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Regional Market Integration in Italy During the Unification (1832-1882)

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Abstract

The 19th century was a period of great transformations for Italy. Political unification was achieved in 1861 while economic unification was still far off. Ever since, Italian industrialization has been unbalanced, as the pre-existing gap between Northern and Southern economic development has widened. In this context, the creation of the Italian national market has been a highly debated topic. Originally, it was thought that Italian regions did not experience much market integration even after the Unification. This was due to the low complementarity between its regions. However, in recent work, Federico (2007) finds evidence of market integration starting even before 1861. The purpose of the present study is to examine market integration in 19th century Italy within its regional context. The question is whether the Italian market integration observed previously was due to a catch up of some regions in integrating with the international market while others were already integrated or whether the convergence was due to higher integration among Italian regions. Wheat prices will be used as a stand in for overall market integration. The analysis includes descriptive tools such as the mapping of prices and coefficients of variation as well as panel data analysis on the causes of price differentials among city pairs. The results tentatively confirm the hypothesis of the rise of a national market, as price differentials increased more after Unification in the presence of an adjacent foreign market in the city pair .

1. Introduction

Italy achieved political unification in 1861 after two wars of independence and a military campaign, known as the Expedition of the Thousand. A third war was necessary to take the region of Venice, and the First World War finally allowed the territories of Trento and Trieste to join Italy. Before the Unification, the Italian territory was composed of

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several small states. Among them, the Kingdom of Piedmont and Sardinia would take a leading role in the process of unification. The newly born state was created through annexations to Piedmont and the first Italian king was the former Piedmontese king, Victor Emmanuel II. The political fragmentation of pre-Unification Italy resulted in a complex system of alliances and spheres of influence, and further manifested in byzantine tariff laws and an uneven transportation network.

This work will analyze the patterns of regional market integration in 19th century Italy with respect to its neighbours. This is done in light of its peculiar geopolitical situation and the consequent turmoil. Previous studies by Zamagni (1984) and Cafagna (1989) have shown a low degree of economic and market integration within Italy before and after the unification of 1861, with Northern regions appearing to be much more economically developed and integrated with their respective neighbour countries than the Southern regions. This is part of the broader debate on the causes of the economic dualism that has affected Italy throughout its history and still persists today. On the other hand, Federico (2007) states that Italy experienced a process of price convergence and market integration throughout the period. The purpose of this work is to analyze price convergence in Italy and its border lands 1832-1882. The price convergence observed by Federico (2007) could be due only to increasing integration among Italian regions. It could also be due to an increasing integration of the Southern regions to the international market, supposing that the Northern regions were already more integrated with the international market[1]. This second explanation would conciliate the observed price convergence and the assessments on the low market complementarity between North and South proposed in previous work.

[1] In theory, the opposite would be possible as well: the Southern regions being more integrated with the international market and the Northern regions catching up; however, at first sight this option appears less likely.

This analysis starts from the assessment of Federico (2007) on increased market integration in Italy in the 19th century. The research question is therefore whether the Italian regions increased or decreased the level of price convergence and market integration in the 19th century with respect to the adjacent markets (namely France, Switzerland and the Hapsburg Empire). Italian regions could result to be more integrated both to each other and to the adjacent markets. In this case it is not possible to state whether this is due to a higher level of trade among them or of each of them with the neighbours using only price series[2]. However, in case of decreasing integration with the neighbours and increasing integration among Italian regions, a hypothesis of formation of a stronger national market can be formulated.

For this investigation, we will examine series of wheat prices. The main primary sources are the series of Italian markets collected in the Archivio Economico dell'Unificazione Italiana and the series used by Jacks (2005, 2006). The contribution of this work lies in its focus not on general market integration in Italy but on the regional differences observed in the participation to this process both in Italian and foreign markets. For this purpose, the series of the adjacent markets in France, Switzerland and the Hapsburg Empire were included. The empirical strategy is based on both descriptive and econometric tools. The former are used to map the evolution of prices in the period. The maps constructed are based mainly of the price series and coefficients of variation in four benchmark periods of five years each. The mapping of five-year periods instead of single years in chosen to avoid bias from outlier years, usually due to temporary shocks as are inherent in agricultural markets in the pre-modern era. The main result is that both price series and coefficients of variation show an increased price convergence among Italian markets and a general divergence of the

[2] In that case, as discussed later, trade flows would be necessary.

adjacent markets. This suggests that some formation of a national market was taking place over the period.

The econometric analysis consists in panel data regressions. Price differentials between all city-pairs are used as dependent variable; geographic distance, dummies for railway connection, tariff regimes and absence of an international border are used as explanatory variables. Also, city or region specific dummies are included. More relevant is the dummy variable capturing the effect of a non-Italian market in each city pair, with "Italian" defined universally according to the eventual political borders of unified Italy[3]. This dummy is different from the one capturing the effect of two cities being in the same state in a certain year, as it does not change with political borders but captures whether or not a city is part of the future Italian national market. Given the hypothesis of the formation of a national market that arises from the price maps, the expectation is that this dummy will be more significant in the later periods. This is because, in relative terms, the degree of integration among Italian markets seems to increase in comparison to the degree of integration of the Italian markets with the adjacent ones. To check, I interact it with another dummy that is equal to 1 for the post-Unification period. The results of the interaction of the dummy seem to confirm this hypothesis.

The work is organized as follows. Section 2 presents an historical overview on the period of the Unification, with a discussion of the historical roots of the Italian market dualism and the issue of market integration in 19th century Italy. Section 3 explains the empirical approach adopted. Section 4 presents the results. Section 5 provides some concluding remarks and suggestions for further research.

[3] This includes cities that joined Italy by the end of the period under exam; only Trieste, among the "Italian" cities is not included.

2. The Italian Unification: History, Economy and Market

2.1. Historical Roots of the Italian Economic Dualism

Throughout it's history, since the downfall of the Roman Empire in 476 A.D, the Italian peninsula constantly experienced high political instability. After the Golden Age of the 15th and 16th centuries, Italian regions were frequently occupied and administered by other European powers. This condition persisted until the mid-19th century, when the process of unification began. On the eve of Unification, the political geography of the peninsula was the following: the Kingdom of Piedmont and Sardinia, on the border with France, as well as the Grand Duchy of Tuscany were independent; the Duchy of Parma and the one of Modena were formally independent but in the hands of sovereigns coming from the Bourbon family and the Hapsburg family respectively; Lombardy and Venetia were part of the Hapsburg Empire; the Papal states in Central Italy was under the power of the Pope and under the military aegis of France[4]; the Southern regions were joined in the Kingdom of the Two Sicilies. Figure 1 shows the pre-Unification states that roughly correspond to the present administrative units of the Italian state.

[4] See Riall (1994, p.14).The French troops stationed in Rome until 1870 as champions of the secular power of the Pope; the Italian army was able to take Rome because of the redirection of the French troops after outbreak the Franco-Prussian war.

Figure 1 – Italian States on the Eve of Unification (1861).

Source: Elaboration from http://www.age-of-thesage.org/history/italy_unification_map.gif

The spurt towards a unified Italy originated from the Kingdom of Piedmont and Sardinia that undertook a series of so called independence wars to take control over other regions. In 1848 Piedmont unsuccessfully tried to take Lombardy and Venetia from the Hapsburg Empire for the first time. In 1859, through the alliance with France against the Hapsburg Empire, it annexed only Lombardy, while Parma and Modena joined the Kingdom through a referendum. In 1861, the Piedmontese king supported

a military campaign, called the Expedition of the Thousand[5]. Starting from Sicily, most of the remaining Italian territories were annexed to the newly born Kingdom of Italy. In 1866, Venetia was taken through the third independence war in alliance with the Prussians against the Hapsburg Empire. In 1870, Rome and the territories of Central Italy were taken from the Pope.

When this period of political turmoil and military campaigns was over, the newly born state had another challenge ahead: its economic integration. Around 1861, the Italian economy was mostly rural. A process of industrialization comparable to that of other European countries like England had not yet started in Italy at the time of the Unification. The industrial take-off did not occur until the 1880s, with the development of the so called "Industrial Triangle" in the area between Milan, Turin and Genoa. The production of new industries was mostly focused on textiles, steel, iron, automobiles and other heavy products. The South was rural before 1861 and continued to be so throughout the 19th century. The diverging path of industrialization can be pictured looking at the regional index of relative industrialization (Fenoaltea, 2006; p. 234): the industrial triangle had an index of 1.2 in 1871 and 1.37 in 1901 while the main Southern regions (Sicily, Calabria, Campania and Puglia) had an index of 0.91 and 0.81 respectively[6].

With the beginning of a process of industrialization in the Northwest, the economic dualism that led to a growing divergence between the South and the North had started. For both the different potential and the growing divergence after Unification, the young Italian state had to soon face the issue of the economic dualism between the

[5] The campaign was not officially undertaken by the Kingdom of Piedmont and Sardinia, but it is well known that the thousand volunteers headed by Giuseppe Garibaldi acted with the support of Victor Emanuel II.
[6] The national average is set to 1.

North and the South. This divergence persists at present and is one of the most debated issues of the Italian economic history.

A vivid debate arose among scholars on the causes and responsibility of the falling behind of the Italian Southern regions. Many Italian scholars, like Sereni (1968) and Romeo (1970) claim that the industrialization of the North had occurred through the exploitation of the South[7]. They see in this perspective the protectionist measures passed to protect the newly established industries. In their view, the tariffs subsidized the industrial sector of the North while lowering the surplus of the consumers in the South. Moreover, the investments in infrastructures were targeted to boost the factories of the Industrial Triangle, allowing the North to exploit the market of the South (Fenoaltea, 2006; p. 219). In this perspective, the gap between regions was not caused by differences in the productive system but by the economic and strategic policies adopted by the Italian Governments after 1861. This view is strongly opposed by Cafagna (1989, p. 187), who states that the dualism existed before 1861 and was therefore not determined by the economic policy of the new Italian Government. For this analysis, the debate on the market integration of the two regions is important. Sereni (1966) concludes his work stating that it was the integration between the Italian regions that caused the falling behind of the South; the sudden exposition to the products from the North, produced with lower costs had led to an "exploitation" of the Southern markets. The reply by Cafagna (1989, p. 193) is that there was no sufficient complementarily between North and South so that the exploitation of the North towards the South could be even possible. The classical colonial exploitation occurs when the colony exports primary products to the centre and the centre exports industrial products to the colony. It is also frequent, for this exchange to be possible, that there are several colonies that provide all the primary

[7] For an overview on these scholars see Fenoaltea (2006), p.217.

products needed for the industrial production. This pattern was not observed within 19th century Italy. The share of market for the Northern industrial products covered by the South was very low; most of it was directed to the internal consumption of the North and to export. Zamagni (1990, p.96) disagrees as well with the colonial view described above. The main element that allowed for the formation and persistence of the economic disequilibrium is the agricultural structure: the Northern regions had an intensive agriculture joint with a stronger network of transports, trading, credit and proto-industry. The Southern regions had an extensive agriculture with low productivity and lack of all the other elements that eventually supported industrialization elsewhere. A last insight into Italian agriculture comes from Zanghieri (1969). Italy was a late industrializer compared to other European countries. This delay changed the conditions for industrialization. Growth could not be led just by one sector, such as the textile or the railways. In order to have a multi-sectoral advance, agricultural surplus was essential. The agriculture of the Southern regions at the time of the Unification was at a substance level. It was therefore unable to create the conditions for the industrial take off, such as the creation of new markets for industrial goods and the release of capitals and labour force.

2.2. The Problem of Market Integration

Assessing the influence of market forces is useful to addressing the problem of Italian dualism. In the 1960s, the general view on this point was that the Unification had a great impact on the integration of the national market. This was believed because of the commitment of the Government to connect the Italian regions: railroads were built, customs were abolished and tax unification was pursued. This view was contested by authors like Zamagni (1984) and Cafagna (1989) and has become the standard view on post-Unification market integration. Before Unification,

less than 20% of Italian trade was taking place within Italian states. There was also a strong asymmetry among states in the participation to the Italian and international market[8]. Table 1 shows the trade flows among Italian states in 1858.

Table 1- Trade Flows Among Italian States in 1858 (millions of lire).

	Import			Export		
	Total	From other Italian states	%	Total	To other Italian states	%
Kingdom of Piedmont and Sardinia	321.2	55	17.1	236.7	25	10.6
Lombardy	86	25.8	30	126.5	25.3	20
Venetia	90.1	27	30	59.8	18.0	30
Duchy of Parma	18	7.2	40	14.5	7.2	50
Duchy of Modena	25.7	6.4	25	18.6	9.3	50
Grand Duchy of Tuscany	79.2	8	10	44.5	17.8	40
Papal States	71.9	14.2	20	63.2	9.5	15
Kingdom of the Two Sicilies	127.6	11.3	8.9	139.1	11.9	8.6
Total	819.7	154.9	18.9	702.9	124	17.6

Source: Zamagni (1984, p.1640),

From the table above, it appears clear that the states that were most open to trade with the others were the Northern ones while Southern states had very little trade with the other areas that were going to form the Kingdom of Italy only three years later. Sereni (1966, p.105)

[8] Zamagni (1984, p.1641).

proposes the 1880s as the threshold for the formation of the national market, thank to the calculations of correlation coefficients of prices; however, Zamagni (1978, p.1643) believes that even after that period, the intra-market integration had not yet occurred. Taking the data from 1911 and dividing Italy into Northwest, Northeast-Centre and South, Zamagni shows the estimates for the international flows of the three macro regions[9]. All regions were net importers of wheat and raw materials. There was some movement among regions for fruits and vegetables but "most of the Southern exports were directed abroad […] [while] the only little complementarity was between the Northwest and Northeast-Center".[10] Zamagni concludes that "for the characteristics of the process of Italian development between the Unification and the First World War, trade in the Northwestern regions was intense, that some trade existed between the Northwest and the Northeast-Centre while trade between the South and the rest of the country and within the South was extremely small"[11].

Two elements are often analyzed in order to assess market integration in 19th century Italy are the development of railroads and the evolution of customs before and after 1861. Di Gianfrancesco (1979, p.260) claims that Italian economic development was quite balanced and the transport revolution had the effect of producing the gap between North and South. This was due partly to the policy pursued during the first half of the 19th century in the Northern regions that developed the connections with the regions of central Europe rather than with the Southern Italian regions. After 1861 as well, the Italian railway system was much stronger in the North than in the South. Railways and the formation of the Italian state is the title of a work by Schram (1997). The

[9] The data for earlier periods was not available.
[10] Zamagni (1984, p.1643).
[11] Ibidem, p.1648.

perspective adopted here is quite negative on the effectiveness of the Italian railways system. The effort shown by the newly born state to develop railroads was impressive given the previous situation. However, the result was not sufficient to integrate the Southern regions with the more industrialized areas of the country. Zamagni (1984, p. 1649) is pessimistic, too. She claims that the railways were thought to be the key element to integrate areas that, however, were not complementary. This led to a transport policy by the Government that was substantially unsuccessful in creating a national market. More recently, Fenoaltea (2006, p.215) confirms that the wave of railway construction in the post-Unification period does not seem to have created a national market.

After Unification, customs were suddenly homogenized. The Piedmontese regime was extended to all regions, despite what the previous level of tariffs were. Since 1859, the Kingdom of Piedmont Sardinia had adopted a free trade policy. This radical decision reflected the determination of the Piedmontese liberals to adopt a British-style trade policy. This was also the heritage of the former Prime Minister Camillo Benso Earl of Cavour, who had been one of the fathers of unified Italy. In 1860s, Europe seemed to be very favourable to trade liberalization: France and the United Kingdom signed a commercial treaty in 1860 and the German states created the Zollverein (Toniolo, 1990; p.54). Given the level of tariffs of the previous Italian states, the new regime turned out to be somehow more traumatic for the Southern regions. Calderoni (1961, p.3) reports that most trade policies before 1861 were protectionist, especially in Lombardy and in the Papal States. The Kingdom of the Two Sicilies also had a high tariff while the only free trade policy was pursued by Tuscany. Piedmont was somewhere in the middle. After 1859, the tariff level adopted had a maximum level of 10% on any import and almost absent on exports (Calderoni, 1961; p.12). To give a sense of the previous levels, table 2 proposes a partial overview of

the tariffs on wheat in the pre-Unification states in 1858. We look at wheat because wheat prices will be used in the later stages of this work.

Table 2 - Tariffs on wheat in the pre-unitary states in 1858 (Italian lire per kilogram).

	Kingdom of Piedmont Sardinia		Lombardy and Venetia		Duchy of Modena		Duchy of Parma		Grand Duchy of Tuscany		Papal States		Kingdom of the Two Sicilies	
	Imp	Exp	Imp	Exp	Imp	Exp	Imp	Exp	Imp	Exp	Imp	Exp	Imp	Exp
Wheat	-	-	1.74	-	0.10	0.10	1	0.3	-	0.07	-	-	9.55	1.43

Source: Cappellari della Colomba (1866), p.132

What can be seen from the table is that Lombardy and the Kingdom of the Two Sicilies are the ones with the highest tariffs, while states in central Italy are more liberal. Unfortunately the data is quite sketchy.

By 1859, the process of unification of the Italian tariffs had started. The Piedmontese tariff was extended to all the newly annexed territories. The 1859 tariff was characterized by a tight relationship with France. All the previous treaties with other states were cancelled and the existing ones within Piedmont were extended to all the territories. The fast and somehow abrupt extension of the tariff was justified by a school of thought that was very strong in the era of Cavour. The economic backwardness of some annexed territories, especially in the South, was seen as consequence of the protectionist regimes that were in place before Unification. Switching to a liberal regime would have immediately boosted economic growth. Federico and Tena (1998) in their work on the trade regime of Italy in the period 1870-1920, confirm that Italy could not be considered a protectionist country after Unification. Toniolo (1990, p.54) criticizes the way the extension of the Piedmontese tariff was implemented. The speed with which it was carried on was a unique case in Europe (the Zollverein was adopted much more slowly to allow for a

reallocation of the production factors). The South seemed to be the area hit by the provision. Piedmont and Tuscany already had a liberal regime while Lombardy, in spite of coming from a quite protectionist regime, had a highly productive agriculture that could take advantage from trade liberalism. The Papal States had almost no manufacturing and therefore could not be hit much. The South had developed some manufacturing under the protection of high tariffs. This insight suggests that Italy switched to what can be called a liberal trade regime in the 1860s. This could have been traumatic for some regions and a soft transition for others.

The AEUI collection contains some anecdotal evidence on the foreign trade of some pre-unitary states. Unfortunately the folders on trade flows destinations were completed for Tuscany, the Papal States and Lombardy-Venetia. Tuscany seems to have had a very low level of exchange with the other Italian states compared to non Italian trade partners. Great Britain was the first partner in terms of exports to Tuscany in 1822 with 20% of the total; the others were France with 11%, Russia with 11%, Austria-Hungary with 7%, Germany with 5% and Piedmont with 5%. The only relevant Italian states are Lombardy-Venetia and Piedmont. There was some import of cereals from the Papal States and the Kingdom of the Two Sicilies, but since those are not even mentioned in the list of overall importers, the amount of imports must have been very low (under 5%)[12]. On the side of exports, in 1832, 16% were directed towards Great Britain, 16% towards Turkey and Egypt, 10% towards France, 7% towards the Papal States and 6% to Austria-Hungary, United States and Kingdom of the Two Sicilies[13]. The Papal States before Unification were producers and exporters of cereals. The main trading partners were of Great Britain, France and Switzerland and the exports

[12] Parenti (1959, p.17).
[13] Ibidem, p.18 .

towards these countries also consisted in cereals. Germany and Austria-Hungary had some relations with the Papal States as well, through the port of Trieste. The level of trade with the other Italian states was low[14]. The last analysis on the trade flows of pre-unitary states is on Lombardy-Venetia. 75% of imports from Lombardy between 1851 and 1857 (on the eve of the annexation of Lombardy to Piedmont) were taking place with other Italian states. The main partner was Piedmont. The exports towards Switzerland were around 60%. Wheat is quoted as good exported towards Piedmont and imported from Modena and Parma[15]. The port of Genoa was more appealing to traders of Lombardy because of its proximity compared to the port of Trieste. Venetia had stronger link with the Papal States and the Kingdom of the Two Sicilies compared to Lombardy. This was true at least until 1839, when some restrictive tariffs with Venice were approved in the Kingdom of the Two Sicilies and some preferential treaties were signed with France, Great Britain and Spain. The region mostly imported wheat and for the period 1852-1856 exports of wheat were forbidden due to the bad harvests of those years[16]. According to the AEUI account, the trade among Italian states appeared to be quite low in the period before Unification. This was presumably the situation before Unification. In the next paragraphs, we will try to get some sense of whether the situation changed after 1861 or the Italian regions continued to have low levels of trade among each other.

The latest work on Italian market integration in the 19th century by Federico (2007) casts a different light on post-Unification market integration. Federico (2007, p.300) suggests that the process of integration had started well before 1861 and Unification did not accelerate the convergence. The main results of this work are that the Italian market

[14] Bonelli (1961, p. 110).
[15] Glazier (1966, p.43).
[16] Ibidem, p.46.

for wheat was quite efficient in the period, that the process of market integration had started in the 1840s and resumed in the 1870s after a slow down due to political turmoil; and that the integration was mainly due to improvements in the maritime transportation. This perspective is consistent with the works by Jacks (2005, 2006) on commodity market integration. Jacks (2005, p.399) finds that the world-wide convergence started around 1835, and not only after 1870 as conventionally believed.

3. Testing Market Integration in 19th Century Italy: the Empirical Approach

This research is mostly based on 24 series of wheat prices for selected markets in the period 1832-1882. The core of the dataset is the series used by Federico (2007) and collected from the Archivio Economico dell'Unificazione Italiana (AEUI). The AEUI collection is a source of information published starting from the 1950s concerning many aspects of the Italian economic and social life in the 19th century. One of the central topics is the prices of several commodities on thirteen Italian markets over the 19th century. For the period of interest, only wheat is reported for a sufficient number of cities. Out of thirteen cities, ten are suitable for the research: Turin, Genoa, Milan, Parma, Florence, Rome, Catania, Palermo, Cagliari, Sassari. The AEUI collection includes the prices of wheat in the port of Trieste. Trieste has been annexed to Italy only in 1918 after the collapse of the Hapsburg Empire. It appears to be suitable to include it in this dataset because of the large percentage of Italian population. Other Italian markets were found in the datasets used by Jacks (2005, 2006): Brescia, Mantua, Padua, Portogruaro, Udine, Ferrara. These prices are provided in lire per hectolitre as well. Jacks (2005, 2006) is the source for some of the adjacent market prices as well. Ljubljana, Vienna, Paris, Lyon and

Marseille are expressed in US dollars per 100 kg. The last set of series on the Swiss markets of Bern and Zurich come from an unpublished sources collection by Pfister (1989) and from Müller and Waser (1878) respectively. A discussion on the conversion of the series is included in Appendix A.

The work by Federico (2007) is the most recent piece of research on market integration of 19th century Italy. It evaluates the level of overall market integration over the period under examination using wheat prices. Geographical distance between markets, transport costs, a time trend and dummy variables to control for specific characteristics are used as explanatory variables. This work is a useful starting point to analyze, in depth, Italian market integration from a regional point of view, looking at the relationship each region had with the adjacent markets. In the previous paragraphs qualitative and descriptive evidence (Cafagna, 1989; Zamagni, 1984) on the patterns of Italian market integration were provided. According to these accounts, it appears that in the decades before Unification, Italian states did not have very tight commercial relations and were more prone to trading with foreign partners. After the Unification, the situation does not seem to have improved much, according to the authors. The evaluations by Zamagni (1984) and Cafagna (1989) and the results by Federico (2007) might not be incompatible. There is no doubt that prices converged over the 19th century. The question is whether the convergence was due to an increased level of exchange among Italian regions (especially between the Northern regions and the Southern regions) and therefore to the creation of a national market, or if it was due to an increased openness of the Southern regions towards other foreign countries. The sudden decrease of the internal tariffs that the South experienced with Unification might have fostered this process of market integration that led to a convergence of Italian wheat prices.

The aim of this work is to pursue a strategy similar to that used by Federico (2007). The new contribution is to focus not only on the national integration within the Italian borders, but to relate it to some of the adjacent markets. The dataset from the AEUI series is enlarged with additional Italian series and with the series of wheat prices of the neighbour countries (France, Switzerland and the Hapsburg Empire). The idea is to study the movements of wheat prices taking into account the relationships between the Italian markets and their neighbours. This can be interesting because of the presence of markets that, before Unification, belonged to neighbours and were later annexed to Italy after Unification (see all the markets of Lombardy and Venetia). It is possible that these political elements created patterns of price convergence not identical to the ones predicted by distance and transport technology.

The first step of the analysis is to exploit descriptive tools. A mapping of prices is proposed to give a visual idea of which markets were close to which. The maps are shown for the average of 5 year periods to avoid the effect of seasonal fluctuations that could be biased if the prices of only one year were taken. As in Federico (2007), coefficients of variation are an important tool in the analysis. The strength of this statistical tool is that it is very suitable for comparisons since it is dimension-less. It is also a good measure of σ-convergence. The coefficients of variation between markets are plotted. The plot gives a sense of the pattern of variability in the period. The same measure is calculated and plotted according to the same sub-groups shown for the prices. For the same 5 year periods as before, coefficients of variation of markets in each region with respect to the foreign markets are calculated and mapped to show the evolution in the whole period.

After the descriptive analysis, an econometric analysis is carried on. A panel data model is used to model the time dimension more properly. The baseline specification is the following:

$$|P_i - P_j|_t = \alpha_1 DISTANCE_{i,j,t} + \alpha_2 DISTANCE_{i,j,t}\text{^2} + \Sigma \alpha_k CITY_k + \alpha_4 TARIFF_{i,j,t} + \alpha_4 RAILLENGTH_{i,j,t} + \alpha_5 FREIGHT_{i,j,t} + \alpha_6 RAIL_{i,j,t} + \alpha_7 STATE_{i,j,t} + \alpha_8 NONITALIAN\_B\_U_{i,j} + \alpha_9 NONITALIAN\_A\_U_{i,j} + \alpha_{10} TREND_t + \varepsilon_{i,j,t}$$

The dependent variable is the average of price differentials between city i and city j, $|P_i - P_j|_t$. The idea is to explain what leads prices to be different in different cities. The main explanatory variable is geographical distance in kilometres between cities, called $DISTANCE_{i,j,t}$. The square of $DISTANCE_{i,j,t}$ is used to best model the relationship between price differentials and distance between markets. The other explanatory variables are dummies. City dummies, $CITY_k$, are used to capture city-specific characteristics; each city-dummy has value 1 if the city is in the pair and zero otherwise. The dummy $TARIFF_{i,j,t}$ has been constructed using anecdotal evidence from qualitative sources[17]. The variable is equal to 1 when a protectionist regime on wheat between the two cities is in place. The variable $RAIL_{i,j,t}$ has value 1 when the two cities are connected through railroads and 0 otherwise. It is computed using both railroad maps and qualitative sources on railway lines[18]. The dummy $STATE_{i,j,t}$ captures the institutional effect of the two cities belonging to the same state; it has value 1 when the pair is in the same state and value 0 when the city-pair is in a different city. $RAILLENGTH_{i,j,t}$ is a measure of the length in kilometres built in Italy each year. $FREIGHT_{i,j,t}$ is a measure

[17] Calderoni (1961) and Nicali and Favale (2004).
[18] See Briano (1977), Tajani (1944), Lartilleux (1952), Palau (1998) and Michel (1986). Also, a very useful tool is Wikipedia, where the years of the opening of most lines is reported.

of the freights factors for wheat for the United Kingdom[19]. TREND is a time trend that captures the general improvement of technology over the period. The dummies NONITALIAN_B_$U_{i,j}$ and NONITALIAN_A_ $U_{i,j}$ capture the mere effect of the presence of a non future Italian market in the pair. They take value 1 when the pair is formed by a non Italian market and an Italian market and 0 otherwise. The former is for the period before 1861 and the latter for after.

The aim of this analysis is to spot any possible change in the patterns of market integration of Italian regions within Italy and of the same cities with the foreign adjacent markets. In order to study this, the optimal data would be on trade volume jointly with prices. Unfortunately, it has not been possible to collect data on the volumes of trade among Italian states and foreign countries before Unification and among Italian regions and foreign countries after Unification. If some research could be done for the pre-Unification period, it is very unlikely that complete data could be collected at regional level for the period after Italy was unified. Knowing only the prices but not the trade flows when international convergence of prices jointly with regional convergence in one country is observed, could create inconclusive results. In that case it would not, in fact, be possible to state to what extent the regional convergence is due to an integration of the regions with each other or to the integration of each of them with the international market.

4. Results

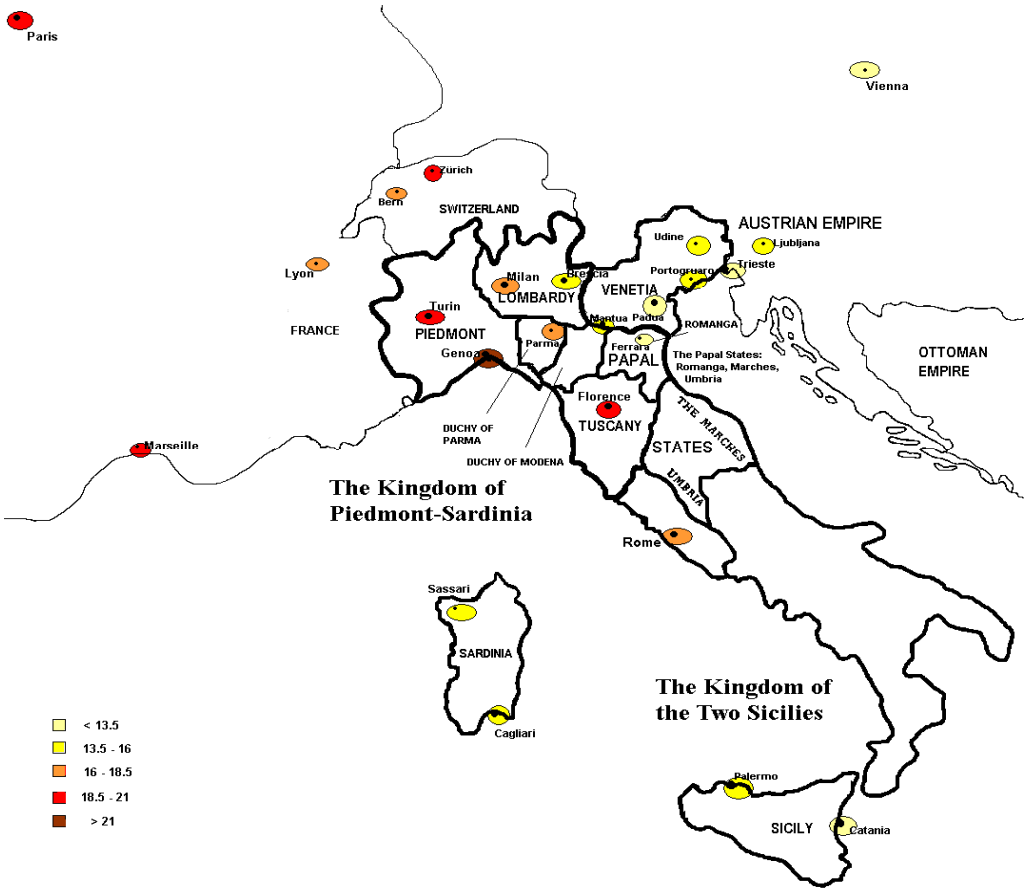
4.1 Descriptive analysis

Mapping the price levels for different periods and comparing them to spot the pattern over time can be more illustrative. Figures 2, 3, 4 and

[19] The same figures for Italy in 1832-1882 are not available; the evolution of freight rate of the United Kingdom in the same period are used as proxy as in Federico (2007).

5 map the prices in four benchmark periods (1832-36, 1847-51, 1862-66 and 1876-80[20]).

Figure 2 – Wheat Prices in 1832-36 (in lire per hectolitre).



The mapping of wheat prices is useful in visually spotting the evolution of the price convergence in the period analyzed. In figure 2, it looks like the national market was not yet formed. The Northwestern regions seem to be closer to France and Switzerland than the others; the Northeastern regions are predictably closer to the other Hapsburg cities. The main element to remark is the difference in prices between Southern Italy and France and Switzerland.

[20] The last period does not extend to 1882 because of too many missing values.

Figure 3 – Wheat Prices in 1847-51 (in lire per hectolitre).

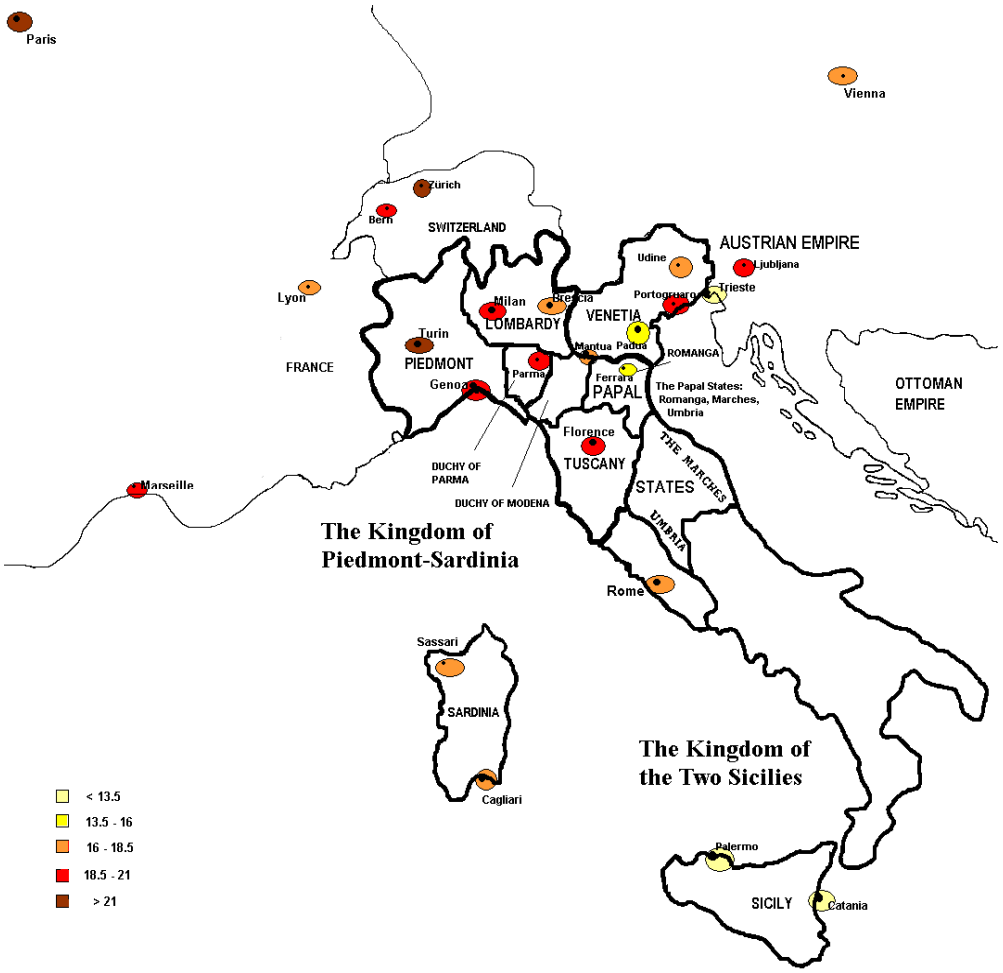
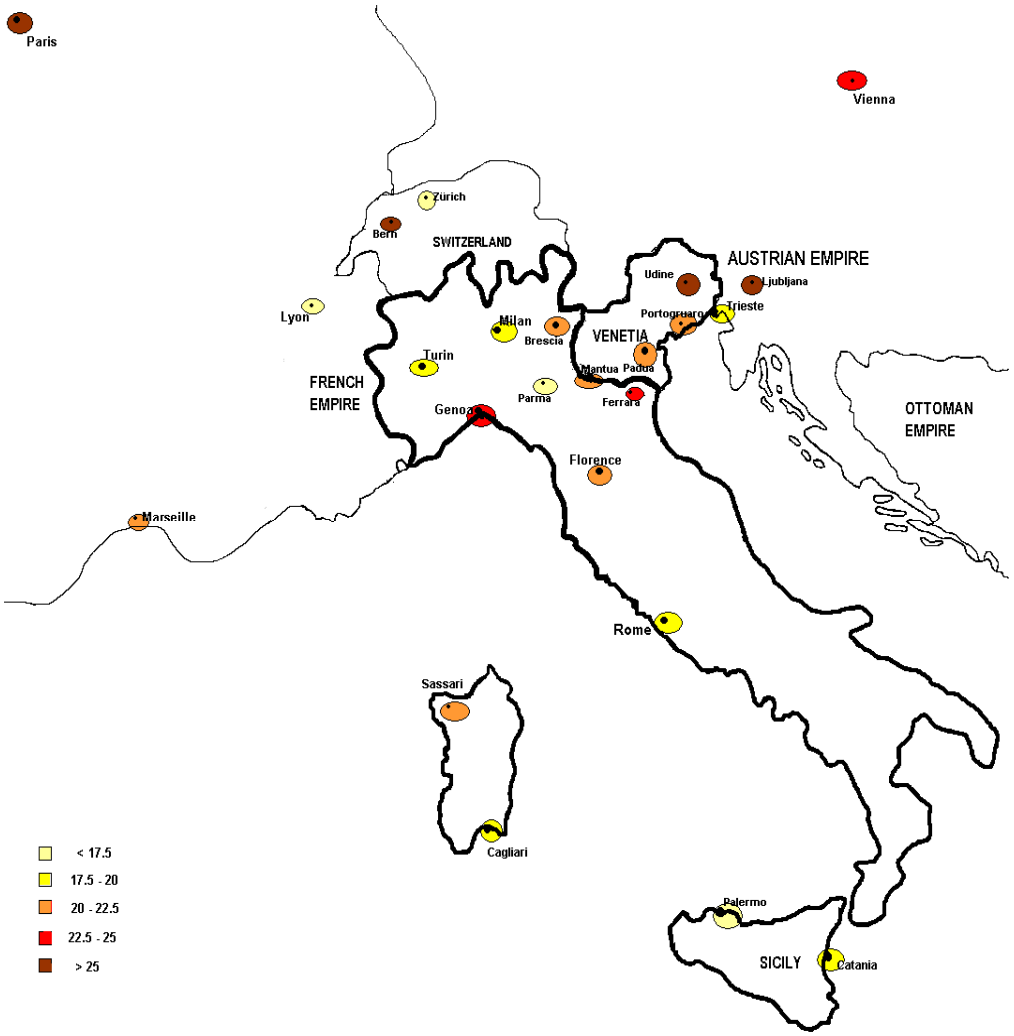


Figure 3 shows a less sharp division between Northwestern and Northeastern regions. This could be due to an anticipation of the upcoming annexation of Lombardy, and later Venetia, to Italy[21]. The Southern regions were still at a lower level of prices.

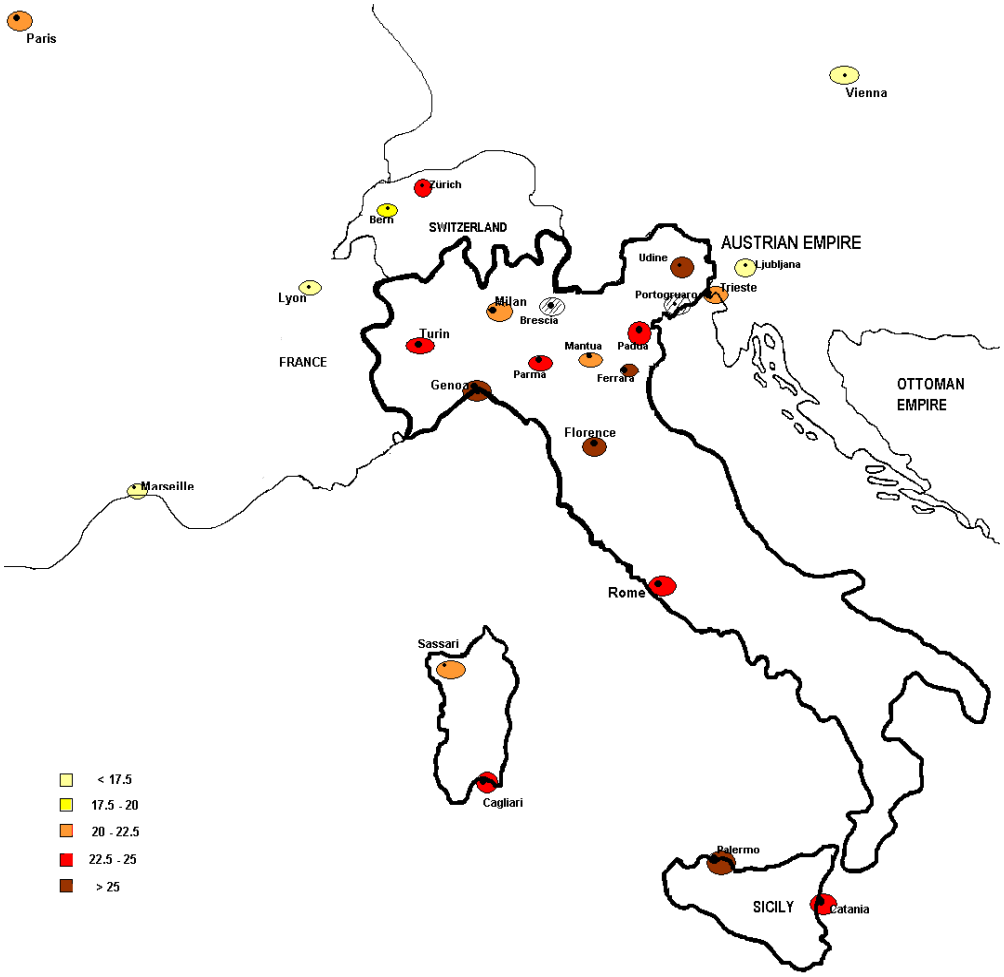
[21] This "anticipation" of changes in borders by the price integration patterns is also observed by Schulze and Wolf (2009) for the Hapsburg Empire; here the authors somehow observe the phenomenon the other way, which means they find a border effect among different ethno-linguistic groups in the Empire.

Figure 4 – Wheat Prices in 1862-66 (in lire per hectolitre).



The period shown in figure 4 is a bit hard to assess since it is the period right after Unification. It looks like the Northwestern regions are less integrated with the French and Swiss markets compared to the previous periods.

Figure 5 – Wheat Prices in 1876-80 (in lire per hectolitre)[22].

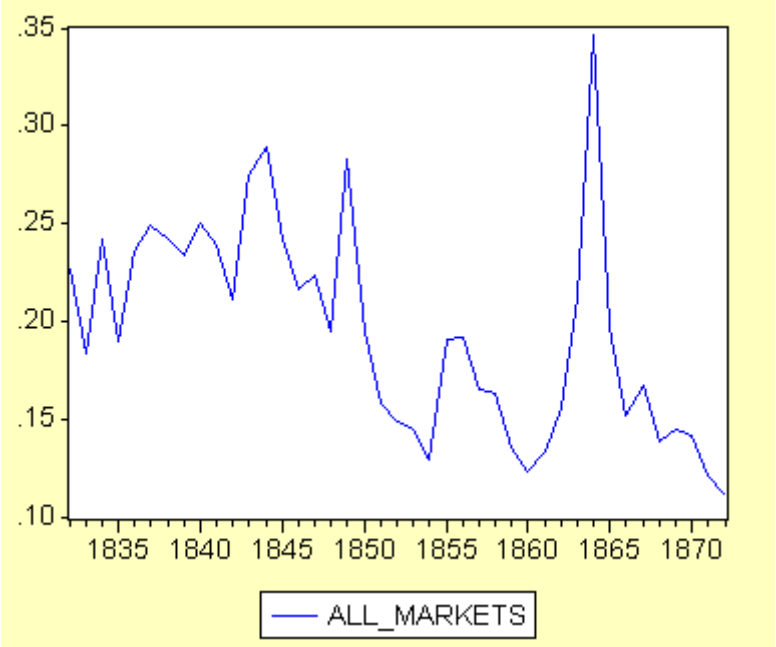


The last map in figure 5 shows the situation at the end of the 1870s. Looking at the distribution of prices, it would seem the hypothesis of the Southern regions converging to the prices of the adjacent foreign markets after Unification is not confirmed. The impression is, that by the end of the 1870s, the Italian national market was formed.

We can now look at the coefficients of correlation of the series. Figure 6 shows the pattern of the coefficient of variation of the series for the whole period.

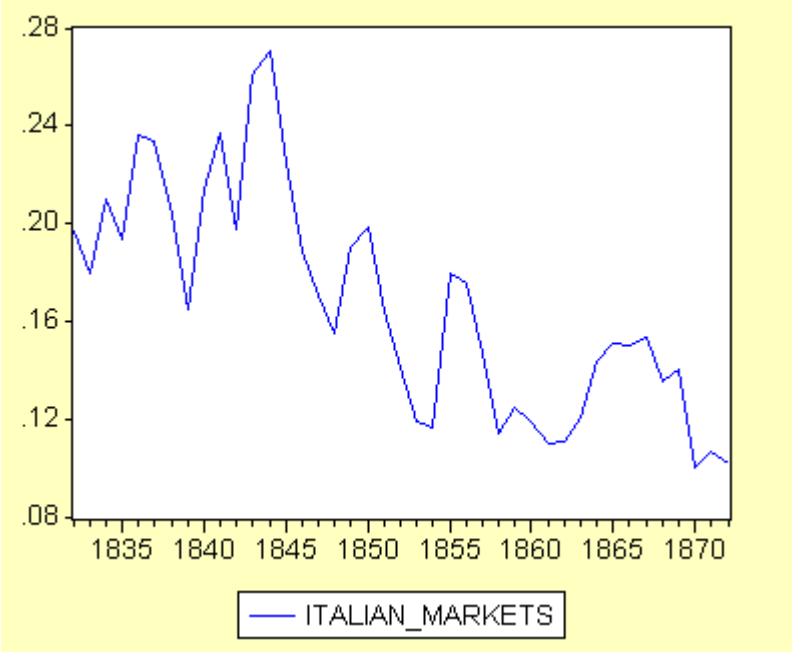
[22] Brescia and Portogruaro are not available for this period.

Figure 6 – Coefficients of Variation Within Cities, 1832-1882



Looking at the pattern of the coefficients of variation, the decrease of variation among the markets is not very sharp and seems to be stronger in the 1850s. After 1860 there is a sharp increase in variability that decreases again after 1865. Figure 7 shows only the Italian series.

Figure 7 – Coefficients of Variation Within Italian Cities, 1832-1882



The coefficients of variation of the Italian series alone tell a different story compared to the coefficients of variation of all the series. The decrease of the coefficients of variation is stronger. The trend of the variation is negative with swings due probably to periods of bad harvest. There is a slow down in this process only after 1861, which is an effect observed also by Federico (2007, p.312). The slow down in the process of price convergence is sharper if the adjacent markets are included. This suggests that the convergence with foreign markets was inhibited by the political process of integration. The coefficients of variation seem to confirm the hypothesis of the formation of a national market.

The last insight using the coefficients of variation is the mapping of the evolution of the coefficients of each pre-unitary state with respect to the adjacent markets. The periods used are the same of figures 2, 3, 4 and 5.

Figure 8 – Coefficients of Variation of Wheat Prices Between Each Pre-Unitary State and the Adjacent Markets, 1832-1836.

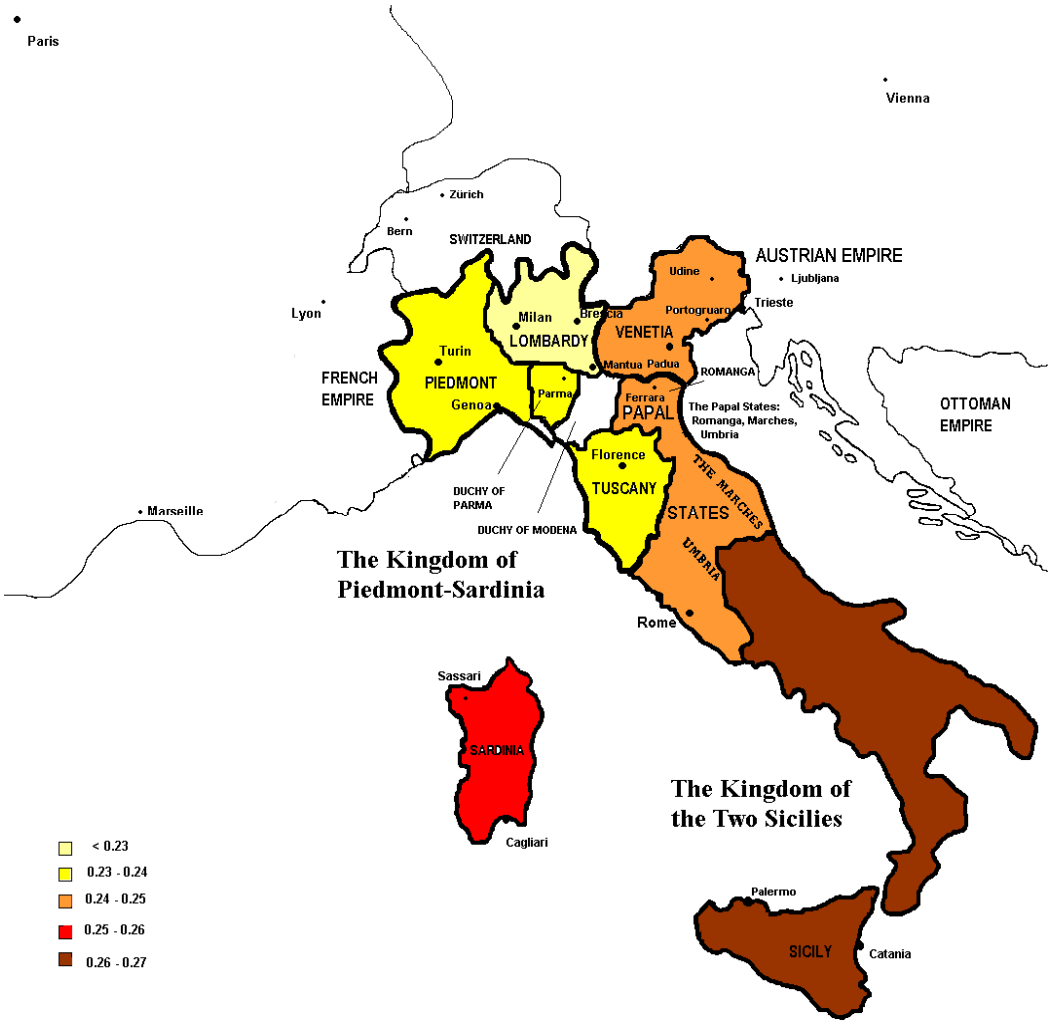


Figure 9 – Coefficients of Variation of Wheat Prices Between Each Pre-Unitary State and the Adjacent Markets, 1847-1851.

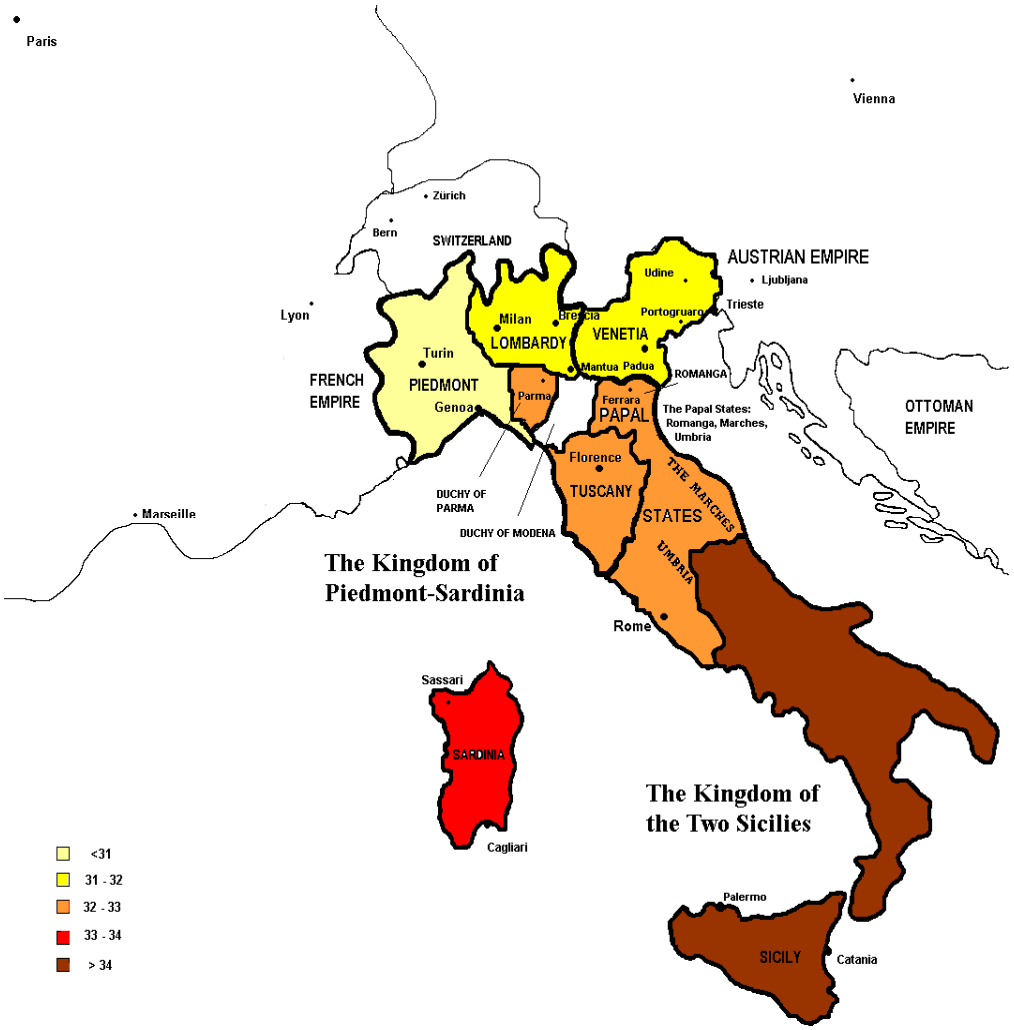


Figure 10 – Coefficients of Variation of Wheat Prices Between Each Pre-Unitary State and the Adjacent Markets, 1862-1866.

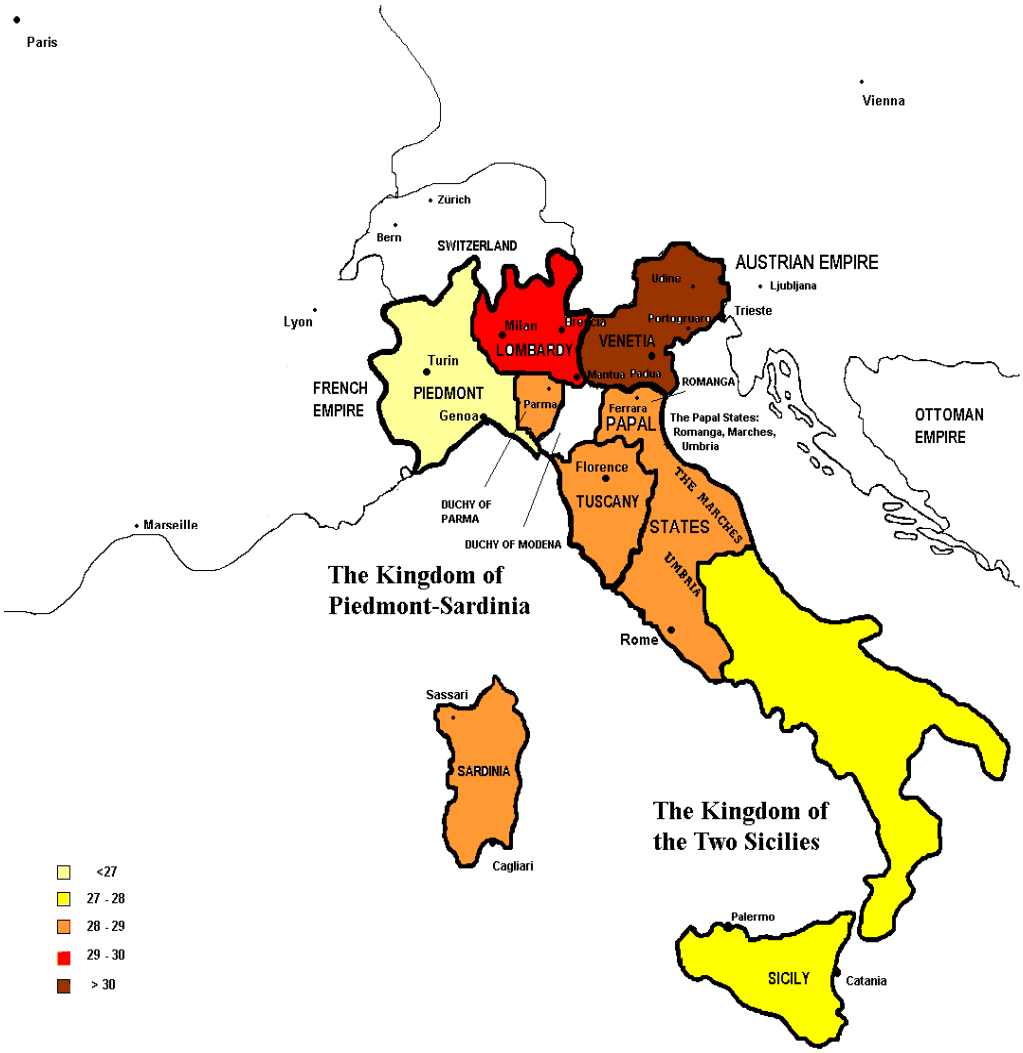
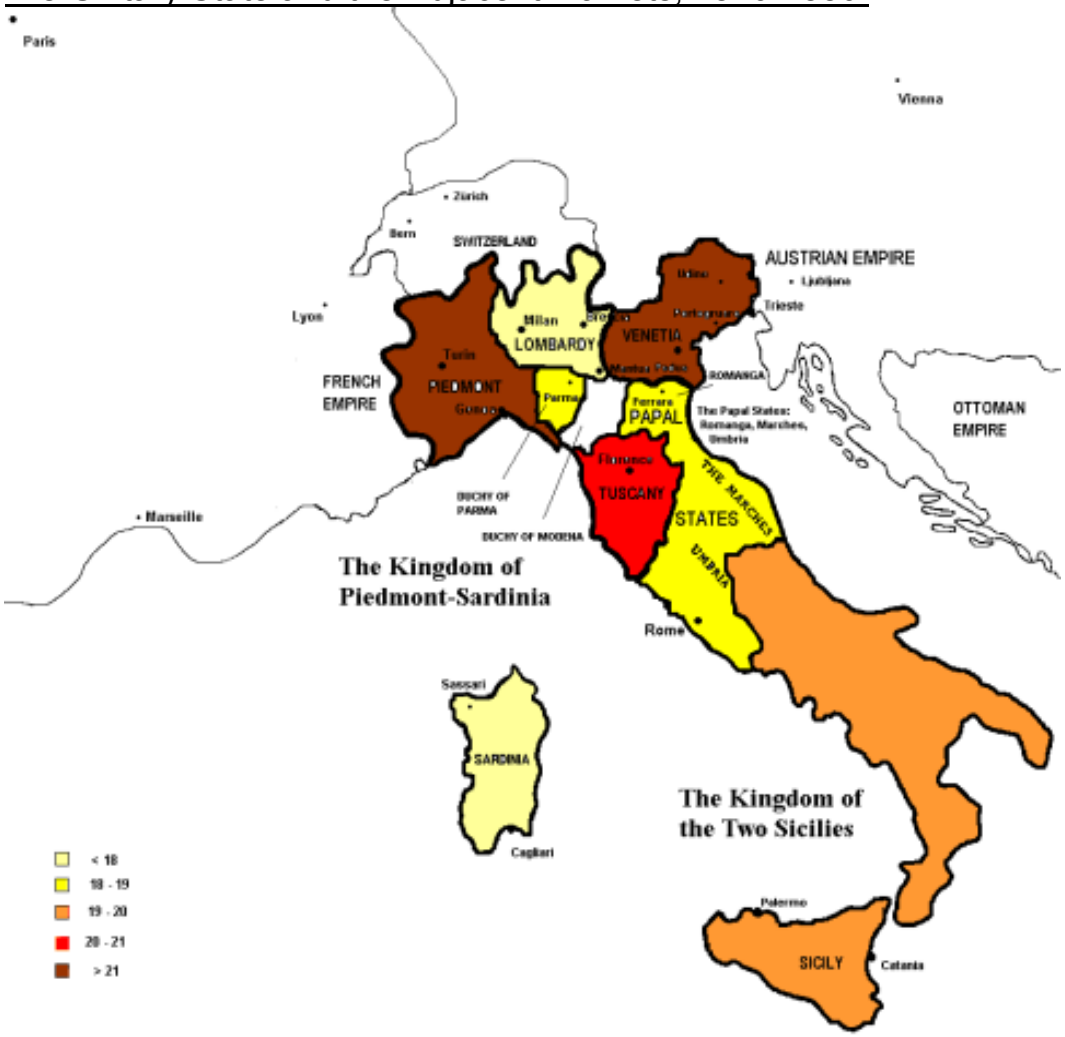


Figure 11 – Coefficients of Variation of Wheat Prices Between Each Pre-Unitary State and the Adjacent Markets, 1876-1880.



Figures 8, 9, 10 and 11 show almost a reversal of the level of the coefficients of variations with the adjacent markets between North and South. The South starts with a higher level and ends with an intermediate level in the last period while the Northern regions seem to be experiencing an increasing detachment from the level of prices of their neighbours.

Summing up, the descriptive tools used in this section seem to confirm that the 19th century saw the formation of an Italian market. The stronger evidence comes from the mapping of wheat prices; at the beginning of the period there is much more heterogeneity of prices within

the Italian regions compared to the last period. At the end of the 1870s, the national market appears to have formed, and prices are much more homogenous within the national borders. The coefficients of variation suggest the same conclusion: variability of prices is decreasing in the whole period under consideration. However, towards the end of the period, the decrease is much sharper if only Italian markets are considered. The next paragraph addresses the same questions using panel data analysis.

4.2 Econometric analysis

In this section, some econometric tools will be used to test whether there is a change in the patterns of regional market integration in the period under exam. The baseline specification used is the following:

$$|P_i - P_j|_t = \alpha_1 \, DISTANCE_{i,j,t} + \alpha_2 \, DISTANCE_{i,j,t}\text{^2} + \Sigma \, \alpha_k \, CITY_k + \alpha_4 \, TARIFF_{i,j,t} + \alpha_4 \, RAILLENGTH_{i,j,t} + \alpha_5 \, FREIGHT_{i,j,t} + \alpha_6 \, RAIL_{i,j,t} + \alpha_7 \, STATE_{i,j,t} + \alpha_8 \, NONITALIAN\_B\_U_{i,j} + \alpha_9 \, NONITALIAN\_A\_U_{i,j} + \alpha_{10} \, TREND_t + \varepsilon_{i,j,t}$$

Table 3 presents the results. Column (1) gives the results of the baseline specification; column (2) proposes the following alternative specification with an interaction term:

$$|P_i - P_j|_t = \alpha_1 \, DISTANCE_{i,j,t} + \alpha_2 \, DISTANCE_{i,j,t}\text{^2} + \Sigma \, \alpha_k \, CITY_k + \alpha_4 \, TARIFF_{i,j,t} + \alpha_5 \, RAILLENGTH_{i,j,t} + \alpha_6 \, FREIGHT_{i,j,t} + \alpha_7 \, RAIL_{i,j,t} + \alpha_8 \, STATE_{i,j,t} + \alpha_9 \, NONITALIAN_{i,j} + \alpha_{10} \, UNIFICATION + \alpha_{11} \, NONITA*AFTER_{i,j} + \alpha_{12} \, TREND_t + \varepsilon_{i,j,t}$$

The two dummies $NONITALIAN\_B\_U_{i,j}$ and $NONITALIAN\_A\_U_{i,j}$ are substituted with the interaction between the dummy $NONITALIAN_{i,j}$ and the dummy UNIFICATION. The former captures the presence of a non Italian city in the pair for the whole period and the latter is equal to

1 when the year is after 1861. The interaction dummy NONITA*AFTER$_{i,j}$ interacts NONITALIAN$_{i,j}$ with UNIFICATION; it is equal to 1 when there is both a non Italian market in the pair and the year is after Unification. The use of this different specification is technically more appropriate. This is because the other two dummies need to be included in the regression singularly to take into account the effects of having a non Italian city in a pair and the effect of being in a year after Unification.

Table 3 – The Causes of Price Differentials, OLS Estimate.

$\lvert P_i - P_j \rvert$	(1)	(2)
Constant	2.35 (1.07) *	2.56 (1.07) *
DISTANCE$_{i,j}$	-.00 (.00)	-.00 (.00)
DISTANCE$_{i,j}$^2	.10 (.04) *	.10 (.04) *
ROME	.17 (.48)	.15 (.48)
TURIN	.66 (.48)	.64 (.48)
MILAN	.62 (.48)	.60 (.48)
GENOA	2.02 (.48) *	1.20 (.48) *
FLORENCE	2.66 (.48) *	2.64 (.48) *
FERRARA	1.13 (.49) *	1.09 (.49) *
PALERMO	1.30 (.48) *	1.32 (.48) *
CATANIA	1.13 (.48) *	1.15 (.48) *
PARMA	.58 (.48)	.55 (.48)
CAGLIARI	.24 (.45)	.24 (.45)
SASSARI	.27 (.46)	.26 (.45)
BRESCIA	.80 (.49)	.75 (.49)
MANTUA	.71 (.48)	.68 (.48)
PADUA	1.51 (.49) *	1.47 (.48) *
PORTOGRUARO	.67 (.48)	.63 (.48)
UDINE	1.20 (.48) *	1.17 (.48) *
TRIESTE	1.37 (.48) *	1.31 (.48) *
LJUBLJIANA	1.39 (.48) *	1.33 (.48) *
VIENNA	1.34 (.48) *	1.30 (.48) *
PARIS	2.35 (.48) *	2.31 (.48) *
MARSEILLE	1.45 (.48) *	1.40 (.48) *
LYON	1.76 (.48) *	1.71 (.48) *
BERN	1.42 (.48) *	1.36 (.48) *
ZURICH	2.63 (.48) *	2.56 (.48) *

$TARIFF_{i,j,t}$	-.29 (.21)	-.26 (.21) *
$RAILLENGTH_{i,j,t}$	.00 (.00)	-.00 (.00) *
$FREIGHT_{i,j,t}$	-.04 (.01) *	-.05 (.01) *
$RAIL_{i,j,t}$	-.05 (.13)	-.06 (.14) *
$STATE_{i,j,t}$	-.51 (.22) *	-.48 (.22) *
$NONITALIAN\_B\_U_{i,j}$	-.48 (.12) *	
$NONITALIAN\_A\_U_{i,j}$	.71 (.13) *	
$NONITALIAN_{i,j}$		-.22 (.13)
UNIFICATION		.63 (.18) *
$NONITA*AFTER_{i,j}$		.99 (.18) *
$TREND_t$	-.05 (.01) *	-.04 (.01) *
N observations	8581	2581
R^2	0.1004	0.1038
Adj. R^2	0.0968	0.1002
F	28.05	28.29

* significant at 5% level, standard errors in brackets.

Column (1) of table 3 reports the results of the baseline specification. The R^2 is 0.10, and some of the main variables are significant. The square of distance is significant and correctly signed, since distance is supposed to have a positive effect on price differentials. The time trend is significant and negative, reflecting the general price convergence experienced at an international level over the 19th century. The railway and tariff variables are not significant, probably because of the quality of the data used to construct them. The freight factors are significant but incorrectly signed. Many of the city-dummies are significant, especially for non Italian markets. The dummies that are of more interest for this research are $NONITALIAN\_B\_U_{i,j}$ and $NONITALIAN\_A\_U_{i,j}$. With this specification, both are significant but have different signs before and after Unification. $NONITALIAN\_B\_U_{i,j}$ is significant and negative while $NONITALIAN\_A\_U_{i,j}$ is positive. The coefficient is -0.48 for the former and 0.71 for the latter. This result suggests that the role of the non Italian markets changed over the period with respect to the Italian markets. Column (2) presents a specification with a different

construction of the dummy for non Italian markets. The result is that the interaction dummy is positive and highly significant, suggesting that foreign markets after the Unification had a positive effect on price differentials. The other coefficients behave in a similar way of the first specification. The econometric analysis therefore seems to confirm the hypothesis of the formation of a national market in the period of the Italian Unification.

A brief discussion on the panel data model chosen is necessary. Usually fixed effects are introduced in panel data regressions. Including fixed effects, time independent effects are assumed for each observation. This creates problems when some explanatory variables do not change overtime (in this case, distance is one of them). Introducing fixed effects in this case would have not allowed for the estimation of the coefficient of distance, which is the main explanatory variable. For this reason it has been decided not to include them. This problem could be overcome if transport costs were available for the whole period. It was not possible to use them for this work.

5. Concluding Remarks

The 19th century was, for Italy, a century of great political and economic transformations. Italy was unified in 1861 after many centuries of division and foreign occupations. The dualism of the Italian economic system originated before the political unification; economically, the Italian regions had very different patterns of growth, with the Northwestern regions experiencing some proto industrialization even before 1861, while the South remained exclusively rural. This tendency accelerated after the unification as the North industrialized, despite the economic policies pursued by subsequent Italian governments hoping to promote the "catch-up" of the Southern regions. In this framework, market integration

has been related to economic growth and to the formation of the Italian dualism by many scholars (Sereni, 1966; Zamagni, 1984; and Cafagna, 1989). Two schools of thought exist on the question. The first postulates that market integration between North and South following unification led to an "invasion" of Northern industrial products and the consequent aborting of the nascent Southern industrial economy. The second proposes instead that the Northern and Southern regions were not well integrated even after unification, and that the lagging of southern industrialization has roots outside of the national economy. More recently, Federico (2007) has studied the problem of Italian market integration through a quantitative analysis on prices. The conclusion of this work is that Italy experienced a process of market integration throughout the 19th century dating from well before 1861.

The work by Federico (2007) on overall market integration performed forms the starting point for this analysis on regional market integration. While that study is based on wheat prices of Italian markets only, by adding the series of wheat prices of the adjacent foreign markets, it is possible to study the patterns of prices of Italian markets with respect to their neighbours. Given the process of market integration observed for 19th century Italy, the goal of this work was to study its relation with the international market. In particular, it is interesting to establish whether the decrease of the price differentials among Italian regions was achieved through a higher national level of exchange. The alternative is that some Italian regions were, at an earlier stage, already well integrated with the international market and that the eventual price convergence within Italy was the result of a later catch up of other regions. To answer this question properly, the best strategy would be to use volumes of trade. Unfortunately it has not been possible to collect data on the volumes of trade among Italian states and foreign countries before Unification and among Italian regions and foreign countries after Unification. The analysis

has, as a consequence, been limited to the study of wheat prices only. The mapping of the prices in benchmark periods seems to confirm that Italian markets experienced a process of price convergence in the period, while the adjacent markets seem to have followed a different pattern. The mapping of coefficients of variation confirms this assessment. An econometric analysis using wheat prices of twenty-four Italian and adjacent markets was carried out. The strategy was to explain the price differential between market pairs with explanatory variables similar to those used in previous works. In this case, a dummy variable for the presence of a "non-Italian" market in a city pair was included in the regression. The purpose was to study the evolution of the significance and sign of the coefficient of this dummy. In case of increasing importance in the determination of price differentials over the period, this would suggest that foreign adjacent markets had lowered their level of price integration with the Italian markets. The econometric analysis confirms that after the Unification of 1861 the presence of an adjacent market in the market pairs resulted in an increase of the price differential.

Often in this work, the year 1861 had been used as threshold between a "before" and an "after" in the process of market integration. This is of course a simplification and in theory other dates could be chosen as watershed. Finally, the work presented here suffers from some shortcomings that should be outlined briefly, along with possible solutions and suggestions in case of further research. The first shortcoming is on the quantity and quality of the data used. The number of markets, both Italian and non Italian, is not particularly high, especially given the high heterogeneity of 19th century Italy. This is true also in the light of the attempt to add the "international market" to the discussion. It is also likely that other markets not adjacent to Italy had some role in the evolution of prices over the period. The main candidate for this is the United States, whose invasion of European grain markets at the end of the 19th century

has been studied (see O'Rourke, 1997). Another issue is that the variables used to explain price differentials are often proxies for the actual transportation and transaction costs. The transportation costs were not available for this work and have been substituted with geographical distance, railway length, and freight coefficients along with dummies to capture, for example, the existence of a railroad connection between two markets. This is, of course, less precise than using the actual costs and the quality of the estimates suffered from this. As explained in the previous paragraphs, it is also hard to draw inference on market integration among regions without having the volumes of trade. In this case the results on prices seem to confirm a process of market integration stronger among Italian regions than among them and adjacent markets. The effect of adjacent markets on price differentials is stronger in the later period. However, if all the markets in the sample had shown increasing price convergence, it would have been hard to say anything at all about which regions converged with which. This risk could of course be avoided by using volumes of trade. Also, volumes of trade would be useful to confirm or challenge the results obtained with prices. Unfortunately, this type of data is not available for 19th century Italy.

Appendix A

Data Conversion

The data used in the analysis was not collected in the same unit of measurement and currency. Some conversion issues need to be addressed. The Italian series, both from the AEUI and Jacks (2005, 2006) are in lire per hectolitre, which is a volume measure and corresponds to approximately 77 kg. Jacks (2005, 2006) is the source for some of the adjacent market. Ljubljana, Vienna, Paris, Lyon and Marseille are expressed in US dollars per 100 kg. The last set of series on the Swiss markets of Bern and Zurich come from an unpublished sources collection by Pfister (1989) and from Müller and Waser (1878) respectively; they are expressed in grams of silver per kg. The conversions for the foreign markets are performed according to the following strategy. For the markets in dollars per 100 kg, the conversion is about 77 kg=1 hectolitre. The relationship between the common Italian markets, expressed in dollars in Jacks' data set, and the ones expressed in lire in the AEUI dataset, is exploited. Given these common markets, the rate of exchange can be applied to the foreign markets series. One remark is important at this point. The AEUI series start well before 1861, when the Italian lire was introduced. Looking at the conversions done by the authors of the AEUI, it appears that all the figures before 1861 are done at the exchange rate of 1861[23]. To be consistent, the foreign markets series are converted into lire using the same criterion. For the Swiss markets, a more tedious strategy is adopted. The two markets are reported in grams of silver per kg. The figures are multiplied by 77 to have the series in hectolitres. It would than be necessary to calculate the content of silver of the Italian lire for each year. This data is not easily available. What is available is the

[23] The AEUI reports both the prices in lire for the whole period and the prices in the pre-unification currencies. Checking the conversions, it is clear that for the years before 1861 a fixed exchange rate has been used.

silver-gold ratio for every year and the content of gold of the US dollars for every year[24]. The series were therefore converted into US dollars and then converted into lire following the same strategy as the other foreign markets. A discussion on pre-1861 prices is necessary. Before the Unification, the currencies and measures used in the Italian regions were very heterogeneous. After Unification, the Piedmontese lira was extended to all the annexed territories, changing its name into the Italian lira. Most of the series extracted from the AEUI collection are reported in Italian lire per hectolitre for the whole period 1832-1882. However, the Italian lira was the legal tender in the all the Italian regions only after 1861 (1866 for Venetia). Therefore only the markets in Piedmont did not need to have their pre-1861 prices converted into Italian lire. An official rate of conversion between the old currencies and the Italian lira was calculated by the law of August 24th 1862, with which the new currency was established. The AEUI authors decided to use that rate of conversion for all the years before 1862, when the series where expressed in local currency. The most accurate procedure would have been to calculate the content of metal of each pre-Unification currency and use the variations of this content, if any, to estimate the fluctuations of the currencies to each other before 1861. This strategy could have been quite tedious and the authors decided to simplify the work of conversion by using the 1862 exchange rates. Each series has a paragraph of comment on the method of conversion of prices before 1862. The series of Turin (Felloni, 1957b, p.11) is the only market that does not need any discussion since the Pedmontese lire, later turned into Italian lire, was the official currency for the whole period. Felloni (1957a, p.10) also reports that for Genoa, there was a fixed exchange between the local currency (lira fuori banco di Genova) and the Piedmontese lira, therefore there are no issues regarding the conversion. Delogu (1959, p. 10) used for Sardinian

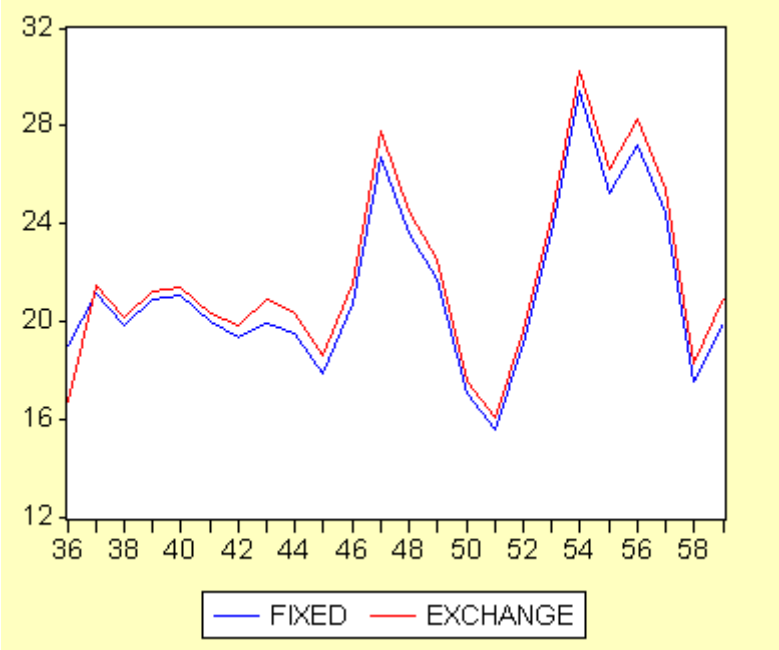
[24] The source was Global Financial Data, www.globalfinancialdata.com.

markets the rate of exchange between the local currency (Sardinian lire) until 1842, when Sardinia switched to the Piedmontese lire as local currency. Petino (1959, p.8) reports that for Catania and Palermo the coefficient of transformation was the exchange rate of 1862, referring to the other series for a discussion. Pinchera (1957, p.9) justifies the use of one unique coefficient between scudi and lire for the series of the Papal States with the "stability of the ratio [between the two] that remained almost unchanged from the Restoration to the Unification"[25]. Bandettini (1957, p.9) reports the series for Florence, converted before 1862 using the same coefficient for all the years. Here the author justifies the procedure, explaining that since 1815, Tuscany did not have any change in its monetary regime. Spaggiari (1959, p.13) confirms that the fixed coefficient used for the series of Parma is justified by the fact that the lira of Parma was at pair with "that [currency] that after the Unification will take the name of Italian lira". Lastly, De Maddalena (1957, p.19) explains that the Austrian lira became the official currency in Lombardy starting from 1823. The conversion between Italian lira and Austrian lira is done according to the conversion at the time of the Unification. Here there is no attempt to justify the procedure, besides the admission that further research has not been carried out. What applies to Lombardy can be extended to Venetia that was under the Hapsburg Empire as well. In order to check that exchange volatility is not a big issue for the series, the work of conversion according to the exchange rate has been performed only on Milan. Felloni (1956, p.45) report a table of the quotations of the Austrian lira in Italian (Piedmontese) lire from 1836 to 1859. These values can be used to convert the series of wheat prices in Austrian lire for Milan and compare them with the series for Milan in Italian lire, both reported in

[25] The period referred to as Restoration in Europe is the period right after the downfall of Napoleon and the Congress of Vienna, when the pre-Napoleonic political setting was restored.

De Maddalena (1957, p. 13). Doing so, we are able to evaluate the pattern of the series converted before 1862 with a fixed exchange rate, and the same series converted according to the official exchange for each year. The original series were also expressed in “moggio”, a measure of volume corresponding to 146.2 litres. They have been converted into hectolitres. It should be noted that the exchange rates did not change for many periods (it was 0.88 in 1837-1840, 0.90 in 1842 -1849 and 1855-1858 and 0.89 in 1850-1853) and the range of variation is 0.88-0.91 for all the years but 1836[26]. Figure 12 shows the two series.

Figure 12 – Wheat prices in Milan, 1836-1859 (in Italian lire per hectolitre).



The “fixed” series corresponds to the one proposed in the AEUI collection, while the “exchange” series correspond to the calculated using the exchange rates for each year. The patterns appear very close and it seems acceptable not to attempt the conversion of all the series and keep

[26] The exchange rate for 1836 is 0.76, which appears to be an strong outlier; it is possible that this figure is an error of transcription since the series does not a have any value that is so detached from the others.

them as they are in the collection. This choice was also made by Federico (2007) who used the same series and does not refer to any recalculation in the data appendix. This choice is reasonable also taking into account the large swings that the series have each year, probably due to exogenous shocks such as bad harvests or wars. The small distortion led by the changes in the exchange rate does not seem to be worth recalculating all the series. There is one last remark about the conversion: the publication of the exchange rates reported by Felloni (1956, p.45) precedes by one year the publication of the wheat prices reported by De Maddalena (1957, p.19). If De Maddalena considered those exchange rates to be the most appropriate for the conversion, the author would have used them as it happened in the case of Sassari and Cagliari by Delogu (1959, p. 10). There is probably some reason why the proper exchange rate was not yet clear, for example the quotations being different from city to city. For all these reasons, including the unavailability of all the series of exchange rates among all the currencies involved, it has been decided to keep the AEUI series as their authors presented them. A concluding remark about the Italian markets is that unfortunately the proportion of them from the South is not as high as the proportion from the North (Catania, Palermo, Cagliari and Sassari can be considered the South). This is probably due to a different quality of the accounting systems in the period. However, the Southern regions were much less divided and only four markets should be sufficient. The Northern and Central markets appear to be quite spread out, which is what is suitable for this type of analysis. For the independent variables, geographical distance between markets is calculated using Google maps. The values of the dummy variables are decided using qualitative information, such as accounts on the history of tariffs, railway maps and the chronology of annexations.

Appendix B

Market Integration in the Literature

The literature on market integration is quite large and in constant evolution. Price differentials and price convergence are usually the most used tools to measure of market integration Earlier approaches focused on the classical law of one price (LOP), elaborated for the first time by Cournot. The LOP states that between two cities, in an efficient market, temporary price differentials are cancelled out by arbitrage and prices of any good converge to the same level in the long run. Of course, the LOP needs some requirements to be relaxed to be applicable to the real world. In particular, the existence of transactions costs allows considering two markets integrated even if their prices are not identical. Engles and Rogers (1996) allow price differential to be equal or smaller than the cost of transporting a good from one market to the other. Two cities can be considered integrated if the absolute value of the difference of their prices is under the so called “commodity points”, such that:

$$|P_i - P_j| <= T_{ij}$$

The range in which prices are allowed to fluctuate is the cost of arbitrage. Sometimes the two cities do not trade with each other to cancel price differentials, but they both trade with a third city. The previous condition must hold for a third market as well:

$$|P_i - P_k| <= T_{ik} \text{ and } |P_j - P_k| <= T_{jk} \text{ so that } |P_i - P_j| <= |T_{jk} - T_{jk}|$$

This is the formalization of the law of one price in its most simple version. As we will see later, the problem with this strategy lies in the determination of the commodity points. Commodity points are

determined by costs of exchange such as transport costs but also information costs that are very hard to quantify. This is why a more sophisticated model is often needed.

Many scholars used the LOP to assess market efficiency and market integration. An early example of study on market integration through price differentials and LOP is the work by Engle and Rogers (1996). In this work, the presence of borders is studied for its influence on market integration. Price differentials are taken as dependent variable and distance is used as proxy for transportation costs. A dummy for the presence of a border is introduced. Parsley and Wei (1996) use a similar specification based on price differentials to study the degree of market integration of 48 American cities for 51 products between 1975 and 1992. As in Engle and Rogers (1996), geographical distance is used as proxy for transportation costs. What the authors want to do is compare the results on the speed of convergence from previous works that used only cross section, with their results from panel data. Before estimating the speed of convergence of prices, the authors assess whether the series have a unit root. The presence of a unit root needs to be excluded to perform the analysis on price convergence[27]. After having rejected the null hypothesis of a unit root, the authors turn their attention to the speed of price convergence. Their specification is the following:

$$|P_i - P_j|_t = \alpha_1 \ln (distance)_{i,j} + \alpha_2 |P_i - P_j|_{t-1} + \alpha_3 \ln (distance_{i,j})^* |P_i - P_j|_{t-1} + \varepsilon_{i,j,t}$$

with price differential between i and j at time t ad dependent variable; log of distance, price differential between i and j at time t-1 and their interaction as independent variable. The results of this work were still preliminary, but the general idea is that the US had a faster

[27] In the presence of unit roots, prices do not converge because shocks are permanent.

convergence of prices compared to the result of cross section analysis. Also, convergence seems to occur faster when the initial gap is wider.

In later works, the concern about the correct modelling of transport costs raised. Ejrnaes and Persson (2000) are two of the fist authors to propose a threshold autoregression model (TAR) to analyze market integration in 19th century France. The degree of market integration is given by the speed of adjustment back to the "equilibrium price differential" after a temporary shock. Ejrnaes and Persson (2000) remark that most of the previous results underestimated the speed of adjustment. This happened because of the use of a single equilibrium as benchmark as follows:

$$\Delta P_{i,t}/P_{j,t} = a + \rho P_i/P_{j,t-1}$$

where $\rho < 1$. The series return to $P_i/P_j = 1$ after a shock if they are co-integrated. An underlying assumption of this type of models is in fact that the series are co-integrated[28].

The model used by Ejrnaes and Persson (2000) is similar to a standard error correction model but with the point equilibrium replaced by a band of equilibria. Below the threshold of price differentials, prices move randomly; above the threshold, prices adjust as effect of arbitrage. The general form of a TAR model is the following[29]:

$$\Phi[(P_i-P_j)_{t-1}-T_{ij}]+ \varepsilon \quad \text{if} \quad (P_i-P_j)_{t-1}>T_{ij}$$

$$\Delta (P_i-P_j) = \varepsilon \quad \text{if} \quad |P_i-P_j|<T_{ij}$$

$$\Phi[(P_i-P_j)_{t-1}-T_{ij}]+ \varepsilon \quad \text{if} \quad (P_i-P_j)_{t-1}<-T_{ij}$$

[28] If two series are co-integrated, it means that the residuals do not follow a random walk but are stationary; from an economic point of view, this means that if there is a short term shock and the series are co-integrated, they will converge back to equilibrium in the long run.
[29] Federico (2007)

With T_{ij} the transaction costs and (1+ Φ) the speed of adjustment. Ejrnaes and Persson (2000, p.164) assess that stable commodity points give by T_{ij} indicate that there is adjustment to the law of one price while the degree of market integration is given by the speed of adjustment. Their result for 19th century France is that adjustment took place within 2-3 weeks. This is a much higher speed of adjustment compared to previous works.

Jacks (2005) also uses a TAR model for a study of intra and international commodity market integration in the 19th century. Data for wheat prices over the period 1800-1913 are used and a threshold regression model on bilateral (city-pair) prices is run. The assumption is that price differentials are always arbitraged away once they can compensate for all costs of exchange. The main assumption is that prices follow a random walk as long as their gap does not reach the arbitrage level. In this model, a time dimension is introduced as well. The model has a threshold-auto-correction mechanism and allows for an estimation of the speed of adjustment of prices via OLS. Jacks uses a panel data for his work. The total period is broken in eleven overlapping sub periods. Then all the possible pairs of cities within each country in the dataset are formed and the speed of adjustment for every country is estimated. To make a cross-country comparison, Jacks takes five important cities worldwide and uses them as a benchmark. The independent variables are trade costs, transportation costs, exchange regimes, and others often used in gravity models[30]. The specification used is the following:

$$\text{Speed of adjustment}_{i,j,t} = \alpha_1 \, \text{distance}_{i,j,t} + \alpha_2 \, (\text{distance}_{i,j,t})\text{^}2 + \alpha_3 \, \text{evol}_{i,j,t} + \alpha_4 \, \text{border}_{i,j,t} + \Sigma \, \gamma_t \, D_t + \varepsilon_{i,j,t}$$

[30] See Estevadeordal et al. (2003) and López-Córdova and Meissner (2003).

with $distance_{i,j,t}$ the distance between cities at time t, $(distance_{i,j,t})^2$ the square of distance, $evol_{i,j,t}$ the lagged variance of the exchange rate and D_t a set of indicator variables for the 22 subperiods. A TAR model like that of Jacks (2005) exploits a strategy to assess the speed of adjustment that avoids the bias of using co-integration analysis[31]. The main results of Jacks (2005) are that, contrary to common wisdom, transport costs were not the main component of trade costs over the 19th century. Therefore the weight of the revolution in transportation on market integration and globalization should be reconsidered.

Dobado and Marrero (2003) choose not to use a TAR model but focus on the study of price convergence following Barro and Sala-i-Marin (1995) and the concepts of β- and σ- convergence[32]. Their strategy consists in studying convergence of corn prices across 30 Mexican states between 1885 and 1908. The methodology is the following:

$$\Delta P_{i,t} = \alpha_1 - \beta_i P_{i,t-1} + \varepsilon_{i,t}$$

with $P_{i,t}$ the natural logarithm of the relative corn price with respect to the overall average in period t. β_i is the reaction of the growth rate of prices at time t in the i-th state to the same figure in the previous period. The model gives a steady state applicable to all states:

$$P_i^* = \alpha_1/\beta_i$$

The steady-state can be stable or unstable depending on β_i. Their results support the β convergence hypothesis. The heterogeneity

[31] The problem of using co-integration is that arbitrage only drives prices down to the commodity points but not beyond them, as happens in commodity markets.
[32] β convergence is observed when lower priced states have a faster growth in prices compared to higher priced states; σ convergence consists in a decrease of price dispersion.

of speed in convergence is explained by the high significance of a dummy for railroads that is added to the regression at a later stage.

As mentioned in the previous paragraphs, one of the latest works on market integration in historical perspective by Federico (2007) is concerned with studying wheat prices convergence in 19th century Italy. Federico (2007) decides not to use a TAR model to estimate the causes of price convergence. According to the author, both the TAR models and the models that use volatility of relative prices as dependent variable that measures market integration present problems. Both strategies assume that 1) transaction costs are constant over time, 2) that the markets are efficient and 3) that direct arbitrage prevails. The first assumption is strong because changes in technology of transportation or in institutional factors can occur; the second assumption might be fulfilled choosing only city pairs that trade with each other, but that could lead to selection bias; the third assumption risks creating bias due to the underestimation of the commodity points[33]. These problems could be overcome if high frequency data was available. In that case, the analysis could be restricted to a short period of time, when changes in transaction costs are less likely to take place, maintaining a sufficient number of observations. In the case of 19th century Italy this type of data is not available for any commodity. The most complete series are the yearly series of wheat prices of the AEUI collection that contain observations for a considerable portion of the 19th century. In this case, Federico suggests using price ratios or price differentials between pairs of markets as dependent variable in regressions and the coefficient of variation of average prices as main descriptive tool.

[33] According to Federico (2007, p. 296), if there is an indirect arbitrage involving a third city, the commodity points calculated assuming direct arbitrage would result underestimated, leading to biased results.

The empirical strategy consists first of all in using the coefficient of variation as descriptive tool to assess the pattern of variability in prices over the period. The result is a general reduction of variability of prices that seems to have started before 1861. After that, Federico tests the efficiency of the wheat market in the periods 1877-1879 and 1886-1889. This analysis is performed through a TAR model as above. The source is not the AEUI collection since that only contains yearly prices, which is a too low frequency. Only for this exercise he uses the Bollettino settimanale dei prezzi that provides high frequency data but for limited periods. The threshold is compared to railway fares. The result is that all city pairs considered but two do not exceed the commodity points. The two that are exceeding them could probably be explained with non observable transaction costs. The next step is the study of the causes of market integration. The analysis is performed in a panel composed by the thirteen AEUI series. As dependent variable, three measures are used in three different regressions. The first dependent variable is the standard deviation of relative prices differentials. The second dependent variable is the coefficient of variation of prices. The third dependent variable is the absolute price differentials. More than one variable is constructed to capture transportation costs given the impossibility of including them all in one. The first general independent variable is geographical distance between markets that captures the bulk of variable cost of transporting wheat from one market to the other. There are then other more specific transport variables: shipping freight rates from Odessa to London as proxy for the Italian freight rates that are not available for the period and the cost of railway transportation between each city pair. A time trend is included to capture the general improvement of technology over the period. A number of dummy variables are then included to control for specific characteristics: there is a dummy for the presence of

a tariff between pairs; a dummy for the presence of a telegraph connection; a dummy for the presence of a border between pairs before Unification; and a dummy for unified Italy. The best specification turns out to be the one with absolute price differentials. The conclusions that Federico draws from this analysis are that Italy experienced a process of price convergence over the 19th century, and that this had started well before 1861. The coefficients of variation show that convergence started around the end of the 1840s, with a temporary slow down in the 1860s. Before Unification, the main causes of convergence were due mostly to the general improvement in the efficiency of international markets (captured by the time trend) and to the liberalization of trade in Italy and the improvement of water transportation. After Unification, convergence was linked to the decrease of transportation costs.

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