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Working Papers in Economic History

June 2009 WP 09-02

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Juan Carmona Pidal and Joan R. Rosès

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JEL Classification: N54; N53; Q15

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Pedro Lains, Stefano Battilossi and Stephan Houpt provided useful comments, as did participants at the Course of UIMP on the "Economic Causes of Spanish Civil War" (Seville, October, 2008), IV Iberometrics Conference (Lisbon, March, 2009) and Workshop in Economic History at Universidad Carlos III. The authors acknowledge financial support from the Spanish Ministry of Science and Innovation projects "Consolidating Economics" within the Consolider-Ingenio 2010 Program, Project SEJ2006-08188/ECON and Project SISJUDES-CM from Madrid Autonomous Community. Rosés recognizes financial support from the European Science Foundation for his visit at ICS, Lisbon, where it was written a large part of the paper. We are grateful to Albert Sabater, Marcela Saouda and María Josefa Calero for outstanding research assistance. The usual disclaimer applies.

Land Markets and Agrarian Backwardness
(Spain, 1900-1936)

1. Introduction

A substantial literature underlines the fact that efficient market institutions are both a necessary and sufficient condition for agrarian development (Hayami and Ruttan, 1985; North, 1990). It is also argued that institutional disparity is the main culprit for the enormous differences in agricultural output per worker around the world.[1] The presence of well-defined property rights would lead to more efficient resource use and provide far greater incentives to undertake investments and innovations that would, in turn, increase agrarian productivity. Following this line of reasoning, international agencies, like the World Bank, have emphasized the role of institutional change causing the emergence of free factor and commodity markets and well-defined land property rights as critical for technological improvements in agriculture (Besley, 1995; Deininger, 2003a).

Therefore, efficient land markets are considered essential for agrarian development.[2] A correctly-functioning land market can significantly improve the rural economy of developing countries in several ways (Deininger, 2003b). First, when the ownership distribution of land is not optimal, land markets can allocate land to more productive producers and thus increase overall efficiency and welfare. Second, the option of sold land facilitates the reallocation of labour from rural to urban jobs, a situation which is likely to help the development of the urban economy. Third, the possibility of land transfer makes land investment more attractive and encourages the shift of capital from the rest of the economy to agriculture. And finally, if land is easy to put onto the market, it can be used as collateral for credit operations which could also be offered at lower cost. In contrast, badly-functioning land markets cause substantial entry barriers for landless participants and dramatic price distortions which are sometimes translated into monopolistic gains on the part of landowners, considerable fluctuations in land prices, and distress land sales by poor peasants.

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[1] In 1985, labour productivity in agriculture in the richest 5 percent of countries was 72 times that of the poorest 5 percent of countries (Restuccia *et al.* 2008).

[2] In this paper, we will treat land markets and land sales markets as synonyms and will only analyse land sales markets. However, it should be noted that badly-functioning land sales markets will be replaced in their pro-growth functions by efficient land rental markets (Deininger, 2003a).

An alternative view of institutions, however, is that market institutions are not a necessary and sufficient condition for economic development. For example, Shiue and Keller (2007: 1189) argue that "[institutions for market exchange] rather than being a key condition for subsequent growth, improvements in market performance and growth occurred simultaneously." In a similar vein, several authors (Landes 1969; Mokyr 1990) have argued that institutions supporting technical progress are equally important but are intrinsically different from institutions supporting market integration and efficiency. On the other hand, many authors place a great deal of emphasis on geographical determinants, such as climate, topography, rainfall, and soil quality as a source of agrarian backwardness. They argue that the adoption of the agrarian technologies created in developed countries on a worldwide scale is difficult because such technologies are suited to Northern Europe's geography and climatic conditions (Diamond, 1997; Gallup, Sachs and Mellinger, 1999). Finally, another group of researchers pointed out the importance of population size and density, and the related pressure on natural resources, as a causal factor for the development of new technological improvements and the adoption of more advanced technologies already available (Boserup 1981). So, in regions with relatively low population density, the most advanced technologies were not adopted and agricultural productivity remained low.

Spanish agriculture during the early decades of the 20th century provides a unique opportunity to study the influence of land markets on agrarian backwardness. At first sight, the institutional structure of Spanish land markets after the liberal reform of the 19th century was comparable to that prevalent in the most developed countries (see section 2 below) but agriculture remained relatively backward during the early decades of the 20th century.[3]

Politicians and economic historians have focused the debate on the importance of the institutional structure of rural Spain.[4] Many attributed the poor performance of agriculture to Spanish agrarian institutions, and hence to the failure of market-oriented liberal reform of land markets. Implicitly, they believed that land sales markets failed miserably and that the unmitigated

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[3] According to O'Brien and Prados (1993: 531), agricultural output per worker in Spain in 1930 was about two-thirds of that in the four major Western European economies (Britain, France, Germany and Italy). Differences were even more pronounced in land productivity: on average, Western Europe output per hectare was 2.67 times greater than Spain's. These low agrarian productivity levels were accompanied by a comparatively large share of the male working population in agriculture, with figures close to, or above, fifty percent up to 1930 (Simpson 1995: Table 1.2.).

[4] See, among others, Carrión (1932), Costa (1911-1912), Fontana (1985), Garrabou (1999), Nadal (1975), Pérez Picazo (1990), Robledo (1993), Ruíz Torres (1994) and Villares (1997).

operation of agrarian factor markets would generate equity and efficiency problems.[5] In particular, they claimed that large Southern estates suffered diseconomies of scale and that substantial efficiency gains could be obtained by transforming them into small landholdings, where extensive production could be replaced by intensive farming.[6] Carmona and Simpson (2007) have challenged the traditional view, underlining that Spanish agrarian institutions were able to adapt to economic change and did not exert such a negative impact on agrarian development (2007: 306-312). Other authors have also denied the institutional explanation, emphasizing the importance of geographical determinants (Pujol *et al.*, 2001), the weak urban and international demand for agricultural commodities (Carmona and Simpson, 2007), the absence of rural out-migration (Tortella 2000), and agrarian protectionism (Simpson 1997) in explaining Spanish agrarian backwardness.

Although a fair amount has been written on Spanish agriculture during the early 20th century, a quantitative assessment of the performance of land markets in Spain is still lacking. For this reason, this paper studies the major aspects of land markets in order to assess whether they worked properly. We will consider, firstly, spatial market integration, using cointegration analysis with data on average land prices, and then, whether land prices were driven by market fundamentals (that is, if the land pricing system was efficient). In this sense, our results indicate that land markets worked properly in Spain during the early decades of the 20th century. For this reason, we conclude that the backwardness of Spanish agriculture should not be attributed to the operation of land markets.

2. The Evolution of Spanish Land Markets

The definition of secure property rights to land is a necessary condition for the development of an efficient land market. According to Deininger (2003a: 25), the definition of land property rights requires: the duration of land rights; a clear identification of boundaries and limits of plots (which also implies the formal recording of boundaries); the individual assignment of land rights; and the existence of enforcement institutions. These enforcement institutions should resolve land rights disputes in order to avoid the emergence of land related social conflict.

Institutions for enforcing land property rights were well developed in Western European countries prior to industrialization (Federico, 2005: 144). In many respects, the land market institutions of early Modern Europe were more advanced than those prevalent in today's

[5] A variant of this argument is provided by Tedde (1994), who argued that land market institutions were well designed but corruption in the application of regulations hurt the poor.

[6] The classical account is that of Carrión (1932).

developing countries. The right of cultivation was transferable and the boundaries of plots were sometimes clearly defined and even registered in documents like notaries' records. However, land property was far from perfect because the co-existence of several rights over land was common and enforcement of land rights was sometimes difficult. Furthermore, the transfer of land was sometimes heavily taxed.[7] The absence of a universal system of registration of land titles increased information costs and prevented the use of land as collateral (Peset, 1978). Finally, much agricultural land did not form part of the market because the church did not sell its lands and the landed elite developed legal mechanisms, like strict settlement, to ensure the continuity of family estates over generations and to guarantee its exclusivity in wealth and political power. In these conditions, land prices overreacted to local shocks and markets were imperfect and inefficient given that the limited amount of sellers and buyers severely restricted competition for land. For all these reasons, land markets did not work in a way that the property rights school prescribes as encouraging economic growth.

In Spain, the transformation of the organization of pre-industrial land markets spanned more than one century from the mid-18th century to the mid-19th century. The development of formal registration began in 1768 with the creation of the registry of mortgages (the *Contaduría de Hipotecas*) by the Bourbons (Peset, 1978: 699). The new system of registration was cheap and hence reduced information and transaction costs, but was not universal or even widely used. It served to improve the effectiveness of local land markets but did not generate a supra-local market for land. The process of institutional change in land markets accelerated during the early decades of the 19th century. The authorities derogated the legal apparatus of the Old Regime that allowed the coexistence of different property rights over land, the remaining feudal rights, many of the old forms of land tenancy, the common land rights, and the restrictions on land sales, grain commerce and employment.[8] Furthermore, to alleviate their budget problems and to finance wars and infrastructures, successive governments put the properties of the Church (1837-1845) and communal lands (1855-1857), which were sold in auctions, onto the market. Finally, the old local system of registration was replaced by a cheap, universal and homogeneous system of land registry in 1865 (Bono, 1979). At the end of the 19th century, the institutional framework of Spanish land markets was as developed as those prevalent in other European countries.

It should also be underlined that the registration of transactions was very useful and relatively inexpensive. First, registration solved disputes about property rights and gave legal backup to any transaction. Second, without registration, it was not possible to use land as

[7] Beaur (2003) for France; Ruiz Torres (1981) and Peset and Graullera (1980) for Spain.

[8] See, for example, García Sanz (1985) and Peset (1992).

collateral for a loan or sell it to covenant of grace. In addition, without registration, former owners could override the actual rights of property, despite having received the payments, by asking for legal right of withdrawal.[9] Finally, the payment of taxes on land transmission could be made in the same registry office, which saved time and provided legal backup to the new owners. The condition of the legal right of withdrawal also limited the possibility of price underreporting and tax evasion because land could be repurchased by the former owner/s at the registered price (not at the price actually paid).

To what extent was land registration used by economic agents? Contemporary literature, including the reports of the registrars' association themselves, mentioned the fact that many small owners preferred to use the services of the registry only when necessary.[10] However, we believe that the complaint of registrars regarding the low rate of formalization of property land titles is not inconsistent with the fact that practically all landholding transactions were, in fact, registered. In consequence, the level of formalization of Spanish land markets was very high. Note that, in theory, market participants could only register a market transaction if the property had been previously recorded (Martinez Alcubilla 1892-94: II, 1076). On many occasions, however, the first registration was made at the time of the first market transaction of the corresponding landholding. In other words, when a new transaction took place, the property was yet to be registered correctly because, for example, the succession of inheritances had yet to be recorded. In consequence, landholdings were registered to put them onto the market (or to use as collateral in mortgages). In favour of this interpretation is the fact that the trend in sales by year/province showed strong similarities with the trend in the registration of inherited estates. At first sight, this coincidence does not make any sense given that the latter relies primarily on mortality rates and not on land market conditions.

[HERE TABLE 1]

Table 1 compares the amount of registered inherited landholdings during the whole thirty-year period and the amount of registered market transactions. From the last column, one can observe that only a minority of landholdings (13 percent) was inherited, and registered as such, in thirty years. Large regional differences in inheritance rates can be observed, from a

9 Dirección General de los Registros Civil y de la Propiedad y del Notariado, (1889-1890), Valladolid: 109 and Sevilla: 1890.

10 Costa (1890) and Dirección General de los Registros Civil y de la Propiedad y del Notariado, (1889-1890) (1906).

minimum of 4 percent in the North region and 9 percent in North Castile, to a maximum of 40 percent in Andalusia, a difference of 10 to 1 between the maximum and minimum. However, these differences cannot be explained by different mortality rates and are very similar to the number of sales (column 4), which would confirm the practice of registering only inherited landholdings when necessary for conducting sales and other market transactions.

The fact is that the land market was very active during this period.[11] The average amount of landholdings sold (and registered) between 1904 and 1933 was about 166,000 per year; that is, about 4,000 units per province/year. Huelva was the province with, on average, fewest sales per year (1,140) and Valencia the most (11,900). If one considers the total value of land sold, the average annual sales of 194.6 billion Ptas. in 1910, Seville remained the province with the highest volume of sales (an average of 13.2 million Ptas. per year) and Cuenca the lowest (an average of half a million Ptas. per year). The average amount of hectares put onto the market was close to half a million per year.

[HERE TABLE 2]

Table 2 presents several alternative measures of the dynamism of land markets in Spanish regions. First, we compute the percentage of the total stock of existing properties that, on average, were exchanged every year. Second, we estimate the value of the total amount of sales over the agrarian production for two benchmarks (1908-1913 and 1931). At first sight, large differences between regions are clear. The most expensive regions in terms of price per plot (see table 2) are also the most dynamic.[12] In particular, Andalusia with 2 percent of holdings sold every year and the Mediterranean with 1.23 percent outperformed the North with only 0.2 percent. Seville, in Andalusia, was the province with the highest transaction rates (about 5 percent

[11] It could be also very useful to compare the figures for the period (table 2, column 1 above) with the last available data for Spanish land markets from the Spanish Statistical Office (INE). During the year 2007, 189,785 plots of the approximate available total of 40 million were sold; that is, 0.47 percent of the total. Note that this is practically the same percentage as the average for the period 1904-34.

[12] Several contemporaries (Costa, 1890) had already observed this point. Furthermore, they attributed this low dynamism of certain markets to failures in the system of land registration. From their point of view, our statistics underestimate total purchases in this region in an unknown proportion. However, this trend of low dynamism is also replicated today (when the registry is universal) and in the 1950s; consequently, it is difficult to attribute it to low registration rates. Instead, we hypothesize that it is a consequence of the prevalence in these regions of certain long-term contracts (like the Foro) that discouraged the sale of land and encouraged the transference of these land rights (Villares, 1982).

per year), while the Galician provinces recorded the lowest rates in the North with about 0.1 percent per year. This picture is not greatly altered if we employ, instead, the relative participation of land sales in agricultural output (columns 2 and 3). Andalusia and the Mediterranean region were the regions where sales represented a major proportion of agricultural output. Northern Castile, and not the North, is the region where these sales were relatively less important. Differences between regions were also minor if we consider agricultural output instead of the amount of plots.

[HERE TABLE 3]

Table 3 shows the regional distribution of land sales for the whole period. The lion's share of the market is in hands of Andalusia and the Mediterranean regions, which accounted for 57 percent of the total value of sales. Instead, if one considers the number of plots put onto the market, the Mediterranean and Northern Castile represent 45 percent of the total. The picture changes again if one considers hectares put onto the market because Andalusia and Southern Castile concentrated more than 60 percent of the total. On average, the most expensive plots were located in Andalusia (with an average price that was about four times those prevalent in the cheapest region, Northern Castile). At provincial level, the most expensive areas are the most industrialized, namely Biscay with about 4,700 Ptas. per plot and Barcelona with 4,200 Ptas. per plot. In contrast, the cheapest province was in Northern Castile (Segovia, with only 215 Ptas. per plot). Considering, instead, the price per hectare, the most expensive were the North and Mediterranean regions whereas the cheapest were Southern Castile and Andalusia. The price per hectare seems inversely correlated with the size of farms.

[HERE FIGURE 1]

Figure 1 shows the evolution of Spanish land sales from 1904 to 1935. The trend in the number of sales experienced a decline, especially between 1904 and the end of the First World War, followed by a period of stabilization and recovery during the 1920s and again a drop from 1929 onwards. Over the entire period, the number of sales declined by 30 percent. The total real value of landholdings sold over the entire period also shows a similar trend with those observed in the case of the number of sales. However, there are two unexpected peaks that correspond to the years 1927 and 1930-31, when a legal change provided the opportunity to appropriate remaining communal lands (the so-called "Montes públicos").[13] So, from 1904 to 1934, the total value of sales (in constant prices) dropped by 40 percent.

[HERE FIGURE 2]

Figure 2 shows the evolution of average land prices per holding and per hectare for Spain from 1904 to 1935. Average prices per landholding experienced several cycles: declining from 1904 to 1908, rising again up to 1913, and falling until 1916 (this year marking the minimum of the period). In the late 1910s prices recovered once more. During the 1920s and the first years of the Second Republic (up to 1934), prices were affected by the aforementioned shocks but maintained, on average, values well above those prevalent in the previous decade. In sum, average prices were slightly higher in the 1930s than in the first decade of the 20th century.

[HERE FIGURES 3a, 3b, 3c, 3d, 3e, 3f]

However, regional experiences were very different. Regarding the amount of properties sold (Figures 3a and 3b above), in Andalusia, the Ebro Valley and Southern Castile, the amount of properties put onto the market was quite stable up to 1929, when it declined spectacularly across all regions (probably as a consequence of the uncertainty caused by the Great Depression and the transition to a new political regime). The Mediterranean region experienced an expansion of its market while in the North and Northern Castile the markets shrank dramatically until 1918. Particularly noticeable is the evolution of Castilian land markets where the amount of landholdings sold fell from a peak of 55,000 in 1904 to fewer than 28,000 in 1922. What our source does not indicate is whether the figures of 1904 indicate a maximum, or the continuation of a downward trend initiated in the previous years. A substantial literature underlines the negative impact of the Grain Invasion on small farmers throughout the country, but especially in the North-Castilian provinces. It is likely that this crisis could have triggered an expansion of distress land sales in the zones where small properties were predominant (García Orallo, 2008).

According to the evolution in the value of sales (Figures 3c and 3d), Spanish regions could be divided into two groups, although all regions shared the same declining trend in land market activity up to First World War. Since then, three regions maintained the same low levels

[13] Interestingly, this unexpected increase in average prices does not follow the typical speculative behaviour of bubbles (Eatwell *et al.* 1998) because the rise in average land prices was not accompanied by a parallel increase in the amount of plots traded.

throughout the period (the Ebro Valley, Northern and Southern Castile) while the remaining three regions (Andalusia, the Mediterranean and the North) shared a moderate expansion of their land markets. Note that this distribution of declining/expanding regions closely resembles the geography of dry farming in Spain. Regions specializing in dry farming, particularly in the extensive production of grain, experienced a period of stagnation while regions with a more diversified production fared much better, regardless of whether they specialized in mixed husbandry (North) or fruits and Mediterranean products (Andalusia and Mediterranean regions).

The evolution of prices is, apparently, more synchronized across Spanish regions (Figures 3e and 3f). Thus, peaks, plateaus and drops in real land prices were shared by the majority of regions. This result suggests the existence of a certain integration in the Spanish land sales market, but we will review this issue in more depth in the following section.

3. Conceptual Foundations

Our objective is, then, to investigate whether Spanish land markets were efficient or not. However, it is much easier to describe the effect of markets on efficiency than to measure it. Datasets do not habitually contain measures of "efficiency", nor do surveys have accurate measures of how well markets work. We will, therefore, use some simple economic theories to suggest ways in which inefficient behaviour in land markets can be captured empirically. Before proceeding, given that we will employ land prices to study the efficiency of land markets, we need to discuss several basic issues concerning which factors play a role in determining agrarian land values.

Most of the literature which attempts to identify and quantify the determinants of agrarian land prices is based on the capitalization approach. The cornerstone of this approach is the principle that the price of agrarian land equals the net present value (NPV) of the stream of all future net returns to land, as in the case of any other asset (Featherstone and Baker, 1987). According to the NPV, the price of land is a direct function of the rents that could be obtained from the use of land for productive activities; that is, the higher the rents, the higher the land price; and that the price of land is a function of the inverse of the interest rate,[14] meaning that higher interest rates will mean lower land prices.

More specifically, the NPV is calculated by estimating the future stream of cash returns resulting from ownership of the asset, and discounting this cash flow based on the level of

[14] Note that, in a competitive world, the market interest rate is the basis for the discount rate, because it represents the opportunity cost of investments.

uncertainty inherent in the expected returns. This model is summarized by the following equation:

$$(1) \qquad V_t = \alpha \sum_{j=1}^{\infty} \alpha^j E_t \left[R_{t+j}\right]$$

where V_t is the equilibrium land value at the beginning of time period t; R_t is the land rent paid in period t, α is a constant discount factor equal to $1/(1+i)$ where *i* is the constant real discount rate and determined elsewhere, and E_t is the conditional expectations operator based on information available at time t. This equation (1) can be further simplified, by assuming a long-run equilibrium between the real value of land and its real return (denote V^* and R^* as the long-run equilibrium value and a constant expectation of equilibrium return). The equation simplifies to:

$$(2) \; v = \beta_0 + \beta_1 r,$$

where $v=\ln V^*$, $r=\ln R^*$, $\beta_1=1$ and $\beta_0=\ln(1/i)$ where ln is the natural logarithm.

It should be noted, however, that this formulation does not necessarily imply that the market price of agrarian land will always equal the present value of the future rents because there could be different factors affecting the market price of land that do not affect the present value measure (Burt, 1986). To be more precise, land rents result from the aggregation of two factors (Melichar, 1979): the net residual income (R_1) and the net capital gains (R_2).

The net residual income (R_1) could be simply defined as the net return to land, accruing from the residual income after subtracting the return to farm labour, management and inputs (except land) that take part in the agricultural production process. In perfect markets, R_1 equals the marginal productivity of land times the net output prices; that is the value of land marginal product (VLMP). This long-run equilibrium rent is called, in the economic literature, a market fundamental because it is based upon fundamental economic variables (Featherstone and Baker, 1987). With constant land supply,[15] VLMP is a function of technological improvements, the cost of inputs (including labour and management), the marketing system (more market efficiency then less marketing costs), the distance and transportation systems, the market information system (which reduces uncertainty and also the probability of an inefficient transaction), tariffs and other macroeconomic measures affecting agricultural production and prices. The local demographic

[15] Obviously, an increase in land supply led to a decrease in land prices. Furthermore, given that land expansion commonly took place in low-quality, marginal or relatively isolated land, average prices decreased more than predicted using constant quality supply shifts.

conditions also have a direct effect on VLMP because a growing population demands more agricultural goods and space for non-agricultural uses (Plantinga *et al.*, 2002).

On the other hand, the net capital gains (R_2) could be defined as the change in land value motivated by variations in opportunity costs or inflation (Lloyd *et al.*, 1991). This rent component is more related to land assets used as stores of wealth than to land used as a productive factor. For this reason, it is sometimes called the non-fundamental price. In consequence, R_2 responds to expectations about the changes in the value of land due to changes in prices and opportunity costs in other economic sectors. Even though there are many varieties of speculative behaviour that could provoke actual land prices to diverge from market fundamental values, the stochastic bubble model developed by Blanchard and Watson (1982) and the fads model developed by Summers (1986) are the most cited models in the literature (Roche and McQuinn, 2001). Each effect stems from a different type of expectations that the relevant economic agents (decision makers) have and from the available information in the market (Featherstone and Baker, 1987). Bubbles are of explosive nature and appear when investors trade in high volumes at prices that are considerably at variance with fundamental values (Roche and McQuinn, 2001).[16] Instead, a fad is characterized by slower but more sustained price increases and falls (West, 1988). In particular, this could be the case of speculative movements of land prices based on the expectations that potential investors have about the trend of real land prices under inflation (Lloyd, 1994). There are also other non-fundamental factors, other than speculative behaviour, which could affect the evolution of land prices, such as taxation (Hoff and Stiglitz, 1993), transaction costs, liquidity constraints (Shalit and Schmitz, 1982), and institutional framework (Feder and Feeny, 1991).

From this short review of the determinants of land prices, we can derive two central principles for our analysis. First, in perfect (efficient) markets, the actual price of land equals the net present value of the stream of all future net returns to land, which should be equal to the VLMP. Second, a land buyer will be willing to pay the full capital value of land, the total net rents (R), land as a productive factor and as store of wealth, because he/she will obtain full benefits of both uses of land. On the other hand, an owner-cultivator (or a tenant) will be willing to pay a rent only based on R_1, without considering R_2 because he only receives the benefits derived from using the land as a productive factor (Castle and Hoch 1982). Thus, if land prices are well above their fundamental value, land markets do not redistribute land to the most capable farmers but

[16] Eatwell *et al.* (1998) define a bubble as "a sharp rise in the price of an asset or a range of assets in a continuous process, with the initial rise generating expectation of further rises and attracting new buyers. (…) The rise is usually followed by a reversal of expectations and a sharp decline in the price".

those with enough wealth (or credit) to cope with the non-fundamental price. Furthermore, financial agents would not lend money to future producers because it is likely that they will be unable to pay for the total value of land (farmers only get R_1 from production but not R_2).

To test the efficiency of the land price system (that is, the efficiency of land markets), we will consider, first, land markets' spatial integration and we will then explore the fundamental determinants of land prices directly. The fact is that if land markets are spatially integrated and price fundamentals explain land price behaviour, one should conclude that land markets are, indeed, efficient.

4. Measuring the Integration of Spanish Land markets

The Law of One Price is one of the most common ways of measuring market integration (Moodley *et al.*, 2000). According to this law, markets are considered spatially integrated for a specific factor if a causal relationship between prices in different spatial markets can be measured. If there is a shock that causes two prices to diverge, the effect will be temporary in a well-defined market and price differentials will eventually converge. The speed of convergence of these two prices defines the degree of market integration.

The Law of One Price could also be applied to the analysis of land prices. If non-fundamental rents play a part in the formation of land prices, and given that the different types of land are unevenly distributed across space, land prices may not converge when a boom/bust shock takes place (Schimtz, 1995). In other words, when land markets are not integrated, property prices deviate from fundamentals independently from changes in risk premium in other markets. In particular, researchers have documented booms in real estate markets based on "myopic" or "rule of thumb" extrapolation of recent values and trends (Hendershott, 1994). Indeed, when this happens, land markets do not work properly and, hence, are not efficient. However, it is also possible, at least theoretically, that bubbles and fads were nationwide giving the impression of fundamental rents integration when land prices were driven by non-fundamentals. In consequence, the existence of land price convergence is only a necessary condition but not sufficient for efficient land markets.

There are several different empirical tests that could be used to investigate the time-series properties of spatial price data and that could also be employed to test for the Law of One Price. Starting from the principle that price levels, like many economic variables, exhibit strong trends and are not always stationary, one could investigate whether the behaviour of price levels can be characterized as having a unit root or rather if prices follow a mean reverting process. If price levels contain unit roots, then a one-off shock on prices will have permanent effects. However, if prices are stationary, then such shocks are temporary and will be eliminated as time passes. The latter is, indeed, an indication of price convergence and, hence, of market integration. The estimated speed of price convergence indicates the degree of market integration.

[HERE FIGURES 4a, 4b]

Previous to econometric analysis, two straightforward measures of market integration are considered: the standard deviation and the coefficient of variance of relative land prices. These two measures would provide information as relative deviations from the Law of One Price decrease as time passes. Figure 4a shows that annual standard deviations for the logarithm of relative prices (with Barcelona's land prices as the denominator) are about 90 percent at the beginning of the period considered, but decrease to an average of less than 80 percent at the end, which is an obvious downward trend in volatility from 1904 to 1934. However, this finding does not necessarily suggest convergence in relative prices because the means of prices could also shift over time. Therefore, a further analysis (Figure 4b) is carried out by dividing the standard deviations of relative prices by their mean in each year so that the effect can be normalized. This graph indicates that the mean does not move in the same direction as standard deviation in each year, therefore, the coefficient of variation also decreases over time.

Levin, Lin and Chu (2002, hereafter LLC) and Im, Pesaran and Shin's (2003, hereafter IPS) unit root tests with panel data provide a sound econometric approach for the Law of One Price. These two procedures are used because they are more powerful than the conventional unit root tests, or at least they improve the power of unit root tests because they provide a larger number of data points and use variation across individuals, thus improving estimation efficiency. These models also allow us to consider the relative version of this law, which has advantages over the absolute version which assumes that transaction costs vary proportionately over time. This could be done by introducing fixed effects in the estimation (Goldberg and Verboven, 2005). It should be noted that this procedure captures land market fixed effects that account for non-time dependence, landholding size differences, and unobserved quality differences.

More specifically, the LLC test for the Spanish land market is carried out by estimating the following equation:

$$(3) \quad \Delta y P_{i,\,t} = \alpha_i + \beta_i P_{i,t-1} + \sum_{l=1}^{Li} \vartheta_i P_{i,t-1} + \varepsilon_{i,t},$$

Where *Pi,t* is the logarithm-difference in the real price of land in province *i* relative to benchmark province at time *t*, and Δ is the first difference operator. The primary interest is the coefficient on the lagged logarithm of price differences, β_i which represents the speed of convergence. Under the null of no convergence, β_i is equal to zero for all *i*, suggesting that a shock to P_{it} is permanent. Using this β_i coefficient, the half-life could also be computed as $-ln(2)/ln(1+\beta)$. The half-life represents the period required to reduce a quantity to one-half of its original amount. Therefore, half-lives ranging from zero to one year, for example, indicate that we need less than one year to eliminate one-half of a deviation of relative prices from its equilibrium.

This LLC test may be viewed as a pooled Dickey-Fuller (or augmented Dickey-Fuller) test, with different lag lengths across the units of the panel. Unlike alternative tests, it is efficient for panels of moderate size, between 10 and 250 individuals with 25 to 250 observations per individual (Levin, Lin and Chu, 2002). A possible criticism of this approach is that the convergence results are sensitive to the choice of the benchmark unit (Parsley and Wei, 1996; Cecchetti et al, 2002; Goldberg and Verboven, 2005; Solakoglu and Goodwin, 2005). To address this criticism, this study adopts three alternative benchmarks (Barcelona, Biscay and Madrid) and also computes the values without adopting any benchmark unit (that is, introducing an average time trend into the calculations). Alternative tests are also available for two different prices: average prices of land sold and inherited. However, only the calculation based on average prices of land sold is relevant for our purposes. Inherited land prices could be considered as sensibility tests. Note that the computed results are not substantially different in any of the alternative calculations (see table 4 below).

The major limitation of the LLC tests is that β_i is the same for all observations (that is, it assumes that the speed of convergence is identical across all locations). The IPS test extends the LLC framework to allow for heterogeneity in the value of β_i under the alternative hypothesis. Thus, IPS tests the null hypothesis H_0: β_i against the alternative that H_0: $\beta_i < 0$ for at least one *i*. The last three columns of table 4 collect the result of applying the LLC test to our database on prices.

Before proceeding, two caveats in the estimation procedure should be solved. The first is the selection of the number of lags to be included in successive calculations to account for possible serial correlation taking into account that each province in each panel had its own lag structure (note that both IPS and LLC tests allow for different lag lengths in each series). Thus, the lag structure was determined on a variety basis by running an augmented Dickey-Fuller test for each province (calculations are available upon request from the authors). The lag length was decided using Bayesian Information Criterion (BIC) since Akaike's Information Criterion (AIC) systematically tend to bias upwards the number of lags.

The second caveat is related to the fact that IPS and LLC tests assume cross-sectional independence when one would expect the presence of spatial dependence across provinces in the behaviour of land prices. Following Buettner (1999), one can distinguish between three types of spatial dependence. In the first type, unobserved regional characteristics, such as market accessibility, soil quality or climate, may be spatially correlated. A second type of spatial dependence arises from common shocks to contiguous regions, causing error auto-regression. Finally, spatial dependence might exist in the dependent variable or the regressors resulting from the similarity of production conditions in neighbouring provinces.

In the paper, therefore, we correct for spatial dependence using a filtering procedure based on Getis and Ord (1992) because, to our knowledge, no other method is currently available.[17] Therefore, in order to control for spatial effects, a two-step procedure is used. First, spatial autocorrelation is removed from the variables using a filter based on a Getis and Ord (1992) spatial association measure and, subsequently, IPS and LLC tests are run using the filtered variables. The filtering methodology is defined as follows:

$$x_i^F = .x_i \frac{\sum_j w_{ii}(\delta)}{(N-1)G_i(\delta)} \qquad (4)$$

with

$$G_i(\delta) = \frac{\sum_j w_{ii}(\delta) x_j}{\sum_j x_j}, \quad i \neq j,$$

where x_i^F is the resulted spatially filtered variable, x_{ij} are original variables considered, w_{ij} are elements of the spatial weights matrix W, and δ is a distance parameter indicating the extent to which further distant observations are down-weighted. Following the approach of Badinger *et al.* (2004), we use the above mentioned spatial weights matrix without assigning over-proportionally decreasing importance to farther distant observations, i.e. we assume $w_{ij}(\delta) = (d_{ij})^{-\delta}$ with $\delta = 1$, where d_{ij} denotes the railway distance between province capitals.[18]

[HERE TABLE 4]

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[17] Alternative estimations, without spatial filtering, are available upon request from the authors but displayed very similar results (albeit slightly slower β coefficients).

[18] The railway distance between province capitals for the early 20th century has been kindly provided by Javier Silvestre. In the case of Balearic Islands, we add the maritime distance to/from Palma to the railway distance to the most closed Mediterranean port with regular ships to Palma.

The LLC tests reject the unit root hypothesis for all different specifications at 1 percent significance level. In all cases, the point estimates are negative and are significantly different from zero. IPS tests also reject the null hypothesis of unit roots. That is, the results show significant price convergence in every period for sales, and inheritance, relative prices, regardless of the specification of the panel model. As we predicted above, the results with no fixed effects indicate slower relative price convergence among provinces than results including fixed effects. In other words, the absolute version of the Law of One Price had less explanatory power than the relative version. On the other hand, in all cases, sales prices converge faster when compared to inheritance prices. In our preferred estimation (that is, sales with fixed effects and trend),[19] the half-life for relative holding prices is estimated to be between 0.21-0.25 year.[20] In other words, it takes around two-and-a-half months to a quarter-of-a-year for a one-off shock from the original relative price to be reduced by half. On the whole, these results indicate the presence of a highly integrated land market in Spain over the first third of the 20th century.

[HERE TABLE 5]

Table 5 presents panel unit roots tests separately for the North and South of Spain. In the provinces of the North, small-medium landholdings predominated and direct cultivation was more common. Instead, in the Southern Spanish provinces, the size of landholdings was large and direct cultivation was much less common. Contemporaries tended to stress the inefficiency of Southern land markets given the presence of large landowners.[21] As in seen table 4, all different tests for any location reject the unit root hypothesis at 1 percent significance level. More prominently, the estimated half-lives were commonly lower in Southern than in Northern provinces, which contradicts the above-mentioned view.

5. Analysing Spanish land markets efficiency

Another approach for considering the efficiency of Spanish land markets is the present value model (see equation 2 above). The model of real land prices requires that, if the real rent is stationary, then the price of land itself must also be stationary. Moreover, assuming a fixed

[19] This procedure corrects for local unobserved effects like land quality.

[20] In any case, these estimates are, if anything, downward-biased values of the "true" level of market integration. Taylor (2003) shows that, when convergence periods are shorter than reference periods, computed convergence speed is biased downwards.

[21] See Carrión (1932).

discount rate, land prices and rents must be cointegrated with a unit coefficient on rents (Gutierrez *et al.* 2007).[22] If all these requirements hold, we can argue that land prices are driven by market fundamentals; that is, that land markets could be considered efficient.

Unfortunately, data on rents are not available for Spain during the period considered. Instead, we have to resort to indirect measures of VMLP. Basically, we will employ the real agricultural value added per hectare as our main proxy for rents. Note that value added is a good substitute for rents only if technical progress is Hicks-neutral (that is, only if the share of land remains constant into gross value added over time).[23] Consequently, we will test the following relationship directly by modifying equation 2:

$$(5)\ \ln V = \beta_0 + \beta_1 \ln VA,$$

where lnV is the logarithm of the real average price per hectare, lnVA is the real gross value added per hectare;[24] and $\beta_0=\ln(1/i)$ where ln is the natural logarithm. Note that the present value model only holds if $\beta_1=1$ and under the assumption that $\ln VA = \gamma * \ln R$; where γ is a constant between 0 and 1 and lnR is the natural logarithm of real rents per hectare.

The test of the present value model (equation 5) is conducted in three successive steps. First, we performed various second-generation panel cointegration tests (LLC and IPS) to determine the time series properties of the variables. It is evident from these tests that both series are stationary with the same two lags and without trend (the model had been selected with the BIC). The results are available upon request from the authors.

We now proceed to test for cointegration. Our methodology is taken from Westerlund (2007), who develops four new panel tests based on the error correction model. The underlying

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22 However, a large part of the literature found no evidence supporting the present value model. According to Gutierrez *et al.* (2007), a possible explanation for the absence of empirical support for the present value model is that standard unit root and cointegration tests may not be powerful enough to detect cointegration when applied to single time series of short to moderate length.

23 We have tested directly this assumption by regressing the logarithm of gross value added on the logarithm of cultivated hectares by province in three different periods (1904-1914; 1915-1924; 1925-1934) and with three alternative methods (OLS, fixed-effects panel regression, and random-effects panel regression). All variables have been previously corrected by geographical dependence according to equation 4. The results indicate that the coefficient of the logarithm of hectares is not significantly different across different periods, which is an indication of share stability. All calculations are available upon request from the authors.

24 See appendix.

idea of Westerlund (2007) is to test for the absence of cointegration by determining whether there exists error correction for individual panel members or for the panel as a whole. Two of the tests, G_t and G_a, assume that the error correction coefficients are equal for all provinces. The second pair, P_t and P_a, does not require all coefficients to be equal, which means that the alternative is formulated as that at least one coefficient is larger than zero for at least one province. Thus, while a rejection by the first two tests provides evidence in favour of cointegration for all N provinces, this is not the case for the other two. It should be noted that these error correction tests use a scheme that accounts for both the time series and cross-sectional dependencies of the regression error.

[HERE TABLE 6]

The computed values of the test statistics are presented in Table 6. Moreover, we include two sets of P-values; one is based on the asymptotic normal distribution, while the other is based on the bootstrapped distribution using 1,000 replications. At first sight, the no cointegration null is strongly rejected by all four tests when using the asymptotic p-values and also with bootstrapped p-values. Taken together these results are strong evidence in favour of cointegration between land prices per hectare and gross value added per hectare.

Given the reassuring results of table 6, we consider several approaches to estimating the long-run (cointegrating) relationship between the variables. Kao and Chen (1995) show that the panel ordinary least squares (OLS) may result in a biased and non-normal distribution of the residuals. The problem is amplified in a panel setting by the potential dynamic heterogeneity over the cross-sectional dimension. Therefore, two alternative methods of panel cointegration estimation have been suggested: within-dimension estimator and between-dimension (group-mean) estimator. Pedroni (2000) proposed a between-dimension fully modified OLS estimator (FMOLS) to accommodate heterogeneity amongst panel member. Subsequently, Kao and Chiang (2000) presented a panel within-dimension DOLS estimator based on including lags and leads of the first difference of the regressors in the estimated equation. However, Monte Carlo evidence in Kao and Chiang (2000) shows that the panel DOLS estimator outperforms both the OLS and the panel fully modified OLS (FMOLS) estimator. We pursue our analysis therefore, and estimate the idiosyncratic cointegration vectors using DOLS.

[HERE TABLE 7]

Table 7 supports our hypothesis of efficient land markets. Thus, we find that real land prices and real gross value added to be cointegrated around a breaking intercept with a cointegrating slope not significantly different from one. This leads us to the conclusion that the present value model cannot be rejected. In other words, Spanish land markets could be considered efficient.

6. Conclusions and Implications for Further Research

In this study, we attempt to determine whether the inadequate performance of market institutions lay behind the relative backwardness of Spanish agriculture during the first decades of the 20th century. Although substantial research has been carried out into the relation between institutions and agrarian development in Spain, the literature lacks a comprehensive analysis of the performance of land markets. In particular, we sought to clarify whether or not land markets were efficient. To tackle this issue we considered the spatial integration of land markets across Spain and whether (or not) land prices were driven by market fundamentals.

Several previous questions had to be addressed when considering spatial integration in land markets. First, our analysis required a sufficiently long series of real land prices. Using new data obtained from the Registrars' handbooks, we were able to extend the nominal land prices series for all Spanish provinces from 1904 to 1934. We then deflated these series by the new rural consumer index. Second, to measure the level of market integration and the subsequent speed of convergence, we used the economic Law of One Price. Following previous studies on market integration, we opted to investigate the time-series properties of our land price data. To do so, we used unit root tests with panel data, LLC and IPS, which are more powerful than the widely used Dickey-Fuller and Augmented Dickey-Fuller tests. These methods also allowed the introduction of fixed effects that account for landholding size and quality differences across provinces. However, before proceeding further, we corrected the series for spatial dependence and selected the number of lags to be included in calculations. Finally, we computed the tests with several alternative benchmark provinces to avoid the problem of sensitivity to the choice of benchmark unit.

Overall, our estimates of land price convergence, under all methods and different specifications utilized, seem to indicate the existence of a fairly integrated land market in Spain. Although these results may be a good indicator of efficient market behavior, it could be the case that land price convergence was not only driven by market fundamentals but also by nationwide bubbles. For this reason, we pursued our investigation on the efficiency of Spanish land markets a little further by considering directly whether land prices could be explained with the present value model.

The analysis of the present value models shows that land prices were driven by market fundamentals. To do so, we constructed a new series of real value added per hectare. We then employed the three-step procedure suggested by Gutierrez *et al.* (2007), testing successively the order of stationarity of land prices per hectare and real value added per hectare, the cointegration between them and whether the slope of the regression of land prices on real value added is one.

Our research demonstrates that the market reforms of the 19th century were enough to produce an efficient land market in Spain. In consequence, we cannot attribute the backwardness of Spanish agriculture to land markets. However, readers should not be deceived; we do not argue that the functioning of the land market is unimportant for economic development, simply that it does not serve to explain the backwardness of Spanish agriculture at the beginning of the 20th century. It is likely that with less efficient land markets, the productivity of Spanish agriculture would have been lower than actually observed.

There are several extensions of our analysis that would be useful. First, we would like to extend the analysis to other secondary markets, particularly to the credit markets. As the literature emphasizes, the development of property rights on land makes it easier for land to be used as credit collateral. However, if mortgage markets failed or were biased, favoring richer participants, access to land markets could be effectively restricted. In consequence, land markets could experience (as a result of this credit restriction) equity problems. Second, following this line of reasoning, it would be desirable to consider the access to land of landless peasants directly. In other words, we need to know how many days of work were necessary to buy an arable plot and how difficult it was for journeymen to enter the land market. Finally, it would be interesting to extend this analysis to other countries and historical periods. The Spanish experience contrasts sharply with today's land markets in developing countries but the extent to which other European countries enjoyed similarly developed land markets requires investigation.

Appendix: Data sources

Land Price data

Our study uses the information provided by the property register yearbooks (*Anuario de la Dirección General*). We used yearly data from 1904, the year that regular publication began, to 1934 when the political upheavals and later the Civil War interrupted the series until the mid-1940s. Information is grouped by provinces (49),[25] and includes the number and total value of farms

[25] However, we do not consider The Canary Islands in our calculations (this choice reduces our sample to a maximum of 48 observations per year).

registered by reason of sale, inheritance, gift, mortgage and first registration. The source also distinguishes between urban and rural properties.

Gross Agricultural Value Added

The gross agricultural value added was computed in the following way. The quantities of production of different agrarian products collected by GEHR (1991) were multiplied by the relative prices and the transforming coefficients provided by Simpson (1994). Then, these real values were converted into nominal values using the disaggregated agrarian prices provided by Prados de la Escosura (2003). Finally, current prices series were converted to real gross value added by deflating them using Rosés and Sánchez-Alonso's rural price consumer index (2009).

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Table 1. Number of Registered Landholdings Inherited and Sold, 1904-1934

	Inherited Holdings (1)	Number of holding sales (2)	Holding stock 1951 (3)	Inheritance/ Sales (4)	Inheritance/ Stock (5)
Andalusia	671,511	929,984	1,635,300	0.72	0.41
Ebro Valley	563,680	570,569	4,172,400	0.99	0.14
Mediterranean	1,023,521	1,130,148	3,176,000	0.91	0.32
North	396,587	560,441	9,655,000	0.71	0.04
Northern Castile	1,195,394	997,387	12,586,500	1.20	0.09
Southern Castile	848,892	646,361	4,396,300	1.31	0.19
Spain	4,699,585	4,834,890	35,621,500	0.97	0.13

Notes: We have grouped the provinces into six macro-regions (following Rosés and Sánchez-Alonso, 2004): Andalusia (Almeria, Cadiz, Cordoba, Granada, Huelva, Jaen, Malaga and Seville), Mediterranean (Gerona, Barcelona, Tarragona, Castellon, Valencia , Alicante and Murcia), Ebro Valley (Lerida, Saragossa, Huesca, Teruel, Logrono, Alava and Navarre), Southern Castile (Caceres, Badajoz, Albacete, Ciudad Real, Cuenca, Guadalajara, Madrid, Toledo), Northern Castile (Salamanca, Zamora, Leon, Valladolid, Palencia, Burgos, Soria, Segovia) and North (Corunna, Pontevedra, Lugo, Orense, Asturias, Santander, Gipuzcoa and Biscay).
Sources: See Appendix.

Table 2. The Relative importance (percent) of Spanish Land Markets, 1904-1934

	Holding sold per year / stock of holdings (1)	Value of Sales / Output 1908-1913 (2)	Value of Sales / Output 1931 (3)
Andalusia	1.96	10.4	8.6
Ebro Valley	0.47	5.5	4.7
Mediterranean	1.23	8.8	6.4
North	0.20	5.1	3.3
Northern Castile	0.27	3.3	2.5
Southern Castile	0.51	5.7	4.5
Spain	0.47	6.8	5.1

Notes: see table 1. All values in Ptas. of 1910. The prices are deflated by the rural consumer price deflator of Rosés and Sánchez-Alonso (2009). The amount of hectares had been estimated by multiplying the total amount of landholding sold by the average size of landholding in each province in 1874-75.
Sources: The stock of holdings is from the agricultural census for 1951 (Instituto Nacional de Estadística, 1951). Simpson (1994) provides data for the agricultural output at current prices.

Table 3. The Regional Characteristics of Spanish Land Markets, 1904-1934

	Amount of Sales per year (1)		Value of Sales per year (in 10^6 PTA.) (2)		Amount of ha. sold per year (in 10^3) (3)		Average Price per plot (4)	Average Price per ha. (5)
Andalusia	32,068	19.24 %	59.9	30.78 %	173.2	35.8 %	1,896.4	377.7
Ebro Valley	19,674	11.80 %	17.1	8.79 %	41.9	8.7 %	873.0	473.7
Mediterranean	38,970	23.38 %	51.4	26.41 %	70.4	14.6 %	1,341.4	767.2
North	19,325	11.59 %	22.4	11.51 %	17.3	3.6 %	1,162.9	1,095.1
Northern Castile	34,392	20.63 %	16.4	8.43 %	50.4	10.4 %	481.7	422.6
Southern Castile	22,288	13.37 %	27.3	14.03 %	130.1	26.9 %	1,229.0	234.1
Spain	166,720	100.00 %	194.6	100.00 %	483.3	100.0 %	1,167.8	434.4

Notes: see table 2.
Sources: see table 1.

Table 4. Panel Unit Root Tests for Spanish Land Markets, 1904-1934

			Levin-Lin-Chu (LLC)				Im-Pesaran-Shin (IPS)		
Dependent	Specification	B	*T*	*t-star*	*p-val*	*Half-life*	*t-bar*	*w-tbar*	*p-val*
a) Barcelona Benchmark									
Sale	NC	-0.1560	-10.529	-10.199	0.0000	4.0860			
	F	-0.8251	-29.092	-19.960	0.0000	0.3976	-4.206	-20.738	0.0000
	FT	-0.9515	-32.468	-19.010	0.0000	0.2290	-4.587	-20.236	0.0000
Inheritance	NC	-0.0816	-7.383	-7.152	0.0000	8.1398			
	F	-0.7515	-27.600	-19.296	0.0000	0.4979	-4.049	-19.589	0.0000
	FT	-0.9022	-31.302	-18.339	0.0000	0.2982	-4.458	-19.215	0.0000
b) Biscay Benchmark									
Sale	NC	-0.1565	-10.659	-10.324	0.0000	4.0738			
	F	-0.8262	-29.519	-20.735	0.0000	0.3961	-4.191	-20.663	0.0000
	FT	-0.9615	-33.527	-20.203	0.0000	0.2128	-4.565	-20.077	0.0000
Inheritance	NC	-0.0815	-7.664	-7.422	0.0000	8.1513			
	F	-0.7541	-28.412	-20.601	0.0000	0.4941	-4.123	-20.924	0.0000
	FT	-0.8947	-32.173	-19.951	0.0000	0.3080	-4.588	-20.356	0.0000
c) Madrid Benchmark									
Sale	NC	-0.1256	-9.065	-8.783	0.0000	5.1626			
	F	-0.7796	-26.094	-15.877	0.0000	0.4583	-3.705	-16.839	0.0000
	FT	-0.9353	-29.529	-15.275	0.0000	0.2531	-4.194	-16.910	0.0000
Inheritance	NC	-0.0511	-5.303	-5.141	0.0000	13.2255			
	F	-0.6857	-22.429	-12.143	0.0000	0.5989	-3.221	-13.144	0.0000
	FT	-0.8589	-25.664	-10.341	0.0000	0.3540	-3.624	-12.219	0.0000
d) Without Benchmark (National average)									
Sale	FT	-0.9459	-34.094	-21.1075	0.0000	0.2376	-4.688	-21.389	0.0000
Inheritance	FT	-0.9015	-32.763	-20.3152	0.0000	0.2991	-4.580	-20.504	0.0000

Notes: All variables Geographically heterokedasticity corrected as described in the text. The lags have been selected on a variety basis with the BIC criterion by running ADF tests for each individual serie. NC: No constant (unconditional convergence); F: Fixed effects; FT: Fixed Effects and Time Trend; Half life (in years) is computed as $-\ln(2) / \ln(1+\beta)$.
Sources: See table 1.

Table 5. Panel Unit Root Tests for Spanish Land Sales Markets, 1904-1934: North / South comparison

			Levin-Lin-Chu (LLC)				Im-Pesaran-Shin (IPS)		
Macro-Region	Specification	B	*T*	*t-star*	*p-val*	*Half-life*	*t-bar*	*w-tbar*	*p-val*
a) Barcelona Benchmark									
North	NC	-0.1714	-9.107	-8.821	0.0000	3.6859			0.0000
	F	-0.7709	-22.427	-15.004	0.0000	0.4703	-3.833	-14.512	0.0000
	FT	-0.9195	-25.734	-14.756	0.0000	0.2751	-4.301	-14.498	0.0000
South	NC	-0.1923	-6.327	-6.131	0.0000	3.2456			0.0000
	F	-0.8661	-17.753	-12.219	0.0000	0.3447	-4.270	-12.418	0.0000
	FT	-0.9524	-19.306	-11.572	0.0000	0.2276	-4.594	-11.871	0.0000
b) Biscay Benchmark									
North	NC	-0.1610	-8.812	-8.535	0.0000	3.9477			0.0000
	F	-0.7742	-22.204	-14.813	0.0000	0.4659	-3.817	-14.407	0.0000
	FT	-0.9557	-26.138	-14.757	0.0000	0.2223	-4.322	-14.629	0.0000
South	NC	-0.2123	-7.016	-6.797	0.0000	2.9052			0.0000
	F	-0.8738	-18.754	-13.617	0.0000	0.3349	-4.560	-13.773	0.0000
	FT	-0.9421	-20.108	-12.739	0.0000	0.2433	-4.764	-12.732	0.0000
c) Madrid Benchmark									
North	NC	-0.1261	-7.644	-7.405	0.0000	5.1438			0.0000
	F	-0.7319	-20.000	-11.455	0.0000	0.5266	-3.480	-12.469	0.0000
	FT	-0.9225	-23.679	-11.255	0.0000	0.2711	-4.072	-13.114	0.0000
South	NC	-0.1659	-5.436	-5.270	0.0000	3.8216			0.0000
	FB	-0.8637	-16.672	-11.038	0.0000	0.3479	-4.120	-11.325	0.0000
	FT	-0.9601	-18.259	-10.488	0.0000	0.2151	-4.443	-10.737	0.0000
d) Without Benchmark (National average)									
North	FT	-0.9254	-27.282	-16.589	0.0000	0.2671	-4.565	-16.622	0.0000
South	FT	-0.9478	-19.504	-11.874	0.0000	0.2347	-4.636	-12.084	0.0000

Notes: See Table 4. The South macro-region is formed by Southern Castile and Andalusia while the remaining regions formed the North macro-region.
Sources: See table 1.

Table 6. Cointegration test results of the present value model, 1904-1934

	Value (1)	Z-value (2)	P-value (3)	Robust P-value (4)
G_t	-4.021	-14.364	0.000	0.000
G_a	-23.164	-11.734	0.000	0.000
P_t	-28.419	-16.051	0.000	0.000
P_a	-24.080	-17.545	0.000	0.000

Notes: We estimate the equation 5. All variables had been corrected for spatial dependence as is described above. The tests of Westerlund (2007) take no cointegration as the null hypothesis. The test regression is fitted with 4 $(T/100)^{2/9}$ lags and leads. The *P*-values are for one-tailed test based on the normal distribution. The robust P-values are bootstrapped using 1,000 replications.

Sources: See appendix.

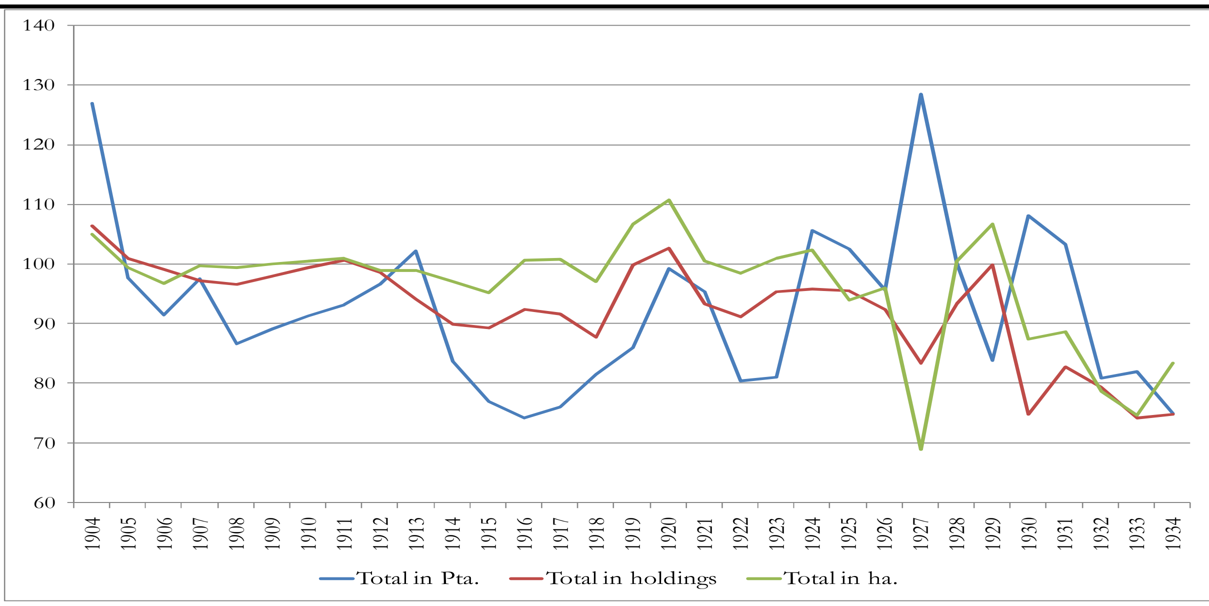
Table 7. DOLS estimates of the present value model, 1904-1934

	Coefficient (1)	Std. Err. (2)	Z (3)	P>/z/ (4)
β_0	1.6727	0.0198	8.44	0.000
β_1	0.9571	0.0423	22.62	0.000
Wald Chi^2	591.42			
R^2	0.2827			

Notes: We estimate the equation 5. The method of estimations is instrumental variables (2SLS) regressions. The DOLS is fitted with 4 $(T/100)^{2/9}$ lags and leads. Coefficients and standard errors are robust. All results and regression statistics are significant at 1 percent level.

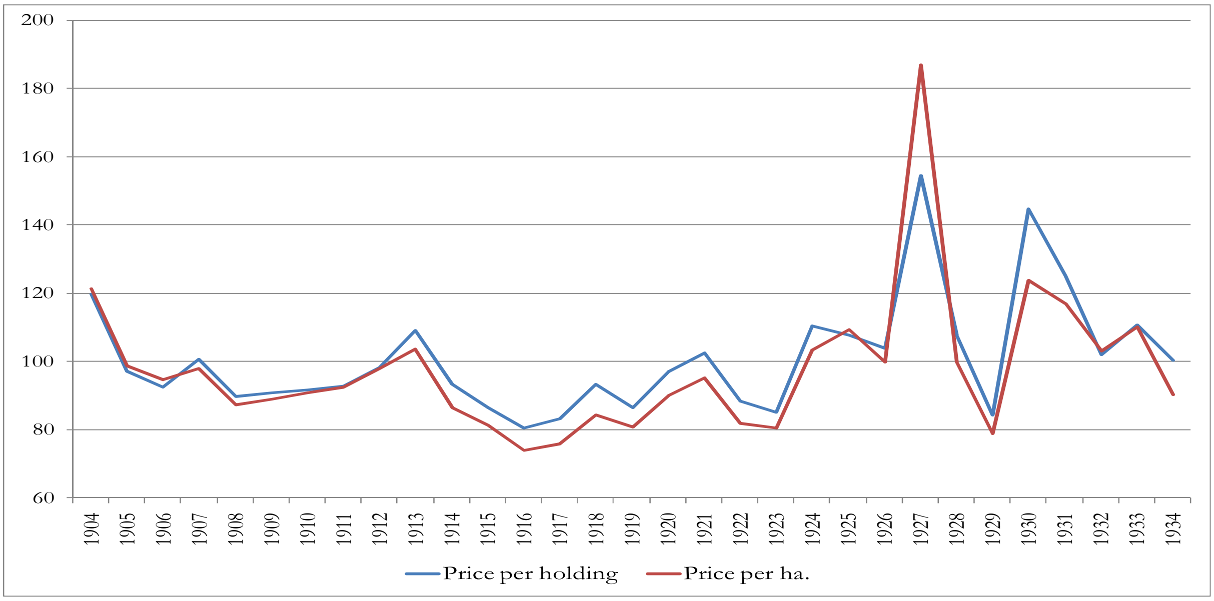
Sources: See table 6.

Figure 1. The evolution of land sales in Spain, 1904-1935 (1904/8 = 100).



Notes: see table 2.
Sources: see table 1.

Figure 2. The evolution of average land prices in Spain, 1904-1935 (1904/8 = 100).



Notes: see table 2.
Sources: see table 1.

Figure 3a. Evolution of the amount of landholdings sold, 1904-34 (Ebro V., Mediterranean and Andalusia)

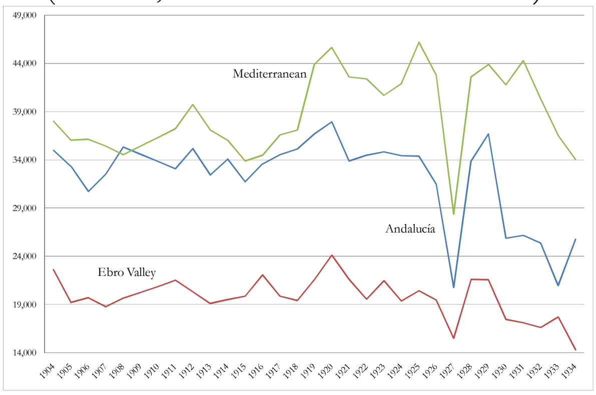


Figure 3b. Evolution of the amount of landholdings sold, 1904-34 (N. Castile, S. Castile and North)

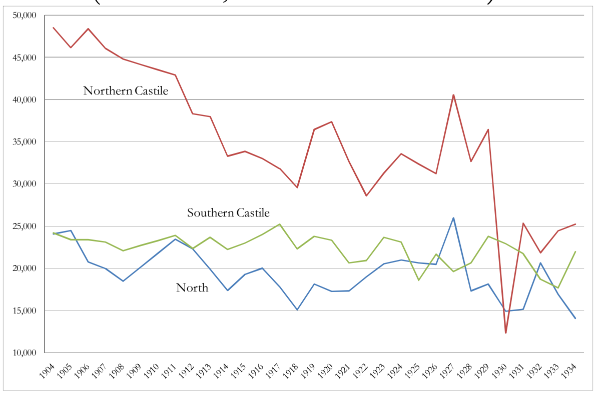


Figure 3c. Evolution of the total real value of landholdings sold, 1904-34, in million Pta. (Ebro V., Mediterranean and Andalusia)

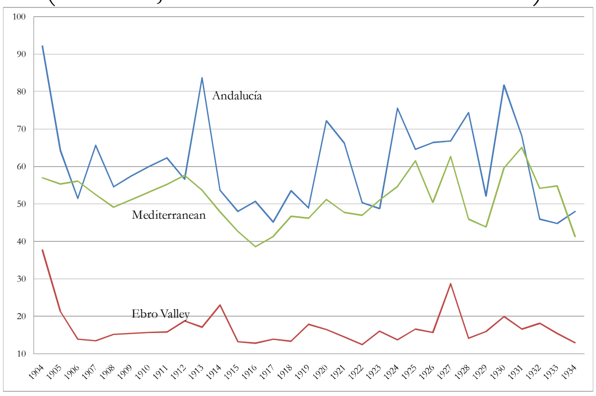


Figure 3d. Evolution of the total real value of landholdings sold, 1904-34, in million Pta. (N. Castile, S. Castile and North)

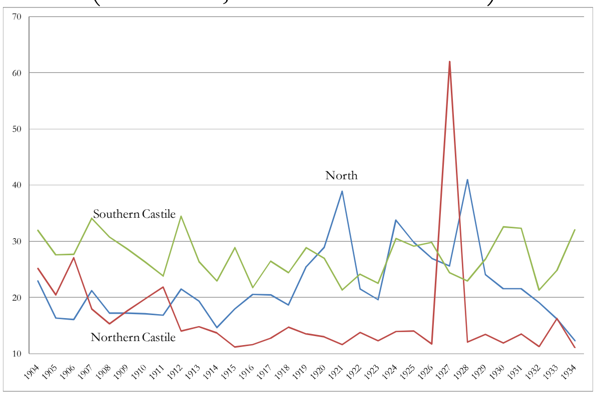


Figure 3e. Evolution of the real price of landholdings sold, 1904-34, in 1910 Pta. (Ebro V., Mediterranean and Andalusia)

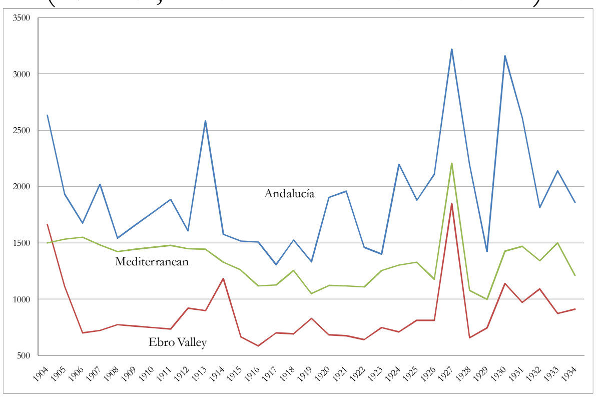
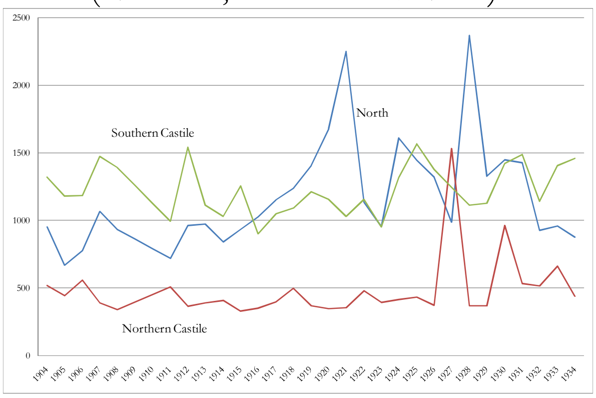


Figure 3f. Evolution of the real price of landholdings sold, 1904-34, in 1910 Pta. (N. Castile, S. Castile and North)



Notes: see table 2.
Sources: see table 1.

Figure 4a. Standard deviation of relative land prices, 1904-1934

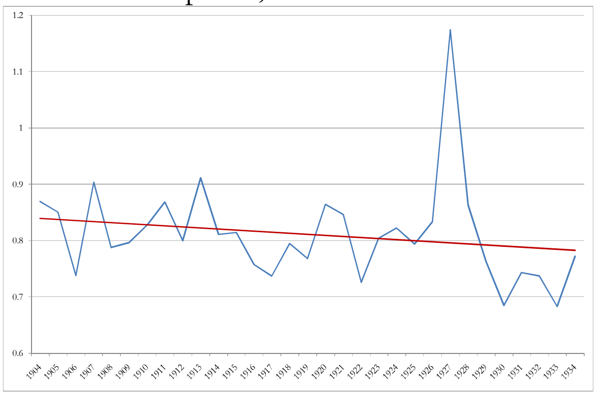
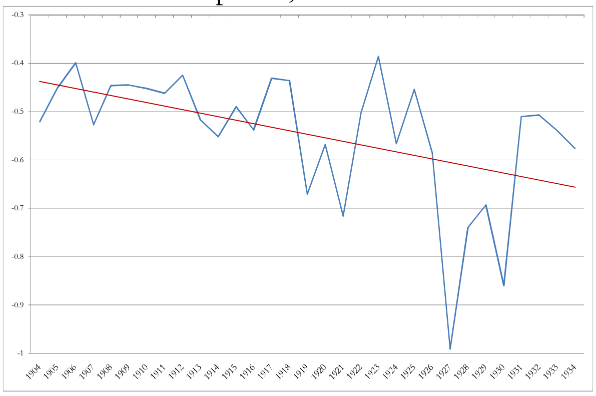


Figure 4b. Coefficient of variance for relative land prices, 1904-1934



Notes: see table 2.
Sources: see table 1.