

RESEARCH ARTICLE

# The role of quality in the grain market: wheat prices formation in eighteenth-century Northern Italy

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## Abstract

The aim of this paper is to analyse the role of wheat quality in the formation of wheat prices in the early modern period, adopting eighteenth-century northern Italy as a case study. Wheat prices have been widely used by economic historians to calculate living standards, determine the degree of market integration, and date famines. Rarely, however, have economic historians focused on how wheat prices were determined. By looking at the wheat supply chain, we will try to make more visible the extent to which wheat quality was crucial in determining the value of wheat and, as a consequence, the final price of grain.

## Introduction

The aim of this article is to show the impact of wheat quality on the final price of the product.<sup>1</sup> To achieve this goal, we will first clarify what we mean by the term ‘quality’ and then, by looking at how contemporaries paid attention to this element, we will try to focus on what actually influenced the final price of the product.

Wheat prices have been used extensively by economic historians for a vast range of goals: firstly, together with historical wage series, they have provided the basis for the analysis of past living standards, the related theories of the Great Divergence between Asia and Europe, as well as the Little Divergence between the Mediterranean area and Northern Europe (Pomeranz, 2000; Allen, 2001; Allen, 2009; Allen, 2015; De Pleijt and Van Zanden, 2016; Van Zanden, 2009). Furthermore, the recent famine debate has highlighted the relevance of wheat price fluctuations – together with mortality rates and qualitative sources – as a clear indicator of famine periods (Alfani and Ó Gráda, 2017: 6–7). Finally, almost the entire corpus of historiography discussing the integration of European markets and the processes of early or late globalisation is rooted in the comparison of the volatility, convergence, and speed of adjustment of wheat prices in different European markets (Persson, 1999; Bateman, 2011; Bateman, 2012; Dobado-González et al., 2012; Chilosi et al., 2013; Federico et al., 2021). As Brunt and Cannon have recently pointed out, all these debates had in common the basic idea that wheat was handled as a standard commodity, with little or no qualitative difference, easily comparable throughout the world, and therefore its market was ruled by the law of one price (Brunt and Cannon, 2015: 82–83, 90; Brunt and Cannon, 2013: 333–334): in other words, given equal supply and demand, and excluding transport costs, wheat should be priced exactly the same in different markets. However, wheat is far from being a standard commodity (Corritore, 2000: 112; Kaplan, 1984: 56–66). Recently, Richard Hoyle pointed out that, in principle, it is quite risky to establish a rigid relationship between prices and products, precisely because of the different qualities of food products that lead to different prices (Hoyle, 2019: 37),

and Giovanni Federico was even more explicit. In his well-known contribution on ‘How much do we know about market integration in Europe?’ he pointed out that when analysing market integration using wheat prices, ‘the main source of systematic distortion is [...] the presence of differences in quality, and thus prices: it is obvious that manufactured goods differed according to their origin and quality, but this also applies to primary products. The (scant) available evidence shows that these differences are substantial and not constant over time on the same market’ (Federico, 2012: 478, 486, 488). In his latest book, Jan de Vries confirms this assertion, saying of the Dutch Republic that ‘wheat was a much less homogeneous product than rye. [...] Wheat from each producing region was associated with distinct qualities and this led to the maintenance of significant price differentials’ (de Vries, 2019: 162), and Kaplan’s words on France, along with those of Enrica Alifano on Naples, also recall the relationship between different levels of quality according to the area where wheat was grown (Kaplan, 1984: 48-49; Alifano, 1996: 51). Contemporary agro-economic debates also emphasise the wide variation in wheat quality (Henry and Kettlewell, 1992: 3-54), its role in setting wheat prices (Tomek and Kaiser, 2014: 133-144), and the importance of consumers and traders themselves being able to assess grain quality (Wilson and Dahl, 1999). Taken for granted in the current scenario, the idea that wheat quality has an impact on grain prices tends to disappear – or be severely neglected – in early modern historical settings, except for the few examples mentioned above. However, this lack of interest in past wheat quality and its economic relevance sounds even more like a paradox when applied to settings far from the so-called ‘Green Revolution’ of the twentieth century, and thus much richer in terms of grain varieties and cultivar differences, as well as much more exposed to intra and inter-annual quality variations due to less effective field control and less effective maintenance of grain stores. In order to understand this sort of paradox, it may be useful to recall that until the early nineteenth century, grain management had been at the crossroads of administrative and commercial interests for centuries, if not millennia, giving rise to a vast written tradition of accounting *explicitly* focused on the quantity of grain rather than its quality. The latter, far from being unimportant to its dealers and administrators, requires a deeper historical investigation to be grasped in its full relevance and economic impact. In order to overcome the hurdle of a seemingly *implicit* – sometimes unspoken – factor, we will approach the issue with a strong focus on the processing of wheat and its final destination. This new approach to the subject will allow us to better understand the value of wheat from the perspective of contemporaries and to place ‘wheat’ in a more accurate space and role within the real economy of the past.

But how did it work in the early modern period? How much did quality matter in the process of wheat price formation? And what kind of quality is at stake: wheat weight, flour yield, or flour quality? To what extent was it important compared to the dynamics of supply and demand? Finally, were contemporaries able to assess the quality of the seeds they would grow, sell, and purchase?

A number of historians have sketched out these questions, more or less explicitly, but have rarely attempted to answer them: in 1996, for example, Rahlf wrote in the German case that not only the amount of wheat harvested but also the quality of the grain (especially in terms of wheat weight) affected flour production and thus the availability of food (Rahlf, 1996). It was not until nearly 20 years later, in 2015, that Brunt and Cannon attempted to provide a quantitative basis for this view, demonstrating for the English case of the nineteenth and twentieth centuries that differences in the quality of wheat meant differences in the quantity and quality of flour that could be made from it, and – most importantly – that wheat prices varied accordingly (Brunt and Cannon, 2015: 78-79). In their article, Brunt and Cannon heavily relied on wheat weight as a direct determinant of wheat quality (the higher the former, the higher the latter), although they acknowledged that other factors also affected grain quality (Brunt and Cannon, 2015: 78). More recently, the two authors have returned to the subject (Brunt and Cannon, 2022), reiterating the idea that variations in wheat quality lead to variations in wheat price, but also that there is a strong link between its seasoning and its density: once dried, the grain shrinks and – as it is sold by

volume – its price increases. The latter article does not mention the weight of the wheat, but we certainly agree that a certain seasoning of the grain had a significant effect on its price (Ronsijn et al., 2022), not only because of its density but also because of the increase in flour yield. In the following pages, building on Brunt and Cannon’s analysis, which covers the whole of the eighteenth century, we will explore the above questions using both qualitative and quantitative methods. In the first part of the article (*What is wheat quality?*) we will analyse the elements affecting the common wording ‘wheat quality’ and the reasons why they were more or less decisive in influencing the *real* value of wheat, that is, its yield once transformed into flour (notably good flour) and eventually into bread. This step is important in order to identify which factors should be taken into account in the price formation process; we will argue, for example, that grain weight was not the best indicator of wheat quality – and subsequent regressions based on time series of wheat prices, weights and yields will confirm this. In the second part (*The control of wheat quality*), we will also show how contemporaries were aware of the importance of wheat quality and how they assessed it in the different areas of northern Italy. This awareness is crucial not only to reiterate the relevance of product quality information in shaping the grain market (Velkar, 2014) but also – even more importantly – to understand how quality management itself has had a direct impact on market dynamics (Walton, 1999). Indeed, if we want to assess – as in the third part – the role played by wheat quality in setting the price of wheat, we should be well aware not only of the agronomic elements that affected the real value of wheat (such as its weight, moisture, ripeness, and gluten content) but also of the ability and technical means available to contemporaries to include these elements in their assessment and, in the end, in the price formation process. This passage will lead us to the third part (*Wheat quality and wheat price formation*); after a general overview of how differences in quality led to different prices, based on sequential and detailed data, we will outline the elements that influenced wheat prices in the town of Ferrara, in the Papal States. In fact, for nearly the whole eighteenth century, the Municipal Archives of the town held documents reporting (once or twice a year) the price of a wheat bushel, its weight, its yield in flour, in refined flour, and in flour for bread-making (Appendix 1). Regressions using these data and control variables will allow us to assess which kind of ‘quality’ mainly influenced wheat prices: weight or yield in different types of flour?

Grains, like any other commodity, have always been valued according to their different quality. As the staple food of human societies, the quality of grain has always been familiar to both traders and consumers. Although some of the broad points made here apply to cereals as a food cluster, we will focus on wheat because of its key role in the supply chain of bread, a staple food in the geographical area at the centre of our analysis. The choice of wheat will allow us to update and contribute to the historiographical debate based on other European areas where wheat, by definition, remained ‘the grain’ throughout the early modern period. Indeed, in urban contexts throughout Europe, wheat left behind an unprecedented amount of administrative and commercial records.<sup>2</sup>

### ***The matter of wheat quality***

Since the dawn of trade, quality has been a relevant factor in wheat price formation. However, for staple grains and their peculiar trade dynamics, the relevance of quality has been deeply intertwined with grain quantity and availability. With this in mind, we have to acknowledge that the common perception of the quality of staple grains has been reshaped year by year on the basis of their actual availability: raising the standard in good harvest years and undergoing many trade-offs in any historical context marked by shortages and real hunger.<sup>3</sup>

During the eighteenth century, the whole of Europe became increasingly obsessed with the quality of grains. This new focus on grain quality – rather than quantity – was due to a number of reasons, including: a significant improvement in crop yields, together with the spread of new staple foods – such as potatoes and maize –, an evolving experimental attitude in medical

approach and dietary knowledge, and – finally – a growing demographic pressure with the consequent need to feed urban areas due to the vulnerability of the social order.

Unlike luxury and exotic goods – such as sugar, coffee, and chocolate – which could only be handled and traded on a commercial basis, cereals played a role in traditional societies as staple food, and quality tended to be subordinate to quantity.

Approaching the subject of wheat varieties from a historical perspective involves a number of hurdles already discussed in the literature, due to the blurred correspondence between vernacular and scientific variety nomenclature (Colella, 1994: 769-770).<sup>4</sup> It is worth noting that the number of Italian wheat varieties nearly doubled during the eighteenth century, reaching the impressive number of 83 by the end of the century (Colella, 1994: 788). The significant increase in the range of wheat varieties was achieved, thanks to a major investment in research by both scientific institutions and trade networks: the shared aim was to combat and prevent famine, a familiar occurrence in this historical setting. Surprisingly, however, even technical and specialised handbooks, such as those on bread-making and baking, tend to use generic terms for wheat, mostly neglecting reference to botanical varieties. We can find some information in the agronomic literature of the time, where we can actually get a broader idea of the factors linking the choice of wheat variety to the value of the seed as a commodity. The value of the wheat variety tended to be based on different reasons depending on the purpose of the purchase and, in particular, the segment of the supply chain for which the seed was intended. Thus, when it came to sowing, the most sought-after features were seed adaptability and resilience, together with the yield at harvest, whereas when grain was bought for trade reasons, the first requirements were good preservability and resistance to transport stress; finally, when it was purchased by millers and end users, the praise was for its flour yield, together with the requirement to be highly nutritious. Here we will focus on the praise of the wheat variety according to bread market traders and end consumers.

In a rich and fragmented picture reminiscent of a mosaic of micro tiles, some wheat varieties were certainly present in the Italian peninsula of the eighteenth century: among them, we can recall those ones commonly named *marciolo*, *tosello*, or *carosello* in northern Italy, *calvello* in central Italy, and *carosella*, *cicirella*, *maiorca* in southern Italy. *Grano rosso*, *gentile*, or *vernereccio* were common wheat varieties for the botanical species *Triticum aestivum* (*sativa*), while for *Triticum durum* the most common would be *russia*, *tumminia*, and *saragolla* (Colella, 1994: 778-781). Overall, in modern times, a number of varieties falling within the spelt botanical group (i.e. belonging to the *Durum* family) gained the scene, fragmenting the centuries-old dominance of bread in the grain market, now also driven by a growing demand from pasta makers.

We know from various sources that each of these common varieties had its own reputation, and here we will focus only on some of the economic implications. In northern Italy, and specifically in the Ferrara area where most of our administrative documents come from, we find the so-called *Barbato nero*, *cascola rossa*, *grano di Puglia*, *marciolo*, *nostrano*, and *tosello*. The latter, corresponding to the better-known *gentil bianco* or *gentil rosso* in Italy and the French *Touzelle*, enjoyed a strong reputation for the good quality of the bread made from it (Manetti, 1765: 8-9, 43).

The choice of a given variety was mainly driven by the quality of the bread that could be made from it. A sort of know-how stemmed from practices also tended to inform the scientific approach to cereal quality, in a lasting information exchange between agricultural and merchandise management. In this way, botanical features could readily be translated into a range of bread characteristics. As we shall see later, the specific weight of the different varieties played a role in flour yield, but in the mindset of the time it could also mean bread with a higher or lower nutritional value (Zotta, 1981: 231). Some botanical features, such as a thick seed coating may lead to a sort of bread that is not thoroughly white, even in a hearty, flavoured dough (Parmentier, 1802: 201).

As a commodity, however, grain was strongly associated with its area of origin, and the commercial reputation of each wheat variety is often based on the growing area of the stock, both in geographical and geomorphological terms.<sup>5</sup> The correlation between variety and provenance

reveals a kind of commercial cliché rather close to today's idea of typicality, which in turn recalls hierarchies among different areas with certain *terroirs* where distinctive climatic paedological features match peculiar growing practices.<sup>6</sup>

Remarkably, some varieties could only be considered profitable if imported from abroad, rather than grown locally, that is, on the Italian peninsula.<sup>7</sup> Likewise, some varieties could only be appreciated if grown in the plains, since the mountain environment tended to spoil them (Colella, 1994: 792 – footnote 35).<sup>8</sup> In this light, the growing area had to be known and recorded for each single batch of wheat, not only in terms of political borders but also by region and, when possible, by micro-area.<sup>9</sup>

When it came to setting the price of wheat, the final assessment would rely on traders' expertise and know-how: they actually appealed to their five senses for a quality test taking place on spot. Let us read what this judgement was based on: '*When wheat is pure and of good-quality, the practise of our bodily senses will be the main judge to perceive it: the shape of the kernel, its colour, volume, dryness, weight, cleanliness: these are the features according to which men can pick up their own grain; yet in any corner you can come across further nuances able to be perceived by merchants, according to which they have been able to shape clusters of peculiar qualities*' (Parmentier, 1786: 13). Let us follow his description into details: '*Top wheat, or first-quality wheat; middling wheat or second-quality wheat; basic wheat or third-quality wheat. First-quality wheat: It is the one whose kernel is tough, coarse, heavy, well-nourished, round, with a not-too-deep groove, an even and fair surface, a yellowish-white on the inside. It roars while you slide it by your hands; it allows your arms to dip easily into the sack: all signs of its excellent quality. Second-quality wheat: it looks thinner, more slender and lighter; you can crash it easily under your teeth; it does not provide its insides such a firm and white substance; the March variety as well as the grey grains can be ranked in this cluster*' (Parmentier, 1786: 13).

At least ideally, these features were to be tested and ascertained by the skilled and trained senses of the buyer. This latter, though, cared also for another crucial feature we are covering in this article: the weight of grain.

Wheat weight was considered and assessed according to two other factors, that is, the volume of the batch and its age, namely the time gone by since when it was harvested from the field. Without taking these elements into account, the weight of the grain cannot simply be taken as a proxy for its quality. In pricing, moisture and parasitism had to be excluded throughout a sensory evaluation: weevil attack, one of the most feared, could easily be tested with water. At first sight, indeed, a hollow-out seed, inwardly devoured by weevils or other pests, could look like a healthy one and required a special evaluation. In the words of the famous French food technician Antoine Augustine Parmentier, wheat merchants knew the 'adequate' weight and, if it was too far away, he recommended checking whether the seeds floated or sank in water: only the latter was considered to be guaranteed against parasitosis (Parmentier, 1802: 338). In this view, weight became the primary indicator of effective and successful preservation: a slight decrease in weight indicated drier and properly preserved seeds, whereas excessive lightness was highly suspicious, likely to reveal a significant starch loss.

Linked to the weight was the stove treatment, which spread-out in the second half of the eighteenth century with a double patent by the Italian Bartolomeo Intieri and the French Henry Louis Duhamel du Monceau. The use of a large heating and drying plant to preserve grain longer and improve its quality was part of the technological breakthrough which took place throughout Europe in those decades.<sup>10</sup> While the authorship of the design of these kilns was long disputed between Italy and France, some administrative sources confirm the actual implementation of such facilities. In Northern Italy, for example, a technical report issued by the public authorities refers to the Intieri stove (named after its inventor) as an infrastructure to be completed using public funds for agriculture and manufacturing. Interestingly, this sort of investment is somehow intertwined with export policy and market regulation, since the large kiln is designed to prevent grain losses due to overstocking, which in turn is typically due to export bans.<sup>11</sup>

### Quality control of wheat

In the previous pages, we have analysed the factors which – in the words of the contemporaries’ – influenced the quality of wheat. First and foremost, its weight, that is, grain density, ageing, and moisture content appear to be the key characteristics with a relevant impact on both the storage life of the grain, the yield in flour, and the quality of the flour. The leap to the assumption that weight, ageing, and moisture were therefore the main determinants of wheat valuation and pricing seems inevitable, but it may not be that simple. In fact, there is a gap – due mainly to the technological level of pre-industrial societies – between what *should* be valued and what *could* actually be valued. In other words: was it possible to check the age, moisture content, and weight before buying the product? With what degree of accuracy? Moreover, since the quality of wheat is primarily related to its yield in (bread-making) flour, rather than its weight, was there a way to take these elements into account in the price formation process? Therefore, if we want to understand how the price of wheat was constructed and the role of quality in this process, we must first understand how quality was assessed in practice.

In general, we agree with Kaplan when he says that ‘there is no question [...] that neither a baker nor a miller nor a merchant could have successfully conducted his business without a thorough knowledge of the criteria of excellence of grain, wheat, and flour’ (Kaplan, 1984: 48). First of all, there is no doubt that contemporaries were well aware of the fact that the quality of the wheat (especially its weight, ageing and moisture) affected both the extraction of flour and the quality of the bread (Corritore, 2000: 112-116). In an anonymous 1793 dossier on the reform of bread prices in Bologna, the author wrote: ‘[...] *it is easy to understand, and practice proves it, that wheat, and its different varieties, do not always produce the same amounts of flour*’.<sup>12</sup> For this reason, the anonymous author suggests that the price of wheat (set by the local authorities once or twice a year) should be based on weight rather than volume (Guenzi, 1982). This was not the first time this issue had been raised in Bologna,<sup>13</sup> and the city was certainly very aware of variations in the weight of harvested wheat – precisely because of its impact on food availability – since local weather observers recorded the weight of the best, ordinary and inferior-quality wheat every year in the eighteenth century (Finzi and Baiada, 1985: 328-330). The bakers, in particular, pushed for grain to be sold by weight rather than volume and achieved their goal in 1795 (Guenzi, 1982: 79).<sup>14</sup> This was precisely linked to the variation in the yield of wheat according to its quality. Another example comes from Bologna: in 1708, the municipal officials responsible for monitoring the food supply pointed out that the amount of wheat brought into the city walls (measured in *corbe* according to the unit used) did not correspond to a real availability of flour, since the grain was ‘of poor quality’ and ‘light because of the continuous rain before the harvest’; as a result, it would have suffered a 18% reduction in the cleaning process and would have produced scarce ground flour of inferior quality.<sup>15</sup> Moreover, in 1716, the local *Assunteria d’Abbondanza* (public food authority<sup>16</sup>) refused to buy a batch of wheat for the same reason,<sup>17</sup> and a description of the famine that struck the province in 1794 stressed that it was the poor quality of the harvest, as well as its quantity, that contributed to the worsening food situation.<sup>18</sup> Also in Ferrara, at the end of the century, similar remarks about the weight of wheat were recorded, along with the prices of wheat and bread, due to the effects of differences in the quality of the grain on its yield in flour and bread<sup>19</sup>; moreover, as in Bologna, in 1765, the local food institution pointed out that there was a direct link between the low flour yield of a batch of wheat and the fact that it was quite damp.<sup>20</sup> Unsurprisingly, this was not a peculiarity of the Papal States, and in the Republic of Venice too, on several occasions during the century, officials stressed the importance of determining the amount of bread rations that could be produced from a unit of wheat, before drawing up contracts with bakers for the production of bread for the soldiers in the fortresses.<sup>21</sup> Moreover, in Mantua, between the end of the sixteenth century and the end of the eighteenth century the weight of a bushel of wheat remained formally the same, but ‘its milling value decreased, because of the increase of dross and impurities in it’ (Corritore, 2000: 113-115). It was not only the amount of flour and bread produced from the

different sorts of wheat that officials were concerned about but also the quality of the bread that could be made from it, notably when the recipients were soldiers (Vertecchi, 2009: 126-127; Kaplan, 1984: 58; Fazio, 1993: 163). In November 1736, for example, the captain of the Venetian fortress of Peschiera, on Lake Garda, wrote to his senior officer in Verona that 'only the quality of the wheat determines the quality of the bread'; he therefore demanded that the grain supplied to the fortress should be of good quality, in order to avoid complaints, as happened in January of the following year.<sup>22</sup> Some similar letters were also written from other fortresses in the Verona area in 1754 and 1761.<sup>23</sup> Other examples exist; in Florence, too, the different types of bread sold by bakers (both in terms of quality and price) were directly related to the quality of the wheat (Gori, 1989: 550-551).

The awareness of the close link between the quality of wheat and its yield, as proved by the previous examples, is the reason why the orders to the merchants responsible for supplying grain to Bologna and Ferrara, or to the fortresses of the Venetian Mainland, contain constant – and standardised – references to the quality of the product to be procured.<sup>24</sup> In short, the typical recommendation was everywhere that the wheat should be of 'good and beautiful' quality, *mercantile* (i.e. marketable), well-weighted, with a good smell, not perished, not *punto*, not sprouted, dry and free from impurities. More rarely, the varieties of wheat (e.g. *stiolo* or *azzalino*<sup>25</sup>) or the storage conditions before purchase (in caves or warehouses, etc.) were also mentioned.<sup>26</sup> In addition to recommendations that the wheat be clean and not spoilt, the most common reference was to its 'good and beautiful' quality (Fornasin, 1999: 11; Fazio, 2004: 37) and its smell, while in terms of weight, it was usually advisable to buy the heaviest or, in the case of wheat already purchased, to ensure that it corresponded to the agreed weight on delivery. The aforementioned lexicon helps us to define the ways in which grains were assessed for quality: firstly, a visual and tactile inspection, then the sense of smell played its part in detecting any defects in the grain. Finally, weighing made it possible to estimate the thickness of the kernels (Kaplan, 1984: 52; Vertecchi, 2009: 102, 126-127, 130-131; Fazio, 1993: 82, 84-85). It is important to emphasise, as recalled in the previous section of this article, that weighing alone was not sufficient to determine the quality of the product (Vertecchi, 2009: 131; Corritore, 2000: 113-115): wet grains were certainly heavier than dry grains, just as freshly harvested grains were heavier than aged grains, but this did not mean a higher yield. On the contrary, the former produced less flour and bread of inferior quality. Moreover, weighing was not such an infallible procedure, as the words of a Bologna purchasing agent attest. In 1773, when asked about the weight of wheat in the various ports of the Italian peninsula, the officer in charge of contracting wheat shipments replied that it was very difficult to rely on weight to determine the quality of the product, because 'it depends on whether we take the weight immediately after the harvest or later, whether it's summer or winter, whether the grains are cleaned or not, and we must also take into account that merchants can falsify it by putting the grain in damp places to increase its weight and volume'.<sup>27</sup> In other words, the weight of wheat was not reliable in itself, not only because it was inherently variable but also because it could easily be altered. This is demonstrated, for example, by a dispute between the grain receiver of the city of Bologna and a grain merchant in 1710: during the unloading of the ships in the port of Volano, the receiver and his porters noticed that the grain was 'damp and not of its natural dryness and ripeness, as it should be'. Therefore, together with the ship's crew and local grain weighers, they compared the weight of the grain with that of the sample received before the purchase and found that 'the wheat had been artificially moistened and spilled'.<sup>28</sup>

Weighing was therefore always combined with a visual, olfactory, and tactile assessment of product quality. This was evident throughout the purchasing process, from the initial negotiations, through the transport stages, and finally when the batches were stored in the granaries, where quality once again played a crucial role in stockpiling (Vertecchi, 2009: 40, 102, 128-133). Firstly, the quality of the product (both in terms of appearance and weight) was clarified and agreed between the buyer and the seller before the purchase; in the case of purchases by public officials at markets more or less distant from the city, in order to supply cities and armies, the quality control

of the products to be purchased was ensured by the delivery of a sample. In practice, the delegate in charge of the grain negotiations would send the municipal or military authorities a so-called *mostra* or *scandaglio*,<sup>29</sup> which consisted of a sample of the product in a small wax-sealed bag, which was carefully examined (for quality and weight) and in some cases even baked, in order to verify the actual yield of the wheat (Corritore, 2000: 112). In order to prevent fraud, the samples were shown to the notary when the contracts were signed, and while one was given to the buyer, another remained with the seller. This procedure was crucial because samples played a role not only in the negotiation and sale of the products but also in the transport of the wheat and its delivery to the granaries of the buyers. In fact, if the products came from distant markets and could often be transferred from wagons to ocean-going vessels, from these to river barges and then back to wagons, the officers in charge of receiving the wheat at the various ports had to check the conformity of the products with the sample, both in terms of quality and weight, at each passage, as in the example of the Bologna receiver mentioned above. The numerous examples of procedures for *misurazione* (measurement<sup>30</sup>) or *visita* (inspection) often refer to the conformity (or otherwise) of the grain using the standard phrase ‘in quality and measure’, and they testify to a constant focus on product quality from the seller’s warehouse to the buyer.<sup>31</sup> In fact, if the wheat did not correspond to the sample inspected at the time of signing the contract when it reached the buyer’s granaries, the latter could refuse to accept the consignments without incurring any penalty.<sup>32</sup> There are many examples of the spread of the practice of the *mostre* or *scandagli* throughout the century in Northern Italy, both in the Republic of Venice,<sup>33</sup> in the papal Legations of Ferrara and Bologna,<sup>34</sup> and in the State of Milan.<sup>35</sup>

While these methods allowed the supplier to estimate the amount of flour, and therefore bread, that could be baked from a unit of wheat, it was only when the product was in the granaries of the fortresses or public buildings in the cities that the actual yield could be verified. This was essential, for example, to understand how much bread could actually be produced for the soldiers (in the fortresses) and to calculate it where there was a fixed price system for wheat and bread (i.e. in almost all the towns of northern Italy). In this latter case, the wheat yield tests included, as far as possible, the different varieties of wheat stored in the towns, in the public and private granaries – for example, the lots bought by the public authorities, but also those harvested in the surrounding fields. In short, the aim was to establish a sort of ‘average yield’ which would make it possible to intervene as fairly as possible in the price of wheat and the weight of bread. Indeed, as in Italy and the rest of Europe (Fazio, 1993: 162; Fazio, 2004: 67; de Vries, 2019), the determination of the price and weight of bread by the public authorities was based above all on testing the yield of a given quantity of wheat, in order to add up the cost of the grain, the costs incurred by the bakers and their fair profit, and thus to assess the real cost of bread and its real availability to the population. If the wheat was expensive, the weight of the loaves could be reduced and vice versa.<sup>36</sup> During the *scandagli*, as these tests were called, it was possible to check the quality of the wheat, its yield in unrefined flour and sifted flour and, finally, the amount of dough and baked bread that it produced.

In conclusion, we can assume that the control of the quality of the wheat traded was a constant concern. The ultimate aim was, of course, to assess the *real* value of the product and its correspondence with the price paid: since the value was closely linked to the yield of the raw and sifted flour, the practices adopted were aimed precisely at estimating it. However, only the final tests of the wheat, the *scandagli*, could give a clear and indisputable answer as to how much product could be obtained from the grain purchased. When the grain was sold, it could only be estimated by sensory evaluation of the batches and by weighing them; this made it possible to assess the degree of moisture and ageing of the grain, characteristics that could then be related to its weight. However, as will be seen in the next section of the paper, this allowed the grain yield to be estimated mainly in terms of unrefined flour, leaving a greater degree of doubt about the ‘qualitative’ element, that is, the yield in sifted flour.



### *Wheat quality and price formation*

In the previous pages, we stressed that the quality of the wheat affected the *real* value of the product, in terms of the yield in flour and therefore in bread. We have also analysed how contemporaries in northern Italy were well aware of this and how they themselves controlled quality in the wheat marketing process. The logical conclusion is that wheat quality affected the process of wheat price formation, as admitted by Persson himself (Persson, 1999: 93) and partially proven by Brunt and Cannon (2015) for the nineteenth-century English case. We fully agree with them when they state that ‘quality variation *could* explain observed price variation’ (Brunt and Cannon, 2015: 82), but we also think that the fact that ‘it makes sense to value grain on the basis of its mass’ (Brunt and Cannon, 2015: 76) is a more questionable statement. In fact, as we have seen in the previous pages, the weight of wheat was (and is) not a unidirectional indicator, as it is closely linked to other qualities of the grain. In the following pages, we will first look at how, in eighteenth-century northern Italy, different batches of wheat (of the same variety and harvested in the same area) received different prices, precisely according to their quality. We fully agree with de Vries when he states that, broadly speaking, ‘while production areas were associated with persistent differences in quality, wheat from a given region could also vary considerably in quality from one year to the next, so that transactions in a given market showed substantial price differences for what was, apparently, the same wheat’ (de Vries, 2019: 162). We will then analyse the variables that might have affected wheat prices: was it really the weight of the grain that caused price variations? Or were there other qualities – such as the yield in flour or baking flour – behind these variations? Finally, we will answer a fundamental question: how important was quality in influencing wheat prices compared to the ‘classical’ forces driving the market, that is, supply and demand?

The key assumption of this article is that the quality of wheat and its yield in flour varied not only because of the variations in the botanical varieties of wheat but also according to the ‘quality of the fields that produce it, and also the physical-meteorological circumstances of each year, which had a particular and direct impact on the amount of product that can be consumed’.<sup>37</sup> The prices we have found for market transactions in the various regions of northern Italy clearly confirm that: in the case of Legnago, one of the most important grain markets in the Verona area, the local Venetian officer sent the prices of the grains sold to the provincial capital every week in order to announce fixed prices in the city (Vecchiato, 1979). With regard to wheat, throughout the eighteenth century, letters referred to three varieties in a standard format: ‘good wheat’, ‘mediocre wheat’, ‘worthless wheat’.<sup>38</sup> The same seems to have been the case in eighteenth-century Paris, described by Kaplan, where there were also three qualities of wheat (Kaplan, 1984: 52), as in Mantua (Corritore, 2000: 114), Florence (Gori, 1989: 557), and Bologna (Finzi and Baida, 1985: 329–330). In Haarlem, in the Dutch Republic, there were also three market prices related to the geographical origin of the wheat, although within these groups further price differences (ranging from 10 to 20%) could then be observed ‘due to perceived quality differences’ (de Vries, 2019: 71). In Legnago, the difference between the prices of the three qualities averaged 3.6% between good and mediocre wheat and 3.7% between mediocre and worthless wheat, with variations probably due to the general price trend. However, even this tripartition is a simplification, because when we look at the transactions that took place in Legnago, it is clear that prices varied even within each category: certainly, the relationship between buyer and seller played a role in these variations (Guerzoni, 2007), but also by the specific quality of the product involved in each sale. Moreover, not only did ‘good’, ‘mediocre’ and ‘worthless’ wheat have different prices in the same market on the same day, but the accounts present a much more varied picture of the types of wheat exchanged (and priced), as was the case in other areas of Italy and Europe (Fazio, 1993: 70; Corritore, 2000: 98–99, 112; Kaplan, 1984: 49): high and low *mercantile* wheat, good and mediocre wheat for bakers, seed wheat, good aged wheat, and newer wheat, such as unweighted wheat.<sup>39</sup> Also in Brescia, in July 1707, the Venetian officer advised the captain of the Lonato fortress to report the different prices of new and old wheat and their weights,<sup>40</sup> and when the grain was finally

brought in, the different sacks had different prices.<sup>41</sup> Even in Udine, ‘bargaining and the different quantities and qualities of stocks traded could produce different prices for the same product’ (Fornasin, 1999: 11). As well as in the Republic of Venice, there are clear examples of the variability of prices according to the quality of wheat in the State of Milan (Parziale, 2009: 105) and in the Papal legations of Bologna and Ferrara: in a letter of August 1715, for example, a merchant appointed by the *Assunteria* of Bologna to find grain lots in Milan wrote that in the Lombard city ‘prices are between *lire* 20 and *lire* 24 per *moggio* of Milan, from the *mercantile* to the finest wheat’.<sup>42</sup> Moreover, in 1735, when the *Assunteria* of Bologna settled its accounts with the local bakers, who had paid a certain amount in exchange for grain, the officers of the public institutions decided that, in order to compensate them fairly for the money they had received, they would distribute more or less grain according to its weight.<sup>43</sup> As in Milan, in 1751 prices in Livorno varied ‘between 14 *lire* and 15 *lire* per *corba*, depending on the better or worse quality of the wheat’<sup>44</sup>; this meant that higher quality grain was more expensive, but also that if the public institution was short of money it could resort to lower quality grain ‘to meet the needs of the country with less spending’.<sup>45</sup> Throughout the century, wheat in Bologna was paid explicitly according to its quality, which was also specified when it was distributed to the bakers, who had to refund the *Assunteria* accordingly: it is interesting to note that even in Bologna, like in Legnago, Mantua, Florence, and Paris, wheat was often divided into good, *mediocre*, and poor.<sup>46</sup> The same happened in Ferrara, where the Papal Legate’s decrees stipulated that even the fixed price of wheat could be reduced in trade according to the quality of the product.<sup>47</sup> Finally, Orsola Gori reports that even in Florence the price of wheat varied according to the maturity, quality, and geographical origin of the product (Gori, 1989: 557, 591, 597-598).

Thus, the characteristics of the wheat affected its quality and the latter its price: but what quality? According to Brunt and Cannon (2015: 76), flour yield was the main concern of wheat buyers, but was weight really a good indicator of flour yield, or was it considered as such? We can test this hypothesis by using an interesting source from Ferrara: the *scandagli* for setting the price of wheat and the weight of bread. In Ferrara, once or twice a year, depending on the fluctuations in the price of wheat, the *Congregazione di Abbondanza* would test the wheat used by the bakers to make bread (Ongaro, 2021). On the basis of numerous samples of wheat taken from private and ecclesiastical granaries,<sup>48</sup> the officers of the *Abbondanza* would note the cost of wheat on the market, calculate its weight, its yield in flour, sifted flour, baking flour, and dough, and finally check how much bread it produced. By adding the bakers’ costs to the calculation, they were able to determine the weight of the bread to be sold, guaranteeing, at least in theory, a fair profit for the bakers and an affordable price for consumers (Ongaro, 2021). Moreover, the wheat price observed by the *Abbondanza* on the market was used by the Papal Legate to set the wheat *calmiere*, that is, the ‘fair’ price to be used in market transactions – although, as mentioned above, the quality of the product could reduce it – and the price the *Abbondanza* itself adopted when buying wheat. The Municipal Historical Archives of Ferrara hold a large number of these *scandagli*,<sup>49</sup> which allow us to relate the price of wheat, its weight, and its yield in flour, in sifted flour (although unfortunately this information is often missing), in flour for bread-making, and in bread for almost the entire eighteenth century. If we base our analysis on regressions to find out which of these variables influenced the price of wheat (see Supplementary Table 1), excluding the yield of bread, which is almost equal to the yield of flour for bread, the results are quite interesting.

The data cover the period from 1712 to 1794. There are many years with missing observations: 45 years have observations, of which 6 have two observations. We converted the data into two time series, one with the first or single and the other with the last or single observation of each year. We then detrended the data by taking the difference between the trend and the observed values. Given the many gaps in the data, we decided to use a LOESS regression to detect the trend. We are interested in the effect on the wheat price (in grams of silver per *moggio*) of three predictor variables, all three of which are potential proxies for wheat quality: (1) grain weight, (2) flour yield, and (3) baking flour yield (all three in kg per *moggio* of wheat).

Supplementary Table 1 shows the Pearson correlations between the three predictor variables. All are positively correlated, but the correlation between bread-making flour yield and the other two predictors is rather low ( $<0.50$ ). As wheat was mainly bought for bread, buyers were mainly interested in the bread-making flour yield and we consider this to be the best indicator of quality. The relatively weak correlation suggests that weight and even the flour yield were rather poor predictors of wheat quality.

The question is whether contemporaries were able to look beyond the easily observable weight of wheat, and consider its yield in bread-making flour when determining the price of wheat. To test this, we compare three regression models run on both time series to test the effect of our three detrended predictor variables on the detrended price of wheat. We include crop yields to control for the effect of supply shocks. We do not include controls for demand fluctuations, such as wages, because the available wage series do not display year-to-year variation. We presume that the effect of short-term demand fluctuations would have been small anyway, given the stickiness of wages and the absence of population shocks.

The results are shown in Supplementary Tables 2 and 3. In addition to showing that crop fluctuations affect the grain price, they also show that both the weight and yield of bread-making flour matter. Flour yield appears to have no effect. Furthermore, they show that the yield in bread-making flour is a (slightly) better predictor of the wheat price than its weight (as indicated by the higher  $R^2$ -values). The results suggest that weight and yield in bread-making flour both capture different characteristics of wheat quality. A high weight of a batch of wheat could indicate that a lot of bread could be made from that batch, but it could also indicate that the wheat was damp and less suitable for bread-making. Wheat weight was strongly correlated with the flour yield, which could also be damp. All this indicates that weight is a ‘noisy’ proxy of wheat quality. Ultimately, what the regressions confirm is that both weight and bread-making flour yield shaped the grain price; it was probably not always easy for contemporaries to distinguish between the two, but they still tended to perceive and value bread-making flour yield.

## Conclusions

In the previous pages, we presented a three-stage analysis. First, we have shown that, especially before the ‘Green revolution’ of the twentieth century, wheat varieties were quite numerous and there could be significant variations in wheat quality, notably in terms of flour yield and bread-making flour. The quality of wheat was linked not only to its botanical variety and geographical origin but also, and understandably, to the specific conditions (especially the weather) under which it was grown and harvested, and the way it was stored and transported. Particularly in the eighteenth century, when ‘food crises generally seem to have been on a smaller scale than in previous periods’ (Alfani and Ó Gráda, 2017: 11) and food concerns became more prevalent in public discourse, the focus on the quality of wheat (and thus bread) became even more important. Contemporaries were well aware that the weight of wheat was only one of the characteristics to be taken into account when assessing grain batches: visual, olfactory, and tactile inspections (by means of *mostre* and *scandagli*) were common practice before the products were bought, during their transport, and when they reached the buyers’ barns. The clear aim was to prevent the baking of inferior wheat, not to say dangerous to public health but also to check the correspondence between the grain and the price paid for it, as the archival documents thoroughly demonstrate.

Secondly, on the assumption that wheat buyers would also pay a specific price based on the quality of the product, we focused on how they actually assessed it, to grasp not only what they *wanted* to assess but also what they *were able* to do, based precisely on the olfactory, tactile, and visual examination of the grain, as well as tests to observe the *actual* bread yield of specific batches. The limitations of such an evaluation, but also its importance in the price formation process, become clear from the regressions proposed in the third section of the article, using the data

collected in the Municipal Archives of Ferrara: comparing the role played in price trends by the weight of wheat, its yield in flour, and its yield in bread-making flour, we found that the weight of wheat and its yield in bread-making flour seem to be much more important in setting the price. Other factors, in particular crop fluctuations, also strongly influenced the price of grain, but wheat quality was certainly important.

In conclusion, we have shown that grain prices were affected by several variables, which means that it is rather risky to use them in historical-economic analysis as if they related to identical products worldwide, reflecting only variations in grain availability or changes in demand or the degree of market integration. The use of data from neighbouring areas where similar varieties of wheat were grown and where climatic and meteorological conditions had a similar effect on the harvests (i.e., where the quality of the wheat on the market was probably the same) could reduce the risk of comparing very different products, but even in this case we should be aware that even in the same province and in the same agricultural year, within the same harvest of the same variety of wheat, the quality of the lots varied – as the archival sources testify – and so did their prices.

**Supplementary material.** The supplementary material for this article can be found at <https://doi.org/10.1017/S095679323000134>

## Notes

1 Currencies and unit of measurement used in the article: Bologna: wheat *corba* (78,6448 litres); *lira bolognese* (5,3725 silver grams). Milan: wheat *moggio* (146,234295 liters). Ferrara: wheat *moggio* (621,8584 liters). Source: Martini, 1883: 92, 205, 350.

2 Descriptions of grains are to be found throughout the agronomic literature of the early modern age: even in these specialized and technical treatises; however, reference is mainly made to implicit rather than truly explicit parameters and the narrative tends to focus on the methods and strategies implemented to improve the quality of flours, given as a shared, innate, and well-rooted idea (Saverio Manetti, 1765).

3 This can be fully grasped if compared with exotic products, typically imported from remote areas: this case, it would be much easier to track down the impact of quality on their trade, rather than it happens with cereal as a whole.

4 In the eighteenth century, the raise of modern botanical taxonomy with the monumental work by Carl Linnaeus did not allow the contemporaries to disentangle themselves more easily in the heap made out of common variety names – strongly locally rooted, the modern scientific names, and the ones used by Latin and Greek authorities.

5 The idea of the strong plasticity of wheat variety according to the place it was grown is widely conveyed, among others, Parmentier, 1802: 199-200 and Manetti, 1780.

6 This correspondence should not be mixed up with the occurrence of scientific and common names referring to an original provenance area such as the case of Polonicum, commonly named *grano di Polonia*, or *Polonio*.

7 It is the specific weight of the yield that is seen as compromised when stemming from a local crop (Bayle-Barelle, 1809: 43-44).

8 ‘Bisogna realmente confessare, che molte qualità, e differenze di Grani sono un effetto dell’esposizione, e cultura del terreno, perché seminate in terre diverse, o con metodo, e trattamento diverso, assai presto degenerano dalla qualità, che prima mostravano.’ [It must be acknowledged that many qualities and differences among different grains are the outcome of the exposure and method of soil culture, because whenever they are being sown in different lands, or gained from a different method or treatment, they quickly lose the quality previously showed off] (Manetti, 1765: 11).

9 In wheat trade, the wheat growing area tends to be handled as basic information, at least ideally reported and delivered with each sample (named *mostra*) corresponding to each single batch of grain: Historic Civic Archive of Milan, *Località Milanese*, c. 75: Istruzioni a Malossari de’ Grani.

10 The dispute between Bartolomeo Intieri and the great chemist Henry Louis Duhamel de Monceau is recalled in contemporary technical handbooks (Galliani, 1754). A thorough overview of the innovation of granary facilities in the latter eighteenth century is provided in Geraci and Marin (2016).

11 State Archives of Milan (from now onward ASMi), *Annona p.a.*, cart. 33 (7.III.1776).

12 States Archives of Bologna (from now onward ASBo), *Assunteria di Abbondanza, Notizie*, b. 2, fo. 307 r.

13 ASBo, *Assunteria di Abbondanza, Notizie*, b. 2, fos. 134 r.-v.

14 In Messina too, in Sicily, during the eighteenth century there was a shift from the evaluation of the wheat based on its volume to an evaluation based on its weight (Fazio, 2004: 75).

15 ASBo, *Assunteria di Abbondanza, Diversorum*, b. 3, fos. 38 v.-39 r.

16 On the *Assunteria di Abbondanza* in Bologna see Guenzi, 1982, and Mocarrelli and Ongaro, 2019.

17 ASBo, *Assunteria di Abbondanza, Diversorum*, b. 3, fos. 519 r.-522 r.

18 ASBo, *Assunteria di Abbondanza, Notizie*, b. 4, fo. 228 r.

- 19 Historical Archives of the Municipality of Ferrara (from now onward HAMF), *Finanziaria XVIII*, b. 100 bis, fo. 83 v.
- 20 HAMF, *Finanziaria XVIII*, b. 79, fo. 541 v. On the public food institution of Ferrara and on the process of bread and wheat price regulation see Ongaro, 2021, and Cazzola, 1971.
- 21 State Archives of Brescia (from now onward ASBs), *Cancelleria Prefettizia Superiore*, b. 81, fos. not numbered, dated June 1730. On the food supply in eighteenth-century Venetian fortresses see Ongaro, 2019, and Ongaro, 2020.
- 22 State Archives of Verona (from now onward ASVr), *Atti dei Rettori Veneti*, b. 881, fos. not numbered, letters dated January 6<sup>th</sup> 1737 and November 12<sup>th</sup> 1736.
- 23 ASVr, *Atti dei Rettori Veneti*, b. 1005, fo. not numbered, letters dated April 4<sup>th</sup> and March 18<sup>th</sup> 1761; b. 1369, fo. 141 v.
- 24 ASBs, *Cancelleria Prefettizia Superiore*, b. 81, fos. not numbered, letters dated July 2<sup>nd</sup>, 4<sup>th</sup> and 6<sup>th</sup>, August 8<sup>th</sup>, 25<sup>th</sup>, September 8<sup>th</sup>, 24<sup>th</sup>, October 8<sup>th</sup>, 1707; June 1730; ASBo, *Assunteria di Abbondanza, Diversorum*, b. 3, fos. 273 r., 276 r., 318 r., 326 v., 441 r.-442 r., 444 r., 446 r., 448 r., 515 v.; b. 4, fo. 118 r.; b. 7, fos. 85 r., 263 r., 267 v.; b. 8, fos. 107 r., 210 r.; ASBo, *Assunteria di Abbondanza, Instrumenti*, b. 2, fos. 108 r., 209 v., 309 v., 400 r., 410 r., 419 r., 420 v., 566 v.; b. 3, fos. not numbered, contract between the *Assunteria di Abbondanza* and Sanson Morpurgo from Ancona, dated November, 5<sup>th</sup>, 1766 and April, 1<sup>st</sup>, 1767; contract between the *Assunteria di Abbondanza* and Coen from Ferrara, dated 1766 and 1767, April, 3<sup>rd</sup>, 1767, and June, 11<sup>th</sup>, 1767; contract between the *Assunteria di Abbondanza* and Giovanni Battista Renoli from Ancona, dated April, 1<sup>st</sup>, 1767; contract between the *Assunteria di Abbondanza* and the Bottoni and Rocci company, dated May, 5<sup>th</sup>, 1767, May, 19<sup>th</sup>, 1767, and June, 11<sup>th</sup>, 1767; contract between the *Assunteria di Abbondanza* and Antonio Massari from Ferrara, June, 11<sup>th</sup>, 1767; ASBo, *Ambasciata Bolognese a Roma*, b. 238, fo. not numbered, letter dated September, 24<sup>th</sup>, 1785; ASBo, *Assunteria di Abbondanza, Notizie*, b. 1, fos. 63 r., 76 r.-v., 98 r., 101 r., 374 v.; HAMF, *Finanziaria XVIII*, b. 77, fo. 100 r.; b. 78, fo. 400 r.; b. 79, fo. 83 r.; b. 82, fos. 226 r., 516 r., 521 r., 544 r.-554 r.; b. 83, fo. 20 r.; b. 84, fo. 191 r.; b. 89, fos. 46 r., 133 r.; b. 97, fo. 156 r.; HAMF, *Patrimoniale*, b. 313, fasc. 42, fo. not numbered, letter dated August 1735.
- 25 ASBo, *Assunteria di Abbondanza, Diversorum*, b. 4, fo. 118 r.; HAMF, *Finanziaria XVIII*, b. 80, fos. 343 r.-v.; HAMF, *Patrimoniale*, b. 313, fasc. 42, fo. not numbered, dated July 1735; Vertecchi, 2009: 125, 127.
- 26 ASBo, *Assunteria di Abbondanza, Diversorum*, b. 7, fos. 263 r., 267 v.; ASBo, *Assunteria di Abbondanza, Instrumenti*, b. 2, fo. 566 v.
- 27 ASBo, *Assunteria di Abbondanza, Diversorum*, b. 7, fo. 423 v.
- 28 ASBo, *Assunteria di Abbondanza, Notizie*, b. 3, fo. 219 r. Kaplan describes similar strategies in order to increase the volume of the wheat (Kaplan, 1984: 55).
- 29 *Mostre* and *scandagli* are the coeval name for the cereals samples. In some cases, the word *scandaglio* can be used also for the baking tests of wheat made by the public institutions in order to fix the bread loaves weight to be produced by the bakers. In the text, it will be specified the meaning case by case. The *mostre* were used also in Sicily in the same period, as in Fazio, 1993: 70; Fazio, 2004: 85; Macri, 2007: 50.
- 30 Examples are numerous not only in Bologna or Ferrara: for example, in Udine, in the Republic of Venice, the *pesatori* (weighers) played a crucial role in the functioning of the grain market (Fornasin, 1999: 9, 11), such as they did in Florence (Gori, 1989: 556), in Milan (Grab, 1986: 31; Parziale, 2003: 328; Parziale, 2009: 40-41), or in Paris (Kaplan, 1984: 546) and in the Dutch Republic (de Vries, 2019: 149).
- 31 ASBo, *Assunteria di Abbondanza, Diversorum*, b. 3, fos. 38 v.-40 r., 111 v.-114 r., 195 v., 197 r., 219 r., 519 r.-522 r., 524 v.-526 r.; b. 5, fos. 1 v., 10 v.-11 r., 22 v.; b. 8, fos. 101 v.-102 r., 177 r., 178 r.; ASBo, *Assunteria di Abbondanza, Notizie*, b. 1, fo. 100 v.; b. 2, fos. 73 r., 100 r.; b. 3, fo. 157 v.; ASBo, *Assunteria di Abbondanza, Instrumenti*, b. 2, fos. 273 r., 410 r., 419 v., 546 r., 566 v., 589 r.; b. 3, fos. not numbered, contracts dated November 18<sup>th</sup> 1766, April 1<sup>st</sup> 1767; HAMF, *Finanziaria XVIII*, b. 78, fos. 349 r., 400 r., 404 v., 406 v., 409 v., 411 r.; b. 79, fo. 75 r.; b. 82, fos. 509 r., 570 r., 596 r.; b. 83, fo. 20 r.; b. 89, fos. 46 r., 133 r., 393 r.-v.; b. 90, fo. 401 r.; b. 93, fo. 455 r.; b. 96, fos. 96 r., 97 r.; b. 100, fo. 25 r.; HAMF, *Patrimoniale*, b. 253, fasc. 37, fo. not numbered; b. 313, fasc. 42, fo. not numbered; ASVr, *Atti dei Rettori di Legnago*, b. 50, fo. not numbered, letter dated November 10<sup>th</sup>, 1738; ASVr, *Atti dei Rettori di Verona*, b. 801, fo. not numbered, letter dated August 3<sup>rd</sup> 1724; b. 881, fo. not numbered, letter dated April 4<sup>th</sup> 1737; b. 951, fos. not numbered, letters dated January 11<sup>th</sup> 1752 and February 24<sup>th</sup> 1753; ASVr, *Archivio Valmarana*, b. 1, fasc. 3, fo. not numbered, letter dated May 1<sup>st</sup> 1749; ASBs, *Cancelleria Prefettizia Superiore*, b. 44, fos. not numbered, letters dated August 12<sup>th</sup>, 22<sup>nd</sup>, 25<sup>th</sup> and September 5<sup>th</sup> and 30<sup>th</sup> 1734; b. 78, fo. not numbered, letter dated April 17<sup>th</sup> 1735; b. 81, fos. not numbered, dated June 8<sup>th</sup> 1730, July 4<sup>th</sup>, 6<sup>th</sup> and 18<sup>th</sup> 1707.
- 32 There are examples of the problems of preserving the quality of wheat during the transport and of refusing the damaged wheat also in Kaplan (1984: 64-65, 75), Fazio (1993: 70; 2004: 85), and Macri (2007: 50, 54).
- 33 ASVr, *Atti dei Rettori di Legnago*, b. 22, fo. not numbered, letter dated April 20<sup>th</sup> 1742; b. 27, fos. not numbered, letters dated April 18<sup>th</sup> 1736; April 9<sup>th</sup> and 16<sup>th</sup> 1739; b. 39, fos. not numbered, letters dated November 4<sup>th</sup> 1717 and December 2<sup>nd</sup> 1717; b. 43, fo. not numbered, letter dated September 7<sup>th</sup>, 1719; b. 50, fo. not numbered, letter dated November 10<sup>th</sup> 1738; ASVr, *Atti dei Rettori Veneti*, b. 881, fos. not numbered, letters dated September 27<sup>th</sup> 1736, November 12<sup>th</sup> 1736, March 31<sup>st</sup> 1737, November 10<sup>th</sup> and 16<sup>th</sup> 1737; b. 951, fos. not numbered, letters dated December 20<sup>th</sup> 1751, January 11<sup>th</sup> 1752, September 2<sup>nd</sup> 1752; b. 993, fo. not numbered, letter dated December 23<sup>rd</sup> 1758; b. 1005, fos. not numbered, letters dated March 18<sup>th</sup> 1761, April 4<sup>th</sup> 1761, December 12<sup>th</sup> 1761; ASVr, *Archivio Valmarana*, b. 1, fasc. 3, fo. not numbered, letter dated May 1<sup>st</sup> 1749; ASBs, *Cancelleria Prefettizia Superiore*, b. 81, fos. not numbered, letters dated June 1730, July 4<sup>th</sup> and 18<sup>th</sup> 1707, August 7<sup>th</sup> and 31<sup>st</sup> 1707, September 5<sup>th</sup> 1707.; Vertecchi, 2009: 102, 132-133.

34 ASBo, *Ambasciata Bolognese a Roma*, b. 238, fasc. 34, fos. not numbered; ASBo, *Assunteria di Abbondanza, Diversorum*, b. 3, fos. 169 r., 219 r., 273 r., 276 r., 279 r.-280 r., 316 r., 318 r., 320 r., 324 r., 326 r., 441 r., 443 v.-516 r., 517 v.-522 r., 523 v., 526 r.; b. 5, fo. 84 v.; b. 7, fos. 432 r., 449 r.; b. 8, fos. 102 r., 177 r.-179 r.; ASBo, *Assunteria di Abbondanza, Instrumenti*, b. 2, fos. 108 r., 271 r.-273 r., 410 r., 419 r.-421 r.; b. 3, fos. not numbered, contract dated November 15<sup>th</sup> 1766, April 1<sup>st</sup> 1767, June 11<sup>th</sup> 1767, May 19<sup>th</sup> 1767; ASBo, *Assunteria di Abbondanza, Notizie*, b. 1, fo. 71 r.; b. 2, fos. 100 r.-101 r.; b. 3, fos. 157 v.-159 r.; b. 5, fos. 358 v.; HAMF, *Finanziaria XVIII*, b. 78, fos. 404 v.-405 r., 408 v.-409 r.; b. 82, fos. 510 r., 512 r., 519 r., 523 r., 526 r., 565 r., 568 r., 596 r., 687 r.; b. 83, fo. 20 r.; b. 84, fos. 100 r.-101 v.; b. 90, fos. 3 r., 116 r., 250 r., 258 r.; b. 93, fos. 578 r., 585 r.-586 r.; b. 94, fos. 3 r.-v., 5 r.; b. 95, fos. 455 r.-456 r., 652 r.-668 r., 740 r.; b. 97, fos. 103 r., 156 r.; b. 98, fos. 537 r., 553 r., 555 r.; HAMF, *Patrimoniale*, b. 351, fasc. 31, fo. not numbered.

35 In Milan, this sort of practice was named *assaggi* and dates back to the sixteenth century: Biblioteca Ambrosiana Milanese, *Grude e ordini diversi*, L.P. 4011; later on we come across the same test under the term *mostre* or *esperimenti* which remained at the basis of the public bread policy even in the reformed pattern of the 1760s (State Archives of Milan, *Annona, p.a.* c. 49 'Capitols per la fabbrica e vendita del pane di formento venale in questa città').

36 The public regulation of bread price was a common practice in Central-Northern Italy: in Bologna and Ferrara (see footnotes 2 and 9), Verona (Vecchiato, 1979), Venice (Mattozzi, Bolelli, Chiasera, and Sabbioni, 1983), Udine (Formasin, 1999), Milan (Parziale, 2002; Parziale, 2009), and Florence (Gori, 1989) for example. For a comparison with the Dutch Republic, see de Vries, 2019.

37 ASBo, *Assunteria di Abbondanza, Notizie*, b. 2, fo. 298 v.

38 ASVr, *Atti dei Rettori di Legnago*, b. 20, fo. not numbered, letter dated August 11<sup>th</sup> 1708; b. 22, fos. not numbered, letters dated August 8<sup>th</sup>, 22<sup>nd</sup>, 29<sup>th</sup> 1716, September 5<sup>th</sup>, 19<sup>th</sup>, 26<sup>th</sup> 1716, October 10<sup>th</sup> 1716, November 14<sup>th</sup>, 28<sup>th</sup> 1716, July 15<sup>th</sup>, 22<sup>nd</sup>, 29<sup>th</sup> 1719, August 5<sup>th</sup>, 12<sup>th</sup>, 19<sup>th</sup>, 26<sup>th</sup> 1719, September 2<sup>nd</sup>, 18<sup>th</sup> 1719, October 28<sup>th</sup> 1719, November 4<sup>th</sup> 1719, January 13<sup>th</sup>, 20<sup>th</sup> 1720, February 3<sup>rd</sup> 1720, March 9<sup>th</sup>, 16<sup>th</sup> 1720, April 27<sup>th</sup> 1720, June 22<sup>nd</sup> 1720, July 6<sup>th</sup> 1720, February 7<sup>th</sup>, 21<sup>st</sup> 1728, May 15<sup>th</sup> 1728, June 12<sup>th</sup>, 17<sup>th</sup>, 26<sup>th</sup> 1728, August 21<sup>st</sup> 1728, December 1<sup>st</sup> 1764, January 16<sup>th</sup> 1765; b. 30, fo. not numbered, letter dated December 15<sup>th</sup> 1764; b. 61, fos. not numbered, letters dated January 3<sup>rd</sup>, 17<sup>th</sup>, 24<sup>th</sup>, 31<sup>st</sup> 1739, February 14<sup>th</sup>, 28<sup>th</sup> 1739, March 7<sup>th</sup> 1739, April 25<sup>th</sup> 1739, May 2<sup>nd</sup>, 16<sup>th</sup>, 23<sup>rd</sup> 1739, June 17<sup>th</sup> 1739, July 4<sup>th</sup>, 11<sup>th</sup>, 18<sup>th</sup> 1739, August 1<sup>st</sup>, 8<sup>th</sup>, 13<sup>th</sup>, 22<sup>nd</sup>, 29<sup>th</sup> 1739, September 5<sup>th</sup>, 12<sup>th</sup>, 19<sup>th</sup>, 26<sup>th</sup> 1739, October 3<sup>rd</sup>, 10<sup>th</sup>, 17<sup>th</sup>, 24<sup>th</sup>, 31<sup>st</sup> 1739, November 7<sup>th</sup>, 14<sup>th</sup>, 28<sup>th</sup> 1739; ASVr, *Atti dei Rettori Veneti*, b. 818, fos. not numbered, letters dated September 5<sup>th</sup> 1722, January 9<sup>th</sup> 1723, February 13<sup>th</sup>, 20<sup>th</sup> 1723; b. 881, fos. not numbered, letters dated March 9<sup>th</sup> 1737, April 13<sup>th</sup> 1737, May 4<sup>th</sup>, 11<sup>th</sup>, 18<sup>th</sup> 1737, June 15<sup>th</sup> 1737, July 6<sup>th</sup>, 13<sup>th</sup> 1737, October 19<sup>th</sup> 1737, December 14<sup>th</sup> 1737, January 4<sup>th</sup> 1738; b. 1042, fos. not numbered, letters dated May 10<sup>th</sup>, 17<sup>th</sup>, 24<sup>th</sup>, 31<sup>st</sup> 1766, June 2<sup>nd</sup>, 14<sup>th</sup>, 21<sup>st</sup>, 28<sup>th</sup> 1766, July 5<sup>th</sup>, 12<sup>th</sup>, 19<sup>th</sup>, 26<sup>th</sup> 1766, August 2<sup>nd</sup>, 9<sup>th</sup>, 16<sup>th</sup>, 23<sup>rd</sup>, 30<sup>th</sup> 1766, September 6<sup>th</sup>, 13<sup>th</sup> 1766, October 25<sup>th</sup> 1766, November 8<sup>th</sup> 1766, December 6<sup>th</sup>, 19<sup>th</sup> 1766, January 3<sup>rd</sup>, 10<sup>th</sup>, 17<sup>th</sup>, 24<sup>th</sup>, 31<sup>st</sup> 1767, February 7<sup>th</sup>, 14<sup>th</sup>, 21<sup>st</sup>, 28<sup>th</sup> 1767, March 7<sup>th</sup>, 14<sup>th</sup>, 28<sup>th</sup> 1767, April 4<sup>th</sup>, 11<sup>th</sup>, 16<sup>th</sup>, 25<sup>th</sup> 1767, May 2<sup>nd</sup>, 9<sup>th</sup>, 23<sup>rd</sup>, 30<sup>th</sup> 1767, June 13<sup>th</sup>, 27<sup>th</sup> 1767, July 4<sup>th</sup>, 11<sup>th</sup>, 18<sup>th</sup>, 25<sup>th</sup> 1767, August 1<sup>st</sup>, 8<sup>th</sup>, 13<sup>th</sup>, 22<sup>nd</sup> 1767, September 19<sup>th</sup>, 26<sup>th</sup> 1767, October 3<sup>rd</sup>, 10<sup>th</sup>, 31<sup>st</sup> 1767, November 11<sup>th</sup> 1767, December 5<sup>th</sup>, 8<sup>th</sup>, 12<sup>th</sup>, 19<sup>th</sup> 1767, January 2<sup>nd</sup>, 9<sup>th</sup>, 16<sup>th</sup>, 21<sup>st</sup>, 30<sup>th</sup> 1768, February 6<sup>th</sup>, 13<sup>th</sup>, 20<sup>th</sup>, 27<sup>th</sup> 1768, March 5<sup>th</sup>, 12<sup>th</sup>, 17<sup>th</sup>, 26<sup>th</sup> 1768, May 21<sup>st</sup> 1768, April 9<sup>th</sup>, 17<sup>th</sup>, 25<sup>th</sup>, 30<sup>th</sup> 1768; b. 1043, fos. not numbered, letters dated March 30<sup>th</sup> 1765, April 20<sup>th</sup>, 27<sup>th</sup> 1765, May 25<sup>th</sup> 1765, June 15<sup>th</sup>, 22<sup>nd</sup> 1765, July 6<sup>th</sup>, 13<sup>th</sup>, 27<sup>th</sup> 1765, August 3<sup>rd</sup>, 10<sup>th</sup>, 17<sup>th</sup>, 24<sup>th</sup>, 31<sup>st</sup> 1765, September 7<sup>th</sup>, 14<sup>th</sup>, 21<sup>st</sup>, 28<sup>th</sup> 1765, October 12<sup>th</sup>, 19<sup>th</sup>, 26<sup>th</sup>, 28<sup>th</sup> 1765, March 15<sup>th</sup>, 22<sup>nd</sup> 1766, April 12<sup>th</sup>, 19<sup>th</sup>, 26<sup>th</sup> 1766, October 11<sup>th</sup>, 18<sup>th</sup> 1766; b. 1184, fos. not numbered, letters dated December 9<sup>th</sup>, 16<sup>th</sup>, 23<sup>rd</sup> 1780, January 13<sup>th</sup>, 20<sup>th</sup>, 27<sup>th</sup> 1781, February 3<sup>rd</sup>, 10<sup>th</sup>, 17<sup>th</sup>, 24<sup>th</sup> 1781, March 3<sup>rd</sup>, 10<sup>th</sup>, 17<sup>th</sup>, 24<sup>th</sup>, 31<sup>st</sup> 1781, April 7<sup>th</sup>, 12<sup>th</sup>, 21<sup>st</sup>, 28<sup>th</sup> 1781, May 5<sup>th</sup>, 12<sup>th</sup>, 19<sup>th</sup>, 26<sup>th</sup> 1781, June 2<sup>nd</sup>, 9<sup>th</sup>, 16<sup>th</sup>, 23<sup>rd</sup>, 30<sup>th</sup> 1781, July 7<sup>th</sup>, 14<sup>th</sup>, 21<sup>st</sup>, 28<sup>th</sup> 1781, August 4<sup>th</sup>, 11<sup>th</sup>, 18<sup>th</sup>, 25<sup>th</sup> 1781, September 1<sup>st</sup>, 6<sup>th</sup>, 21<sup>st</sup>, 27<sup>th</sup> 1781, October 6<sup>th</sup>, 13<sup>th</sup>, 20<sup>th</sup>, 27<sup>th</sup> 1781, November 3<sup>rd</sup>, 10<sup>th</sup>, 17<sup>th</sup>, 24<sup>th</sup> 1781, December 1<sup>st</sup>, 8<sup>th</sup>, 15<sup>th</sup>, 22<sup>nd</sup> 1781, January 1<sup>st</sup>, 12<sup>th</sup>, 19<sup>th</sup>, 26<sup>th</sup> 1782, February 9<sup>th</sup>, 16<sup>th</sup>, 23<sup>rd</sup> 1782, March 2<sup>nd</sup>, 9<sup>th</sup>, 16<sup>th</sup>, 23<sup>rd</sup> 1782, April 6<sup>th</sup>, 13<sup>th</sup>, 27<sup>th</sup>, 30<sup>th</sup> 1782, May 4<sup>th</sup>, 11<sup>th</sup>, 18<sup>th</sup>, 25<sup>th</sup> 1782, June 1<sup>st</sup>, 8<sup>th</sup>, 15<sup>th</sup>, 22<sup>nd</sup>, 29<sup>th</sup> 1782, July 6<sup>th</sup>, 13<sup>th</sup>, 20<sup>th</sup>, 27<sup>th</sup> 1782, September 15<sup>th</sup> 1782, October 5<sup>th</sup>, 12<sup>th</sup>, 19<sup>th</sup>, 26<sup>th</sup> 1782, November 2<sup>nd</sup>, 9<sup>th</sup>, 16<sup>th</sup>, 23<sup>rd</sup>, 30<sup>th</sup> 1782, December 7<sup>th</sup>, 21<sup>st</sup> 1782, January 4<sup>th</sup>, 11<sup>th</sup>, 25<sup>th</sup> 1783, February 15<sup>th</sup> 1783, March 1<sup>st</sup> 1783.

39 ASVr, *Atti dei Rettori di Legnago*, b. 29, fos. not numbered, 'Report of the grain brokers 1764-1766'; ASVr, *Atti dei Rettori Veneti*, b. 1036, fo. not numbered, letter dated February 22<sup>nd</sup> 1766; b. 1042, fo. not numbered, letter dated August 9<sup>th</sup> 1766; b. 1043, fos. not numbered, letters dated July 13<sup>th</sup>, 27<sup>th</sup> 1765, August 3<sup>rd</sup>, 10<sup>th</sup>, 17<sup>th</sup> 1765, September 21<sup>st</sup> 1765; b. 1184, fos. not numbered, letters dated July 7<sup>th</sup>, 14<sup>th</sup>, 21<sup>st</sup> 1781.

40 ASBS, *Cancelleria Prefettizia Superiore*, b. 81, fo. not numbered, letter dated July 6<sup>th</sup> 1707. In England too wheat price varied according to its aging (Hoyle, 2019: 67).

41 ASBS, *Cancelleria Prefettizia Superiore*, b. 81, fo. not numbered, letter dated July 21<sup>st</sup> 1707.

42 ASBo, *Assunteria di Abbondanza, Diversorum*, b. 3, fos. 324 r., 326 r.

43 ASBo, *Assunteria di Abbondanza, Diversorum*, b. 4, fo. 330 r.

44 ASBo, *Assunteria di Abbondanza, Diversorum*, b. 5, fo. 69 r.

45 ASBo, *Assunteria di Abbondanza, Diversorum*, b. 5, fos. 71 r.-v.; b. 8, fo. 176 r.

46 ASBo, *Assunteria di Abbondanza, Notizie*, b. 2, fos. 85 r., 302 r.

47 HAMF, *Finanziaria XVIII*, b. 80, fo. 343 v.; b. 82, fo. 226 v.; b. 84, fos. 192 r.-231 r., 809 r.; b. 92, fo. 687 r.; b. 93, fos. 21 r., 50 r., 59 r., 76 r., 78 r., 263 r.; b. 94, fo. 488 r.; b. 100 bis, fasc. 1, fo. not numbered, decree dated October 27<sup>th</sup> 1767; HAMF, *Patrimoniale*, b. 272, fasc. 26; b. 273, fasc. 54; b. 283, fasc. 50; b. 316, fasc. 41; b. 370, fasc. 16.

48 HAMF, *Finanziaria XVIII*, b. 90, fo. 566 v.

49 HAMF, *Patrimoniale*, b. 254, fasc. 54; b. 257, fasc. 52; b. 273, fasc. 51; b. 276, fasc. 10; HAMF, *Finanziaria XVIII*, b. 77, fos. 152 r., 218, 221 r., r.233 r., 252 r., 266 r., 269 r., 272 r., 314 r., 344 r., 382 r., 388 r., 398 r., 413 r., 440 r., 442 r., 453 r., 481 r., 505 r., 581 r., 585 r.; b. 78, fos. 158 r.-159 v., 318 r., 324 r.-326 r., 342 r., 360 r.-v., 366 r.-370 r.; b. 79, fos. 23 r.-25 v., 359 r.-362 v., 438 r.-441 v.; b. 80, fos. 68 r.-69 r., 155 r.-177 r., 230 r.-242 v., 248 r.-255 v., 261 r.-262 r., 324 r.-326 r., 430 r., 442 r.-v., 533 r.-534 r., 563 r.-564 r., 612 r.-614 r.; b. 81, fos. 11 r.-21 r., 50 r., 89 r., 228 r., 454 v.-455 r., 486 v.-487 v.; b. 82, fos. 27 r.-v., 64 r.-65 r., 75 r.-v., 89 r.-v., 91 r.-v., 184 v.-185 r.; b. 83, fos. 708 r.-709 r.; b. 84, fos. 194 r.-204 r., 266 r.-270 r.; b. 85, fos. 142 r.-144 r., 817 r.-836 r.; b. 86, fos. 763 v.-764 r., 767 r.; b. 88, fos. 254 r.-328 r., 355 r.; b. 90, fos. 315 r.-317 v., 322 r., 329 r.-332 r.; b. 91, fos. 366 r.-367 r., 372 r.-v.; b. 92, fos. 328 r.-329 r., 332 r.-333 r., 336 r.-337 r.; b. 93, fos. 253 r.-254 r.; b. 94, fos. 92 r.-v., 109 r.-110 r.; b. 96, fos. 129 r.-v., 144 r.-v., 157 r.-164 r., 166 r.-184 r., 217 r.-v., 531 r.-535 r., 553 r.-554 r.; b. 97, fos. 946 r.-953 r.

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