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A case study of corn sales: Harston Manor's corn book 1823-42

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Abstract

We analyse the Corn Book from Harston Manor in Cambridgeshire, containing data on wheat sold from the harvests of 1823-42. Annual sales averaged 1000 Bushels. Wheat was sold throughout the year, necessitating considerable intra-year storage; almost a quarter of sales took place one year or more after harvest, generating significant inter-year storage (carryover). New and old wheat exhibit no systematic price differential. Most sales were to a single miller in Harston, leaving little rôle for corn merchants. Observed trades and prices are thus likely characterised by a strategic and cooperative relationship between farmer and miller, rather than a spot market.

Keywords: wheat, grain markets, grain storage, farm accounts.

JEL Classification: O16, N13, G21.

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1. Introduction.

In this short paper we analyse the Corn Book of a medium-sized farm, Harston Manor, in Cambridgeshire for the harvest years 1823-42. The available information is sufficient to provide detailed answers to a series of important questions about how this farm marketed grain: the seasonal pattern of sales and prices; the importance of intra-year and inter-year storage; the relationship between the farmer and the purchasers of grain. As far as we know, there are relatively few analyses of this nature: Hoyle's analysis of Crakanthorpe's accounts in this volume is a rare exception. Until a much larger set of such accounts have been analysed, we cannot know with certainty whether Harston Manor is representative or unusual, but this analysis provides a preliminary perspective on the way that an English farm marketed its produce before the repeal of the Corn Laws in 1846.

To provide context, it is useful to consider what is currently known about grain markets at this time. The widespread availability of historical prices has resulted in a huge number of statistical analyses of price behaviour in grain markets, evidenced by the hundred or so papers using this approach cited in [Federico's \(2012\)](#) survey. Unfortunately, many of these papers rely almost solely on price data, sometimes supplemented with information on transport costs, and this means that they can only address a limited range of questions.

The most common approach is to consider a set of markets that might plausibly trade with each other and then see if the prices in the two markets tend to equality (i.e. they look for the action of the law of one price, or LOOP). If data are measured at a relatively high frequency then it is also possible to analyse the dynamics of prices (e.g. if prices move apart, then how quickly – or “efficiently” – do they move back together again?). Unfortunately, in historical studies it is rare for the price data to be clearly associated with grain of a given quality and therefore some of the variation in price is almost certainly due to variations in the quality of grain rather than behaviour of the grain market. [Brunt and Cannon \(2015\)](#) provide contemporary evidence on the quality of wheat and show that tests of both LOOP and market efficiency may be significantly contaminated by the presence of quality variation.

However, a more obvious criticism is that such studies really tell us only about the ability of market actors to arbitrage price differences between markets; they provide virtually no information about anything else. For example, [McCloskey and Nash \(1984\)](#) have suggested the Middle Ages were characterised by minimal carryover of grain from one harvest year to the next (that is, inter-year storage). But price data alone do not allow us to confirm or reject this hypothesis with confidence, either for the Middle Ages or later periods, and there are very few (direct) data on inter-year storage from other sources. In the presence of production shocks (i.e. bad harvests), an economy can smooth consumption either by arbitrage across regions (trade) or by arbitrage across time (inter-

year storage). But it is clearly difficult to measure market efficiency when data on one of these possibilities (i.e. inter-year storage) is virtually absent ([Persson, 1999](#)). Another question relates to how market actors engaged with each other. Clearly, a supply chain had farmers at one end and consumers at the other end, with intermediate productive steps of millers and bakers. But we do not know to what extent farmers traded directly with millers or relied upon middlemen, such as corn factors.

One way to address some of these issues is to look at very detailed data from individual farmers' accounts. Farmers' account books have already been used to address issues such as the seasonality of different types of farm work ([Burnette, 2013](#)) and gender inequality in wages ([Burnette, 2008](#)). [Brunt and Cannon \(2017\)](#) have also used farm account books to infer the intra-year pattern of wheat storage, using the date at which wheat was threshed to place a time limit on when it might have been brought to market. Most of these sources were either general account books or explicit diaries of labour payments.

But within the archives there is a third type of account book - albeit much rarer – namely a Corn Book. Typically, a Corn Book would note the produce of a given harvest and when it was threshed or sold (or possibly both). In this study we analyse the particularly detailed Corn Book of Harston Manor. Harston is a small village about six miles south of Cambridge and eight miles north-east of Royston (in the neighbouring county of Hertfordshire), both of which we know to have grain markets because the markets were monitored by the British government: the prices and quantities traded in each week were published in the London Gazette.

2. Initial description of the data in the Harston Manor Corn Book

The Harston Manor Corn Book is a hardbound tome about 21½ cm by 17½ cm (reference R51/17/35 in the Cambridgeshire Archives). For each harvest from 1823 to 1842 it records the quantities of grain sold, when they were sold, to whom, and for what price.

We do not know the precise date of wheat harvesting on Harston Manor: in the absence of such information, our descriptive analysis is based on a “harvest year”, which we define as the twelve-month period starting on 1 August and ending on 31 July. This dating is consistent with the contemporary records suggesting that, in this historical period, the harvest in the south of England usually started in early August ([Lawes and Gilbert, 1864](#)). On this definition, inter-year storage (carryover) is any wheat sold in or after the August in the following year. But we also consider a slightly more conservative definition of carryover – being any wheat sold in or after the September in the following year – to make sure that we are not overestimating inter-year storage by choosing an incorrect terminal date.

[< Figure 1: Example pages - about here >](#)

An example of the entries in the Corn Book is given in Figure 1, which shows the harvest of 1827. The total sales revenue from this harvest comes to £738/1/0 (i.e. £738, 1 shilling and 0 pence). The quantity sold was 386 Loads and 2 Bushels, i.e. 1,932 Bushels or 241½ Quarters. Unfortunately, we cannot be sure what form of Bushel is being used: England moved from using the Winchester Bushel to the Imperial Bushel in 1826, but no mention is made of a change of unit in this corn book. It is probable that the measures are Winchester Bushels, since this measure continued to be widely used, and we make this assumption throughout the paper.¹ (The difference is anyway small, with the Winchester Bushel being 31/32 of an Imperial Bushel.) A quantity of 1,932 Winchester Bushels is 681 Hectolitres. Not all of this wheat was sold in the harvest year 1827-28, with the final sale of wheat not taking place until 29 August 1829. Figure 2 illustrates the annual totals harvested and sold in each year and we shall consider the issue of inter-year storage more carefully in the next section. With yields of around 25 Bushels per acre, Harston Manor was harvesting around 70 Acres (30 Hectares) of wheat per annum.

[< Figure 2: Annual totals - about here >](#)

Looking more carefully at the individual transactions, the first sale from the 1827 harvest was that of 30 Loads sold on 29 August to Mr. Inkersole of Harston Mill for 38 shillings per Load. This was quite a large transaction: over the entire period 1823-1842, the modal transaction was just under 20 Loads and the mean transaction was 23½ Loads (i.e. 117½ Bushels). From Harston to Cambridge is 9.7 miles; and from Harston to Royston is 8.1 miles; each of these would have been a round trip from Harston in one full day. But there was considerable variation, as illustrated in Figure 2, which summarises data for all transactions in our data set.

[< Figure 3: Distribution of size - about here >](#)

The harvest of 1827 was sold in twelve transactions in total, of which ten were to Mr. Inkersole of Harston Mill and two were to Mr. Foster of Hauxton. The Corn Book is not consistent in its references to Mr Inkersole – some refer to “Harston Mill” and some merely to “Harston” – but

¹ There was only incomplete standardisation of units at this time. According to the “Returns from corn inspectors of the customs or practices of selling corn in their districts” ([British Parliamentary Papers, 1834](#)) in 1833 both Cambridge and Royston used a measure of a Load equalling five Bushels for sales of wheat. The Cambridge corn inspector makes no comment on the Winchester versus Imperial issue. The Royston corn inspector noted that “the Imperial bushel ... is much detested in this neighbourhood, although submitted to ...”, but that only applies to transactions made in the market place and, as we shall see, most sales from Harston Manor were directly to millers. Many other corn inspectors from other parts of the country noted that farmers preferred to continue using the Winchester bushel.

we assume that these are synonyms. Similarly, Mr. Foster is often referred to as being of “Hauxton Mill”, so the entire harvest of 1827 was sold direct to millers. The full list of buyers is shown in Table 1, which shows that the vast majority of wheat (59 per cent) was sold to Harston Mill. The first reference to Mr. Inkersole is in June 1826 and up until then the biggest buyer was Mr. Wallis, also of Harston: one possible conjecture is that Mr. Wallis was the miller in Harston until Mr. Inkersole took over. But Harston Manor also sold wheat to mills in Danford, Shelford, Shepreth and Barrington: Figure 3 shows that most wheat was sold to buyers that we can clearly identify as millers. This is consistent with other studies that found grain was sold direct to millers ([Tann, 1980](#)), as well as with contemporary accounts from the 1826 Parliamentary Enquiry.² It is also consistent with the fact that only a quarter of the wheat grown in England passed through the most important grain markets monitored by the British government for this period ([Fairlie, 1969: 96, Appendix 2](#)).

< [Figure 4: Wheat sold to millers - about here](#) >

< [Table 1: Buyers of wheat - about here](#) >

3. Grain prices for wheat sold by Harston Manor

We have a total of 295 observations from the Corn Book and, in each case, we observe the quantity sold, the total value of the transaction and the price. Obviously these three variables should obey the requirement that $price \times quantity = value$ but there are a few cases where we do not observe this. Sometimes this is because of small rounding errors, but in ten cases the discrepancy is more than five per cent and we discard these observations.³ We have already seen that Harston Manor was selling wheat from different harvests in the same year and an obvious question to ask is whether older wheat traded at a different price. There are only eight days where Harston Manor sold wheat from both the most recent harvest and from an earlier harvest: if we compare the prices of these simultaneous transactions then we find that new wheat sells for two per cent less but – unsurprisingly – this is statistically insignificant. To expand our sample size, we look at each month where we observe transactions of both new and old wheats: this means that we now have twenty

² For example: “A great proportion of the supply that feeds the population of London consists of flour, which is brought from above [London] Bridge, and does not appear in the market at all; that flour is generally sold by the flour factors, without ever being brought to market at all. One great object of building the new market [the rebuilding of Mark Lane in 1827] was to afford the flour factors an opportunity of exhibiting their flour in the market.” Evidence of Thomas Dimsdale, corn factor, in [British Parliamentary Papers \(1826-7: 674\)](#).

³ These observations sometimes have additional notes in the Corn Book, suggesting that the transaction involved other crops. We have also dropped a single observation of tail wheat (i.e. the lower quality kernels that drop out at the very end of the threshing process).

observations, but the comparisons are imperfect, because they are asynchronous and prices could have changed within the month. Our calculations are illustrated in Figure 5 and show very large differences in absolute size (almost certainly more than would result from price changes over such short periods of time). But, again, there is no systematic price premium for new wheat. This is interesting because it suggests that any fall in the value of wheat parcels held in storage arises from physical losses (such as being eaten by rats) rather than a diminution of quality of the overall parcel (such as being due to mould).

[< Figure 5: Comparison of new and old prices - about here >](#)

Based on this analysis we now compare the Harston Manor prices against the prices in Cambridge and Royston, where the latter is the weekly official weighted-average price reported in the London Gazette ([Brunt and Cannon, 2013](#)), where we have converted the official price into Winchester Bushels. Figure 6 plots the Harston Manor and Cambridge prices (the Royston prices are available only from 1828 onwards, when they are almost indistinguishable from the Cambridge prices on a graph of this size). We do not observe the Harston Manor price every week but, in weeks when it is observed, it averages four per cent higher than the corresponding end-of-week price in Cambridge and five per cent higher than in Royston.⁴ One possible reason for this is that the data in the Corn Book are actually in Imperial Bushels rather than Winchester Bushels, since the Imperial Bushel is approximately three per cent larger, but this is at variance with the evidence that farmers preferred Winchester measure and it does not explain all of the price difference, especially with Royston. Instead, it might be the case that the Harston Manor wheat is slightly higher quality than the average in the market; or it could be that the Manor and the miller save the cost of freight (to and from the market) and split the saving between them.

[< Figure 6: Comparison of prices in Cambridge and Harston - about here >](#)

Finally, we look at the determinants of price, using a series of regressions of the logarithm of the price on possible explanatory variables. In particular we are interested whether the price depends upon the size of the transaction, whether the price is different for millers and whether the price varies systematically through the year. Our regression results are reported in Table 2.

[< Table 2 about here >](#)

Our first regression includes only the variables of interest, where the seasonal pattern in prices is modelled by eleven dummy variables for months of the year. Our measure of the size of the

⁴ In both cases this difference is statistically significant: the standard errors of the mean price differences are 0.47 and 0.58 respectively.

transaction is the logarithm of quantity, so the coefficient on this variable can be interpreted as an elasticity. It appears from the first specification that larger transactions have lower prices, with an elasticity of about four per cent (but marginally statistically significant); and that millers pay six per cent less (statistically significant). An F-test for the joint significance of the monthly dummy variables suggests that the seasonal pattern is not statistically significant.

These results could be misleading because they ignore the year-to-year variation in prices, leading to both omitted variable bias and incorrect standard errors. Thus we include dummy variables for each harvest year in the second specification, which has much smaller parameter estimates and suggests that there is no relationship between price and any of the explanatory variables and that the seasonal pattern is still statistically significant. However, the parameter estimates of the month-dummy variables increase approximately linearly through the harvest year, consistent with the saw-tooth pattern noted by [McCloskey and Nash \(1984\)](#), so we estimate a final specification with a linear trend within the harvest year (i.e. starting in August and finishing in July). The parameter on this trend is statistically significant and suggests that prices rise on average by 0.46 per cent per month, which is 5.7 per cent when expressed at an annual rate. This is a much smaller seasonal variation than the 12 per cent found by [Brunt and Cannon \(1999\)](#) when they re-analysed the medieval data used by [McCloskey and Nash \(1984\)](#). It suggests that the fall in grain prices at the end of the harvest year was relatively small, and thus the costs to the farmer of inter-year storage (arising from the price decline) were correspondingly small. We turn to the issue of storage in the next section.

4. Intra-year and inter-year storage

One of the longest-standing gaps in our understanding of grain markets is about both intra-year and inter-year storage of grain, due to a lack of direct evidence on what was being held in store. For this reason, many analyses have relied upon indirect tests of storage by looking at price behaviour ([McCloskey and Nash, 1984](#); [Nielsen, 1997](#)) or possible grain storage capacity ([Fenoaltea, 1976: 138-139](#)). All of these studies are for the medieval or early-modern period. In this section we answer the question directly by looking at when wheat from each harvest was sold.

Our analysis is summarised in Figure 7, which illustrates both the seasonal pattern of sales and the delay between harvest and sale. The top left-hand graph shows the quantities of wheat sold in each month over the entire twenty-year period. To check whether this pattern is due to the seasonality in years with particularly high sales, we also calculate the proportion of wheat sold within a harvest year and report the mean and inter-quartile range for the proportions in each month: this is illustrated in the bottom left hand graph. This confirms the pattern in the bar chart, but also shows that there was considerable variation in seasonality from year to year.

< [Figure 7: Timing of wheat sales - about here](#) >

The two graphs in the left-hand column of Figure 7 show when grain was sold, but conflate grain from different harvest years. The two graphs in the right-hand column show the quantities sold from each harvest in months after the harvest (assumed always to be in August, since we do not have more precise information on the harvest date). For clarity of exposition, the top right-hand graph distinguishes wheat sold within the harvest year (bars coloured black), wheat sold the following autumn (bars coloured white) and wheat sold in the succeeding calendar year (bars coloured red). The two most striking features of these data are the extent of carryover and the peak in sales in July. We find both of these elements quite surprising.

In terms of carryover, 21 per cent of the harvest was sold in the period from August to December one year after the harvest and a further three per cent was sold in the following calendar year: the total carry-over on the farm was just under a quarter of the whole harvested crop. Even if we use our more conservative definition of carryover to include only wheat sold from September onwards, it still constitutes 17 per cent of the crop. There is a verbal hint in the Harston Manor Corn Book that selling wheat shortly after the following harvest was usual, since only wheat sold in the following calendar year (i.e. the red bars in the figure) was referred to as “Old”, whereas wheat sold within sixteen months of the harvest was still considered “New”. Indeed, of all the wheat sold in the period August-December, no less than 62 per cent was from the previous harvest.

We also remark upon the high level of sales in July. One possible reason for this would be for the farm to create space for the next harvest, but this raises the question of why so much wheat was carried over. Another possible reason is that farmers were getting short of cash at that time, given the extra labour payments for haymaking and harvesting. A separate issue, which we cannot answer here, is when and how the wheat was threshed – and hence in what form it was stored. It is conventional to assume that labour was in relatively short supply while it was needed for the harvest, suggesting that a farmer would not wish to thresh at this point in the harvest cycle. Yet the sale of wheat in August and September from the most recent harvest suggests that there actually was little or no labour constraint.

Our result here is strikingly different from the theory of [McCloskey and Nash \(1984\)](#), which assumed a minimal grain carryover for society as a whole. Of course, their model of minimal carryover also assumed a large seasonal pattern to grain prices (to compensate people for holding the grain through the year) whereas we showed in the previous section that the seasonal increase in grain prices was small.⁵ Clearly, by the nineteenth century carryover could take place on a

⁵ Note that our data are only for carryover on the farm: some grain was stored as part of the supply chain

substantial scale. But the real issue is why there was so much inter-year storage on the farm or, indeed, why this farm was selling wheat at all in the period from August to October (given that the wheat from the previous harvest could have been sold earlier, and the wheat from the most recent harvest would have to be threshed at a time of high labour demand).

We finish this section by discussing the frequency of carryover in more detail. The top panel of Figure 8 shows sales from each harvest: black again denotes sales between August and July, white denotes sales from the following August to December and red shows sales in the following calendar year. Only three harvests out of twenty saw no carryover whatsoever.⁶ The bottom panel shows the relationship between the total size of the harvest and the quantity carried over, together with an OLS line of best fit: above the threshold of 818 Bushels (2,880 Hectolitres) every extra Bushel of wheat harvested is expected to result in 0.45 Bushels of carryover (standard error of 0.12, statistically significant with a p-value of 0.002). Since there is a small amount of left censoring, we could also estimate this with Tobit, but the results are almost identical; similarly, using the more conservative definition of carryover makes little difference to the results.

[< Figure 8: Carryover - about here >](#)

5. Summary and discussion

The Harston Manor accounts offer a fascinating and tantalizing insight into some key issues surrounding grain production and storage in the nineteenth century, and probably earlier as well. Historians have asked the question: how much carryover was there from one harvest year to the next? Was the carryover grain stored in barns or granaries? Was it held by merchants or farmers, in town or country? Was there a labour constraint in threshing (i.e. to what extent did farmers face a trade-off in September between threshing the newly harvested grain and planting the crop for the next season)? How did this affect the adoption of threshing machinery? Historians have tackled these questions using several different approaches – such as looking for patterns in the price data, or estimating the storage capacity of barns. But these methods are indirect – and thereby open to challenge – whereas the Harston Manor records are direct and straightforward to interpret.

The key patterns of behaviour revealed by the Harston Manor records are as follows. First, the farm always stored grain throughout the harvest year, frequently from one harvest year into the following autumn (in 25 per cent of years), and sometimes into later years. Second, the farmer

by millers (or by bakers in the form of flour), and there was presumably also some inter-year storage by corn merchants.

⁶ Using the more conservative definition of carryover of sales from September onwards would increase this to seven years with no carryover.

overwhelmingly sold direct to millers (not to merchants). These two results contradict the McCloskey-Nash characterization of grain production and also explain why we see such a low proportion of output being traded in the markets monitored by the government (i.e. most grain never passed through those markets).

The other striking fact is that, over the whole period, 59 per cent of wheat was sold to a single buyer: the prices paid were consistent with the spot market prices paid in nearby Cambridge, but it would be inappropriate to characterise such a relationship between Harston Manor and Harston Mill as a spot market. Rather, it suggests that there must have been an ongoing relationship between seller and buyer.

This kind of micro-study offers data and results that are rich and precise. The disadvantage is that it is based on only one manor: the challenge is then to collate corn books for more manors, and supplement them with additional sources, in order to paint a fuller picture that can be taken as generally representative of England in the nineteenth century. We should then like to extend the evidential basis, and the analysis, backwards in time to the early modern period. This is our next line of research.

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Figures and Tables

Figure 1: Example pages from the Harston Manor Corn Book

Date	Description	Price	Total
Aug 29 th 1827	New Wheat sold		
30 th	Sold Mr Inkersole Harston Mile		
	of Wheat at 38/ L ^s		57 0 0
14 th	Sold Mr Foster Harston		
	of Rye at 31/ L ^s		21 14 0
30 th	Sold Mr Foster Harston		
	of Rye & Wheat at 27/ L ^s		40 15 6
1828			
8 th	Sold Mr Inkersole Harston		
	of Wheat at 35/6 L ^s		96 18 6
16 th	Sold Mr Inkersole Harston		
	of Wheat at 31/ L ^s Rye 13		19 10 0
June 7 th	Sold Mr Inkersole Harston		
	of Wheat at 36 L ^s		65 10 0
			<u>301 8 0</u>
			17 11 4
			<u>318 9 4</u>
July 2 nd	Sold Mr Inkersole Harston Mile		2 0 0
	of Wheat at 34/ L ^s		90 7 0
July 31 st	Sold Mr Inkersole Harston Mile		101 4 0
	of Wheat at 47/ L ^s		
Aug 20 th	Sold Mr Inkersole Harston Mile		140 16 0
	of Wheat at 46/ L ^s		
Oct 11 th	Sold Mr Inkersole Harston Mile		50 7 0
	of Wheat at 50/ L ^s		
1829 - this wheat laid 12 months without moving.			
Aug 15 th	Sold Mr Inkersole Harston Mile		22 0 0
	of Wheat at 44/ L ^s		
Aug 24 th	Sold Mr Inkersole Harston Mile		31 19 0
	of Wheat at 45/ L ^s		
			<u>436 13 0</u>
			301 8 0
			<u>738 1 0</u>

Figure 2: Annual totals of wheat harvested and wheat sold

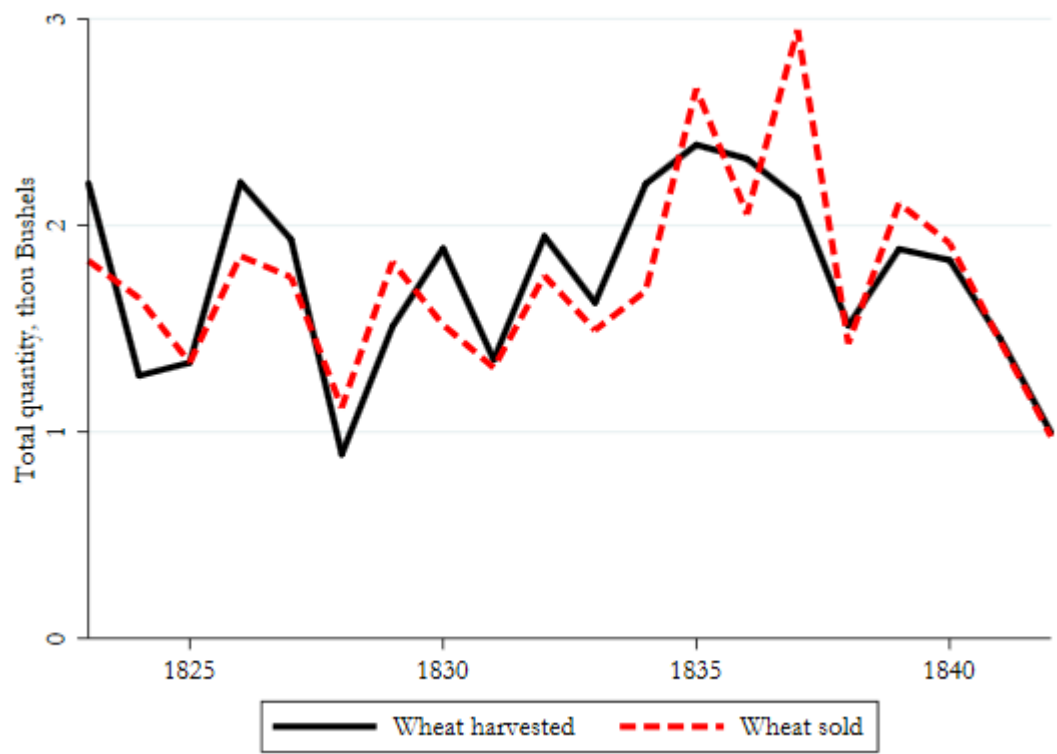


Figure 3: Distribution of size of transactions

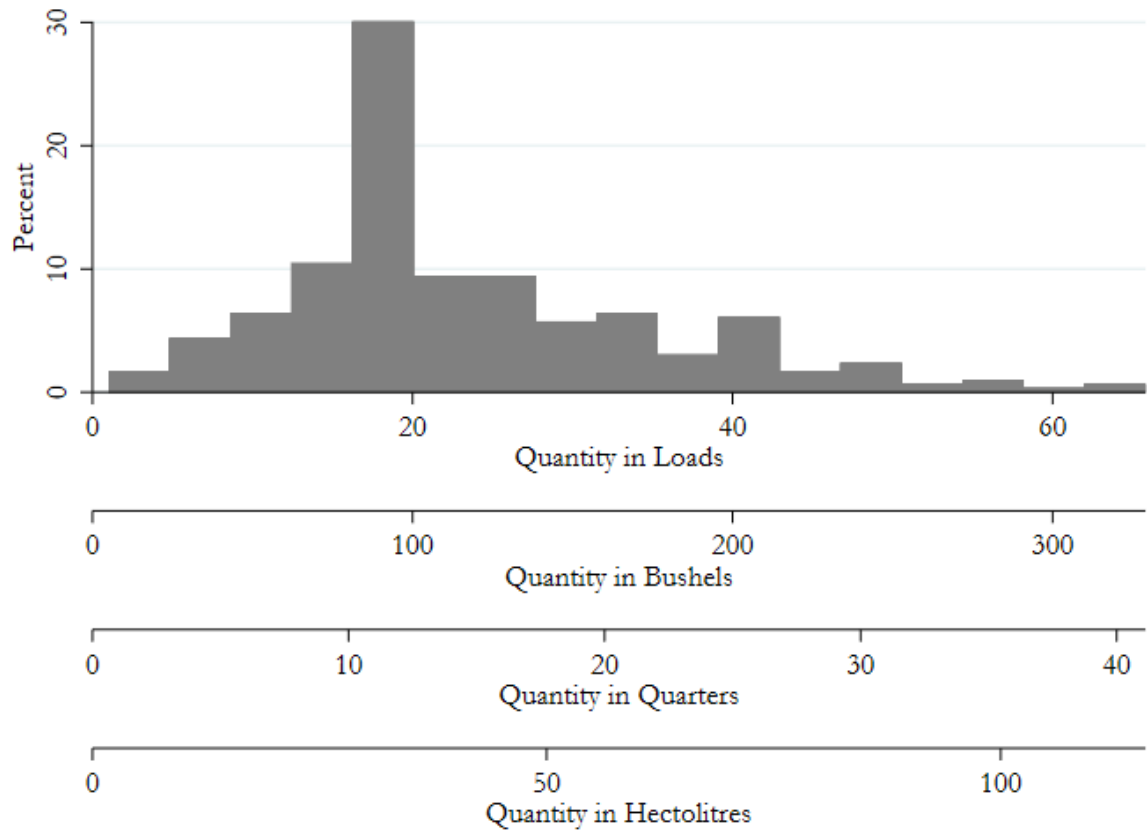


Figure 4: Wheat sold to millers and others

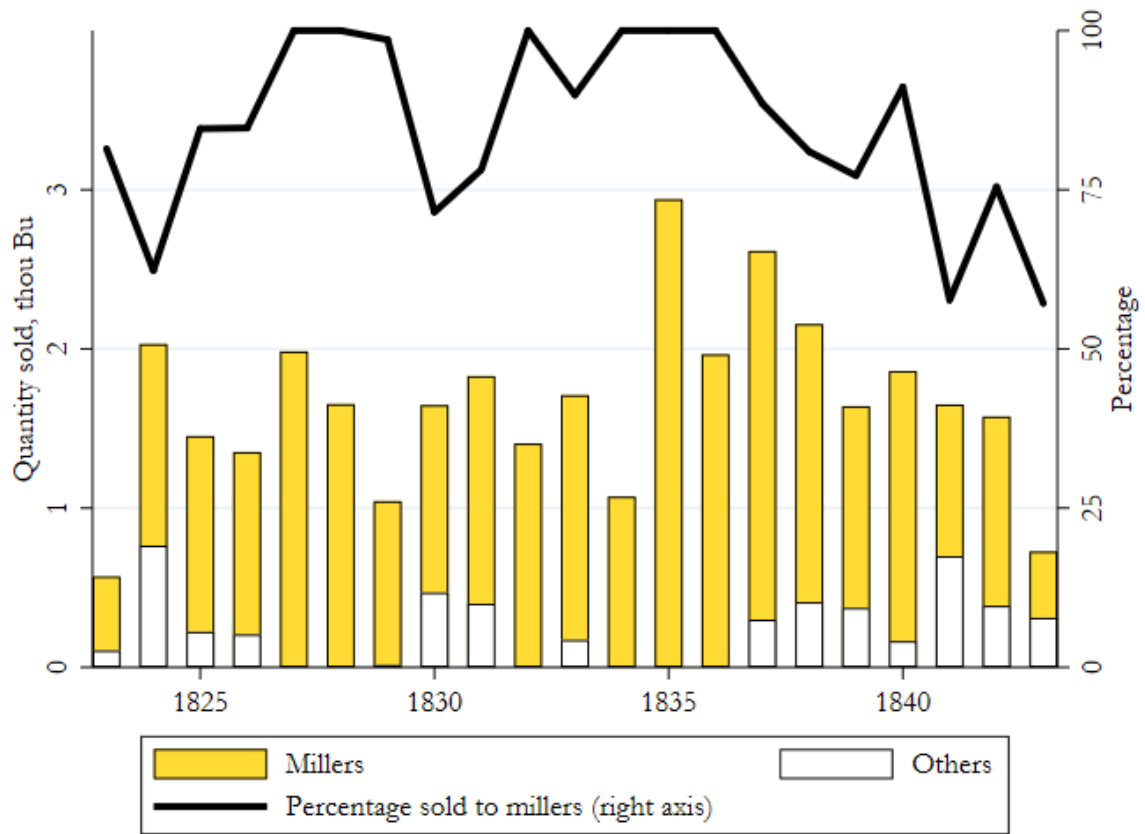


Figure 5: Price comparison of old and new wheats

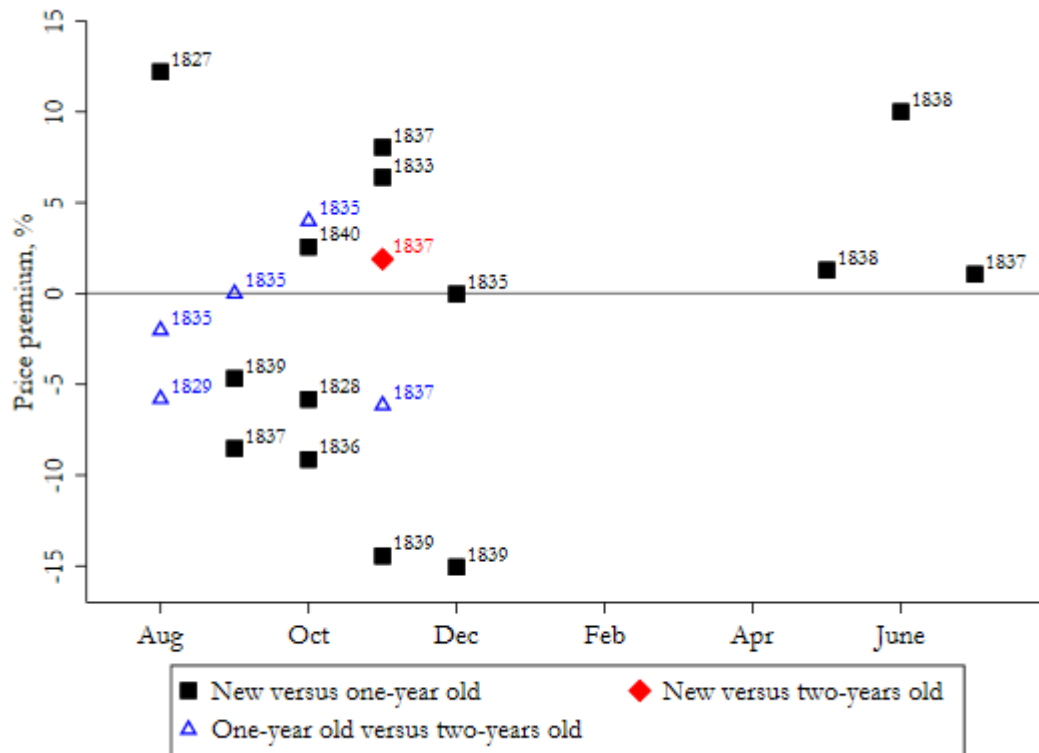


Figure 6: Comparison of price in Harston Manor and Cambridge

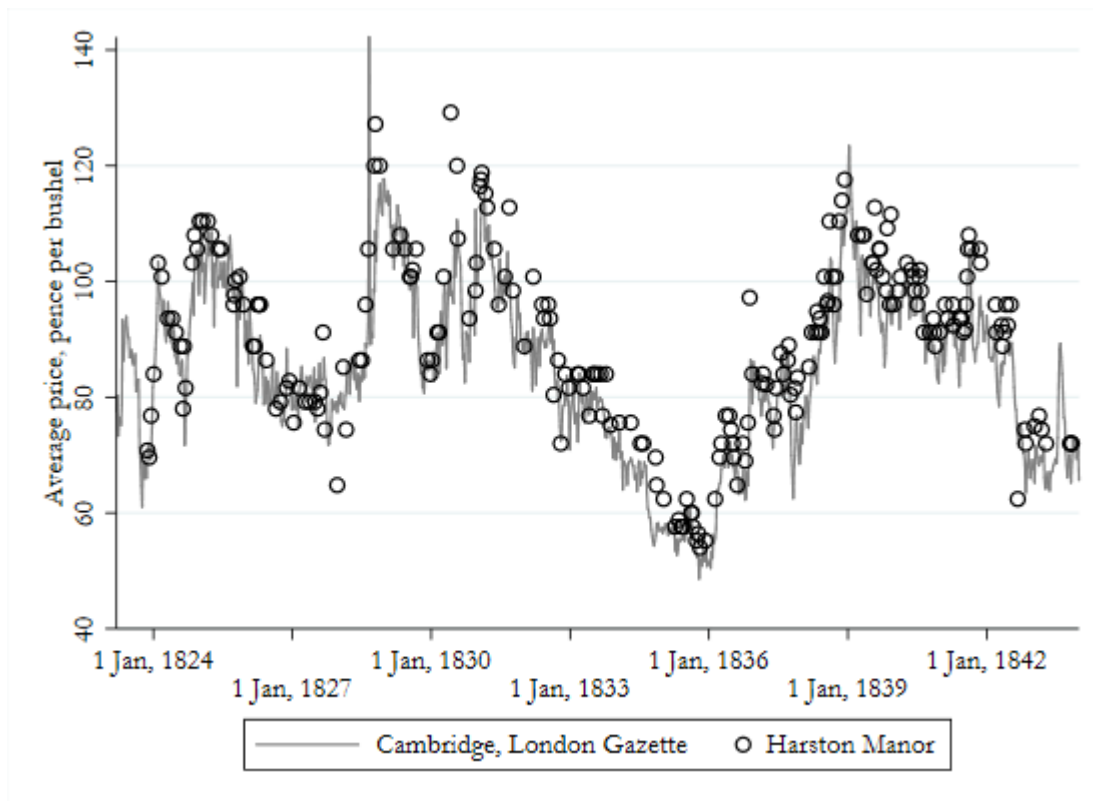


Figure 7: Timing of wheat sales

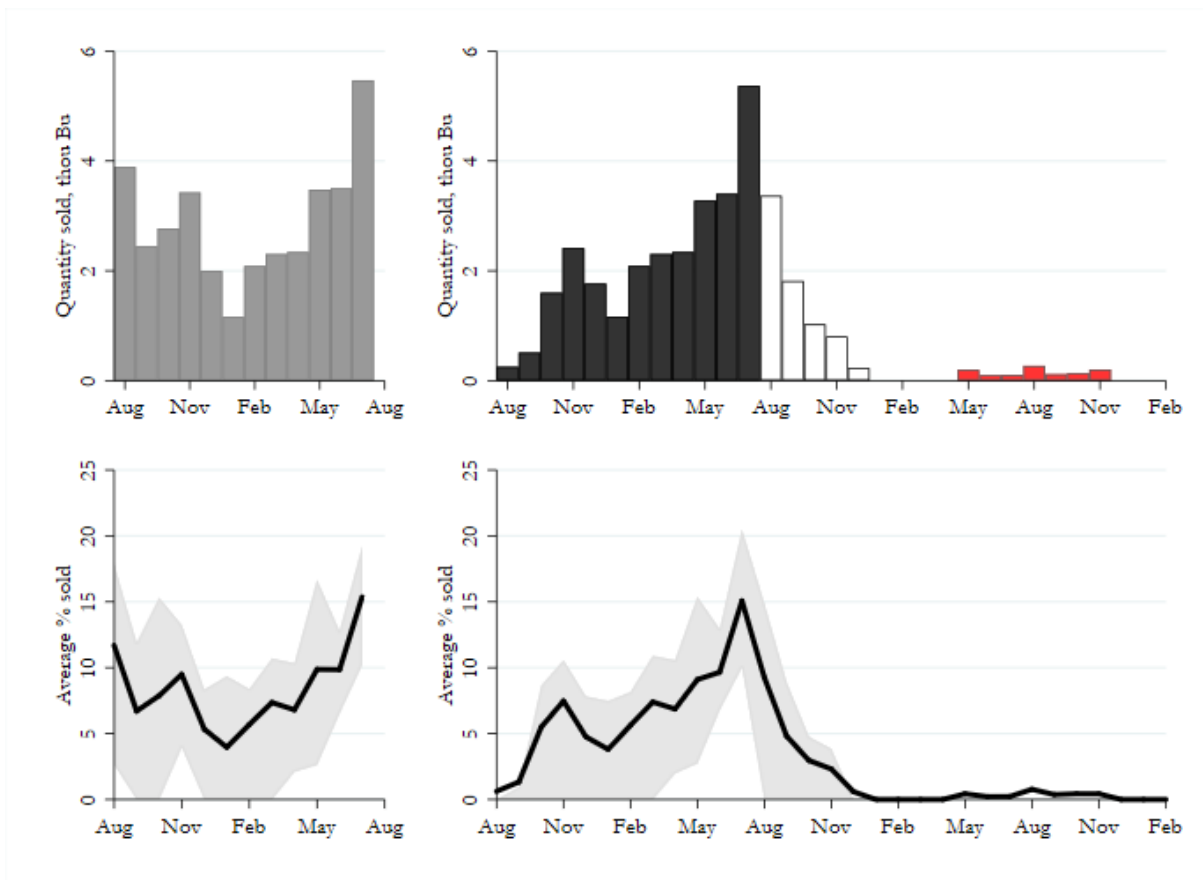


Figure 8: Carryover of wheat

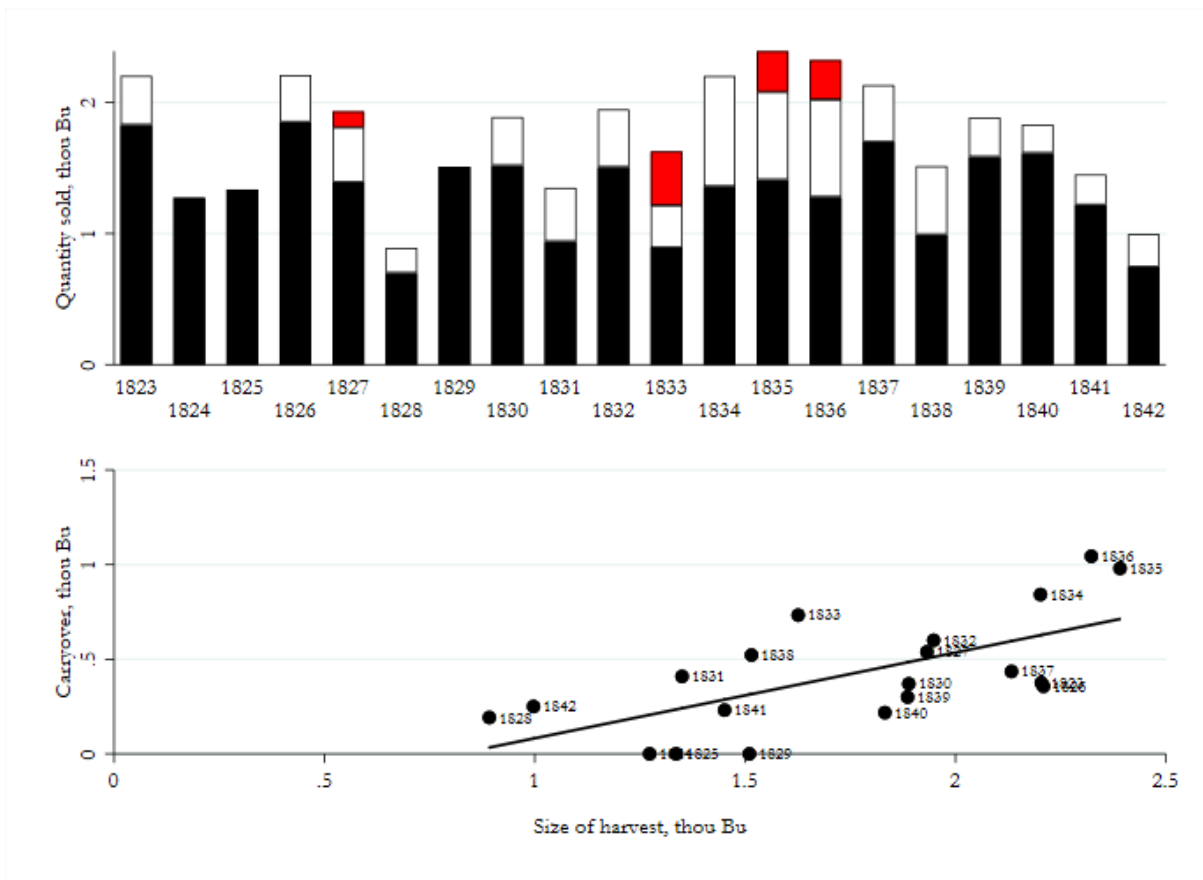


Table 1: Buyers of wheat

Buyer	Number of transactions	Total purchased (Bushels)	Average size of purchase (Bushels)
Mr. Inkersole, Harston Mill	166	20580	124
Mr. Foster, Hauxton Mill	33	4220	128
Mr. Wallis, Harston	20	2910	146
Mr. Nutter, Danford Mill	11	1383	126
Mr. Thurnale, Duxford	13	1372	106
Mr. Smith, Royston	9	945	105
Mr. Nutter, Shelford Mill	5	609	122
Mr. Thurnale, Whittlesford	6	537	90
Mr. Moule, Kneesworth	6	477	80
Mr. Wallis, Shepreth	5	397	79
Mr. Shaw, Cambridge	2	238	119
Mr. Lawrence, Royston	1	180	180
Mr. Dickerson, Bassingbourn	2	150	75
Mr. Swannell, Royston	1	114	114
Mr. Pearce, Shepreth Mill	2	105	53
Mr. Heaver, Kneesworth	1	100	100
Mr. Flitton, Morden	1	100	100
Mr. Sutton, Bassingbourn	1	90	90
Mr. Titchmarsh, Royston	1	86	86
Mr. Smith, Barrington Mill	1	85	85
Mr. Fordham, Barrington	1	47	47
Mr. Northfield, Harston	2	44	22
Mr. Sergent, Haslingfold	1	30	30
Mr. Whitechurch	1	25	25
Mr. Oakey, Sandon	1	25	25
Mr. Wallis, Haslingfield	1	20	20
Mr. Watson, Harston	1	15	15
Mr. Pate	1	15	15

Table 2: Determinants of wheat price

Dependent variable: ln(Price)	Specification 1	Specification 2	Specification 3
ln(Quantity)	-0.0408+	0.00922	0.0117
	(0.0215)	(0.0120)	(0.0118)
Mill dummy variable	-0.0619**	-0.0184	-0.0207
	(0.0238)	(0.0151)	(0.0149)
Harvest-year Month			0.00463**
			(0.0017)
Month dummy variables	✓	✓	
Test for joint significance of month dummy variables	F(11, 269) = 0.80 [p = 0.64]	F(11, 233) = 1.41 [p = 0.17]	
Year dummy variables		✓	✓
N	283	283	283

Robust standard errors in parentheses; in specifications 2 and 3 these are clustered by week. + $p < 0.10$, * $p < 0.05$.