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A rethinking of Labrousse's analyses of wheat price movements in 18th century France: Labrousse *versus* Labrousse?

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Abstract:

Labrousse's two investigations of cereal price movements (Labrousse 1933, 1944) suggest a sort of dualism in the arguments put forward in the two works (Morineau, 1966). Using contemporary data analysis and cliometrics, we propose to test different hypotheses that emerge from our reading of Labrousse (1933 and 1944). The first set of hypotheses relates to the long-term movement of grain prices. The second type of hypothesis relates to price cycles and price volatility. The originality of our approach in part relates to the very long runs of data drawn from different sources. Results of our study of the wheat price evolution partially questions Labrousse's analysis.

Keywords: intercycle, Labrousse, volatility, wheat price

JEL Classification: B11, N13, N33, N53.

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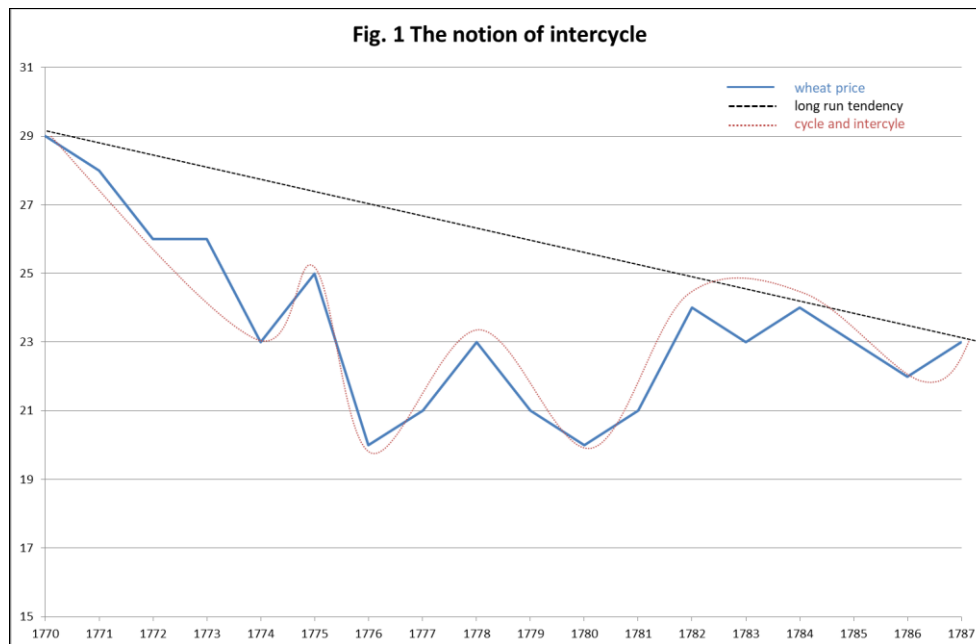
1. INTRODUCTION

The transformation of French historical methodology that Ernest Labrousse (1895-1988) brought about during the interwar period was something of an epistemological: he employed statistical tools drawn from economic analysis to construct new models for historical interpretation (Borghetti 2002, Caron, 1990). He especially focussed on careful analysis of agricultural statistical series, which he presented and criticised in detail. He therefore furthered the study of quantitative history, giving it the task of explaining social dynamics and, more specifically, the history of the kingdom of France during the eighteenth century, paying particular attention to the objective causes of the French Revolution (Borghetti, 2002, p. 16).

Nonetheless, at this Labroussian moment there are some discrepancies between the contrasting arguments advanced in his first two works, leading him to advance two different explanations of the French Revolution. In the thesis that he defended in 1932 and published in 1933 as *l'Esquisse du mouvement des prix et des revenus en France au XVIII siècle* Labrousse essentially describes three trends characterizing cereal prices during the eighteenth century: a long-term, secular upward trend – itself an international trend - extending from 1734 to 1817; followed by a downward movement lasting about 34 years that characterized the early nineteenth century (1933, p. 140). This first trend was accompanied by monetary and political stability. The third trend was a decennial cyclical movement in prices (each cycle taking about 6½ years) that can be reduced to a Juglar cycle (Caron, 1990, p. 424) and a seasonal movement that is amplified at the cyclical maxima.

According to Labrousse, a rise in cereal prices will affect distinct social groups in different ways. This is especially clear in the increasing contrast between the path followed by rents and wages, the former increasing over the century while the trend of real wages fell. These trends, coupled with the progressive deterioration of the peasant economy, would tend to explain the occurrence of the Revolution (Borghetti, 2002, p. 30). The rise in grain prices is therefore considered to be one of the causes of the French Revolution, which broke out "when the long-term movement in cereal prices reached its maximum from the point where it had begun to rise, hence since the first years of the century; while at the same time the cyclical maximum was reached and, a few weeks later, that of the seasonal movement." (1933, p. 618).

Coming back to this in 1944 with *La crise de l'économie française à la fin de l'Ancien Régime et au début de la Révolution*, Labrousse put forward a rather different explanation. Taking greater account of the ideas of the Physiocrats and the analysis of writers favourable to the liberalisation of the grain trade, Labrousse established that the growth of agricultural prices in the long run was more an opportunity for French agriculture and the economy as a whole (1944, p. 149). Even more than in 1933, the "surge in price" of cereals (and more generally of agricultural prices) was treated as the symptom of a lengthy period of prosperity extending from 1733 to 1817, if not from 1726 to 1873. Logically, therefore, the possible economic causes of the Revolution change. Henceforth they would be located in the existence of an intercycle extending between 1778 and 1787 or perhaps 1791, breaking the trend of rising agricultural prices (fig. 1).



Here we would be faced with an "extraordinary" decline in a more general cycle of growth in agricultural prices over a (very) long 18th century. Labrousse then more particularly highlights the impact of the fall in the price of wine on the recession, emphasising that the sale of wine, unlike that of cereals, was the basis of peasant money income. The decrease in wine prices would have led to a reduction in the purchasing power of the small peasantry and of small owners, causing a sales crisis and an economic slowdown preceding the French Revolution.

Some of the differences between these two analyses of Labrousse, from 1933 and 1944, were noted by Morineau (1996), who went so far as to detect a dualism in the theses of the two works. He accused Labrousse of using limited statistical material to construct unreliable explanations of the Revolution. He challenged the chronology and also the existence of the 18th century cycles that Labrousse had identified. More particularly, he questioned the description and interpretation given by Labrousse for the crisis of the 1780s. Morineau's criticism does however have a flaw, since it is based on regional case studies (of the Généralité of Riom in the Auvergne, and Chanteloup-les-Vignes) and not on a general study of prices in France (Lemarchand, 1996, p. 109-111).

Using contemporary data analysis and cliometrics, we propose to test different hypotheses that emerge from our reading of Labrousse (1933 and 1944). Like Labrousse, we do not have data relating to the production of wealth at the national level; this prevents us from studying the correlation of price and production, and forces us to restrict our analysis to price movements.

The first set of hypotheses relates to the long-term movement of grain prices. Do we see an increase in cereal prices during the (very long) 18th century (1733-1817, or even 1661-1873) (Hypothesis 1)? In this movement of rising grain prices, do we detect an exceptional price increase in the eighteenth century, and especially between 1726 and 1789 (Hypothesis 2)?

The second type of hypothesis relates to price cycles and price volatility. Can we conclude that there are Juglar cycles, as Labrousse does (Hypothesis 3)? Can we see an inter-cyclical drop in agricultural prices, of wheat and wine, between 1778 and 1791 (Hypotheses 4 and 5)? Finally, is there volatility differentiated according to type of cereal that increases as one moves down the hierarchy of cereals (Hypothesis 6)?

Our analysis is in four steps. We first present our databases. Then, we analyse the evolution of the wheat price over the 18th century. Next, we discuss the issues of trend and cycle as well as the notion of inter-cycle developed by Labrousse about wheat price and the wine price. Lastly, we study the evolution of the volatility of grain prices and compare the evolution of the wheat price to the prices of other cereals. The originality of our approach in part relates to the very long runs of data drawn from different sources.

Our research follows on from a previous paper (Boyer, Jaoul-Grammare & Rivot, 2019) and is part of a research project which gathers “Cliometricians” and “Historians of Economic Thought” around common issues. It comes from a common wish to develop interdisciplinary dynamics within our research unit. Indeed, mixing history, theory and quantitative approach allows us to call into question common knowledge and to redefine them as done in the past by Fogel (1964) with the impact of railroads on economic growth, or Conrad and Meyer (1958) regarding the profitability of slavery for example. This combination of approaches is “*aimed at encouraging historians of economic thought to examine more systematically these theories or irrelevant theories too hastily accepted as true in the academic literature, the discourse and the textbooks*” (Diebolt & Hagemann, 2019).

2. DATABASES

Our analysis relies on three different databases. We obviously use Labrousse price series (1933; 1970) as well as two others: the series of d’Avenel (1894) and that of Blanqui et al. (1855).

Labrousse series: this comes from two works: 1933 and 1970. First of all, we use data published in 1933. It provides cereal (oats, rye, barley, wheat) price series from 1726 to 1789 (1701-1789 for wheat price). In these series, quantities were measured in setiers. A setier is a capacity measure: 1 setier being about 120 kg. of grain. Prices were given as livre tournoi, which is a unit of account. Secondly, we use data published by Labrousse et al. in 1970. In this case, only the wheat price was published; quantities are measured in hectolitre and prices are given in francs. In fact two changes occurred at the end of the 18th century. On the one hand, from 1795, the series are in franc with the official equivalence 1LT = 0.987 franc Germinal. This exchange rate rests on a “silver-metal” equivalence based on 4.5 g of silver, that is to say 1F = 1.0125LT = 4.5 g silver. This equivalence was in force until 1914. On the other hand, from “An X” of the Republican calendar (1801-1802 in Gregorian calendar), the national unit became the hectolitre (Fig. 2). But the weight of a hectolitre varies across the various cereals (Fig. 3) and also depends on the quality of the cereal (“*Dans nos bonnes années, le blé de première qualité pèse de 79 à 80kgs l’hectolitre ; la deuxième qualité de 77 à 78 ; la troisième*”).

de 75 à 76”, Blanqui et al. 1885, p. 1055).² If we compare the Labrousse series in hectolitres and in setiers, it appears that he averaged according to the following equivalence: 1hl = 77.89 kg.

Fig.2 Official circular establishing the hectolitre as the official unit (1 Vendémiaire An XI i.e 23/9/1802)

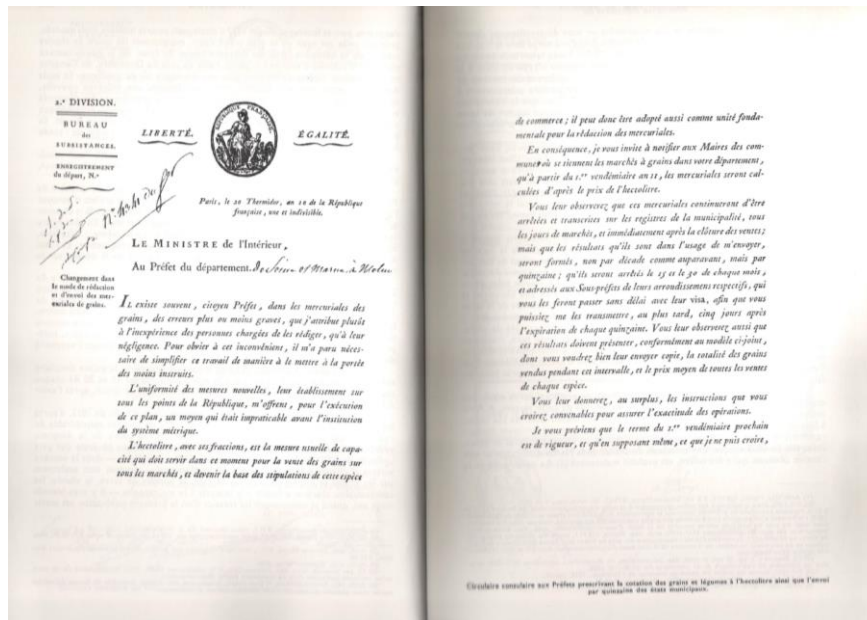


Fig. 3 Weight of 1 hectolitre of different cereals (Blanqui et al. 1855; p. 1059)

Poids ordinaire de l'hectolitre de grains divers.		
L'hectolitre	de froment	pèse 75 à 78 kilog.
—	de seigle	70 à 73 —
—	d'orge	60 à 65 —
—	d'avoine	45 à 50 —
—	de maïs	67 à 68 —
—	de haricots	75 à 78 —
—	de lentilles	78 à 80 —
—	de vesce	79 à 80 —
—	de graine de lin	67 à 68 —
—	de graine de colza	67 à 68 —
—	de moutarde	67 à 68 —
—	de pommes de terre	75 à 76 —
—	de graine de trèfle	80 —
—	de graine de luzerne	80 —

The second series comes from the work of **Georges d'Avenel** (1894). He provided price series for the different cereals (oats, rye, barley, wheat) from 1200 to 1800. Prices are given in francs and the measure used is the hectolitre. His series are reconstructed and took into account the increasing value of silver across the various centuries. Many criticisms have been addressed to these data (Labrousse, 1933, pp. 12-15). Indeed, even Labrousse criticised d'Avenel on two essential points: that the sources were incomplete, and that the average price was often calculated on a few data points. Regarding the first criticism, the sheer number of

² « In our good years premium quality corn weighs 79 to 80 Kg. per hectolitre; that of the second grade corn 77 to 78 Kg. per hectolitre ; and the third grade 75 to 76 Kg. per hectolitre.

sources provided by d'Avenel (1894, tome II, pp. 413-841 i.e. more than 400 pages; see an extract in appendix 1) cannot be ignored, even if he did not published all of them given the sheer number (“*Most of the prices that follows are taken from works and documents, both printed and in manuscript, that for the most part contain many more. The reader who would like more detailed information on wheat prices at a particular time or in a particular region of France should therefore consult the sources. The need to present a work of synthesis constrained me, and I had to make a choice.*” d'Avenel 1894, p.413). As regards Labrousse's second point, since the data on remote centuries -13th to 15th- are scarce, providing even some data, even if their estimation relied on very few numbers, was already an achievement. Despite these criticisms, the fact remains that the work of d'Avenel remained the most important collection of prices series stretching over such a long period (Labrousse, 1933, p.15).

The last set of data used was published in the *Encyclopédie du commerçant* (1855) giving wheat prices from 1202 to 1836. The measure was the hectolitre, and prices were given in Francs. This third series is the least detailed at our disposal, but it is quite similar to the Labrousse series.

Our study covers the period 1661-1789, which roughly corresponds to the period identified by Labrousse. Indeed, even if the *Ancien Régime* includes the two centuries from the reign of Henri IV (1589-1610) up to 1789, some historians limit it to the period 1661-1789, a period of a relative stability in absolutist rule after the death of Mazarin and the real impact of Louis XIV accession. Like Labrousse, we chose this second definition, allowing us to avoid becoming entangled in the period known as *la Fronde* (1648-1653).

3. THE EVOLUTION OF WHEAT PRICES DURING THE EIGHTEENTH CENTURY: A SECULAR INCREASE?

According to Labrousse, two elements characterise the course followed by the price of wheat in the eighteenth century. First of all, he thinks that the wheat price underwent an exceptional increase between 1726 and 1789; secondly, he thought that the period 1733-1817 (even 1733-1873) was a period of economic prosperity, during which prices increased. We will test these two hypotheses.

To compare our three databases we transform the Labrousse wheat price series for the period 1701-1725 by assuming that 1hl=77.89kg. The wheat price follows a similar path in our three sources, but the linear trends differ according to the series used: where the d'Avenel and the *Encyclopedie* series show a decrease, Labrousse points to an increase (Fig.4). This is certainly due to the shorter period covered by the Labrousse series, which omits the beginning of the period when prices were higher. This seems to be confirmed by taking account of a longer period. Despite Labrousse's thesis that prices increased over three centuries, the development of the wheat price over the period 1600-1890 does not confirm this point of view instead, prices are quite stable, alternating between decreasing and increasing (Fig 5). As maintained in Labrousse (1944), we can only confirm a definite increase from 1726 to 1873 (Appendix 2); but this was not exceptional!

Fig. 4 The development of the wheat price (HI in F) according to three series 1661-1789

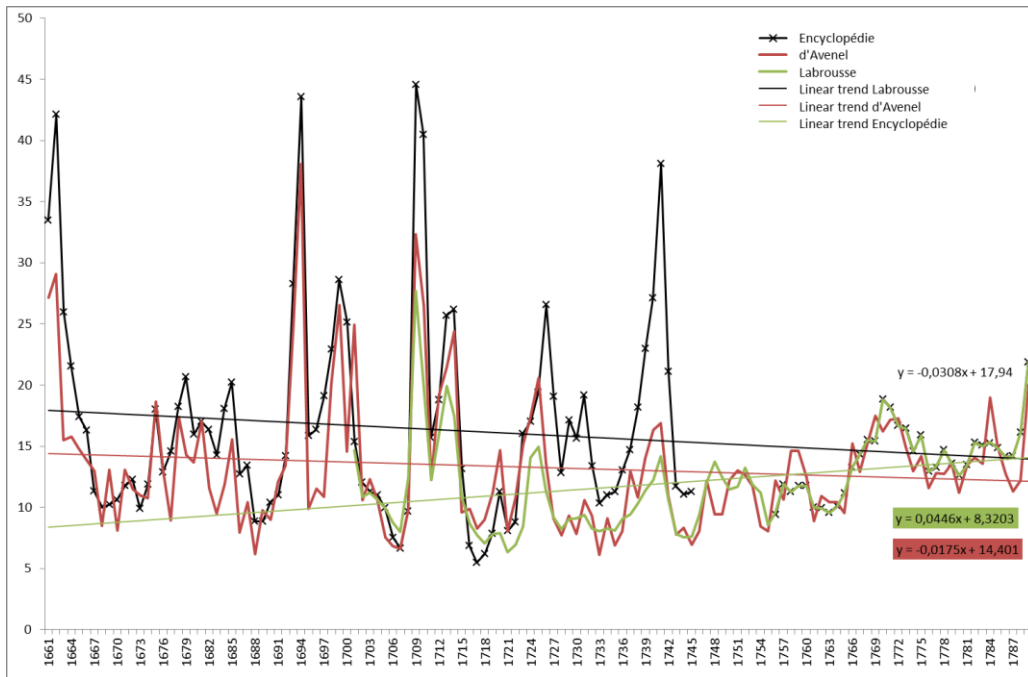
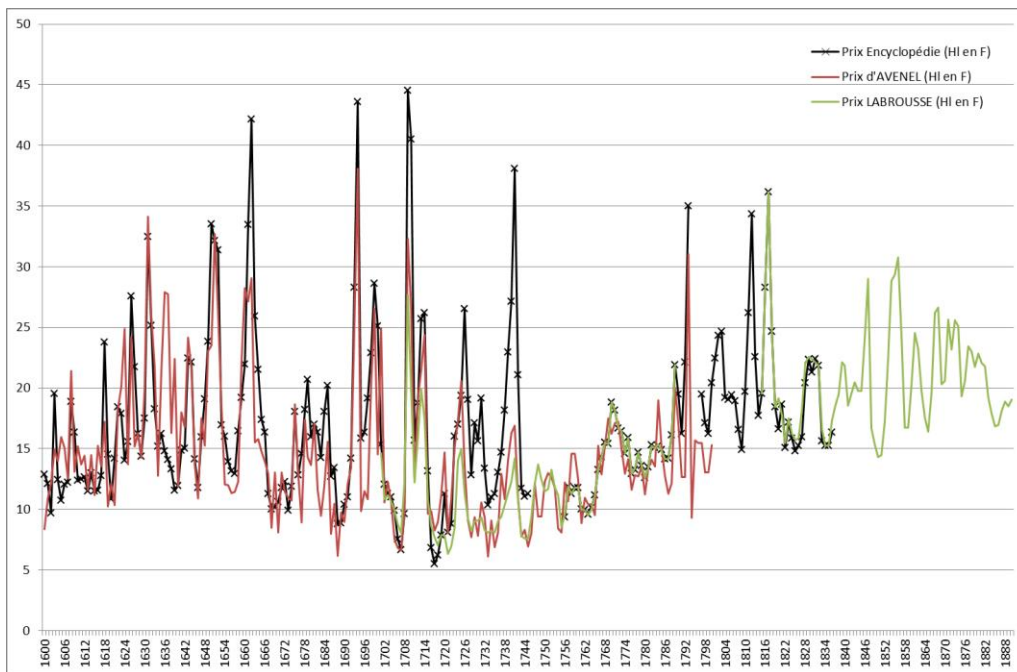


Fig. 5 The evolution of the wheat price (HI in F) according to three series 1600-1890



To analyse path followed by the wheat price in greater depth we use the methodology of outliers. This econometric method (Chen & Liu, 1993; Gómez & Maravall, 1997) detects atypical points affecting the evolution of a time series. It relies on real shocks, and thus allows us to distinguish between permanent and temporary shocks to a series, and is therefore more suitable for historical analysis.

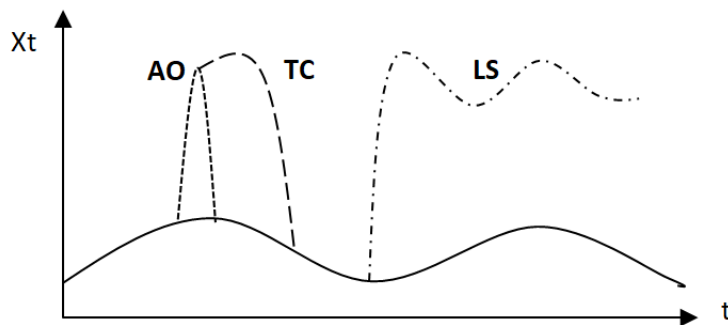
Here, we distinguish three main outliers:

- Additive Outliers (AO) that affect only a single observation at some points in a time series, and not its future values.

- Level Shifts (LS) that increase or decrease all the observations from a certain time point onward by some constant amount.
- Temporary Changes (TC) that allow an abrupt increase or decrease in the level of a series, which then returns to its previous level rapidly and exponentially.

It is considered that AOs are outliers that are related to exogenous and endogenous changes respectively in the series, and that TCs and LSs are more in the nature of structural changes. TCs represent ephemeral shifts in a series, whereas LSs are more the reflection of permanent shocks (Fig 6)³.

Fig. 6 Different outliers impact on a time serie X_t



Results show persistent outliers whatever the series analysed (Table 1). The events that have a real impact on the path followed by the wheat price appear to be meteorological. The year 1709, for example, influences all series. The years 1694-1695 are prominent in the d'Avenel and Encyclopedie series. 1694 has a positive impact on the wheat price, whereas 1695 has a negative impact on the price for this year.

Table 1. Outliers detection for the wheat price

Serie	Outlier	Type	Impact	Value
Encyclopedia	1695	LS	Permanent	-1,09
	1709	TC	Temporary	1,27
	1711	TC	Temporary	-0,77
D'Avenel	1694	AO	Temporary	0,99
	1709	TC	Temporary	1,28
Labrousse	1709	TC	Temporary	0,65

There is in any case no outlier detected in 1734 and in 1778. The well-known increase from 1734 appears neither in d'Avenel nor the *Encyclopedie* series, nor in Labrousse's. The break in 1778 does not appear either.

This analysis of the trend of the wheat price, comparing three different series, calls into question Labrousse's analysis. Indeed, using a longer period of analysis, we do not find a secular increase in the wheat price. Moreover, the exceptional rise in grain prices that would have occurred circa 1734 according to Labrousse does not appear, nor the break he identified in 1778.

³ For the reader interested in the complete mathematical and statistical presentation of the outlier methodology, please see Darné and Diebolt (2004, 2006).

Consequently we reject both Hypothesis 1 and Hypothesis 2. There is no increase in cereal prices during the (very long) 18th century (Hypothesis 1). By the same token, we do not detect any exceptional price increase in the eighteenth century, and especially between 1726 and 1789 (Hypothesis 2).

4. TREND, CYCLE AND “INTER-CYCLE”

This rejection of Hypotheses 1 and 2 suggests that we should investigate the inter-relationships between three kinds of phenomenon that Labrousse identifies as 1. the trend; 2. the cycle; and 3. an intermediate phenomenon in between the two preceding ones, which he calls an «intercycle».

Besides the secular trend he identified, Labrousse describes in *l'Esquisse* (1933) a decennial cyclical movement in prices (each cycle taking about 6½ years). So, can we conclude (with Labrousse) that there are Juglar cycles (Hypothesis 3)?

Regarding the long-run trend, Labrousse argues that:

“The so-called secular phase 1733-1817 is not all of a piece. Independently of short-run phases of increase and decrease that do not interest us for the moment, it incorporates some periods of slow progress, accelerated progress, and extraordinarily, a decline. It begins quite slowly, from 1733 to 1764, picking up speed just after the Seven Years War and quickly becoming exceptional. After a normal cyclical reflux – which, again, does not interest us here, around 1778 an abnormal reflux begins that assumes an intercyclical character, ending around 1787. The underlying change then resumes and persists, despite crises of a very different character, until the final years of the century, up to the period of the Consulate and the Empire, during which it again accelerates.” (Labrousse 1944, p. xxiii).

So is there an intercyclical fall in agricultural prices, of wheat and wine, between 1778 and 1791 (Hypotheses 4 and 5)?

4.1. The Cycle and long-run trend for wheat

To analyse the long-run tendency and cyclical component of each cereal price we use the modern method of spectral analysis (Diebolt et Doliger, 2006), which allows us to break down the time series into long-run tendency and cyclical components. This method is particularly appropriated in the study of business cycles because it allows detecting waves even if they are hidden “*in the bulk of all the other oscillations*” (Metz, 2011, p. 212).

This method analyses a time series X_t in respect of frequencies; low frequency refers to the long run, whereas high frequency refers to the short term. Econometric analysis divides the series into distinct fluctuations that allow us to describe the tendency and the cyclical component (periodicity + range) of a series.

A serie X_t can be divided as: $X_t = T_t + C_t + \varepsilon_t$ with T_t the tendency, C_t the cyclical component and ε_t a residual.

T_t is obtained by smoothing the series with an HP-filter and C_t is deduced by difference.

Hence the spectral analysis essentially concerns C_t .

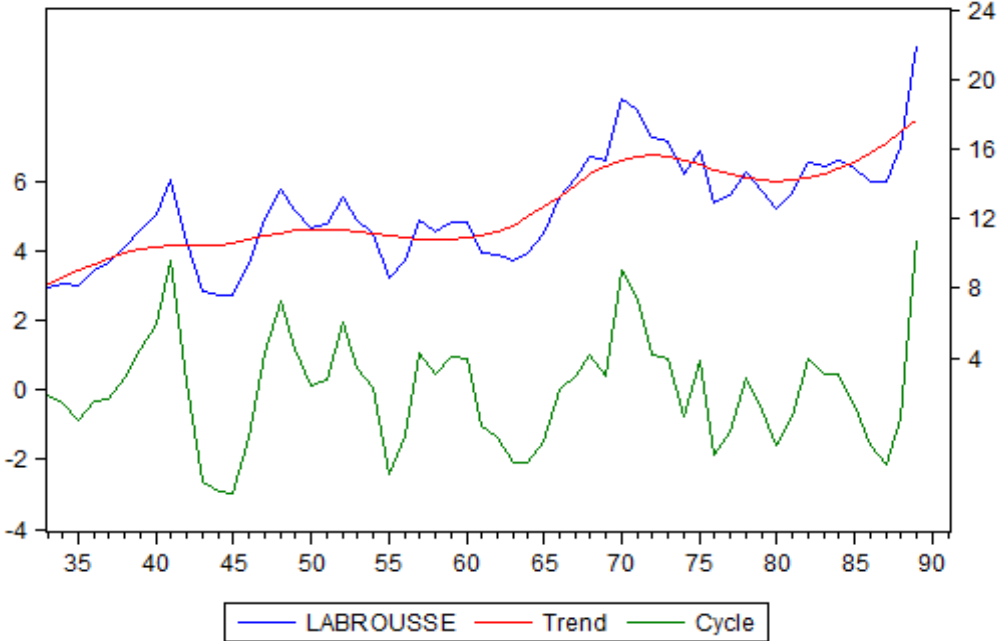
The spectrum of a series indicates the importance of the differing frequencies of the series. For this, we estimate the spectral density which provides for each frequency: the percentage of the variance of the series due to this frequency. The frequency with the higher density indicates the value of the cyclical component of the series.

With co-spectral analysis it is then possible to study the similarity (consistency) and the synchronisation (position) of the cyclical components of each cereal. The consistency measures the degree of linear correlation between same-frequency components of two series. The closer to “1”, the more similar the evolution. The position estimates the time-related gap between two series. A positive position indicates that the first series is k in advance of the second series.

Labrousse smoothed his series using a thirteen-year moving average (MA).⁴ This method is open to criticism for two reasons: first, it may introduce cyclical fluctuations (Slutsky, 1937; Bird et al, 1965) into series that do not such fluctuations (Slutsky-Yule effect); second, it is sensitive to aberrant value. We use here the Hodrick & Prescott (HP) (1997) filter instead of the MA method. The advantage of the HP filter over MA is that it is less sensitive to aberrant values than MA, and that it reduces the S-Y effect. It is moreover a tool favoured both at the national and the international level (Bouthevillain, 2002). It permits simultaneous estimation of different-frequency cycles. It is not necessary to smooth a series to remove short-term fluctuations (Klotz et Neal, 1973).

Over the period 1733-1791, whatever the series, we observe a slight increase of the wheat price from 1733 to the beginning of the 1760s. Then there is a rise until 1770, when the wheat price began to decrease, until the end of the 1770s. Following that it began to increase again after 1785 (Fig. 7-9). Spectral analysis shows that the wheat price has a ten-year cycle (the blue line indicates the frequency with the higher density, from which is deduced the cyclical component of the series).

Fig. 7 – Cyclical and spectral analysis of the Labrousse wheat price 1733-1789



⁴ Each year was replaced by the average of its value, the six previous years and the six following years.

Fig. 8 – Cyclical and spectral analysis of d’Avenel’s wheat price 1733-1791

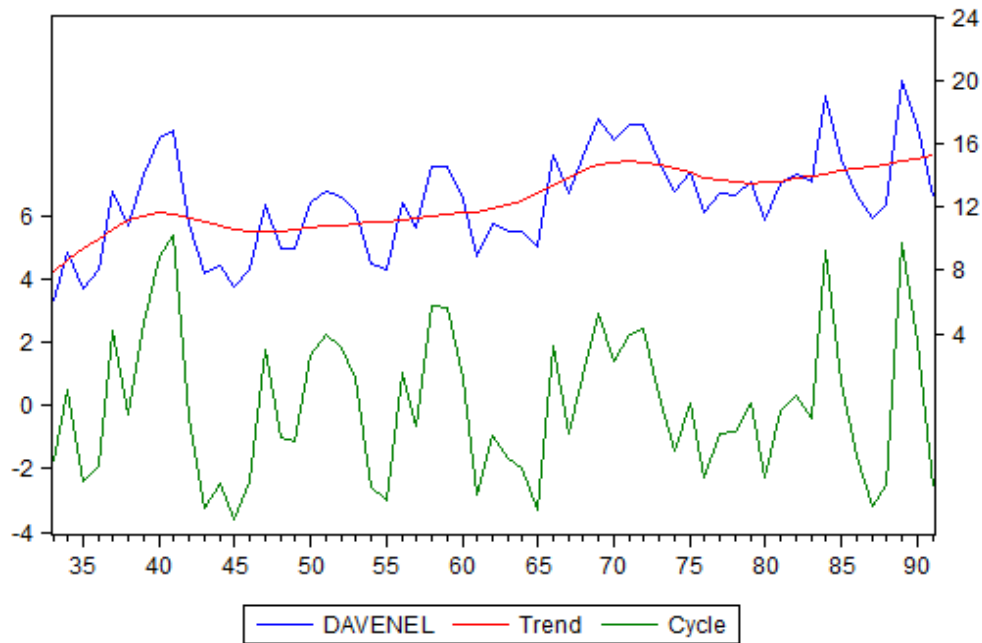
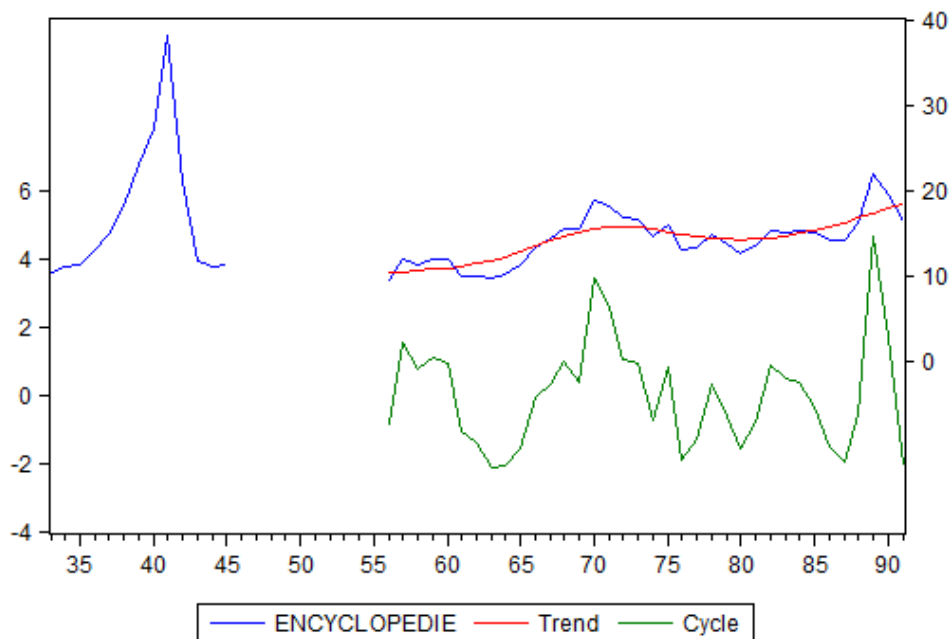


Fig. 9 – Cyclical and spectral analysis of the Encyclopedie wheat price 1733-1791



If the spectral analysis seems to confirm Labrousse’s thesis about a ten-year cycle in the wheat price, it provides perspective upon the secular increase. Indeed, this appears to be a succession of increasing and decreasing periods within what is admittedly a general increasing tendency, but not a secular one. The alternation of decreasing and increasing stages leads us to analyse the notion of inter-cycle as developed by Labrousse.

4.2. Cycle and “intercycle” for wheat and wine

In *La crise de l'économie française à la fin de l'Ancien Régime et au début de la Révolution*, Labrousse emphasises the existence of what he calls an intercycle. According to him, an inter-cycle is “*a decreasing or increasing fluctuation which contains an entire ten-year cycle and a part or the whole of another cycle; the phase lasts ten or twenty years and involves a marked decrease or increase*” (Labrousse, 1944, p. 200).

He identified this phenomenon for the wheat price over the period 1770-1791, with an inter-cyclical decrease from 1770 to 1780; he also talked about an inter-cyclical decrease of “wine revenue” from 1772 to 1782 (Appendix 5).

To begin with we analyse this notion of an intercycle for the wheat price, using the three series used previously. Then we focus on the wine price as a proxy for viticultural income.

The series are given in LT (Appendix 3 & 4). The long-run tendencies show that wheat and wine seem to follow a similar path until around the 1780s, when wheat increased at the same time that the wine price decreased (Fig. 10).

Over the whole period (1726-1789) the cyclical component of the wine price can be characterised by a 10 years cycle (Fig. 11), like the wheat price, so we can test for a common cyclical component with the wheat price using co-spectral analysis. We find that the consistency equals 0.3, so there is no correlation between wine and wheat price.

The cyclical analysis of the wheat price for the period 1770-1790 seems to confirm only partially the phenomenon of an inter-cycle (Fig. 12-13-14): whatever the series, it appears as an inter-cyclical decrease from 1770 to 1780 and an inter-cyclical increase from 1780 to 1791. However, even if the inter-cycle seems to be verified, these variations are not exceptional!

Contrary to the wheat price, the wine price shows a decrease throughout the period 1770-1790 (Fig. 15). Despite this general decreasing trend, with a high rate of decrease from 1778 to 1781, the wine price increased from 1785, calling into question the general fall of viticultural income as suggested by Labrousse.

Fig. 10 Long run tendencies of agricultural prices (Labrousse series)

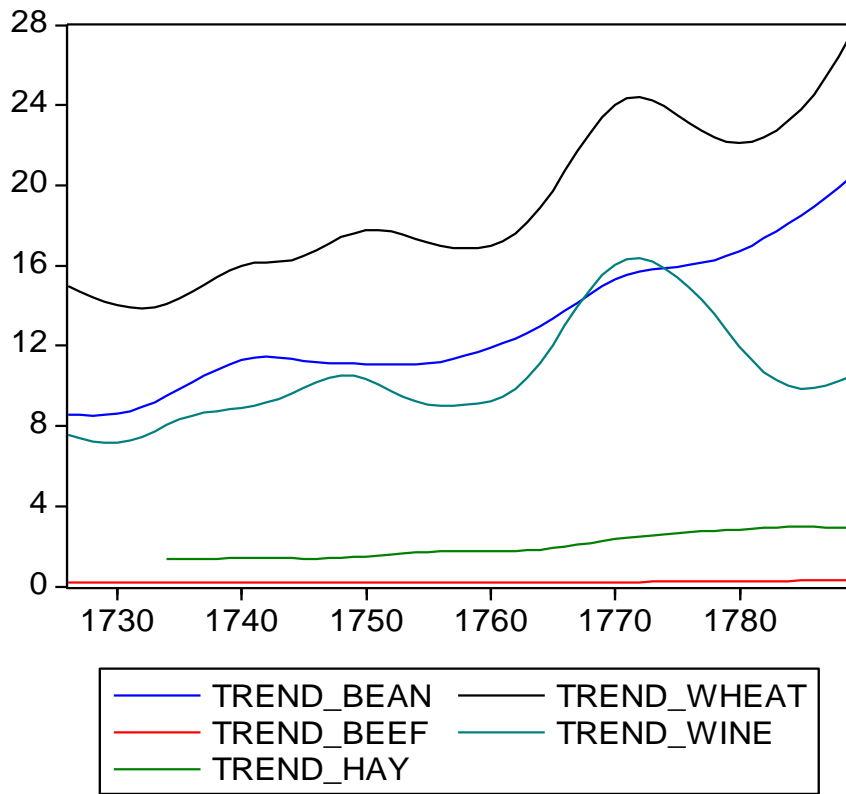


Fig. 11 Cyclical and spectral analysis of the wine price 1726-1790

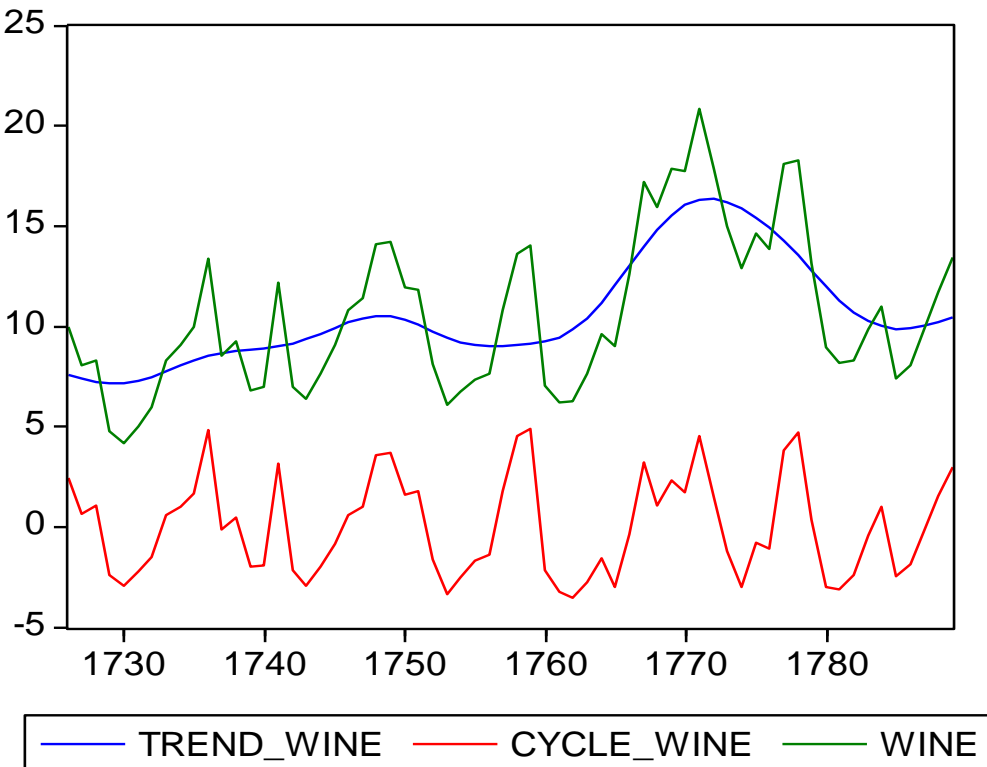


Fig. 12 – Cyclical analysis of Labrousse wheat price 1770-1791

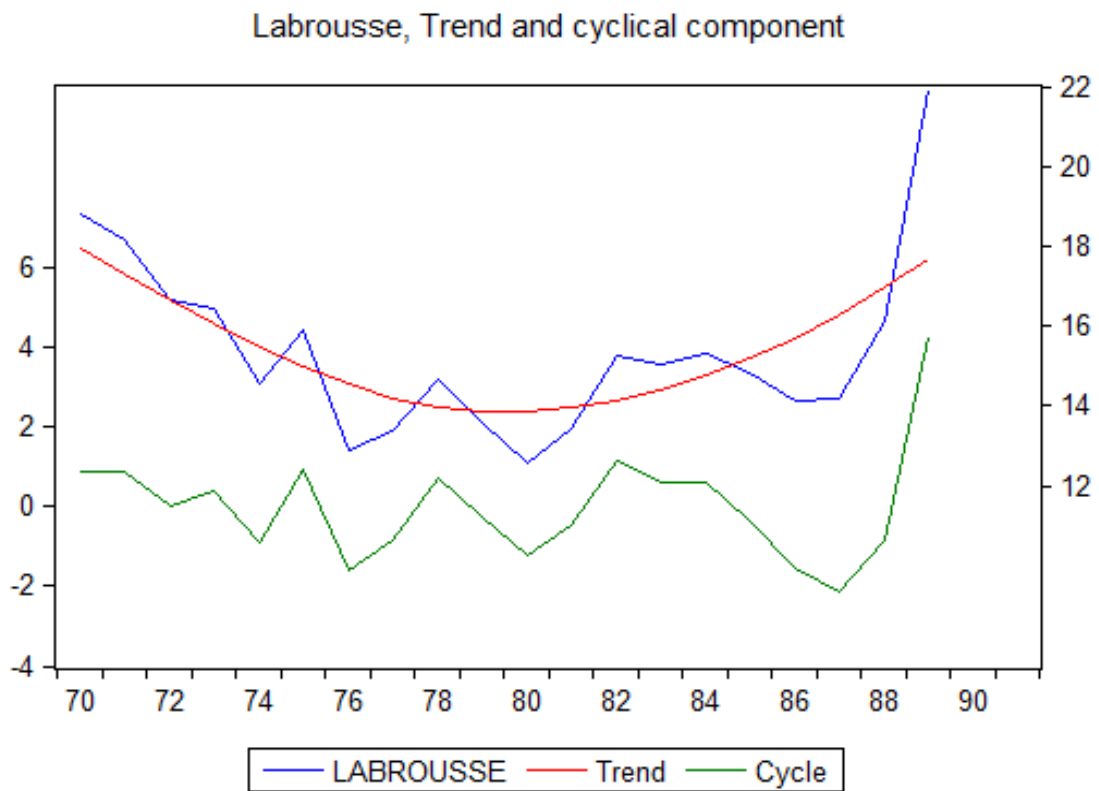


Fig. 13 – Cyclical analysis of d’Avenel wheat price 1770-1791

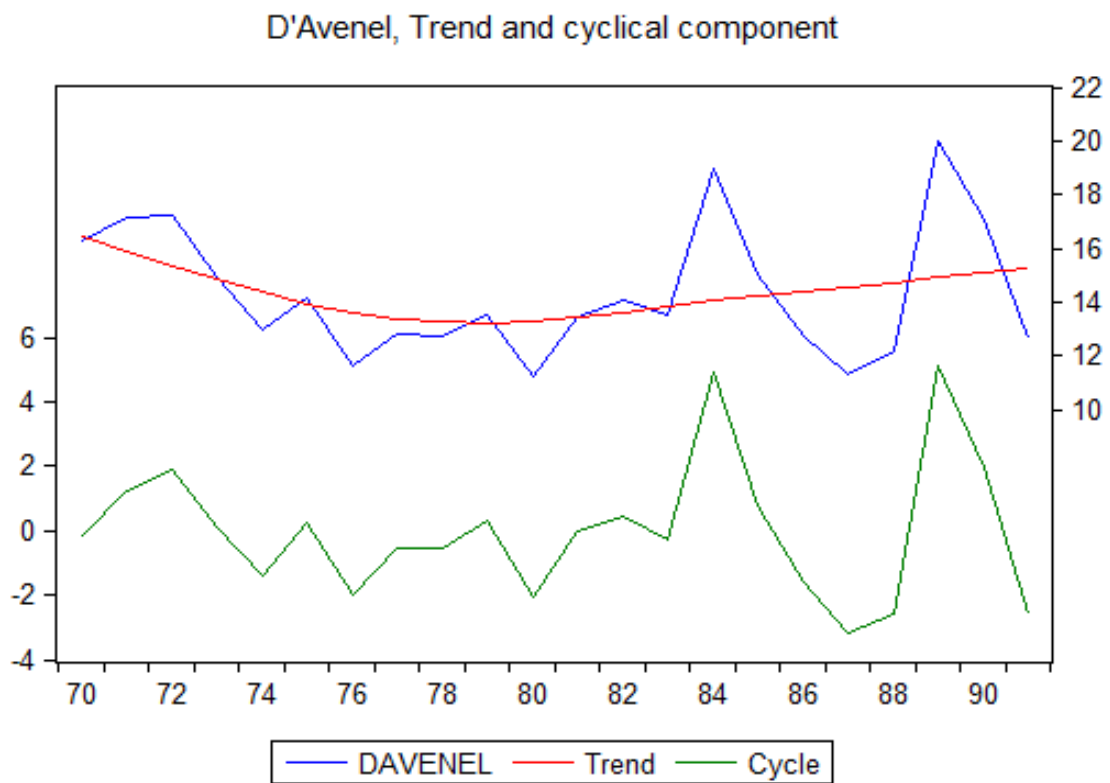


Fig. 14 – Cyclical analysis of Encyclopedie wheat price 1770-1791

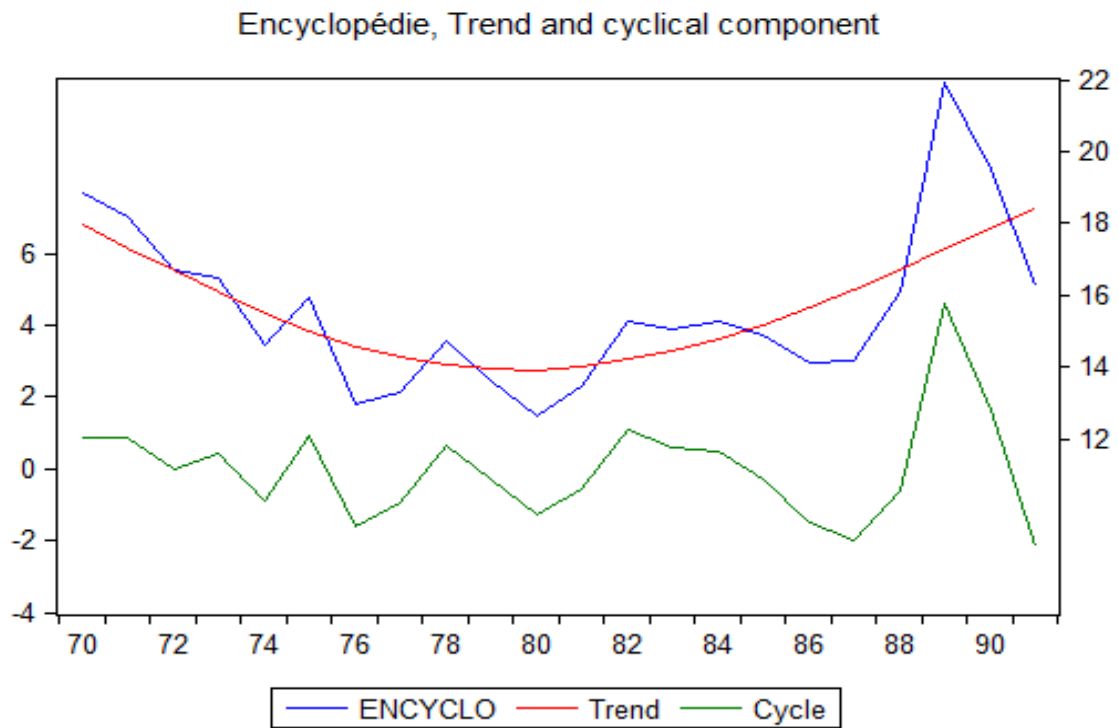
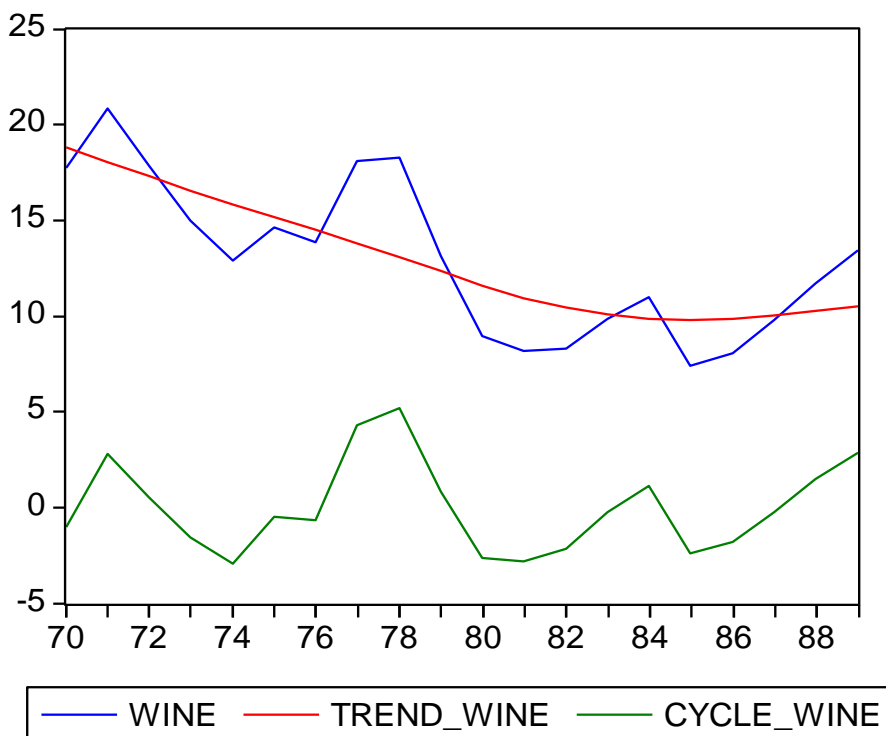


Fig. 15 – Cyclical analysis of wine price 1770-1789



5. VOLATILITY IN CEREAL PRICES

In *l'Esquisse* (1933) Labrousse also concludes that volatility in cereal prices increases as one moves down the hierarchy of cereals. In this last part we analyse the path taken by cereals prices (wheat, oats, barley, rye) using two databases: the series provided by d'Avenel, and that provided by Labrousse. The d'Avenel series cover the period 1661-1789 and gives the price of the hectolitre in francs (Fig. 16). The Labrousse series give the price of a setier (S) in livres tournoi (LT) and cover the period 1726-1789 (Fig. 17).

The price volatility is composed with three elements (Rzepkowski, 2001). The *historical volatility* shows the ex post price variations over a past period; it is the sum of two components: the unconditional volatility due to new events and the conditional volatility. The *conditional volatility* also named GARCH (Engle, 1982), measures the persistence effect proper to financial series. The *implicit volatility* corresponds to the risk price and represents the anticipated volatility. The conditional and implicit volatility are used with the aim of forecast and assessment of the market efficiency whereas the historical volatility appears more as a narrative tool.

So, in order to compare the price volatility for each cereal, we calculated the standard measure of the volatility: the standard deviation. We are conscious that this measure suffers from two essentials problems: first, series are non-stationary and affected by a trend which implies an inflated variance; secondly, the standard measure includes country and time-specific factors that indirectly influence market efficiency (Földvári & Van Leeuwen, 2011). However, our approach is historical and descriptive: we only try to determine what the price variations are across the various cereals and we do not analyse the market efficiency. Moreover, all the series are TS processes, so the inflated volatility affects all the series in the same way.

Fig. 16 The evolution of cereal prices – D'Avenel series 1661-1789 (Hl in F)

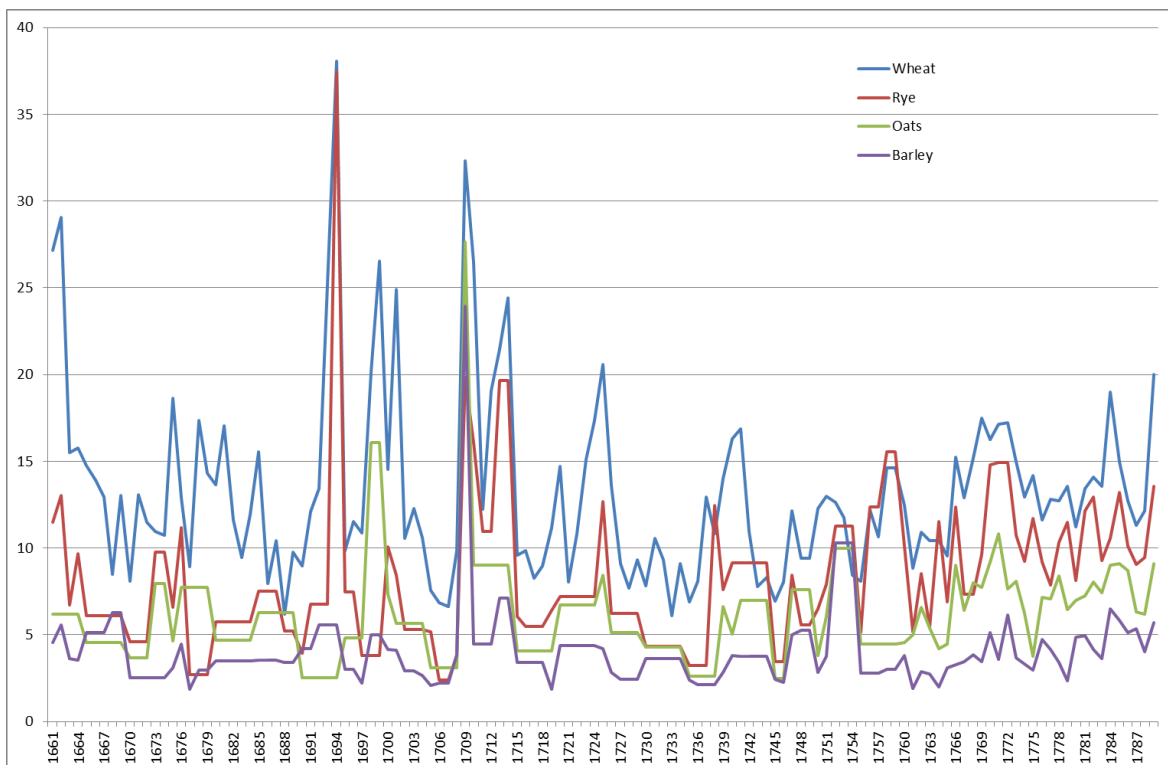
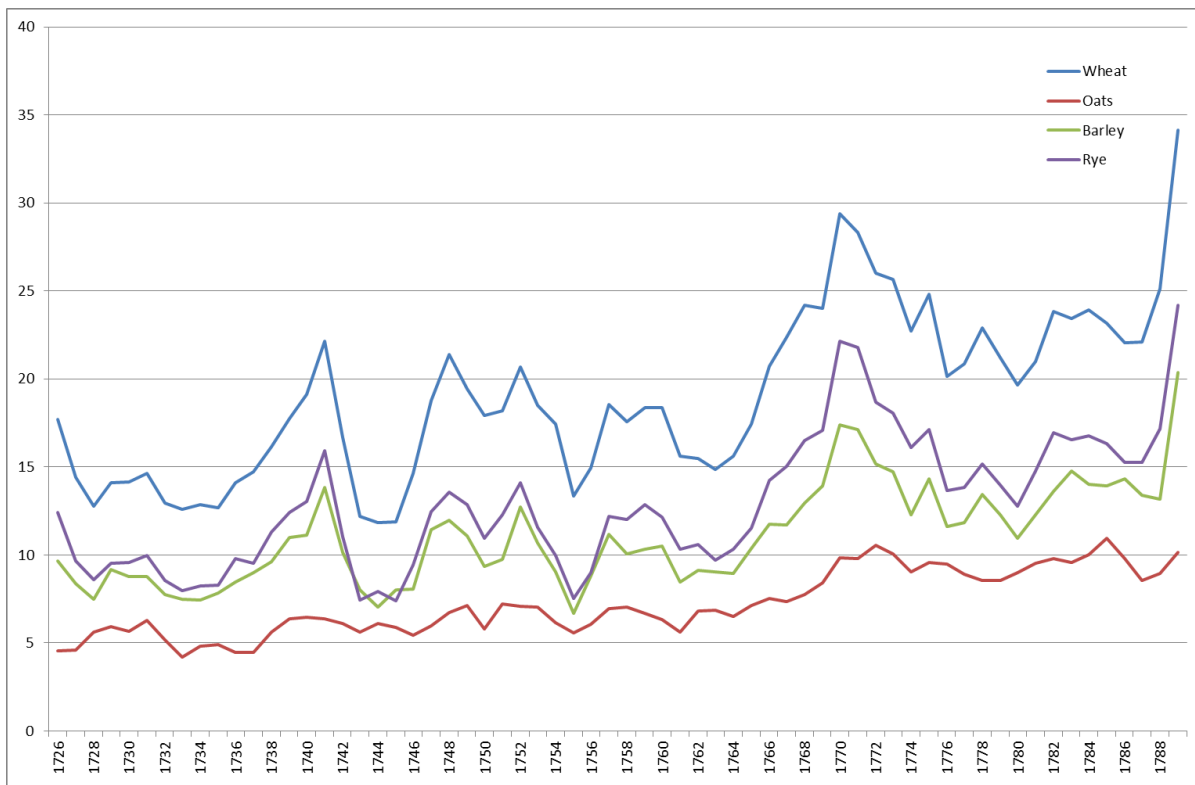


Fig. 17 The evolution of the cereal prices – Labrousse series 1726-1789 (S in LT)



We are interested in price volatility with respect to the hierarchy of grains: we compare price volatility by estimating the five-year variance of the price of each cereal in various periods.

Whatever the series used, the price volatility obeys almost the same hierarchy: the wheat price is more volatile than others cereal prices (Appendix 6 & 7). The higher volatility was observed during poor harvest periods (1691-1695; 1706-1710) (Fig. 18 & 19) and just before the French Revolution⁵. So we reject our Hypothesis 6, according to which volatility in grain prices increases as one goes down the cereals hierarchy.

⁵ This element is not tested here. Testing the impact of large shocks on prices volatility can be apprehended with the framework of GARCH-M and GJR-GARCH models (Charles & Darné, 2020).

Fig. 18. Price volatility – Labrousse series

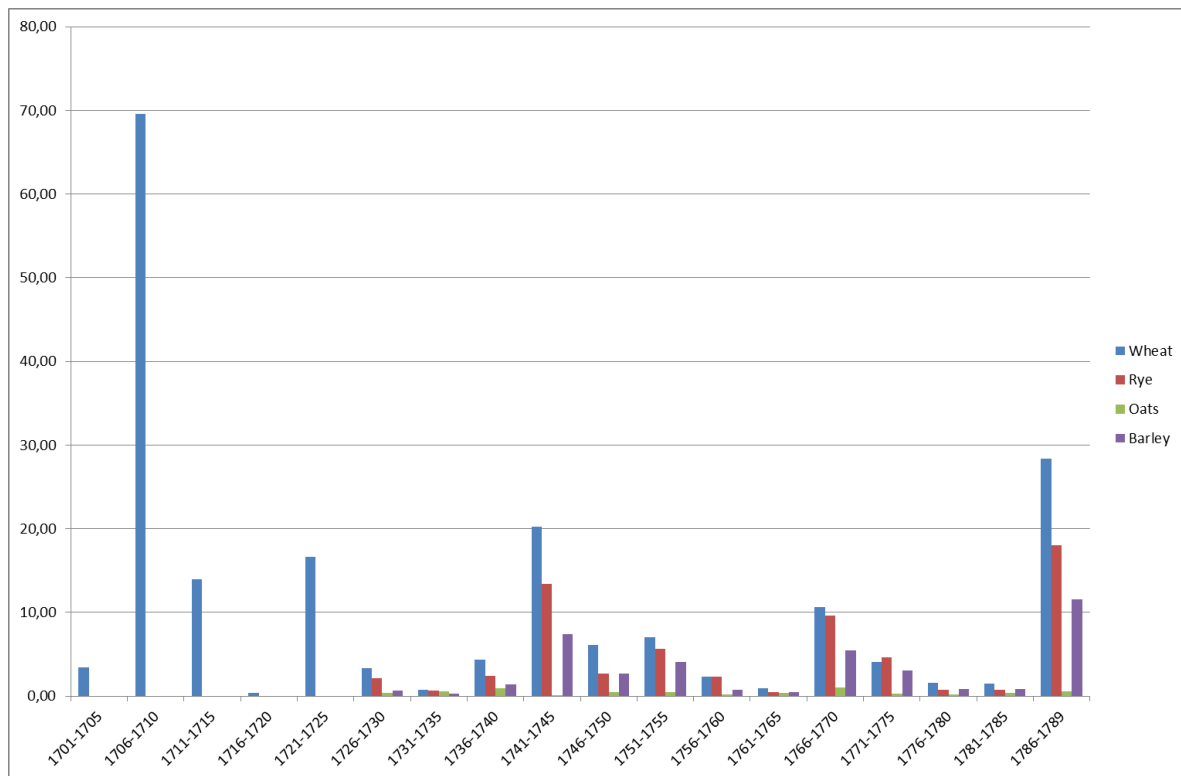
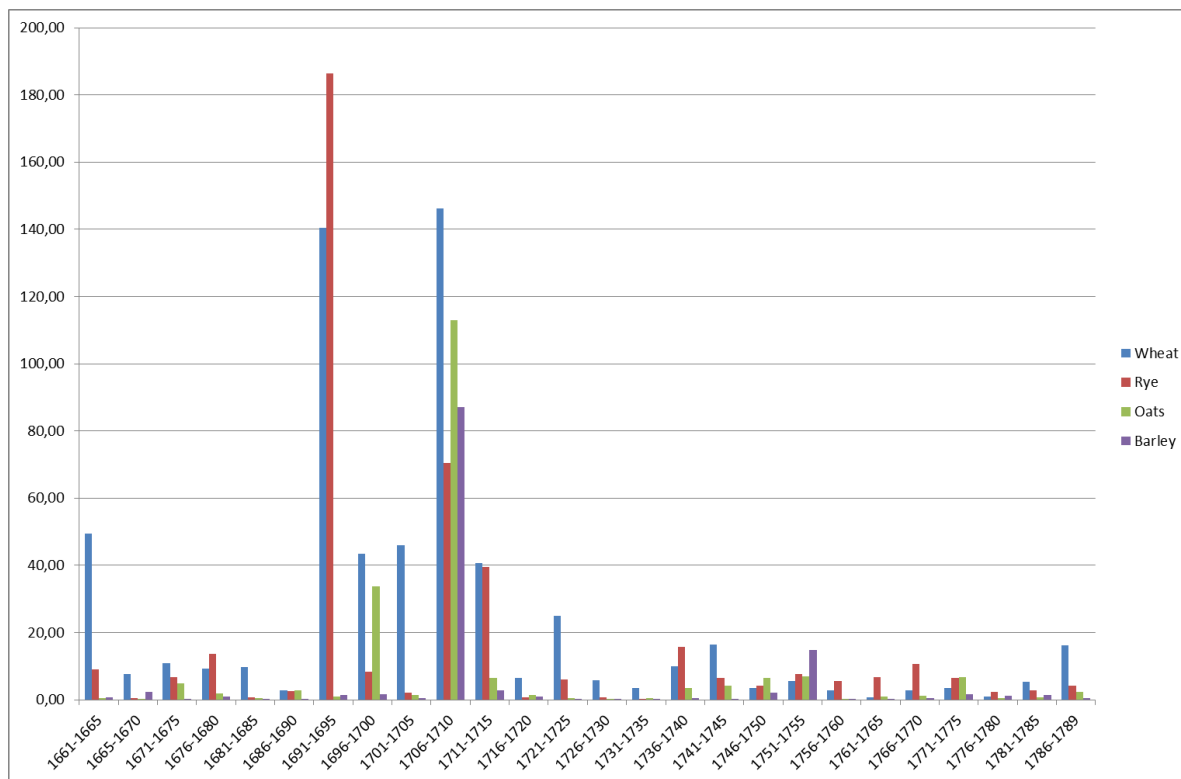


Fig. 19. Price volatility – d'Avenel series



6. CONCLUSION

Our analysis of the evolution of the wheat price partially questions Labrousse's analysis.

First of all, taking into account a longer period allows us to have a much better overview of the evolution of cereals price, and to disprove the existence of a secular increase in the wheat price. Moreover, the exceptional rise in grain prices that occurred circa 1734 does not really seem to exist, nor the break of 1778.

Secondly, if the analysis seems to confirm Labrousse's thesis about a ten-year cycle in the wheat price over the periods 1726-1789 and 1733-1789, it also allows us to reconsider the phenomenon of an inter-cycle with an adjusting function over the ten years before the Revolution.

Thirdly, we show that contrary to the wheat price, the wine price shows a decrease throughout the period 1770-1790. Despite this general decreasing trend, with a rapid decrease from 1778 to 1781, the wine price increased from 1785, calling into question the general fall of viticultural income that suggested by Labrousse as an explanation of the Revolution.

Finally, we show that, contrary to Labrousse (1933), price volatility almost conforms to the same hierarchy: the wheat price is more volatile than others cereal prices. This higher volatility was observed during poor harvest periods (1691-1695; 1706-1710), and just before the French Revolution. These common cyclical relationships, with the wheat varying more than others cereals, reveal the importance of the wheat price in cereal price regulation.

Finally, beyond partially disproving Labrousse's analysis, our study raised the question of the determination of the wheat price and that of the causes of the cycle. We find that meteorological conditions provide an exogenous factor, but the existence of a cyclical and inter-cyclical component also suggests an endogenous determination. This specific point will be the subject of further research.

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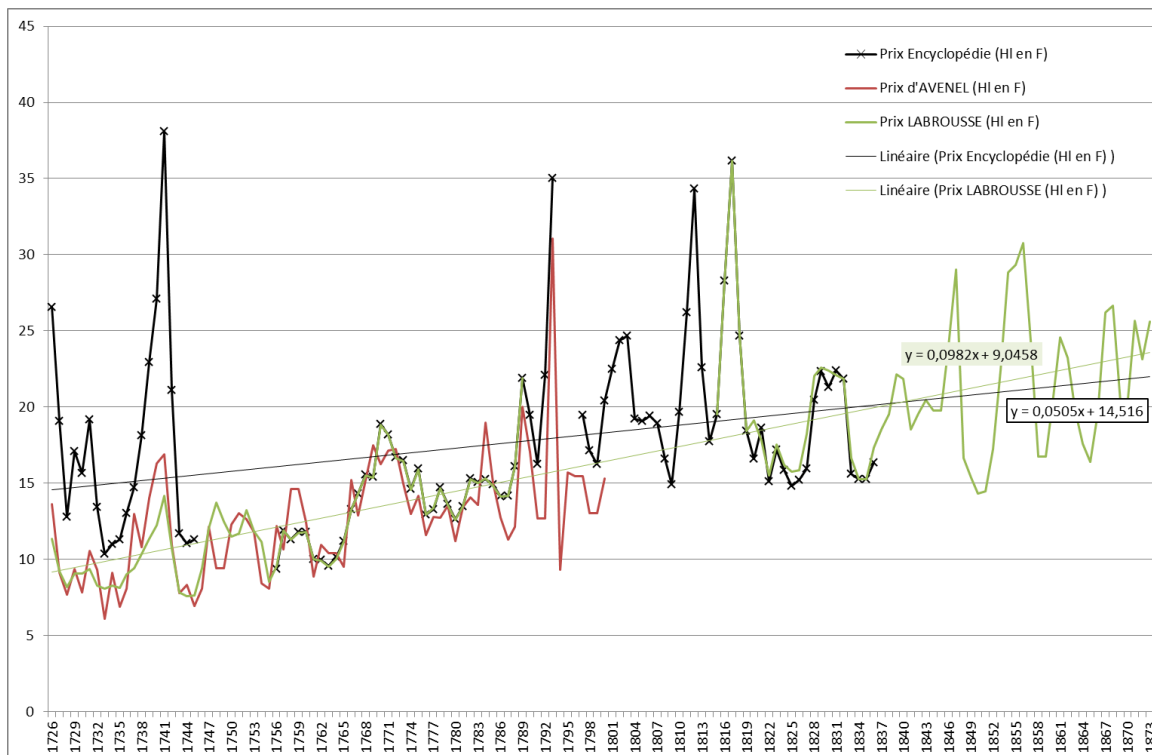
Appendix 1 – Extract from the d’Avenel source (1 page from 420)

PRIX DES FROMENTS				ET BLÉS ⁽¹⁾				
SOURCES DES PRIX CI-CONTRE.	QUANTITÉS de l'époque.	QUANTITÉS actuelles CORRESPONDANTES.	PRIX en MONNAIE de l'époque.	PRIX actuel COURRANT.	OBJETS.	LOCALITÉS.	DATES.	PRIX en francs de l'époque.
L. DeLisle, <i>Class agricole en Normandie</i> , 587.	La mesure.	4 hect. 94 lit.	40 sous.	69 00	Blé.	Saint-Taurin-d'Évreux (Eure).	1141	9 98
L. DeLisle, <i>Class agricole en Normandie</i> , 588.	La somme.	7 hect. 80 lit.	40 sous.	69 00	Froment.	Rouen.	1146	5 28
<i>Idea</i>	Le setier.	(Moy. 4 h. 50 l.)	5 sous.	6 10	<i>Idea</i> .	Normandie.	1150 (environs).	1 35
<i>Idea</i>	3 minis, 5 setiers et 1 minis.	194 hect. 81 lit.	31 l. 2 s. 6 d.	76 55	<i>Idea</i> .	Beaumont-le-Roger (Normandie).	1162	3 92
<i>Idea</i>	Le setier.	2 hect. 3 lit.	10 sous.	12 25	<i>Idea</i> .	Fosse-Louvain (Normandie).	1178	5 00
<i>Idea</i>	<i>Idea</i> .	2 hect. 4 lit.	12 s. 8 d.	15 51	<i>Idea</i> .	<i>Idea</i> .	1179	7 60
L. DeLisle, <i>Class agricole en Normandie</i> , 589.	Le minis.	57 hect. 46 lit.	7 l. 1 s. 2 d.	17 82	<i>Idea</i> .	Pays de Caux (Normandie).	1180	5 61
<i>Idea</i>	Le boisseau.	35 lit. 75 c.	1 sou.	1 25	<i>Idea</i> .	Cirencey (Manche).	1180	3 41
<i>Idea</i>	<i>Idea</i> .	35 lit. 75 c.	4 et 6 sous.	6 10	<i>Idea</i> .	Île de Jersey.	1180	15 60
<i>Idea</i>	<i>Idea</i> .	51 lit. 75 c.	5 sous.	6 10	<i>Idea</i> .	Mortain (Manche).	1180	9 85
<i>Idea</i>	<i>Idea</i> .	35 lit. 75 c.	5 sous.	6 10	<i>Idea</i> .	Cotentin.	1180	15 60
<i>Idea</i>	Le setier.	4 hect. 32 lit.	9 sous.	10 98	<i>Idea</i> .	Bayeux (Calvados).	1180	2 54
<i>Idea</i>	<i>Idea</i> .	4 h. 68 l. 50 c.	10 sous.	12 25	<i>Idea</i> .	Bacneville (Calvados).	1180	2 61
L. DeLisle, <i>Class agricole en Normandie</i> , 590.	Le minis.	45 hect. 80 lit.	2 l. 8 s.	58 76	<i>Idea</i> .	Evri (Normandie).	1180	1 25
<i>Idea</i>	<i>Idea</i> .	60 hect. 6 lit.	2 l. 10 s.	61 25	<i>Idea</i> .	Nonancourt (Eure).	1180	1 01
<i>Idea</i>	<i>Idea</i> .	56 hect. 94 lit.	3 l. 18 s.	95 30	<i>Idea</i> .	Vernueil (Eure).	1180	1 67
<i>Idea</i>	16 setiers 3/4.	72 hect. 38 lit.	7 l. 10 s. 9 d.	185 66	<i>Idea</i> .	Bayeux (Calvados).	1180	2 56
<i>Idea</i>	7 minis 23 minis.	479 hect. 24 lit.	20 l. 18 s.	512 00	<i>Idea</i> .	Maulieu-sur-Bille (Eure).	1180	0 87
<i>Idea</i>	Le minis.	56 hect. 80 lit.	1 l. 13 s.	40 40	<i>Idea</i> .	Varville (Normandie).	1180	1 09
<i>Idea</i>	Le setier.	4 hect. 32 lit.	14 sous.	17 15	<i>Idea</i> .	Bayeux (Normandie).	1184	3 96
<i>Idea</i>	Le minis.	46 hect. 80 lit.	8 l. 8 s.	205 76	<i>Idea</i> .	Gisors et Dange (Eure).	1184	5 30
L. DeLisle, <i>Class agricole en Normandie</i> , 591.	<i>Idea</i> .	63 hect. 18 lit.	4 l. 16 s.	117 56	<i>Idea</i> .	Bec-Thomas (Normandie).	1195	1 86
<i>Idea</i>	Le setier.	4 hect. 32 lit.	14 sous.	17 15	<i>Idea</i> .	Bayeux (Calvados).	1195	3 96

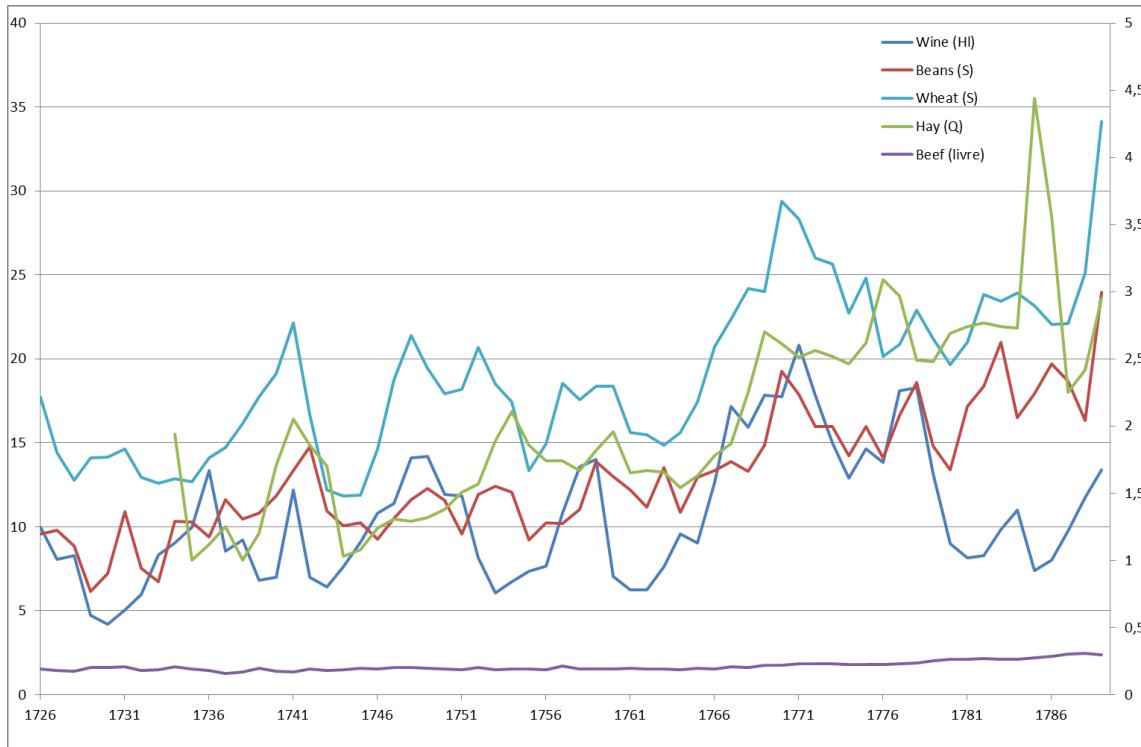
¹ Les prix des froments et des blés ont été réunis dans le même tableau, faute de pouvoir les distinguer. Cependant en pays. Le mot «froments» signifiait parfois la première qualité de blé, parfois le blé en général. Le mot «blés» équivaudrait au mot «blés» dans le même sens que le mot «grains». Mais, plus fréquemment, «blés» correspond à «froments»; chaque marché en un seul tableau, est de nature à faire laisser plutôt que laisser la moyenne que nous tirons des prix qui vont suivre.

deux mots, qui sont à peu près synonymes dans la langue contemporaine, ne l'étaient pas toujours dans le langage de nos aïeux. Le mot «froments», des récoltes et des seigles. On disait couramment du «blé méteil»; quelquefois aussi on employait à l'époque, d'ailleurs, des usages particuliers. Toutefois on doit considérer que la confusion de ces grains, diversement nommés

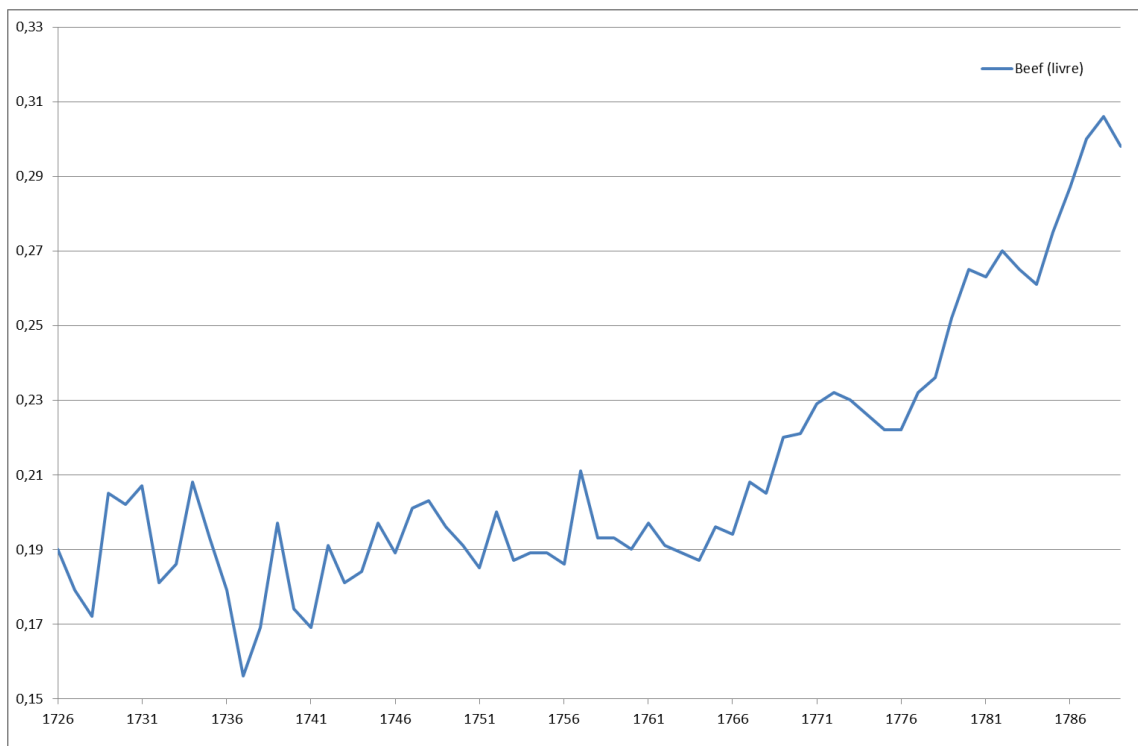
Appendix 2.



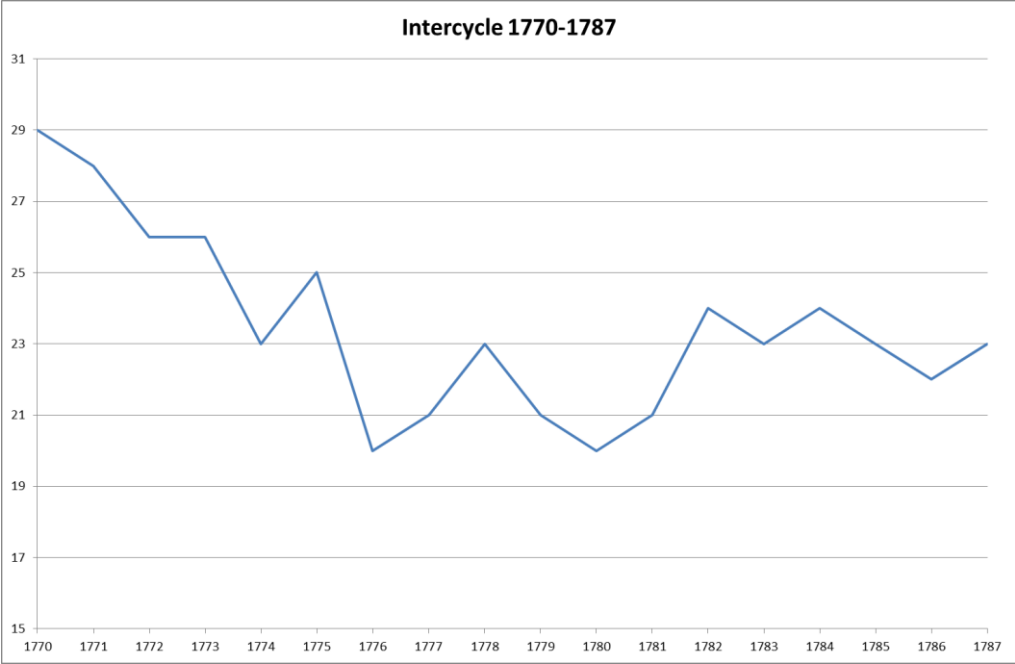
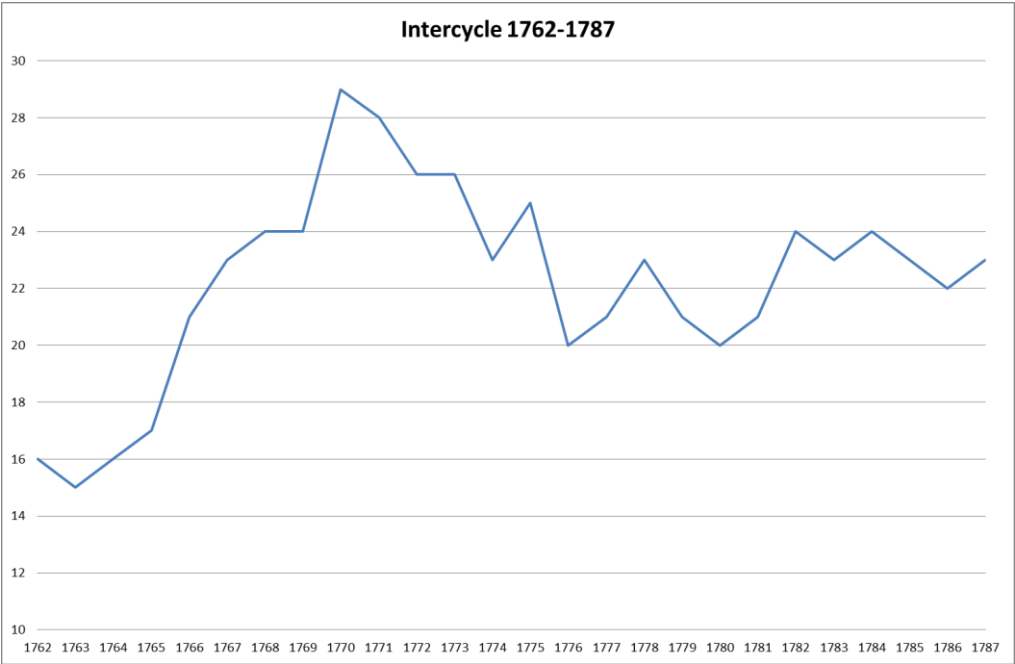
Appendix 3 Agricultural prices 1726-1789



Appendix 4 Beef price 1726-1789



Appendix 5. The notion of inter-cycle according to Labrousse (1944)



Appendix 6. Price volatility – Labrousse series

	Wheat	Rye	Oats	Barley
1701-1705	3,42			
1706-1710	69,56			
1711-1715	13,94			
1716-1720	0,33			
1721-1725	16,60			
1726-1730	3,33	2,11	0,42	0,68
1731-1735	0,72	0,61	0,57	0,30
1736-1740	4,34	2,38	0,94	1,43
1741-1745	20,27	13,43	0,08	7,39
1746-1750	6,15	2,72	0,48	2,65
1751-1755	6,98	5,66	0,46	4,08
1756-1760	2,28	2,28	0,18	0,75
1761-1765	0,91	0,45	0,33	0,49
1766-1770	10,60	9,59	1,01	5,48
1771-1775	4,11	4,63	0,33	3,01
1776-1780	1,54	0,72	0,15	0,84
1781-1785	1,44	0,73	0,34	0,82
1786-1789	28,41	18,02	0,54	11,52

Appendix 7. Price volatility – d’Avenel series

	Wheat	Rye	Oats	Barley
1661-1665	49,43	8,99	0,53	0,81
1665-1670	7,74	0,44	0,16	2,32
1671-1675	10,90	6,72	4,85	0,06
1676-1680	9,22	13,65	1,86	0,90
1681-1685	9,66	0,64	0,51	0,00
1686-1690	2,78	2,49	2,84	0,11
1691-1695	140,42	186,35	1,05	1,32
1696-1700	43,53	8,24	33,76	1,52
1701-1705	45,89	2,00	1,32	0,56
1706-1710	146,23	70,37	112,92	87,04
1711-1715	40,56	39,47	6,51	2,87
1716-1720	6,45	0,59	1,37	0,82
1721-1725	25,05	6,01	0,58	0,01
1726-1730	5,78	0,73	0,13	0,28
1731-1735	3,40	0,24	0,56	0,32
1736-1740	9,87	15,81	3,44	0,54
1741-1745	16,34	6,45	4,09	0,36
1746-1750	3,48	4,18	6,58	2,19
1751-1755	5,59	7,68	7,02	14,87
1756-1760	2,88	5,47	0,00	0,19
1761-1765	0,69	6,79	0,89	0,29
1766-1770	2,86	10,65	1,26	0,57
1771-1775	3,50	6,53	6,65	1,60
1776-1780	0,90	2,34	0,52	1,08
1781-1785	5,28	2,79	0,74	1,38
1786-1789	16,15	4,17	2,38	0,53