73	23.26	15.73	20.93	14.16	28.72	19.43	20.39	13.80	18.22	12.33	15.38	10.41	18.41	12.46
1473/74	30.23	20.46		(11.89)	29.35	19.86	20.91	14.14	20.54	13.90	16.09	10.88	20.74	14.03
1474/75	32.56	19.43	20.35	12.14	35.00	20.89	27.23	16.25	21.71	12.95	20.37	12.16	21.90	13.07
1475/76	27.52	16.42	18.31	10.93	28.72	17.14	19.16	11.43	23.26	13.88	14.29	8.53	23.45	14.00
1476/77	27.13	16.19	16.28	9.72	21.61	12.90	17.88	10.67	18.23	10.88	14.78	8.82	18.41	10.99
1477/78	47.29	24.69	21.22	11.08	33.75	17.62	24.30	12.69	17.83	9.31	13.02	6.80	18.02	9.41
1478/79	45.35	23.68	29.36	15.33	33.75	17.62	45.10	23.55	37.94	19.81	28.67	14.97	38.13	19.91
1479/80	41.86	21.86	20.93	10.93	36.26	18.93	47.16	24.63	39.86	20.81	34.17	17.85	40.05	20.92
1480/81	48.84	25.50	25.58	13.36	33.75	17.62	32.38	16.91	31.30	16.34	24.11	12.59	31.49	16.45
1481/82	81.40	42.51	54.65	28.54	41.28	21.56	64.67	33.77	38.21	19.95	28.29	14.78	38.40	20.06
1482/83	90.70	47.36	44.19	23.08	41.28	21.56	137.41	71.76	71.61	37.40	65.73	34.33	71.80	37.50
1483/84	34.50	16.09	25.58	11.93	33.75	15.74	29.66	13.83	62.89	29.32	57.85	26.97	63.08	29.41
1484/85	29.07	13.56	19.19	8.95	23.70	11.05	18.33	8.55	20.01	9.33	17.96	8.37	20.20	9.42
1485/86	41.86	24.98	24.42	14.57	23.70	14.14	18.85	11.25	15.89	9.48	13.03	7.78	16.09	9.60
1486/87	52.71	24.58	44.25	20.63	36.26	16.91	36.50	17.02	27.96	13.04	23.52	10.97	28.15	13.13
1487/88	52.33	24.40	44.48	20.74	35.00	16.32	26.05	12.15	40.36	18.82	35.90	16.74	40.55	18.91
1488/89	51.16	23.86	62.97	29.36	33.75	15.74	28.11	13.11	41.67	19.43	42.05	19.61	41.86	19.52
1489/90	60.47	43.45	59.70	42.90	24.33	17.48	33.41	24.01	52.00	37.37	34.98	25.14	52.20	37.51
1490/91	93.02	66.85	40.87	29.37	34.58	24.85	21.42	15.39	29.07	20.89	29.07	20.89	29.26	21.03
1491/92	59.69	34.06	85.35	48.70	41.91	23.91	28.42	16.22	31.01	17.69	28.54	16.28	31.20	17.80
1492/93	46.12	26.32	67.01	38.24	41.28	23.55	44.07	25.15	36.30	20.72	35.66	20.35	36.50	20.83
1493/94	27.91	15.92	25.85	14.75	26.21	14.96	21.83	12.46	29.10	16.60	29.39	16.77	29.29	16.71
1494/95	23.84	13.60	17.23	9.83	18.68	10.66	15.65	8.93	18.72	10.68	16.04	9.15	18.91	10.79

1495/96	19.77	11.28	11.65	6.65	18.68	10.66	14.73	8.40	15.60	8.90	13.42	7.66	15.79	9.01
1496/97	20.74	11.83	18.49	10.55	21.19	12.09	14.73	8.40	14.47	8.26	12.81	7.31	14.66	8.37
1497/98	26.16	14.93	27.05	15.44	31.23	17.82	24.51	13.99	18.86	10.76	18.08	10.32	19.05	10.87
1498/99	26.74	15.26	26.12	14.90	28.72	16.39	24.14	13.77	25.03	14.28	27.03	15.43	25.23	14.39
1499/00	18.02	10.28	12.99	7.41	17.42	9.94	13.18	7.52	22.56	12.87	21.51	12.27	22.76	12.98
1500/01	25.97	14.82	15.23	8.69	22.44	12.81	15.57	8.89	12.37	7.06	10.95	6.25	12.56	7.17

Note: In the series expressed in grams of silver per hectolitre, the added prices that constitute the integrated price sample are noted in parentheses.