Applied Economic Analysis

The Catalan commercial integration with early modern Europe, 1630–1778

Carles Manera and Jose Perez-Montiel
Department of Applied Economics, Universitat de les Illes Balears, Palma de Mallorca, Spain

Oguzhan Ozcelebi
Department of Economics, Istanbul University, İstanbul, Turkey, and

Andreu Seguí
Department of Applied Economics, Universitat de les Illes Balears, Palma de Mallorca, Spain

Received 23 November 2023
Revised 20 April 2024
15 July 2024
Accepted 22 September 2024

Abstract

Purpose – This study aims to analyze whether the Barcelona markets integrated with Europe during the 17th and 18th centuries.

Design/methodology/approach – This study uses the unit root tests with multiple structural breaks under both the null and alternative hypotheses proposed by Carrion-i-Silvestre *et al.* (2009) and Harvey *et al.* (2013). These tests are robust to multiple unknown breaks in the series.

Findings – The results suggest that the Barcelona wheat markets integrated with some European cities during the 18th century.

Originality/value – The results are important because they highlight the importance of considering nonlinearities and structural breaks in the series to study market integration with historical perspective. Contrary to the results obtained using conventional unit root tests, when this study applies unit root tests robust to structural breaks in the series, it finds that the law of one price holds in some cases.

Keywords Nonlinearity, Unit root tests

Paper type Research paper

1. Introduction

During the 19th century, Catalonia followed the Industrial Revolution and became "the factory of Spain" (Nadal, 1975). According to Vilar (1958, 1974), Fontana (1973) and Pollard (1981), the roots of this process can be traced back to the 18th century, when

This work has been carried out thanks to the financial support of the research project PID2022-137648OB-C21, funded by Ministerio de Ciencia e Innovación (Madrid), MCIN/AEI/ 10.13039/501100011033 and by the European Regional Development Fund, "ERDF A way of making Europe".

Applied Economic Analysis
Emerald Publishing Limited
2632-7627
DOI 10.1108/AEA-11-2023-0444

Catalonia enjoyed a process of market development. Vilar (1958) and Fontana (1973) suggest that the most marked characteristic of the economic progress of 18th century Catalonia is a rapid adaptation to the fluctuations of foreign markets. These authors argue that external markets had a decisive influence in the Catalonian agrarian markets: They facilitated the specialization and intensification of crops that made it possible to overcome the classic Malthusian pitfalls and gave continuity to an economic expansion spurred on by population growth (Torras-Elias, 1984).

With insights from Vilar (1958) and Fontana (1973), Valls (2004) documents that, due to the French–Dutch armed conflicts, Catalonian wines and liquors were able to enter some European markets in the late 17th century. According to Torras-Elias (1981, 1984), the structure and the property rights of land in Catalonia enabled the region to take advantage of this situation and successfully achieve a significant degree of specialization (in grapevines, but also cereals and manufactures, see Badia-Miró and Tello, 2014) and a considerable integration with Atlantic Europe. As this process of market integration and specialization evolved, an increasing number of households began to produce to sell in the market, and eventually, capitalism developed in Catalonia (Martínez-Galarraga and Prat, 2016, p. 552).

However, can we conclude that the Catalan economy was integrated with other European economies in the early modern period? There is still considerable controversy on when and how European markets integrated (Gallego, 2004; Chilosi *et al.*, 2013). The debate is divided by those suggesting the existence of regional and national market integration for the early modern period (Jacks, 2004; Llopis and Sotocona, 2009; Persson, 1997; Rönnbäck, 2009; Chilosi *et al.*, 2013; Dobado-González *et al.*, 2012; Sharp and Weisdorf, 2013; de Zwart and Flynn, 2021; de Zwart and van Zanden, 2018); and those who argue that European integration took place in the first half of the 19th century (O'Rourke and Williamson, 2002, 2004; Bateman, 2011; Federico, 2011, 2012; Özmucur and Pamuk, 2007; Uebele, 2011; Federico and Tena-Junguito, 2017).

This paper contributes to this debate by studying the relationship between wheat prices in Barcelona and other European cities. For the empirical exercise, we use a unit root analysis which overcomes some of the shortcomings of the methods used in the existing literature. The main advantage of this approach is that it deals with inherent nonlinearity and unknown structural shifts in the time series.

The results of our research are mixed. On the one hand, they are in line with the studies defending the hypothesis that there was market integration before the 19th century, because we find that Barcelona was commercially integrated with Naples and Amsterdam during the early modern era. On the other hand, there was no market integration between Barcelona and other European cities like Winchester. Our results suggest that the Catalonian economy was internationally integrated before the industrial, transport and communication revolutions; however, the evidence of integration is rather scarce.

2. European market integration

The most generally accepted hypothesis is that the integration of European markets began in the 19th century under the auspices of the industrial and transport revolution [see O'Rourke and Williamson (2002, 2004); Bateman (2011)]. These phenomena made for outstanding changes in the availability of products and factors to the point of revolutionizing the entire global economy: While preindustrial economies were self-consumption economies in which trade and, above all, foreign trade, were secondary, the purpose of industrial economies turned into producing to sell, which is highly dependent on both internal and external commerce. But is there no evidence of market integration before the 19th century?

In the 17th century, a commercial system began to emerge in Europe. This system made regional economies more interdependent. At the same time, overseas expansion reinforced this articulation between European regions, providing incentives and a greater supply of monetary means (Allen, 2001). Large maritime distances were not a hindrance in communications during the preindustrial economic era (Barquín, 1997). Maritime transportation was the fastest way of transport of the time, guaranteeing connections between cities with access to nearby ports. The main drawbacks were primarily Corsair activities during wartime and climatic uncertainties. In both cases, the operation of insurance policies was a common practice among merchants, with risk premiums delineating the hazard margins of the proposed voyages. In addition, businessmen established commercial networks to save time in business dealings (Manera *et al.*, 2022).

Different studies show the integration processes of European markets during diverse periods of the modern age. Özmucur and Pamuk (2007) sustain that, although there is no continental tendency toward greater integration in the period 1500–1800, during the early modern era, parts of Europe became increasingly integrated between them and with other parts of the continent. Probably, the reduction in transport costs in the 17th and 18th centuries, an increasing labor productivity in maritime transport from the end of the Middle Ages until 1800 (Lucassen and Unger, 2000), and the decrease in piracy and privateering in the 18th century (Hillmann and Gathmann, 2011), contributed to explaining part of this regional market integration. In addition, European market integration benefited, first, from the Dutch penetration in the Baltic and, afterward, from the arrival of Dutch and English sailors and merchants into the Mediterranean (De Vries, 2009; Prak and van Zanden, 2024).

Jacks (2004) and Dobado-González *et al.* (2012), among others, affirm that a succession of phases of integration and disintegration characterized early modern Europe. These authors prove that, despite numerous interruptions, there was a long-term tendency toward commercial integration in the 18th century. On the other hand, Federico (2012) concludes that in the early modern Europe, there was a succession of stages of integration and disintegration, but does not find a clear tendency toward integration in the long term. Our paper contributes to this empirical debate by studying if Barcelona was integrated with other European markets in the 17th and 18th centuries.

3. The commercial integration of Catalonia across the 17th–18th centuries: Agricultural specialization and proto-industry

The Catalan economy faced an adverse situation from early to mid-17th century. The decrease in agricultural production is reflected in cereal prices with two especially violent cycles, 1628–1631 and 1634–1644, inserted in a generalized famine in Europe. The War of the *Segadors* (1640–1653), within the framework of the Thirty Years' War and the Plague of 1652 aggravated the inflation caused by bad harvests. It interrupted the configuration of a model based on agricultural specialization, with the consolidation of cereal in counties such as Urgell and the expansion of viticulture in Camp de Tarragona, and the advance of the textile proto-industry (Vilar, 1964; Torras-Elias, 1981; 1984; 1997; Sànchez and Valls, 2023).

The textile manufacturers experienced strong tensions in Barcelona at early 17th century, when the large workshops and merchants reduced production costs, with the help of cheaper rural labor, at the expense of the small workshops organized in guilds (Vilar, 1964, 2, pp. 318–324). Afterward, the Treaty of the Pyrenees (1659) facilitated the importation of French manufactures into the Principality (Molas, 1977, pp. 71–74). The sector responded to this increased competition with a specialization in producing fine woolen cloth in towns such as Igualada, Terrassa and Sabadell (Torras-Elias, 2008; Marfany, 2012).

Commercial agriculture also took off strongly during the last quarter of the 17th century, this time spurred on by foreign demand after England and the Netherlands boycotted French wine in response to taxes on the exit of Bordeaux wines. English and Dutch looked for new suppliers in the Iberian Peninsula, favoring the expansion of wine exports in Porto and Catalonia. Catalan viticulture, concentrated in Camp de Tarragona, was based on producing wine to be distilled in brandy, a product that was easy to manufacture and transport and whose consumption had spread throughout northern Europe. The business progressed rapidly in the Principality thanks to an emphyteutic system based on the *Rabassa Morta*, the involvement of Dutch businessmen based in Barcelona and lower taxation than in Castile (Torras-Elias, 1997; Badia-Miró and Tello, 2014; Fàbregas, 2014; Ferrer-Alòs, 2020, pp. 251–257) [1].

English and Dutch ships arrived at the Catalan coast at the beginning of the 17th century, loaded mainly with wheat and salted fish. From the last quarter of the 1600s onward, they began to load brandy and dried fruit produced in Catalonia with a destination to Amsterdam, from where they were redistributed throughout northern Europe (Torras-Elias, 1997). Barcelona did not monopolize these exports, which favored the Catalan integration in the Atlantic circuits, although it continued to be the central hub of the Catalan port system. Commercial agriculture and commercial relations with England and the Netherlands promoted the development of other ports in the Principality, such as Salou, Mataró and Arenys de Mar, which, in the long run, became competitors of Barcelona in distinct branches (e.g. shipbuilding) (Molas, 1977, pp. 71–74; García-Espuche, 1998, p. 32; 2004, pp. 263–64). The arrival of the Bourbons to the Spanish throne at the beginning of the 18th century generated uncertainty among the Barcelona bourgeoisie, fearful of the possible impacts that the *rapprochement* to France would have on the economic model forged during previous decades through contacts with the English and the Dutch (García-Espuche, 2004). The basis of this model, agricultural specialization and textile proto-industry, however, consolidated throughout the 1700s, marking the path for the subsequent industrialization of the Principality.

The correlation of the Barcelona cereal prices with those of Cervera, Tárrega, Gerona, Urgell and Segarra suggests an integration of grain prices in the regional market in this period. As a great center of consumption and importing market, the city of Barcelona had a powerful influence on the prices of the rest of the Principality. In contrast, Catalan production impacted the oscillations of the Barcelona market (Serra, 1988, pp. 260–266). After the War of Succession, the Principality progressively integrated into the national market, thanks to the abolition of internal customs, which also favored the sale of Catalan draperies in Castile (Llopis and Sotocona, 2009; Torras-Elias, 2008).

The price trend in Barcelona changed from the mid-17th century, with a slight increase between 1746 and 85 and a more pronounced rise until the end of the century (Feliu, 1991, p. 27). Between the War of Succession and the Napoleonic invasion, Catalonia did not go through as many episodes of extraordinary mortality as inland Spain did, and Barcelona got rid of those that other countries suffered (Ferrer-Alòs, 2021). The fluctuations in prices, very similar to those shown by the curves in France and other Mediterranean cities, are due to droughts or frosts, which caused severe supply problems. However, Barcelona managed to avoid the disturbances in Madrid in 1765 thanks to the importation of cereal, while in 1789, the popular discontent was similar to that registered in Paris (Vilar, 1964, vol. 3, pp. 443–470).

The arrival of foreign wheat, redirected from Barcelona to the rest of the Catalan territory, made it possible to mitigate the limitations of local harvests and smooth out the oscillations in the price curve. But the opposite situation also occurred when the Franco-British conflicts conditioned the arrival of foreign grain to Barcelona. In addition to the rise in prices, influenced by both factors, the cereal market was characterized by an expansion of the geography of the Catalan supply. The central Mediterranean ports continued to be Catalonia's main suppliers during the 18th century. However, shipments from the Thirteen Colonies, first on British and then on American ships, represented an increasing percentage of imports (Vilar, 1964, vol. 4: 98–99, 482–535; Martínez-Ruiz, 2005).

The Catalan drapery demonstrated a great capacity to adapt to changes in Castilian demand throughout the 18th century, during which the substitution of wool for cotton also stood out. The evasion of union regulations led to a verlagssystem in the hands of a small group of manufacturing merchants (Torras-Elias, 2008; Marfany, 2012). As far as aguardiente is concerned, the monopoly project (*estanco*) for this genre in the Crown of Aragon did not go ahead and, finally, it was suppressed in the Spanish European dominions six years later and replaced by an equivalent on retail sale (Torras-Elias, 1997). Regarding exports, Northern Europe continued to be the main destination for Catalan brandy, but there were changes regarding its redistribution. The Third Family Pact (1761) between France and Spain caused the ports of the Seine and the Belgian coast to displace Amsterdam (Ferrer-Alòs, 2020). The wars against England conditioned trade relations with northern Europe throughout the 18th century, which affected both the import of wheat and salted fish and the export of brandy and dried fruit. The limitations in these businesses, observed in cases such as that of the Alegre-Gibert company, led to the expansion of Catalan interests toward the Indies, first through the privileged port of Cádiz and then directly, with shipments doubling in the case of spirits from the enactment of the Free Trade Act in 1789 (Vilar, 1964, vol. 4, pp. 482–535; Ferrer-Alòs, 2020).

Based on the above-described evolution of the Catalan economy, we can affirm that Catalonia had commercial ties with other European economies in the early modern period. This leads us to ask to what extent the Catalan economy was commercially integrated with Early Modern Europe. To answer this question, we analyze the evolution of relative wheat prices in several European cities, with the wheat prices of Barcelona as *numéraire*, to study the fulfillment of the law of one price (LOP). To this aim, apart from conventional unit root tests, we use the unit root tests proposed by Carrion-i-Silvestre *et al.* (2009) and Harvey *et al.* (2013). These tests account for multiple structural breaks in the series when testing the null hypothesis of a unit root. To our knowledge, this is the first article in the literature using this methodological approach.

4. Data and methodology

4.1 Data set

As a standard-size unit, we use wheat prices in terms of grams of silver per liter and transform them into natural logs. Wheat prices are widely used in the literature on market integration because grain is a good proxy for inferring about the overall process of markets (see Chilosi *et al.*, 2013 for details). In addition, because grain markets were heavily regulated (Federico, 2011), we can assume that if grain markets were integrated, the markets for most other goods, easier and cheaper to transport, also were integrated.

We use the data from the Allen–Unger database. The price data for Barcelona is fully available for the period 1630–1778. We then select the wheat prices of several European cities to test whether they are integrated with the wheat prices of Barcelona. The selection of these European cities is based on the availability of data. Unfortunately, we only have reliable and available data for Arnhem, Winchester, Angers and Aix-en-Provence for the period 1630–1778. For the timeframe 1700–1778, we have proper data only for the cities of Amsterdam, Naples and Utrecht. Because there are numerous missing observations for the remaining cities of the Allen–Unger database for the period under analysis, making extrapolation impossible, we did not include them in the study because the results of the unit root tests would not be statistically reliable.

Thus, based on the disposable and proper data, we consider the cities Barcelona (Iberian Peninsula), Winchester (Northwestern Europe), Arnhem, Amsterdam and Utrecht (Western Europe), Angers and Aix-en-Provence (Northwest and South France, respectively) and

Naples (Apennine Peninsula). We are aware that the small number of cities is a shortcoming. However, these eight cities are overall representative of the areas of regional market integration reported by Chilosi *et al.* (2013). Using principal component analysis, Chilosi *et al.* (2013) identify seven areas of regional market integration in Europe for 1630–1789: Northwestern Europe, Western Europe, Central France, Helvetia, Central Europe, Apennine Peninsula and the Iberian Peninsula. Because we incorporate cities that belong to the regions reported by Chilosi *et al.* (2013), we analyze whether wheat prices follow the LOP beyond the frontiers of these regional or segmented markets, i.e. we test the fulfillment of the LOP between, not within, European regions. Unfortunately, due to the lack of appropriate data for the analysis, we cannot represent the regions Helvetia and Central Europe. However, we dispose of data on wheat prices in French, Dutch and British cities, allowing us to study the commercial integration between Barcelona and Atlantic Europe (see Figure 1).

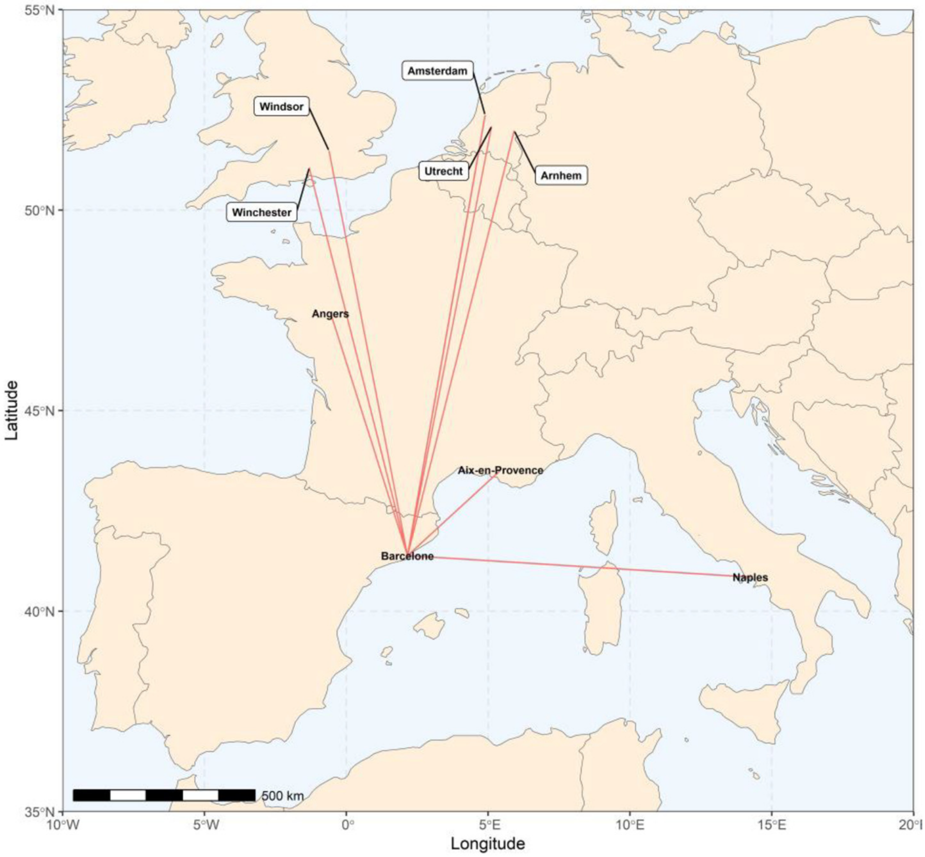
We study the relationship between markets with different geographical characteristics, such as coastal or inland markets within northern Europe, which may affect the wheat price in Barcelona (Vilar, 1964; Serra, 1988). Because we have available data for the wheat prices of the eight cities only for 1700–1778, in Figure 2 we plot all price series (in red color) across this period for comparison. We also plot the relative wheat prices (with Barcelona as *numéraire*) in green color. Figure 2 suggests heterogeneity in the evolution of wheat prices, with phases of relative stability and epochs of exceptionally low or high prices. For the LOP to apparently hold, visual observation should indicate a tendency in the price series (red line), while the relative prices (green line) should present a stationary trend. In most cases, this is what Figure 2 seems to depict; however, there are clearly different phases in the tendency of both the level and the relative prices. Thus, given the evidence of breaks in the series, we use a nonlinear approach to study the integration of these markets.

4.2 The law of one price

We test the existence of market integration by testing the LOP. Although cointegration provides relevant evidence of market integration (Persson, 2004; Ejrnæs and Persson, 2000), following Dobado-González *et al.* (2012), we are more restrictive to consider market integration and require the LOP to hold, which means that the cointegration parameter must be equal to −1. We thus test integration between distant markets in a way consistent with the LOP.

The rationale behind the LOP posits that in an efficient market, arbitrage opportunities are temporary (Dobado-González *et al.*, 2012: 684). This suggests that over the long run, trade eradicates arbitrage opportunities. In an ideal scenario, devoid of transaction costs, prices for identical goods across integrated markets would converge. Stochastically, the strong version of the LOP implies the natural logarithm of the relative price between Barcelona and Amsterdam, i.e. $\ln(P_t^{Ams}/P_t^{Bar})$, over the studied period, can be depicted as a constant zero-mean random variable, subject to temporary shocks oscillating around this mean.

However, in the real world, we must adopt a weaker version of the LOP, allowing for a constant mean of the two log nominal prices to deviate from zero. This nonzero mean accounts for transaction costs. Thus, a secondary requirement within our analytical framework is stationarity, i.e. the presence of a (zero or nonzero) constant mean within the time series of the relative prices. Following Dobado-González *et al.* (2012), we examine cointegration by testing only the nonstationarity of the log relative prices between two cities [e.g. $\ln(P_t^{Ams}/P_t^{Bar})$]. Once we establish that individual nominal prices in levels are nonstationary, verifying the stationarity of relative prices entails assessing the validity of the LOP between two cities: $P_t^{Ams}/P_t^{Bar} = c$, or $\ln(P_t^{Ams}) - \ln(P_t^{Bar}) = \ln(c)$. If price logarithms are first-order integrated variables, for the LOP to hold, the prices of the two cities must be cointegrated with a cointegration vector (1, −1). That is:



Source: Authors' own creation

Figure 1. The seven cities included in the sample

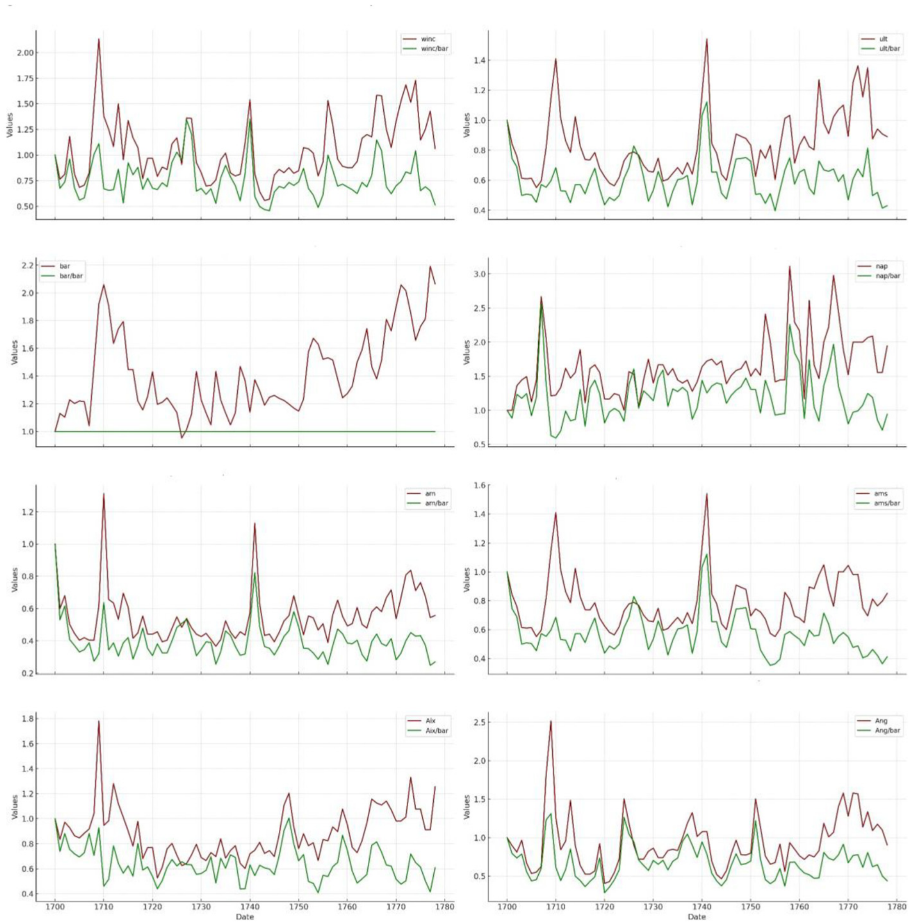
$$\ln\left(P_t^{Ams}\right) - \ln\left(P_t^{Bar}\right) \sim I(0) \quad (1)$$

Thus, when the LOP holds, the markets are said to be integrated.

To analyze the simultaneous evolution of a set of variables (in this case prices), a starting point is the vector autoregressive (VAR) framework. When these variables can be first-order integrated and they show cointegration relations, the S. Johansen procedure can be used to test and estimate cointegration relations and different constraints. The baseline VAR model can be expressed as follows:

$$\Delta Y_t = \mu + \Pi Y_{t-1} + \sum_{j=1}^{p-1} \Gamma_j \Delta Y_t + \varepsilon_t, \quad (2)$$

where Y_t is a vector (mx1) of variables, in our case wheat prices, ε_t is a vector (mx1) of random variables, iid $(0,\Omega)$, μ is a vector (mx1) of constants, Π y Γ_j (j = 1,…,m) are matrixes



Source: Authors' own creation with Allen–Unger data

Figure 2. Wheat prices and relative wheat prices with Barcelona as *numéraire* (1700 = 1)

(mxm) of coefficients and Δ is the differential operator, so that $\Delta Y_t = Y_t - Y_{t-1}$ is the observed change in the wheat price at moment t.

The long-term properties of the previous model depend on the range, r, of matrix Π. If it has a null range ($r = 0$), then the variables are not cointegrated and they evolve independently in the long term. If matrix Π has a full range (r = m), the system's variables are stable. Finally, the most interesting situation arises when the matrix's range is an intermediate one, $0 < r <$ m. In this case, there are r cointegration relations among the variables and $n - r$ common stochastic trends, and matrix Π can be written as $\Pi = \alpha\beta'$, where α and β are matrixes (mxr). Matrix β captures the cointegration vectors while matrix α contains adjustment factors.

Several studies in economic history evaluate the LOP internationally to analyze market integration (Rogoff *et al.*, 2001; O'Rourke and Williamson, 1994; Klovland, 2005). Dobado-

González *et al.* (2012, 2015) provide a comprehensive literature review on the timing of price convergence, tracing it back to the 18th century through an international examination of wheat prices. However, a limitation of the methods used in the existing literature on the LOP is that they do not consider potential structural breaks in the variables. Perron (1989) warned that the power to reject the unit root null hypothesis decreases substantially if the data contain an ignored structural break. Thus, by considering nonlinearity and structural breaks within the price series, we expect that the unit root tests that this paper uses to study the LOP will yield more evidence of market integration. In other words, we aim to uncover some up-to-now "hidden" market integration.

4.3 Unit root tests with multiple structural breaks

Because integration can be susceptible to structural changes, we explore the adherence to the LOP while considering nonlinearity and structural breaks within the price series. Upon visual inspection of the time series (Figure 2), it seems that the variables may have undergone structural breaks in most instances. Unaddressed structural breaks can introduce bias into the results, and the potential nonlinearity of this relationship warrants further empirical investigation – for detailed discussions, see Perron (1989, 1990, 2006) and Zivot and Andrews (1992), among others. This issue is nontrivial, as the presence of structural breaks may influence the outcome of a threshold cointegration analysis. Instead of relying solely on simple augmented Dickey–Fuller (ADF) or Kwiatkowski–Phillips–Schmidt–Shin tests, it may be advisable to consider the test proposed by Perron and Rodríguez (2003). However, the application of this test would depend on the outcomes of the pretesting stage, which involves determining the presence of structural breaks using the test statistic outlined in Perron and Yabu (2009). It is worth noting, though, that, as demonstrated by Harvey *et al.* (2013), using such pretesting statistics can yield suboptimal results if the magnitude of the change in the slope of the time trend is minimal – a scenario which is relevant in the current context. Thus, careful consideration is required when deciding on the appropriate methodology for addressing structural breaks in the analysis.

Therefore, we use the generalized least squares (GLS)-based unit root tests with multiple structural breaks under both the null and alternative hypotheses, as proposed by Carrion-i-Silvestre *et al.* (2009). Commonly used unit root tests with structural changes, such as those by Zivot and Andrews (1992), Perron (1997) or Vogelsang and Perron (1998), assume that if a break occurs, it only does so under the alternative hypothesis of stationarity. The methodology introduced by Carrion-i-Silvestre *et al.* (2009) addresses many of the issues encountered by standard unit root tests when dealing with unknown break dates. Carrion-i-Silvestre *et al.* (2009) propose a class of modified GLS tests, referred to as MGLS, originally developed by Stock and Watson (1999) as M tests. These tests use GLS detrending of the data, as suggested by Elliott *et al.* (1996), and use the modified Akaike information criteria to determine the order of autoregression.

5. Results

The first step is to test whether the price series have a nonlinear structure. We have found that the Jarque–Bera normality tests reject the null hypothesis of normality for each of the series at the 5% significance level. This result indicates a nonlinear structure in the variables. This suggests the necessity of using a nonlinear approach. In fact, we apply the two-step cointegration test of Engle and Granger (1987) and do not detect cointegration due to the presence of nonnormality in the data. This indicates the necessity of using a nonlinear approach to study the fulfillment of LOP.

The next step is to test the level of integration of the individual log price series. This is a crucial step: The log relative price can be stationary because both log nominal prices are stationary; this, however, has nothing to do with the LOP, which requires that the log nominal prices are cointegrated with a cointegrating parameter equal to −1. Thus, verifying that the series are not stationary in levels is important before studying the stationarity of the relative log prices.

When checking the stationarity properties of the price series, we face a problem: Conventional unit root tests indicate that only the series of wheat prices in Barcelona is nonstationary. Table 1 shows that all series except Barcelona are stationary at the 5% significance level. According to Dobado-González *et al.* (2012), this result implies that nominal prices are not market-clearing: Because stationarity implies a long-term fixed, constant value, a stationary price level cannot change over the long run as to clear the market (Dobado-González *et al.*, 2012, p. 682). Thus, we cannot test the LOP with the logarithms of the wheat price series being stationary.

However, given that trend breaks are typically observed in macroeconomic time series, it is essential for unit root tests to accommodate them to prevent the significant power loss associated with unmodeled trend breaks. Perron (1989) demonstrated that neglecting trend breaks in the data leads to unit root tests with virtually no power, even in asymptotic conditions. Therefore, we adopt the Model II proposed by Carrion-i-Silvestre *et al.* (2009), which considers that the structural break may impact the slope of the time trend. In our analysis, we use the procedure that permits up to three breaks, allowing for a more comprehensive assessment of the data and ensuring that trend breaks are appropriately accounted for in the unit root tests.

Table 2 shows that, across the period 1700–1778, the null hypothesis of a unit root with multiple structural breaks cannot be rejected at the 5% level in any of the tests for Barcelona, Naples and Amsterdam. For the period 1630–1778, we do not reject the null for Barcelona and Winchester. Thus, for the period 1630–1778, we can test the LOP for the relative wheat price of Winchester with respect to that of Barcelona; while the 1700–1778 data allows testing the LOP for the relative wheat price of Amsterdam and Naples with respect to Barcelona. We cannot test the LOP between the prices of Barcelona and those of the rest of the cities because the latter are stationary and, thus, are not market-clearing prices (Dobado-González *et al.*, 2012).

Next, we proceed to check the stationary properties of the relative wheat prices with Barcelona as *numéraire*. Table 3 indicates that for the period 1700–1778, the null hypothesis is rejected only for the relative prices of Naples. Thus, the wheat prices of Barcelona and Naples operate according to the LOP, indicating evidence of market integration of Barcelona with Naples during the 18th century. Hence, we conclude that allowing for unknown

Table 1. Conventional unit root tests for the log price series

	1700–1778				1630–1778				
	$\ln P_t^{Ams}$	$\ln P_t^{Utr}$	$\ln P_t^{Nap}$	$\ln P_t^{Bar}$	$\ln P_t^{Arn}$	$\ln P_t^{Win}$	$\ln P_t^{Ang}$	$\ln P_t^{Aix}$	$\ln P_t^{Bar}$
ADF	−3.91*	−3.91*	−5.81*	−2.65	−5.26*	−4.10*	−4.18*	−3.06*	−5.03*
DFGLS	−3.01*	−3.40*	−1.01*	−1.58	−2.43*	−4.12*	−4.11*	−3.00*	−3.21*
PP	−3.88*	−3.95*	−5.69*	−2.57	−5.27*	−3.98*	−4.08*	−4.01*	−4.00*
KPSS	0.15*	0.55*	1.14*	0.50	0.31*	0.32*	0.30*	0.17*	0.22*

Notes: This table presents the *t*-statistics of the conventional unit root tests. * indicates the stationarity of the series at the 5% significance level
Source: Authors' own creation

Table 2. Generalized least squares (GLS)-based unit root tests with multiple structural breaks of Carrion-i-Silvestre *et al.* (2009) for the log price series

	1700–1778					1630–1778			
	$\ln P_t^{Ams}$	$\ln P_t^{Bar}$	$\ln P_t^{Nap}$	$\ln P_t^{Utr}$	$\ln P_t^{Arn}$	$\ln P_t^{Win}$	$\ln P_t^{Ang}$	$\ln P_t^{Aix}$	$\ln P_t^{Bar}$
MZA	−16.65	−19.32	−21.54	−22.18*	−32.53*	−21.67	−30.47*	−27.56*	−22.82
MSB	0.17	0.16	0.15	0.15*	0.12	0.15	0.13	0.134*	0.14
MZT	−2.89	−3.10	−3.28	−3.33*	−4.03*	−3.29	−3.90*	−3.29*	−3.37

Notes: This table presents the *t*-statistics of the generalized least squares (GLS)-based unit root tests with multiple structural breaks of Carrion-i-Silvestre *et al.* (2009) for the log price series. * means rejection of the null at the 5% level. We use Model II in Carrion-i Silvestre *et al.* (2009): Structural break may affect the slope of the time trend. The critical values were obtained by simulations using 1,000 steps to approximate the Wiener process and 10,000 replications
Source: Authors' own creation

Table 3. Generalized least squares (GLS)-based unit root tests with multiple structural breaks of Carrion-i-Silvestre *et al.* (2009) for the log relative prices

	1700–1778				1630–1778		
	$\ln\left(P_t^{Nap}/P_t^{Bar}\right)$	$\ln\left(P_t^{Ams}/P_t^{Bar}\right)$	$\ln\left(P_t^{Utr}/P_t^{Bar}\right)$	$\ln\left(P_t^{Arn}/P_t^{Bar}\right)$	$\ln\left(P_t^{Ang}/P_t^{Bar}\right)$	$\ln\left(P_t^{Aix}/P_t^{Bar}\right)$	$\ln\left(P_t^{Win}/P_t^{Bar}\right)$
MZA	−29.77*	−18.86	−22.15*	−9.47	−18.31	−24.97*	−20.05
MSB	0.13*	0.16	0.15*	0.23	0.16	0.14*	0.15
MZT	−3.85*	−3.06	−3.29*	−2.17	−3.02	−3.53*	−3.16

Notes: This table presents the *t*-statistics of generalized least squares (GLS)-based unit root tests with multiple structural breaks of Carrion-i-Silvestre *et al.* (2009) for the log relative price series. * means rejection of the null at the 5% level. We use Model II in Carrion-i Silvestre *et al.* (2009): Structural break may affect the slope of the time trend. The critical values were obtained by simulations using 1,000 steps to approximate the Wiener process and 10,000 replications
Source: Authors' own creation

multiple structural breaks in the series provides more support for the LOP hypothesis in the 18th-century Europe than conventional, i.e. linear, unit root tests. That said, evidence of European market integration is scarce. We also reject the null for the relative price of Utrecht for the period 1700–1778, and Aix-en-Provence for the period 1630–1778, but since the prices of Utrecht and Aix-en-Provence follow a stationary process, we cannot conclude that the LOP is fulfilled for these pairs of cities.

Finally, we apply the minimum GLS detrended Dickey–Fuller statistic (MDF) of Harvey *et al.* (2013) to test if the relative prices under study follow a stationary process. These authors consider that the fixed magnitude trend break asymptotic theory of Carrion-i-Silvestre *et al.* (2009) does not predict well the finite sample power functions of M tests, and power can be very low for the magnitudes of trend breaks typically observed in practice. In response to this problem, Harvey *et al.* (2013) propose a unit root test that allows for multiple breaks in trend both under the null and the alternative hypotheses, obtained by taking the infimum of the sequence (across all candidate break points in a trimmed range) of local GLS detrended ADF-type statistics, MDF_m. They show that this procedure has power that is robust to the magnitude of any trend breaks, thereby retaining good finite sample power in the presence of plausibly sized breaks. They also demonstrate that, unlike the OLS detrended infimum tests of Zivot and Andrews (1992), these tests display no tendency to spuriously reject in the limit when fixed magnitude trend breaks occur under the unit root null.

Table 4 presents results for the MDF_1 and MDF_2 (Harvey *et al.*, 2013) tests applied to the relative prices at the 5% significance level. We find that the test which permits only a single break (MDF_1) rejects in favor of stationarity for the relative prices of Barcelona and Amsterdam for the period 1700–1778. We also reject the null for the relative price of Barcelona and Naples, as we did with the test of Carrion-i-Silvestre *et al.* (2009). Finally, we see that for the period 1630–1778, we reject the null for the relative price of Barcelona and Arnhem when considering a single structural break (MDF_1), but the price of Arnhem follows a stationary process, so we cannot test the LOP for this pair of cities.

The case of market integration between Barcelona and Naples is *a priori* not surprising given its close ties with the Catalan coast (Camprubí, 2019). The records of the entry of ships in the Barcelona port, published in the Madrid Gazette, indicate that the Neapolitan coast was the third or fourth most important origin of the ships that arrived between 1776 and 88, after France, England and, depending on the year, the Netherlands (Vilar, 1964, vol. 4: 88–98; Bacquelaine *et al.*, 1988) [2]. In addition, Naples, together with Genoa, financially linked the Italian peninsula with Madrid through, precisely, Barcelona, where families of Neapolitan merchants such as the Brunasso, Picetty and Berio settled, and there were commercial companies with correspondents in the Neapolitan city (Maixé-Altés, 1987, Maixé-Altés, 1992, Maixé-Altés, 1994, pp. 259–260).

Our results also yield some support on market integration of Barcelona with Amsterdam. This aligns with the documented commercial relations developed between the Spanish Monarchy and the Netherlands during the second half of the 17th century, after the signing of the Treaty of Münster (1648). The Dutch navigation stood out as a neutral flag during the conflicts of the House of Austria against France and England, achieving privileges and advantages that strengthened its position. Spanish–Dutch commercial contacts weakened during the first two decades of the 18th century, as a result of Spain's political *rapprochement* with France and Great Britain, the Spanish Succession War and competition from French and British merchants, which caused the failure of businesses such as the Kies–Jäger company in Barcelona (Fàbregas, 2014). This situation forced the Netherlands to change its strategy from 1720 onward, thereby opting to relocate its agents and prioritize direct contact with the colonial market. However, the shift in trade policy did not imply an abandonment of its interests in the Iberian Peninsula, where a Dutch colony persisted in Cádiz, nor did it prevent

Table 4. Unit root tests with multiple structural breaks using the minimum Dickey–Fuller statistic (MDF) of Harvey *et al.* (2013) for the log relative prices

	1700–1778			1630–1778			
	$\ln\left(P_t^{Nap}/P_t^{Bar}\right)$	$\ln\left(P_t^{Ams}/P_t^{Bar}\right)$	$\ln\left(P_t^{Utr}/P_t^{Bar}\right)$	$\ln\left(P_t^{Arn}/P_t^{Bar}\right)$	$\ln\left(P_t^{Ang}/P_t^{Bar}\right)$	$\ln\left(P_t^{Aix}/P_t^{Bar}\right)$	$\ln\left(P_t^{Win}/P_t^{Bar}\right)$
MDF_1	−3.84*	−3.768*	−3.11	−4.43*	−2.80	−3.26	−2.88
MDF_2	−5.29*	−3.77	−3.60	−4.41	−2.99	−3.52	−3.08

Notes: This table presents the *t*-statistics of the unit root tests with multiple structural breaks of Harvey *et al.* (2013) for the log relative price series. * indicates rejection of the null at the 5% level. Structural break (m =1, 2) may affect the slope of the time trend. We use the modified Akaike information criteria (MAIC) to select the order of the autoregression k. The critical values for MDF_1 and MDF_2 are taken from Harvey *et al.* (2013), Table 1, and are −3.85 for MDF_1 and −4.58 for MDF_2
Source: Authors' own creation

Dutch shipping from continuing to be the link between the Baltic and Mediterranean Spain, where, throughout the 17th century, the demand for products from northern Europe increased (Israel, 1990; Crespo, 2000, pp. 21–36; 2009). Thus, the significant integration found is in line with the relevance that the Dutch had in the importation of cereals and the promotion of commercial agriculture related to the export of brandy in Catalonia (Torras-Elias, 1997; Ferrer-Alòs, 2020).

In sum, our findings might reveal that market integration might be due to the type of connection between the cities. Naples and Amsterdam were connected to Barcelona, either directly or with stops, via maritime routes, while the rest of the cities under study had an intermediary port always. However, more research on it is needed, and the new economic geography models can be relevant to link these findings with the role of location.

6. Conclusions

We study the fulfillment of the LOP between wheat prices in Barcelona and other European cities across the 17th and 18th centuries. Our empirical results align with the existing literature pointing to the existence of market integration before industrialization. However, our study stands out in several aspects: First, by means of robust unit root techniques, we study market integration between Barcelona and eight European cities. Second, allowing the presence of structural breaks in the series enabled us to identify unit root properties in the log price series that conventional unit root tests did not identify. This allows us to test the fulfillment of the LOP for markets which otherwise would not have been submitted to empirical evaluation. Our findings, hence, place the importance of accounting for nonlinearity and structural breaks to analyze the LOP. In sum, we provide new information on the international integration reached by the Catalonian economy during the 18th century.

We have found that Barcelona was commercially integrated with Naples and Amsterdam between 1700 and 1778. Other relative prices also follow a stationary process during this period; however, we have not been able to validate the fulfillment of the LOP because most of the wheat prices under study also follow a stationary process. This means that those are not market-clearing prices, i.e. they do not change over the long run as to clear the market. For the period 1700–1778, those cities with market-clearing prices (Naples and Amsterdam) were, in fact, integrated with Barcelona. Unfortunately, our study has only considered nine cities of the Allen and Unger (2018) database. Further research on this topic needs applying time series techniques that are robust to missing observations so more cities can be included in the analysis.

Notes

1. Using wheat price series, Manera and Sansó (2006) show the integration of the markets of Barcelona, Valencia and Mallorca. At the same time, in their connections with Spanish cities, the Catalans developed versatile commercialization and distribution mechanisms: From street vending to the formation of network with agents in important cities, participating in fairs, markets and even stores. These levels of exchange supported a modest, but tangible, structuring of a domestic market under construction, to which Catalan products or reexports were offered (Muset, 1997).
2. The news of the arrival of ships from Naples to Barcelona does not usually specify the merchandise loaded. They only indicate that the ships carried "botada" (see *Diario curioso, histórico, erudito, y comercial, público, y económico* 19 (25-1-1762), p. 6; 29 (4-2-1762), p. 7; 12 (10-3-1762), p. 3).

References

Allen, R.C. (2001), "The great divergence in European wages and prices from the middle ages to the First World War", *Explorations in Economic History*, Vol. 38 No. 4, pp. 411-447, doi: 10.1006/EXEH.2001.0775.

Allen, R.C. and Unger, R.W. (2018), "The Allen Unger commodities dataset", *DANS Data Station Social Sciences and Humanities*, doi: 10.17026/dans-zsu-xavf. V2, UNF:6:SGLR8TqoEC+VzoK14qZhXA==[fileUNF].

Bacquelaine, M.L., Asensio, J.A. and Fàbregas, J. (1988), "Registro de entrada de navios en el puerto de Barcelona entre 1776-1788, según la Gazeta de Madrid", *Pedralbes*, Vol. 8 No. 1, pp. 437-446.

Badia-Miró, M. and Tello, E. (2014), "Vine-growing in Catalonia: the main agricultural change underlying the earliest industrialization in Mediterranean Europe (1720–1939)", *European Review of Economic History*, Vol. 18 No. 2, pp. 203-226, doi: 10.1093/EREH/HEU006.

Barquín, R. (1997), "Transporte y precio del trigo en el siglo XIX: creación y reordenación de un mercado nacional", *Revista de Historia Economica – Journal of Iberian and Latin American Economic History*, Vol. 15 No. 1, pp. 17-48, doi: 10.1017/S0212610900006297.

Bateman, V.N. (2011), "The evolution of markets in early modern Europe, 1350–1800: a study of wheat prices", *The Economic History Review*, Vol. 64 No. 2, pp. 447-471, doi: 10.1111/J.1468-0289.2010.00540.X.

Camprubí, X. (2019), "El Mediterrani com a via de comunicació entre Catalunya i Itàlia als segles XVII i XVIII", in Dantí, J., Sola, F.X., Sola, D. and Ida, M. (Eds), *Actes Del VIII Cngrés D'Història Moderna de Catalunya: Catalunya I el Mediterrani*, Universitat de, Barcelona, Barcelona, pp. 840-864.

Carrion-I-Silvestre, J.L., Kim, D. and Perron, P. (2009), "GLS-based unit root tests with multiple structural breaks under both the null and alternative hypotheses", *Econometric Theory*, Vol. 25 No. 6, pp. 1754-1792, doi: 10.1017/S0266466609990326.

Chilosi, D., Murphy, T.E., Studer, R. and Tunçer, A.C. (2013), "Europe's many integrations: geography and grain markets, 1620–1913", *Explorations in Economic History*, Vol. 50 No. 1, pp. 46-68, doi: 10.1016/J.EEH.2012.09.002.

Crespo, A. (2000), "El comercio marítimo entre *Ámsterdam y Cádiz* (1713-1778)", *Banco de España – Servicio de Estudios*, Madrid.

De Vries, J. (2009), *La Revolución Industriosa. Consumo y Economía Doméstica Desde 1650 Hasta el Presente*, Crítica, Barcelona.

de Zwart, P. and Flynn, D.O. (2021), "The significance of early globalization: arguments and evidence", *Palgrave Studies in Comparative Global History*, Palgrave Macmillan, Cham, pp. 35-67.

de Zwart, P. and van Zanden, J.L. (2018), *The Origins of Globalization: World Trade in the Making of the Global Economy, 1500-1800*, Cambridge University Press, Cambridge.

Dobado-González, R., Garciá-Hiernaux, A. and Guerrero, D.E. (2012), "The integration of grain markets in the eighteenth century: early rise of globalization in the West", *The Journal of Economic History*, Vol. 72 No. 3, pp. 671-707, doi: 10.1017/S0022050712000332.

Dobado-González, R., Garciá-Hiernaux, A. and Guerrero, D.E. (2015), "West versus far East: early globalization and the great divergence", *Cliometrica*, Vol. 9 No. 2, pp. 235-264, doi: 10.1007/s11698-014-0115-9.

Ejrnæs, M. and Persson, K.G. (2000), "Market integration and transport costs in France 1825–1903: a threshold error correction approach to the law of one price", *Explorations in Economic History*, Vol. 37 No. 2, pp. 149-173, doi: 10.1006/EXEH.2000.0733.

Engle, R.F. and Granger, C.W.J. (1987), "Co-integration and error correction: representation, estimation, and testing", *Econometrica*, Vol. 55 No. 2, pp. 251-276, doi: 10.2307/1913236.

Elliott, G., Rothenberg, T. and Stock, J.H. (1996), "Efficient tests for an autoregressive unit root", *Econometrica*, Vol. 64 No. 4, pp. 813-839.

Fàbregas, J. (2014), "Joan Kies, un comerciant en el trànsit dels segles XVII al XVIII", *Estudis D'història Agrària*, No. 26, pp. 35-52.

Federico, G. (2011), "When did European markets integrate?", *European Review of Economic History*, Vol. 15 No. 1, pp. 93-126, doi: 10.1017/S1361491610000146.

Federico, G. (2012), "How much do we know about market integration in Europe?", *The Economic History Review*, Vol. 65 No. 2, pp. 470-497, doi: 10.1111/J.1468-0289.2011.00608.X.

Federico, G. and Tena-Junguito, A. (2017), "A tale of two globalizations: gains from trade and openness 1800–2010", *Review of World Economics*, Vol. 153 No. 3, pp. 601-626, doi: 10.1007/S10290-017-0279-Z/FIGURES/8.

Feliu, G. (1991), *Precios y Salarios en la Cataluña Moderna*, Vol. 1, Banco de España – Servicio de Estudios, Madrid.

Ferrer-Alòs, L. (2020), "Commercial structures and the globalisation of viticulture in Catalonia: from brandy to wine and cava (eighteenth-twentieth centuries)", *The Historical Review*, No. 17, pp. 251-303.

Ferrer-Alòs, L. (2021), "Las crisis de mortalidad en cataluña (1700-1860). cronología, intensidad y geografía", *Revista de Demografía Histórica – Journal of Iberoamerican Population Studies*, Vol. 39 No. 3, pp. 83-120.

Fontana, J. (1973), *Cambio Económico y Actitudes Políticas en la España Del Siglo XIX*, Ariel, Barcelona.

Gallego, D. (2004), "La formación de los precios del trigo en España (1820-1869): el contexto internacional", *Historia Agraria*, No. 34, pp. 61-102.

García-Espuche, A. (1998), *Un Siglo Decisivo: Barcelona y Cataluña, 1550-1640*, Alianza Editorial, Madrid.

García-Espuche, A. (2004), "Barcelona entre dues guerres. Economía i vida quotidiana (1652-1714)", *Eumo Editorial*, Barcelona.

Harvey, D., Leybourne, S. and Taylor, A.M.R. (2013), "Testing for unit roots in the possible presence of multiple trend breaks using minimum Dickey–Fuller statistics", *Journal of Econometrics*, Vol. 177 No. 2, pp. 265-284.

Hillmann, H. and Gathmann, C. (2011), "Overseas trade and the decline of privateering", *The Journal of Economic History*, Vol. 71 No. 3, pp. 730-761, doi: 10.1017/S0022050711001902.

Israel, J. (1990), *Dutch Primacy in World Trade, 1585-1740*, Oxford University Press, Oxford.

Jacks, D.S. (2004), "Market integration in the North and Baltic seas, 1500-1800", *Journal of European Economic History*, Vol. 33 No. 3, pp. 285-329.

Klovland, J.T. (2005), "Commodity market integration 1850-1913: Evidence from Britain and Germany", *European Review of Economic History*, Vol. 9 No. 2, pp. 163-197, doi: 10.1017/S1361491605001449.

Llopis, E. and Sotocona, S. (2009), "Antes, bastante antes: la primera fase de La integración del mercado Español de trigo, 1725-1808", *Historia Agraria*, No. 36, pp. 225-262.

Lucassen, J. and Unger, R.W. (2000), "Labour productivity in ocean shipping, 1450–1875", *International Journal of Maritime History*, Vol. 12 No. 2, pp. 127-141, doi: 10.1177/084387140001200208.

Maixé-Altés, J.C. (1992), "Mercado exterior y abasto urbano: el caso barcelonés del siglo XVIII", *Estudis D'Història Econòmica*, Vol. 1992 No. 2, pp. 79-97.

Maixé-Altés, J.C. (1994), *Comercio y Banca en la Cataluña Del Siglo XVIII: la Compañía Bensi and Merizano de Barcelona (1724-1750)*, Universidad de A Coruña, A Coruña.

Maixé-Altés, J.C. (1987), "Parentesco y relaciones sociales en el seno de la burguesía barcelonesa: los extranjeros en la Barcelona de los siglos XVII y XVIII", *Manuscrits*, No. Vol. 6, pp. 151-180.

Manera, C., Morey, A. and Seguí, A. (2022), "Merchant networks and profits on merchant capital in the Mediterranean (Majorca, 18th century)", *Business History*, Vol. 66 No. 5, doi: 10.1080/00076791.2022.2087632.

Manera, C. and Sansó, A. (2006), "The Mediterranean Sea: a bridge between coasts. 18th century trading links between the East coast of Spain and the Balearic Islands", in Cavaciocchi, S. (Ed.), *Ricchezza Del Mare, Ricchezza Dal Mare, Secc. XIII-XVIII*, Le Monnier, Florence, pp. 179-200.

Marfany, J. (2012), "Land, proto-industry and population in Catalonia, c", *1680-1829. An Alternative Transition to Capitalism*?, Ashgate, Farmham.

Martínez-Galarraga, J. and Prat, M. (2016), "Wages, prices, and technology in early Catalan industrialization", *The Economic History Review*, Vol. 69 No. 2, pp. 548-574, doi: 10.1111/EHR.12127.

Martínez-Ruiz, J.I. (2005), "El mercado internacional de cereales y harinas y el abastecimiento de la periferia española en la segunda mitad del siglo XVIII: Cádiz, entre la regulación y el mercado", *Investigaciones de Historia Económica*, Vol. 1 No. 1, pp. 45-79.

Molas, P. (1977), *Comerç i Estructura Social a Catalunya i València Als Segles XVII i XVIII*, Curial, Barcelona.

Muset, A. (1997), "Penetració i expansió del comerç català en el mercat espanyol al segle XVIII. Sistemes de comercialització", *Estudis D'Història Econòmica*, No. Vol. 14, pp. 221-230.

Nadal, J. (1975), *El Fracaso de La Revolución Industrial En España: 1814-1913*, Ariel, Barcelona.

O'Rourke, K.H. and Williamson, J.G. (1994), "Late nineteenth-century Anglo-American factor-price convergence: were Heckscher and Ohlin right?", *The Journal of Economic History*, Vol. 54 No. 4, pp. 892-916, doi: 10.1017/S0022050700015539.

O'Rourke, K.H. and Williamson, J.G. (2002), "After Columbus: explaining Europe's overseas trade boom, 1500–1800", *The Journal of Economic History*, Vol. 62 No. 2, pp. 417-456, doi: 10.1017/S0022050702000554.

O'Rourke, K.H. and Williamson, J.G. (2004), "Once more: when did globalisation begin?", *European Review of Economic History*, Vol. 8 No. 1, pp. 109-117, doi: 10.1017/S1361491604001078.

Özmucur, S. and Pamuk, S. (2007), "Did European commodity prices converge before 1800?", in Hatton, T.J., O'Rourke, K.H. and Taylor, A.M. (Eds), *The New Comparative Economic History: Essays in Honour of Jeffrey G. Williamson*, MIT Press, Cambridge, MA, pp. 59-85.

Perron, P. (1989), "The great crash, the oil price shock, and the unit root hypothesis", *Econometrica*, Vol. 57 No. 6, p. 1401, doi: 10.2307/1913712.

Perron, P. (1990), "Testing for a unit root in a time series with a changing mean", *Journal of Business and Economic Statistics*, Vol. 8 No. 2, pp. 153-162, doi: 10.1080/07350015.1990.10509786.

Perron, P. (1997), "Further evidence on breaking trend functions in macroeconomic variables", *Journal of Econometrics*, Vol. 80 No. 2, pp. 355-385, doi: 10.1016/S0304-4076(97)00049-3.

Perron, P. (2006), "Dealing with structural breaks", *Handbook of Econometrics*, Palgrave Mcmillan, Cham, Vol. 1, pp. 278-352.

Perron, P. and Rodríguez, G. (2003), "GLS detrending, efficient unit root tests and structural change", *Journal of Econometrics*, Vol. 115 No. 1, pp. 1-27, doi: 10.1016/S0304-4076(03)00090-3.

Perron, P. and Yabu, T. (2009), "Testing for shifts in trend with an integrated or stationary noise component", *Journal of Business and Economic Statistics*, Vol. 27 No. 3, pp. 369-396, doi: 10.1198/JBES.2009.07268.

Persson, K.G. (1997), *Grain Markets in Europe, 1500–1900: Integration and Deregulation*, Cambridge University Press, Cambridge.

Persson, K.G. (2004), "Mind the gap! Transport costs and price convergence in the nineteenth century Atlantic economy", *European Review of Economic History*, Vol. 8 No. 2, pp. 125-147, doi: 10.1017/S1361491604001133.

Pollard, S. (1981), *The Peaceful Conquest: The Industrialization of Europe, 1760-1970*, University Press, Oxford-New York, NY.

Prak, M. and van Zanden, J.L. (2024), *Pioneers of Capitalism: The Netherlands, 1000-1800*, Princeton University Press, Princeton.

Rogoff, K., Froot, K.A. and Kim, M. (2001), "The law of one price over 700 years", IMF Working Paper, 01/174.

Rönnbäck, K. (2009), "Integration of global commodity markets in the early modern era", *European Review of Economic History*, Vol. 13 No. 1, pp. 95-120, doi: 10.1017/S1361491609002391.

Sànchez, À. and Valls, F. (2023), "Crises in Catalonia at a time of growth and transition, 1680-1840", in Catalán, J. (Ed.), *Crises and Transformations in the Mediterranean World. Lessons from Catalonia*, Palgrave Macmillan, Cham, pp. 175-224.

Serra, E. (1988), *Pagesos i Senyors a la Catalunya Del Segle XVII: baronia de Sentmenat, 1590-1729*, Crítica, Barcelona.

Sharp, P. and Weisdorf, J. (2013), "Globalization revisited: market integration and the wheat trade between North America and Britain from the eighteenth century", *Explorations in Economic History*, Vol. 50 No. 1, pp. 88-98, doi: 10.1016/J.EEH.2012.08.002.

Stock, J.H. and Watson, M.W. (1999), "A comparison of linear and nonlinear univariate models for forecasting macroeconomic time series", in Engle, R. and White, H. (Eds), *Cointegration, Causality and Forecasting: A Festschrift in Honour of Clive W.J. Granger*, Oxford University Press, Oxford, pp. 1-44.

Torras-Elias, J. (1981), "Estructura de la indústria pre-capitalista. La draperia", *Recerques: Història, Economia, Cultura*, No. 11, pp. 7-28.

Torras-Elias, J. (1984), "Especialización agrícola e industria rural en Cataluña en el siglo XVIII", *Revista de Historia Economica – Journal of Iberian and Latin American Economic History*, Vol. 2 No. 3, pp. 113-127, doi: 10.1017/S0212610900013331.

Torras-Elias, J. (1997), "Productes viticoles i integració mercantil a Europa, ss. XVI-XVIII. Una panoràmica", *Estudis D'història Económica*, No. 14, pp. 23-33.

Torras-Elias, J. (2008), "Fabricants sense fàbrica. Els Torelló, d'Igualada (1691-1794)", *Revista de Historia Industrial*, No. 36, pp. 169-174.

Uebele, M. (2011), "National and international market integration in the 19th century: evidence from comovement", *Explorations in Economic History*, Vol. 48 No. 2, pp. 226-242, doi: 10.1016/J.EEH.2010.12.003.

Valls, F. (2004), *La Catalunya Atlàntica. Aiguardent i Teixits a L'arrencada Industrial Catalana*, Eumo, Vic.

Vilar, P. (1958), "Agricultural progress and the economic background in eighteenth-century Catalonia", *The Economic History Review*, Vol. 11 No. 1, pp. 113-120, doi: 10.2307/2591686.

Vilar, P. (1964), *Catalunya Dins L'Espanya Moderna*, 4 Edicions 62, Barcelona.

Vilar, P. (1974), "La Catalunya Industrial: reflexions sobre una arrencada i sobre un destí", *Recerques: Història, Economia, Cultura*, No. 3, pp. 7-22.

Vogelsang, T.J. and Perron, P. (1998), "Additional tests for a unit root allowing for a break in the trend function at an unknown time", *International Economic Review*, Vol. 39 No. 4, p. 1100, doi: 10.2307/2527353.

Zivot, E. and Andrews, D.W.K. (1992), "Further evidence on the great crash, the oil-price shock, and the unit-root hypothesis", *Journal of Business and Economic Statistics*, Vol. 20 No. 1, pp. 25-44, doi: 10.1198/073500102753410372.

Further reading

Barquín, R. (2001), *Precios de Trigo e Índices de Consumo en España, 1765-1883*, Universidad de Burgos, Burgos.

Bogucka, M. (1973), "Amsterdam and the Baltic in the first half of the seventeenth century", *The Economic History Review*, Vol. 26 No. 3, pp. 433-447, doi: 10.2307/2593544.

Catalán, J. (Ed.) (2023), *Crises and Transformations in the Mediterranean World. Lessons from Catalonia*, Palgrave Macmillan, Cham.

Colomé-Ferrer, J. and Soler-Becerro, R. (Eds) (2022), *Vins, Aiguardents i Caves. La Comercialització de la Producció Vinícola Catalana (Segles XVIII-XIX)*, Universitat Rovira i Virgili, Tarragona.

Crespo, A. (2009), "Merchants and observers: the Dutch Republic's commercial interests in Spain and the merchant community in Cadiz in the eighteenth century", *Dieciocho: Hispanic Enlightenment*, Vol. 32 No. 2, pp. 193-224.

De Vries, J. (1987), *La Urbanización de Europa, 1500-1800*, Crítica, Barcelona.

De Vries, J. (1976), *The Economy of Europe in an Age of Crisis, 1600-1750*, Cambridge University Press, Cambridge.

De Vries, J. (2010), "The limits of globalization in the early modern world", *The Economic History Review*, Vol. 63 No. 3, pp. 710-733.

de Zwart, P. (2016), "Globalization in the early modern era: new evidence from the Dutch-Asiatic trade, c. 1600–1800", *The Journal of Economic History*, Vol. 76 No. 2, pp. 520-558, doi: 10.1017/S0022050716000553.

Delgado, J.M. (1989), "Comercio colonial y crecimiento económico (1776-1808): una interpretación a partir de los precios", *Institut D'Anàlisi Econòmica*, Barcelona.

Fontana, J. (1955), "Sobre el comercio exterior de Barcelona en la segunda mitad del siglo XVII", *Estudios de Historia*, No. 5, pp. 197-219.

Fontana, J. (1971), *La Quiebra de la Monarquía Absoluta*, Ariel, Barcelona.

García-Baquero, A. (1988), "Cádiz y el *Atlántico* (1717-1778)", *Escuela de Estudios Hispano-Americanos-Diputación de Cádiz, Cádiz*,

Hobsbawm, E. (1997), *La Era de la Revolución, 1789-1848*, Crítica, Barcelona.

Hocquet, J.C. (1985), *Le Sel et le Pouvoir*, Albin Michel, Paris.

Jeannin, P. (1982), "Les interdépendances économiques dans le champ d'action européen des Hollandais (XVIème-XVIIIème siècles)", in Aymard, M. (Ed.), *Dutch Capitalism and World Capitalism*, *Cambridge University Press-Maison des Sciences de L'Homme*, Paris-Cambridge, pp. 147-169.

Morineau, M. (1985), "Incroyables gazettes et fabuleux métaux. Les retours de trésors américans d'après les gazettes hollandaises (XVI-XVIII siècles)", *Maison des Sciences de L'Homme*, Cambridge University Press, Paris-London-New York, NY.

O'Rourke, K.H. and Williamson, J.G. (2006), *Globalización e Historia: la Evolución de Una Historia Atlántica en el Siglo XIX*, Prensas Universitarias de Zaragoza, Zaragoza.

Rapp, R.T. (1975), "The unmaking of the Mediterranean trade hegemony: international trade rivalry and the commercial revolution", *The Journal of Economic History*, Vol. 35 No. 3, pp. 499-525.

Sánchez, À. (2013), *Indianes, 1736-1847. Els Orígens de la Barcelona Industrial*, Edicions La Central, Barcelona.

Sereni, E. (1980), *Capitalismo y Mercado Colonial*, *Crítica*, Barcelona.

Corresponding author
Jose Perez-Montiel can be contacted at: jose.perez@uib.es