Universidad Carlos III de Madrid
www.uc3m.es

Working Papers in Economic History

March 2010 WP 10-04

Amartya Sen revisited: trade, inequality and growth in central Spain, 1700-1800.[1]

Carlos Santiago Caballero

Abstract
This paper studies the effects of trade and inequality in central Spain during the eighteenth century, taking as case study the province of Guadalajara and the surrounding regions. The first part of the paper presents a specific factors model as theoretical framework that will later be applied to the empirical data. The second part introduces an analysis of income inequality in the province during the eighteenth century and concludes that inequality decreased, especially during the last third of the century. Finally the paper addresses this unexpected result and concludes that it was consequence of the success of the land reform carried out by the central government in the late 1760s. The reform was a success in Guadalajara thanks to the characteristics of its population and the lack of bargaining power of pressure groups. Following Sen's ideas, the reduction in inequality meant that markets could work properly and that a majority and not only a few could take full advantage of the benefits of trade.

Keywords: Trade, inequality, pressure groups, institutions.
JEL Classification: D63, F1, N33, N53, O1, O18

Carlos Santiago Caballero: Department of Economic History and Institutions, University Carlos III of Madrid, C/Madrid 126, 28903 Getafe, Spain.
Email: csantiag@clio.uc3m.es
http://www.uc3m.es/portal/page/portal/dpto_historia_economica_inst/profesorado/carlos_santiago_caballero

[1] Financial support from the Spanish Ministry of Science and Innovation project "Explicando el desarrollo de las regiones europeas, 1850-2008" ECO2009-13331-C02-01 is acknowledged.

Amartya Sen revisited: trade, inequality and growth in central Spain, 1700-1800.[1]

Carlos Santiago Caballero
Department of Economic History and Institutions
University Carlos III of Madrid

Abstract

This paper studies the effects of trade and inequality in central Spain during the eighteenth century, taking as case study the province of Guadalajara and the surrounding regions. The first part of the paper presents a specific factors model as theoretical framework that will later be applied to the empirical data. The second part introduces an analysis of income inequality in the province during the eighteenth century and concludes that inequality decreased, especially during the last third of the century. Finally the paper addresses this unexpected result and concludes that it was consequence of the success of the land reform carried out by the central government in the late 1760s. The reform was a success in Guadalajara thanks to the characteristics of its population and the lack of bargaining power of pressure groups. Following Sen's ideas, the reduction in inequality meant that markets could work properly and that a majority and not only a few could take full advantage of the benefits of trade.

Keywords: Trade, inequality, pressure groups, institutions.

JEL classification: D63, F1, N33, N53, O1, O18

Carlos Santiago Caballero: Department of Economic History and Institutions
Universidad Carlos III de Madrid, C/Madrid 126, 28903 Getafe, Spain.
Email: carlos.santiago@uc3m.es
http://www.uc3m.es/portal/page/portal/dpto_historia_economica_inst/profesorado/carlos_santiago_caballero

[1] Financial support from the Spanish Ministry of Science and Innovation project "Explicando el desarrollo de las regiones europeas, 1850-2008" ECO2009-13331-C02-01 is acknowledged.

This paper takes Amartya Sen seriously.[2] In 1981 Sen published *Poverty and Famines: An Essay on Entitlement and Deprivation*, where he highlighted the importance of the distribution of food as a key aspect to explain market failures and the emergence of famines.[3] For Sen, how much food an economy is able to produce is important, but as important if not more is how well distributed that production is. Therefore, increasing inequality opens the road to economic asymmetries that undermine the benefits of trade and economic integration. This paper takes into consideration Sen's ideas and applies them to eighteenth century central Spain. The results indicate that Sen was right not just in the case of twentieth century famines, but also in the role that inequality played in agrarian economies like preindustrial Spain. The paper will show that egalitarianism was a positive factor for the right distribution of trade benefits and to explain the unexpected success in certain parts of Spain of the agrarian reform of the late eighteenth century. In this sense the paper will coincide with Engerman and Sokoloff, underlining the importance of low inequality to prevent the actions of pressure groups, with the consequent development of economically inefficient institutions.[4]

The first part of the paper will study the effects of trade in central Spain during the second half of the eighteenth century, a period when trade relations intensified in the interior of the country. We will use the province of Guadalajara next to Madrid as case study for several reasons. First of all Guadalajara was a province that appeared to be disconnected from the trade network in central Spain during the first half of the eighteenth century. The situation changed from the 1750s onwards when the levels of economic integration in the interior increased. Secondly, theory predicts that as a grain producer land-abundant region, Guadalajara and its population would enjoy the benefits of trade, especially in an economic environment where the growing demand of Madrid increased the price of grain. For that reason and also for its proximity to Madrid, Guadalajara seems to be an ideal candidate to analyse the effects of trade and the consequences of increasing economic integration. We will theoretically approach the case by using a factors specific model. The first part of the paper will therefore introduce the model that will serve as framework to predict the effects of open trade in Guadalajara. Later on, the paper will study how the variables included in the model changed in the case of eighteenth century Guadalajara. We will show that as the factors specific model predicts, the amount of labour dedicated to grain production increased during the second half of the century while it decreased in urban areas. At the same time and although in per capita levels production was reduced, the increase in the price of grain compensated and increased the revenues of grain producers.

The second part of the paper will show that in addition to the benefits of trade, inequality between grain producers of Guadalajara diminished during the last third of the eighteenth century. This finding is particularly important because the literature has seen the eighteenth century in Spain as a period of increasing inequality. According to

[2] Following Mankiw, Romer, and Weil (1992)
[3] Sen (1981)
[4] Engerman and Sokoloff (2002)

Sen (1981) the reduction in inequality levels should also prevent market failures caused by pressure groups and therefore to better extend the benefits of trade. Finally the paper will argue that the most plausible explanation of this phenomenon was a land reform, carried out by the enlightened governments that ordered the allocation of common lands owned by local councils between small producers. The intention of the government was guaranteeing the supply of food in large urban areas like Madrid, encouraging the creation of a middle class of peasants. This new social class would be wealthy enough to promote demographic growth and to constitute the economic foundations of the kingdom. In that sense the reform worked in Guadalajara, where the number of producers increased, the amount of very small producers was reduced, and population growth was sustained while it stagnated in the rest of the interior. We will conclude that the most important reason for the success of the reform in the province was the equality that existed between grain producers of Guadalajara. In line with Engerman and Sokoloff (2002), the lack of bargaining power from local oligarchies facilitated the development of the reform, and made possible the success of an economically efficient institutional framework.

A trade model for 18th century Guadalajara.

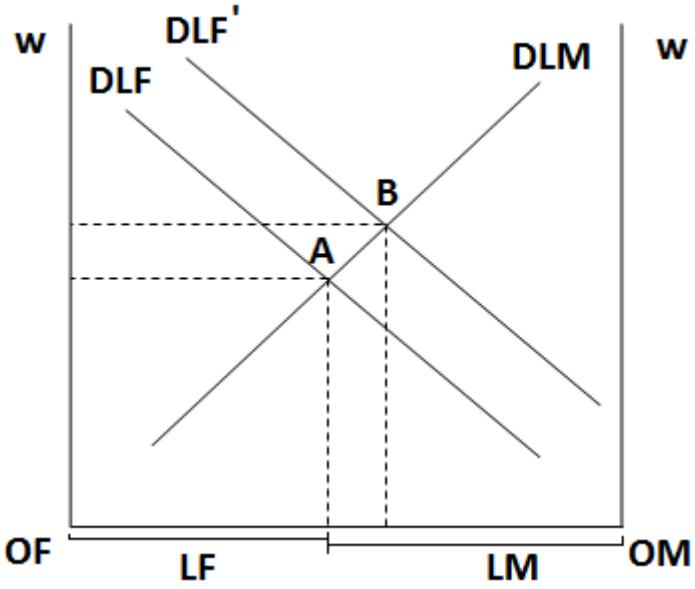
Eighteenth century Europe was still an agricultural economy where the primary sector was by far the most important employer and producer. Spain far from being an exception was an extreme case, both in the rural character of its population and the predominant role of agriculture in the economy.[5] Within this framework the importance of grain trade has been a key issue in the economic history of preindustrial economies (Kessler and Temin, 2007). The literature has explored the effects of economic integration of grain markets and their importance in areas as different as the Baltic Sea or China before the industrial revolution (Hybel 2002, Shiue, 2000 and Persson 2000). The behaviour of grain markets has also been extensively used in the study of the first globalization, when the reduction of transport costs made possible the transoceanic movement of grain (O'Rourke and Williamson, 2002). Different studies also addressed an important question, who were the winners and the losers of trade? (O'Rourke, 1997).

To address those issues and given the characteristics of the case that we are studying, we decided to use a specific factors model as theoretical framework to analyse the effects of trade. We will use the most traditional version with and economy with two sectors and three factors, being two of them specific to each one of the sectors and the third one perfectly mobile. In our case we will take manufactures and agriculture as the two sectors of the economy. The three factors available in the economy will be capital, land and labour. Capital will be specific to manufactures, land to agriculture, and labour will be perfectly mobile between both. One of the most important assumptions of the

[5] Madrid and Barcelona where the only two cities with more than 100,000 inhabitants, the old cities of Castile were in clear decline and in the north the largest city was Bilbao with not more than 12,000 inhabitants. It is estimated that an 80 percent of the Spanish was rural (Soler Pascual 2000).

model is implicit on its name, the fact that two of the factors are immobile. Although assumptions in economic models tend to oversimplify the functioning of the real economy, in this case they seem to be perfectly plausible. First of all it is clear that land, although necessary for the construction of workshops and factories, is a factor that is almost exclusively associated to the primary sector. Secondly, the use of capital in eighteenth century Spain was scarce in agriculture (Soler Pascual, 2000), and therefore considering it fixed to manufactures is not an extreme conjecture. Finally the existence of internal migrations in Spain is not a new phenomenon, and therefore the free movement of labour between both sectors also appears to be a realistic assumption (Carbajo Isla, 1987: 115). Finally the factors specific model is better suited to study short term changes like the ones that we are analysing instead of long run effects where other alternatives like the Heckscher-Ohlin model would be more appropriate.[6]

Figure 1: Specific factors model



Point A in Figure 1 represents a closed economy in autarky where there is no trade and therefore both goods are being produced to cover the necessities of its population. When the economy is open to commerce, if local prices are different to those in the surrounding areas trade takes place and both local and external prices tend to converge. The new equilibrium will move to B and the local economy will specialize in the production of the good that uses more intensively the factor that is more abundant in relative terms. Therefore, if the local economy is relatively land-abundant, it will produce food that will be exported and will import manufactures from the surrounding areas.

[6] See Roses (2003) as example.

The effects predicted by the model are several and allow us to distinguish between winners and losers. The winners will clearly be the producers of food that will be able to export their products at a higher price. At the same time they will enjoy lower prices of manufactures that will be imported from the exterior. On the other hand, capitalists producing local manufactures will suffer with the competition from the exterior that will reduce their revenues, and also with the increasing prices of food. Finally the net effect on workers will be ambiguous. There will be a transfer of labour from manufactures to agriculture and nominal wages in the local economy will increase. However, in real terms the effect will depend on the relative weight of manufactures and food in their personal budgets. If manufactures represent the lion share of the budget then real wages will probably increase, but if food dominates the budget real wages may fall.

So what was the situation of eighteenth century Guadalajara within this theoretical framework? Guadalajara was a province where land was clearly the most abundant factor. It has been estimated that in the early 1750s Spain had a population density of 18.6 inhabitants per square kilometre and Castile of 17.2.[7] On the other hand, population density in Guadalajara was 9.7 inhabitants per square kilometre. Compared to the rest of Castile at a regional level, Guadalajara presented the lowest population density with the closest area being the Centre-South of Castile with 11.1 inhabitants per square kilometre.

Table 1: Population densities in Castile

	Density
North	34.1
South	18.8
Centre-North	14.8
Centre-South	11.1
Guadalajara	**9.7**

Source: See appendix

Density figures show an important feature of Spanish agriculture; the existence of two models of agrarian production. The system in the north consisted on a large number of very small producers, while the south of the country was dominated by extensive properties controlled by local oligarchies that employed large amounts of rural workers. Small producers in the north were criticised for not being able to take advantage of economies of scale producing in economies of subsistence. On the other hand, big landowners in the south were accused of not reinvesting the benefits obtained from their exploitations in productive activities. The system in the south also produced a large pool of unskilled low salaried social class that as the small producers in the north lived at subsistence levels. Table 2 presents an estimation of the proportion of rural workers (jornaleros) in the four main areas of Castile and in Guadalajara. The results show the existence of the two systems, with the proportion of rural workers in the economy

[7] Own calculations from Fernandez de Pinedo (1980:18) and Lacomba (1999:321)

increasing as we move south. Although producers in the north had access to land and this reduced the proportion of poor people, pressure on land was so high that the exploitations were too small. Population in the south had to deal with a different problem, the unequal distribution of land that forced them to work as salaried workers with a high proportion of poor people as result. Guadalajara however appears to be an outlier in this progression, presenting proportions of rural workers similar to those that existed in the north of Spain. This view is supported with the study of the proportion of extremely poor people in each region.[8]

Table 2: Population density, rural workers and poor people

	Density	Workers/1000	Poor/1000
North	34.1	5	9
South	18.8	186	22
Centre-North	14.8	66	25
Centre-South	11.1	149	36
Guadalajara	**9.7**	**9**	**12**

Source: See appendix

Therefore, Guadalajara seems to combine the best of the two systems. Low population density prevented pressure on land and therefore on the continuous division of properties that existed in the north. On the other hand, the extremely low percentage of rural workers meant that producers in Guadalajara had a relatively easy access to land. This conjecture is supported by the small proportion of poor people that existed in Guadalajara.

The levels of economic integration in the interior of Spain were relatively low during the first half of the eighteenth century, and Guadalajara was especially affected by this fact. From the different main roads that led from Madrid to the periphery, the one that crossed Guadalajara presented the lowest level of economic integration.[9] Therefore, combining the lack of integration with a generous natural endowment and easy access to land, Guadalajara enjoyed a better supply per capita of grain and therefore lower price than the surrounding provinces.

[8] Poor people are defined by the manuscripts as beggars.

[9] We measured economic integration along the main roads connected to Madrid by measuring the volatility of the price of wheat along them. The information was extracted directly from the manuscripts from the Catastro de la Ensenada.

Table 3: Average wheat prices and volatility by province, mid 18th century

	Average Price	Coefficient of Variation
Guadalajara	15.0	11.2
Cuenca	16.8	10.4
Toledo	17.4	9.1
Ciudad Real	17.4	6.7
Madrid	17.8	10.8
Albacete	19.6	10.1

Sources: See appendix

Table 3 shows the average price of wheat by municipality in the six main provinces of South Castile in the early 1750s.[10] The results show that the average price of wheat in Guadalajara was 15 reales, while prices in the other five provinces were substantially higher. Table 3 also presents information about the coefficient of variation of prices within each province, showing that the variation was higher in Guadalajara than anywhere else. This fact supports the idea that in the early 1750s Guadalajara was not well integrated into the economy of South Castile.

In summary, mid eighteenth century Guadalajara was a province where land was abundant, labour scarce, access to land easy, and economic integration low. The economic consequences were low grain prices, small proportion of rural workers and modest poverty levels.

The second half of the eighteenth century saw a significant change in the levels of economic integration in the interior of Spain. All the available evidence seems to indicate that commercial connections between Madrid and the rest of Castile increased during this period, in part consequence of the investments carried out by the central government (Uriol, 1978). In the early 1750s king Fernando VI send and Irishman, Bernardo Ward, to Europe in order to study the economies of the main powers and to write a report with his recommendations. The conclusions of Ward were clear, the encouragement of internal and external trade were the keys to wealth and growth and should therefore be a priority for the government. Another important reason to improve the road network was the necessity of guaranteeing the supply of Madrid as political centre of the country. Population in the capital grew from 95,000 inhabitants in 1723 to 150,000 in 1752 (Carbajo Isla, 1987:169), and during periods of harvest failure and food scarcity civil unrest was a major concern for the Bourbon government (Soler Pascual, 2000).[11] Carlos III was proclaimed king of Spain in 1759 and during his reign he followed the recommendations included in Ward's report, starting a programme of investments to improve the infrastructures of the country. With Carlos III the

[10] In the paper we consider New Castile and the province of Albacete as South Castile.
[11] The Esquilache riots of 1766 took place in Madrid as consequence of the growing price of bread.

construction of roads focused more in economic rationality and less in the grandiose but inefficient projects that preceded him (Uriol, 1978:636). However, the intervention did not rely just on the construction and improvement of roads, it also proceeded to standardize distance measurements in all the country. The new legislation defined that one league had to contain 24,000 feet, and the distance to Madrid had to be clearly identified in all the roads (Uriol, 1978:630). While local governments had to pay for the regional developments, the construction and improvement of the main roads were paid with a new tax on salt consumption introduced in 1760. The investment was so high that the tax on salt intended for just 10 years was paid until the end of the century.[12]

Consequence of the intense construction works or not, the truth is that the levels of economic integration in the interior of Spain increased substantially during the second half of the eighteenth century. To check quantitatively if the economy of the interior became more integrated, we compared the original price series of wheat that we collected from Madrid with the series from Toledo, Valencia (Hamilton, 1947), Barcelona, Majorca (Feliu, 1991) and Navarre (Arizcun Cela, 1989). We observe that although the links with the north and the islands decreased, in the interior they increased during the second half of the eighteenth century. Recent studies have also pointed in the same direction, showing that integration levels within the interior of Spain grew during the same period (Llopis and Sotoca, 2005).

Table 4: Cross correlation coefficients with the Madrid series

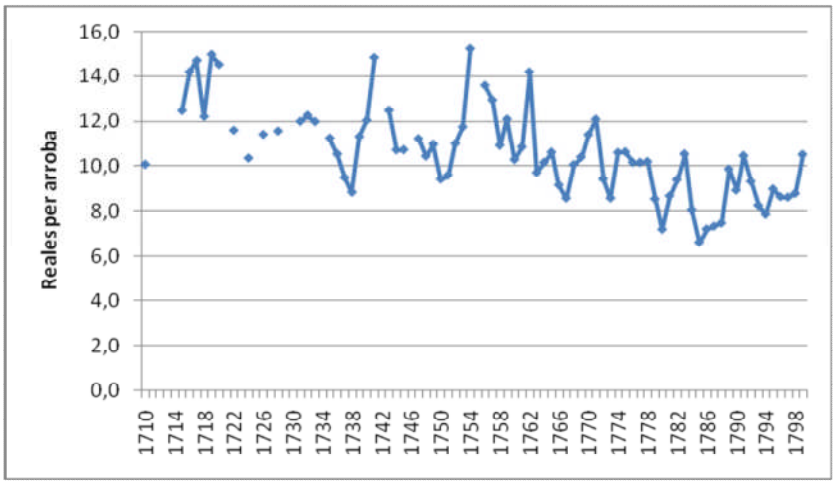
	TOLEDO	VALENCIA	BARCELONA	MAJORCA	NAVARRA
1698-1725	0.40	0.01	-0.24	0.46	0.01
1725-1745	0.25	0.21	0.14	0.44	0.49
1745-1760	0.29	-0.17	-0.43	0.39	-0.20
1760-1789	0.68	0.31	0.34	-0.07	0.03

Sources: See appendix

As infrastructures improved, transport costs were reduced. Figure 2 shows how transport costs of moving barley from Madrid to Santiago fell during the second half of the eighteenth century coinciding with the public works ordered by Carlos III (Erias Roel and Gelabert, 1975). Similar conclusions were reached by Uriol, who argued that moving wheat in the interior of Spain both by pack animals and wagons became cheaper during the second half of the eighteenth century (Uriol, 1977).

[12] Artola (1982:128)

Figure 2: Real cost of moving one arroba[13] of barley from Madrid to Santiago in reales



Sources: See appendix

But to what extent was Guadalajara influenced by these improvements? It was certainly affected by the investments from the central government and Guadalajara became more integrated with the rest of the interior, especially with Madrid. For example the number of links with the major road network increased in Guadalajara during the second half of the eighteenth century (Madrazo, 1984:59). The increasing integration between the grain markets of Madrid and Barcelona presented in table 4, indicates that the main road that crossed Guadalajara connecting both cities also increased its use. Although not as exhaustive as a quantitative analysis, we also count on chronicles from travellers that support this improvement. In 1769 the Italian poet Victorio Alfieri visited Spain and travelled from Barcelona to Madrid in a coach with two horses spending fifteen days. In 1786 Townsend did the same trip in just fourteen days, including one day that he rested in Zaragoza (Uriol, 1977:149). It is not strange that the government was especially interested in connecting Guadalajara with the rest of the country and especially with Madrid. As a grain producer the province could become another granary for the capital joining more traditional suppliers like Old Castile, improving the supply of food in the city.

At the early 1750s the province of Guadalajara had a surplus of 115,303 fanegas of wheat that could be exported to the surrounding areas.[14] Given an estimated consumption per capita of 6 fanegas per year per inhabitant, the surplus in Guadalajara would be enough to maintain a population of almost 20,000 people.[15] Ringrose estimated that by 1757 the city of Madrid had a population of 126,326 inhabitants (Ringrose, 1983:331). Therefore, the surplus of Guadalajara would be enough to maintain a 16 per cent of the population of Madrid. However, was it profitable to move

[13] One arroba was the equivalent to 11.5 kilos.
[14] The number was calculated gathering the information from all the municipalities in the province from the manuscripts of the Catastro de la Ensenada. For a more detailed explanation see data appendix.
[15] A consumption of 6 fanegas per inhabitant has been proposed by Simpson (1989: 363)

wheat from Guadalajara to the capital? The price differential between the surplus regions of Guadalajara and Madrid in the early 1750s was on average 6 reales per fanega, although it could reach up to 10 reales per fanega.[16] The distance between the fertile central area of Guadalajara and the capital was 100 kilometres and the cost of moving one fanega of wheat that distance between 4.1 and 6.7 reales per fanega.[17] Therefore, moving wheat from Guadalajara to Madrid was profitable. Given that the price of wheat doubled from 1750 to 1800 and that transport costs decreased, the possibilities of exchanges between Guadalajara and Madrid grew significantly.

The outcome of Guadalajara joining the trade network in the interior of Castile had evident effects in the province. Returning to the factors specific model previously described, having a clear comparative advantage in the production of grain Guadalajara specialised in the production of food. Grain prices in Madrid doubled during the second half of the eighteenth century, fuelled by the growth of the capital to more than 184,000 inhabitants by 1799 (Ringrose, 1983:27). In relative terms, the consumer price index (CPI) that we created for New Castile and the prices of grains grew at similar rates during the first half of the eighteenth century.[18] However, during the second half the price of grains exceeded the growth of the CPI when the price of wheat grew twice as fast as the price of textiles or commodities (Hamilton, 1988). The adjustment predicted by the specific factors model took place and labour moved from urban to rural areas producing a ruralisation of the economy in Guadalajara. Using population as an estimation of labour force, baptismal series show that during the second half of the eighteenth century rural population in Guadalajara increased by 30 per cent. In the case of the more urban and densely populated areas of the province close to Madrid, population decreased by around 20 per cent.[19] A similar process, although less intense, is observed in the rest of New Castile. During the second half of the eighteenth century population in the cities (except Madrid) fell significantly while it grew in rural areas (Reher, 1990:65). Therefore, the adjustment of labour took place with people moving to or simply staying in the countryside. The effect that increasing grain prices had in the motivations and opportunity cost of the peasants was severe. Grain producers had little incentives to move to the cities when the value of their production was growing, while skilled and unskilled real wages in the cities of New Castile from 1750 until 1800 fell by 50 per cent.[20] In a province where land was abundant, it is not surprising to see that the number of grain producers in Guadalajara increased by 50 per cent from 1750 to 1800.[21] The demographic increase was particularly intense during the last third of the century. However, demographic trends in Guadalajara until 1770 are not very different to those presented in other areas of the interior. During the period 1700-1770 baptismal

[16] Data from the Catastro de laEnsenada.
[17] Own calculations form Uriol (1977)
[18] The variables and method to estimate the CPI are explained in detail in the appendix.
[19] Baptismal records were obtained directly from the baptismal books in the Historical Diocesan Archive of Siguensa-Guadalajara.
[20] Own calculations from Hamilton (1988)
[21] The number of producers was obtained from the tithe books in the Historical Diocesan Archive of Siguensa-Guadalajara. The books contained the number of grain producers in each municipality.

series increased in New Castile by 28 percent, in Old Castile by 22 percent, in Madrid by 17 percent and in Guadalajara by 19 percent. It is in the period 1770-1800 when clear differences appear between Guadalajara and the rest of the interior. The series in Madrid stimulated by the growth of the capital grew by 4 percent, but in Old Castile fell by 2 percent and in New Castile by 4 percent. Nevertheless, instead of declining as in Old and New Castile, the series in Guadalajara increased by 15 percent.[22] The answer to this unexpected behaviour can be found in the unique economic characteristics of Guadalajara highlighted before. However, there was another variable that according to the literature behaved in an unexpected way in Guadalajara, the inequality between grain producers that declined from 1770 and that reinforced the benefits of trade.

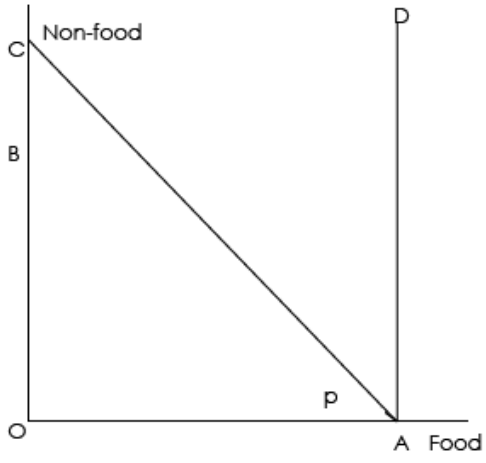
Income inequality and Sen's entitlements theory

According to Amartya Sen how well production is distributed is as important if not more as how much is produced. Therefore, the distribution of food production is a key element in order to explain demographic changes. In his entitlements theory Sen states that:

"The entitlement approach to starvation and famines concentrates on the ability of people to command food through the legal means available in the society, including the use of production possibilities, trade opportunities, entitlements vis-à-vis the state, and other methods of acquiring food"(Sen, 19891:45).

For Sen, there are four ways of commanding food; through trade, own production, own labour, and inheritance. To study the relationship between food production and demographic movements, we should look not just at the total levels of food production, but also at the ability of every individual to command his own supply (Sen, 1977:33). The next figure summarises the main points of the entitlements approach.

Figure 3: The entitlements approach

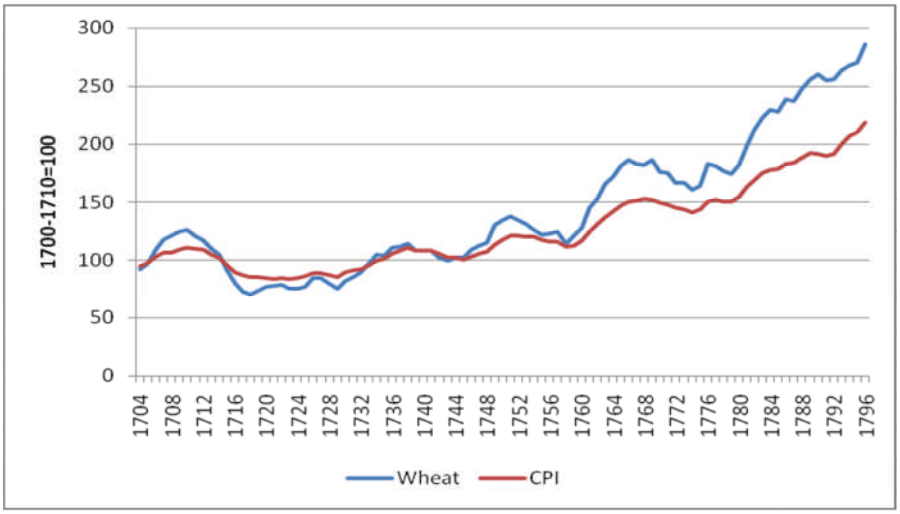


[22] Data from Llopis (2004) and own estimations.

Figure 3 shows the Possibilities of Consumption Frontier (PCF) for an individual in an economy where there are only two sort of goods, food and non-food. If that is the case, then the frontier given depends on the relative prices of both goods (p) (Sen, 1981:437). *A* is the minimum amount of food necessary to survive, and therefore with the price *p* the starvation region is defined by the triangle *OAC*. This region can change if prices change, for instance if *p* grows meaning that now food is more expensive and therefore less accessible. The individual will only be immune to price changes if he is able to produce himself an amount of food superior to *A*.

Figure 4 shows the comparison between wheat prices and the Consumer Price Index (CPI) in New Castile, and confirms that prices of wheat grew faster than the CPI during the second half of the eighteenth century. The results suggest that between 1700 and 1750 price changes in both series were very similar, but that in 1750 the situation changed and the price of wheat increased more rapidly that the CPI. This trend was maintained during the rest of the century and during the last years of the 1790s when the differential between the price of wheat and the CPI reaches its maximum value of the century.

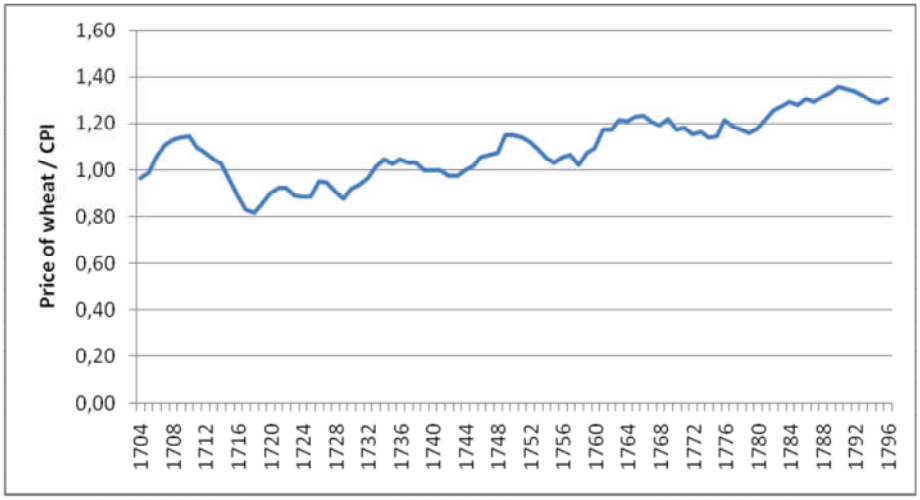
Figure 4: Wheat Prices and CPI in New Castile, 1700-1800 (9 years moving average)



Source: Hamilton (1947) and accounting book from the parish of Santa Maria Magdalena (Getafe)

Using the theoretical framework proposed by Sen, we can study how the environment faced by the population in New Castile changed in terms of food entitlements and accessibility to its supply. Dividing the price index of wheat by the CPI we can obtain a ratio that estimates the value of p in the entitlements theory. Figure 6 shows how this ratio changed during the eighteenth century.

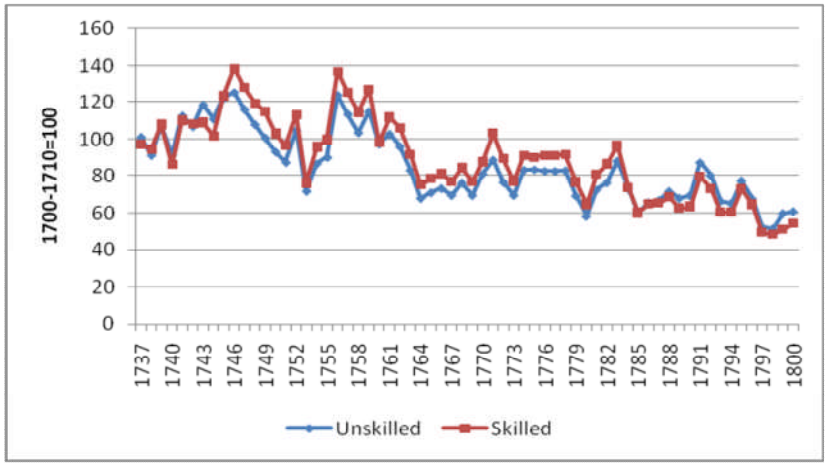
Figure 6: Wheat Prices/ CPI, 1700-1800 (9 years moving average)



Sources: See appendix

During the eighteenth century the ratio increased from a minimum of 0.8 in 1720 to 1.3 in the 1790s. The increase was especially intense during the second half of the century when most of the growth took place. This meant that the situation of those who had to rely on the market to acquire their supply of food worsened considerably during this period. This situation is supported by the decrease of real wages of skilled and unskilled workers in New Castile that fell by 50 per cent from 1755 until 1795 and that are presented in Figure 7.

Figure 7: Real wages of skilled and unskilled workers in New Castile, 1736-1800 (1700-1710=100)



Source: Own calculations from Hamilton (1988)

The modification in the model suggested by Sen is presented in the following figure where the ratio price/CPI changed from p to p* increasing the starvation region in the graph by the area CBA.

Figure 8: Effect of change in relative prices (I)

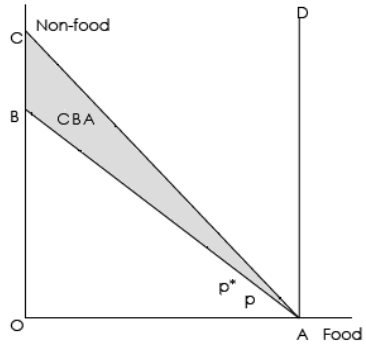
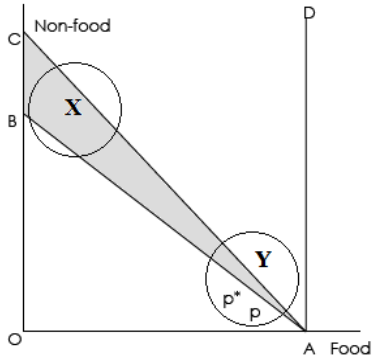


Figure 9: Effect of change in relative prices (II)



However, the consequences of this increase in prices would not be the same for everyone. A worker living from a salary would tend to be located in the area X, where the personal supply of food is small and most of the consumption has to be based on products bought from the market. Peasants would tend to be on the area Y, where the personal production of food is large. Therefore, within this theoretical framework an increase of food prices like the one that took place in eighteenth century Spain, affects workers more than peasants. Grain producers will even be benefited from the new situation if they are able to produce above A, where they produce enough to survive and also a surplus that could be sold in the market. On the other hand, as Sen described, if the benefits of increasing grain prices in Guadalajara are kept in the hands of a few, the overall effects on population of commercial exchanges could be negative. Consequently, to better analyse who were the winner and losers of the opening trade in Guadalajara, we should also check what happened with the distribution of its benefits.

Estimating income inequality in 18th century Guadalajara.

To carry out a study of income inequality we decided to use the information provided in the *tazmia* books. The books are a very rich source of information for economic historians, including detailed records about the amount that was taxed (tithe) by the church to every peasant in every town and village every year. The use of tithe records to analyse the evolution of agrarian production has been a common feature in the

economic history of Spain.[23] Estimating incomes through grain production can present some problems; however there are good reasons to follow that procedure. First, grains represented the bulk of the agrarian economy of Guadalajara. According to the information available, the other main source of agrarian output was the production of wool. A survey of a sample of municipalities in Guadalajara showed that in any case the value of the production of grains represented around 90 per cent of the value of the total agrarian production. Guadalajara was also a rural and agrarian province, so the influence of urban activities was less important than in other provinces like Madrid. The towns that existed in Guadalajara were in fact agro-towns that in economic terms worked as big village and not like traditional urban centres.

However, in order to calculate more accurately how representative grain production was of total incomes, we used the information provided in the Catastro de la Ensenada to estimate the percentage that grain production represented of total income and not just of agrarian output. This calculation was carried out for the sample of municipalities that are presented in this paper.[24] To estimate agrarian production we used the main tithe records, grains and also wool and lambs were included in the answers to question 16 of the Catastro. We also include all the minor tithes that were normally paid to the local priest and that contain a wide variety of products from vegetables to chickens, pigs, and honey. To be sure that the estimation included the production that was not taxed with the tithe, we used the answers to questions 10, 11 and 12 in the Catastro. Question 11 asked about the different products that were produced in the village. We used that information to check what was produced and what did not appear in the information about tithes. However, the question does not reveal the amount of each item that was actually being produced. We can nevertheless estimate this amount indirectly through the information provided in questions 10 and 12 of the Catastro. Question 10 explained the different types of land including quality, the size of each plot and more importantly the products that were being cultivated on each one. Question 12 explains the productivity of each sort of land depending on what product was cultivated on them. Therefore, combining the land that was being dedicated to each product and the productivity, we were able to estimate the production that was not included in the tithes. Finally, the information in question 14 presented the average prices of the products cultivated in the municipality that were used to transform the production from kind to cash.

However, to complete the estimation of income we also included information about wages. In every village there was normally a priest, baker, etc. and their income was not included in the previous calculations. The Catastro presents information about the

[23] Ladurie and Goy (1982) see the studies by Ardit (1989), Benitez Sanchez-Blanco (1982), Bilbao and Fernandez de Pinedo (1982), Erias Roel (1982), Garcia Sanz (1982), Lemeneunier (1982), Lopez-Salazar Perez and Martin Galan (1981), Macías Hernández (1986), Palop Ramos (1982), Ponsot (1969), Sebastian Amarilla (1992) and Vidal (1978)

[24] The municipalities are Alboreca, Alcuneza, Alpedroches, Angon, Anquela del Pedregal, Aragosa, Bañuelos, Castejon de Henares, Ciruelos del Pinar, Fuensaviñan, Galve de Sorb, Hijes, Ledanca, Miedes de Atienza, Mojares, Rillo, Santiuste, Sienes, Torrubia, Valdelcubo, Villares de Jadraque and Villaseca de Henares.

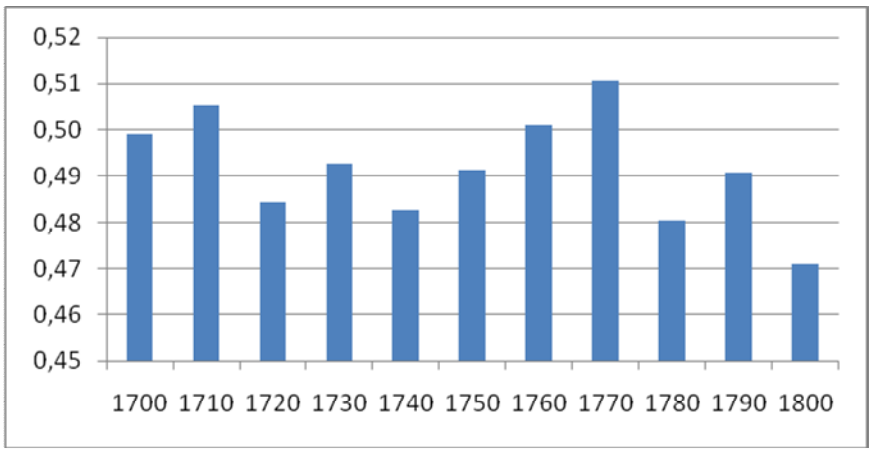
wages and incomes of that part of the population that was added to agrarian production. To complete the estimation we also included the information about part time jobs carried out by peasants while they were not directly engaged in agriculture. Some of the salaries were paid in kind (normally wheat) and in those cases, as in agrarian production, salaries were transformed into cash to be aggregated. Although the information from the Catastro could be improved, the estimation of total income is the best that is available given the sources and therefore the best possible proxy. The results show that in the early 1750s grain production represented almost 70 per cent (68%) of the total income in the sample presented in this paper. The following decades were a period of rapid inflation of grain prices that rose more than the CPI, a situation that reduced real wages. Hence, we suppose that this percentage grew during the period and that 68 per cent should be taken as a minimum for the second half of the eighteenth century. Therefore, we believe that although not perfect, the use of grain production can be used as a good proxy of income.

The Gini Coefficient measures the dispersion of the observations in a sample and has been widely used to measure inequality. The coefficient takes values between 0 and 1 attributing a value of 0 to perfect equality and a value of 1 to perfect inequality. In other words and in the case that we are studying, the Gini Coefficient would be 0 if all the peasants produce exactly the same amount of grain and 1 if one single peasant owns all the production. In mathematical terms the Gini Coefficient can be defined as:

$$G_1 = 1 - \sum_{k=1}^{n} (X_k - X_{k-1})(Y_k + Y_{k-1}) \qquad (1)$$

Where G is the Gini coefficient, X is the cumulated proportion of the population variable, Y is the cumulated proportion of the production of cereals and G is the Gini coefficient. Using the information provided by the *Tazmias* books from around 15,000 producers and following the methodology presented above, we generated decadal calculations of the Gini coefficient for cereal production in Guadalajara.

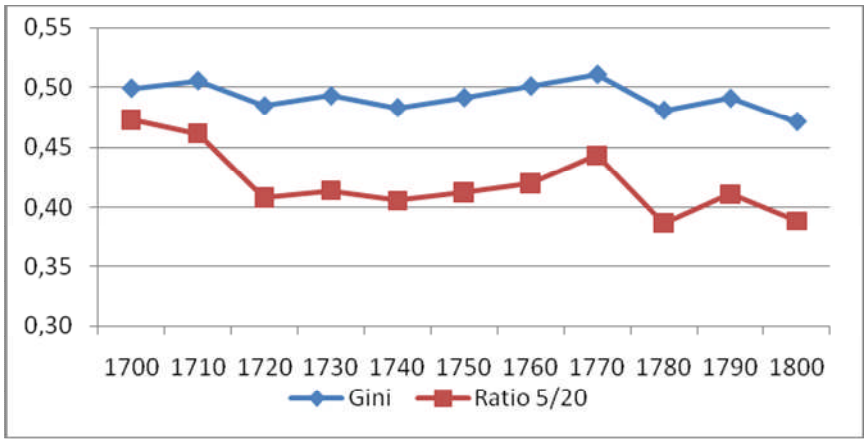
Figure 10: Decadal Gini coefficient in Guadalajara 1700-1800



Sources: See appendix

The results show three long term trends during the eighteenth century. The first one is a period of convergence and inequality reduction from 1710 until 1740. The second one shows an increase of inequality starting around 1750 and ending around 1770. The last period shows again convergence between producers that took place from 1770 until the end of the century. The trend during the eighteenth century as a whole shows a period of convergence between small and big producers, when inequality in cereal production was reduced. Other inequality proxies present a very similar behaviour. Figure 11 shows the relationship between the Gini coefficient previously presented and the ratio between the production of the top 5 per cent and the bottom 20 per cent producers. The results indicate that the trends are the same, reinforcing the conclusions obtained from the Gini coefficient. The results were again the same when we used a Theil index instead of a Gini coefficient.

Figure 11: Average Gini v Ratio 5/20, 1700-1800



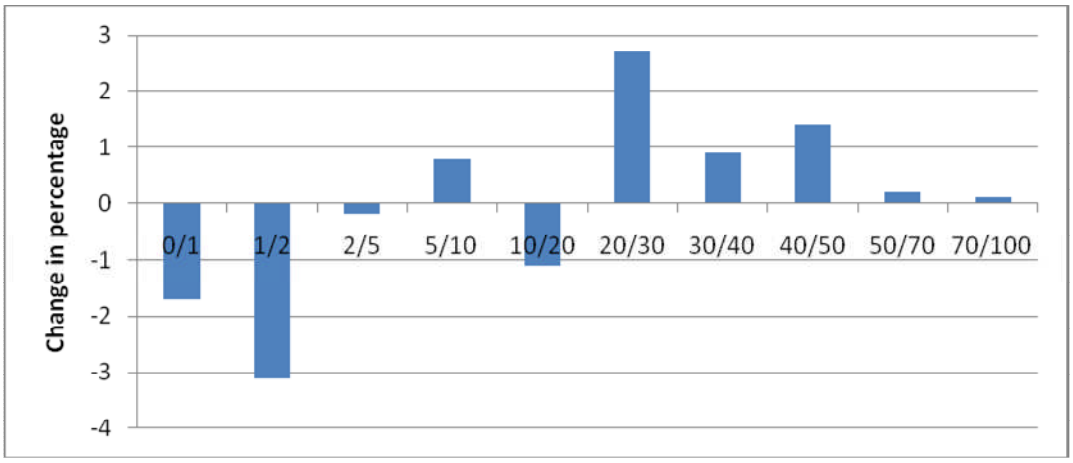
Source: see appendix

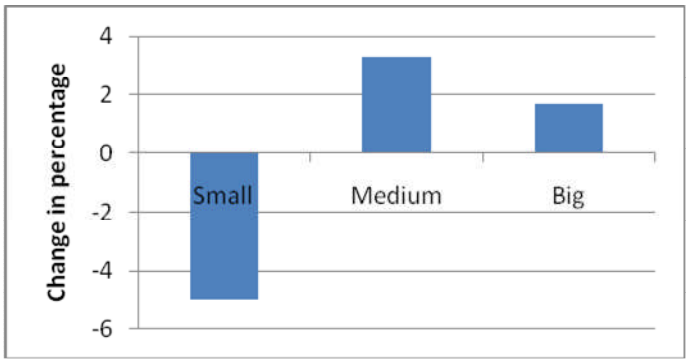
Inequality decreased from a Gini coefficient of 0.5 in 1710 to 0.48 in 1740 and then increased to 0.51 in 1770. The last trend shows the most intense change of the century when the Gini coefficient fell from 0.51 in 1770 to 0.47 in 1800. But what is the significance of these numbers? What was the effect of the reduction in the Gini coefficient from 0.51 to 0.47 that took place during the last third of the century? Is it a consequence of small producers catching up? We can provide some answer to these questions. In our sample, doubling the production of the bottom 12 per cent would reduce the Gini coefficient by 0.1 points. To reduce it by 0.4 points, that is the reduction that took place during the late eighteenth century, we would have to double the production of the bottom 33 per cent of the distribution. The next question is to understand why inequality levels were being reduced and if it really was based on small producers catching up. In order to answer this question we have to study what happened between the four main turning points 1710, 1740, 1770 and 1800.

All producers at each turning point were divided into ten equal sized groups depending on their production levels. Taking index numbers and 100 as the output of the maximum producer, individuals were divided depending on their percentile in relation to this

maximum. The first group includes the number of peasants whose production levels were between 0 and 1 per cent of the output of the biggest producer, etc.[25] Two graphs were created for each period, the first with the variations in percentage in the number of individuals in each group, and the second with a summary of the first one containing not 10 groups but three; small, medium and big producers. Small producers were those within the first three groups (less than 5 per cent), medium producers were those within the following four groups (5 per cent to 40 per cent) and big producers those within the top three groups. (More than 40 per cent). Between 1710 and 1740 the results show a reduction in the value of the Gini coefficient of 2 points. There was a reduction of 5 per cent in the number of small producers. These small producers went probably to the group of medium producers and some of these moved upward to join the big producers. As Figure 12 shows, it was in the groups of the very small producers where the reductions were more important while the biggest increase took place in the group of medium producers.

Figure 12: Changes in the distribution of the production 1710/1740



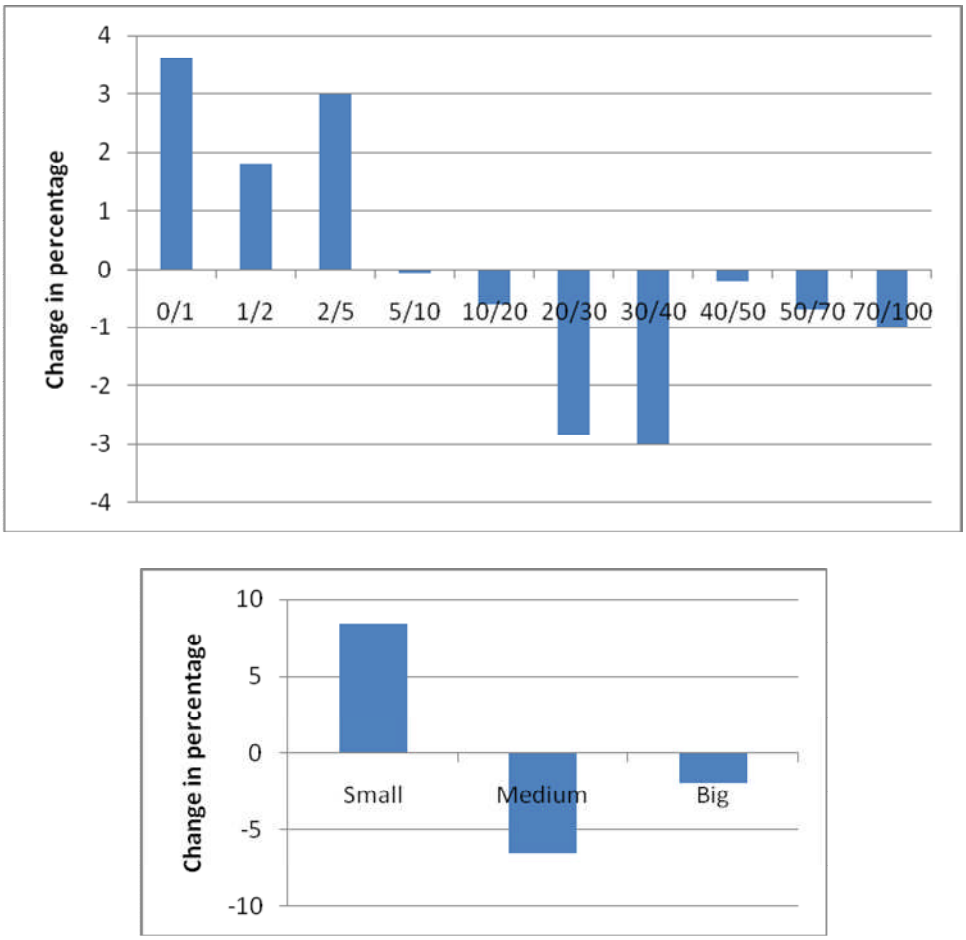


Source: see appendix

[25] The ten groups are 0%-1%, 1%-2%, 2%-5%, 5%-10%, 10%-20%, 20%-30%, 30%-40%, 40%-50%, 50%-70% and 70%-100%.

1740-1770 was a period of divergence, with the Gini coefficient growing three points from 0.48 to 0.51. The increase was intense, the reduction gained during the previous period was lost, and inequality rose to the absolute maximum of the century. The number of small producers grew by more than 8 per cent, 3 points more than the reduction between 1710 and 1740. It was in the group of medium producers were the biggest reduction took place, especially in the 20/40 percentiles.

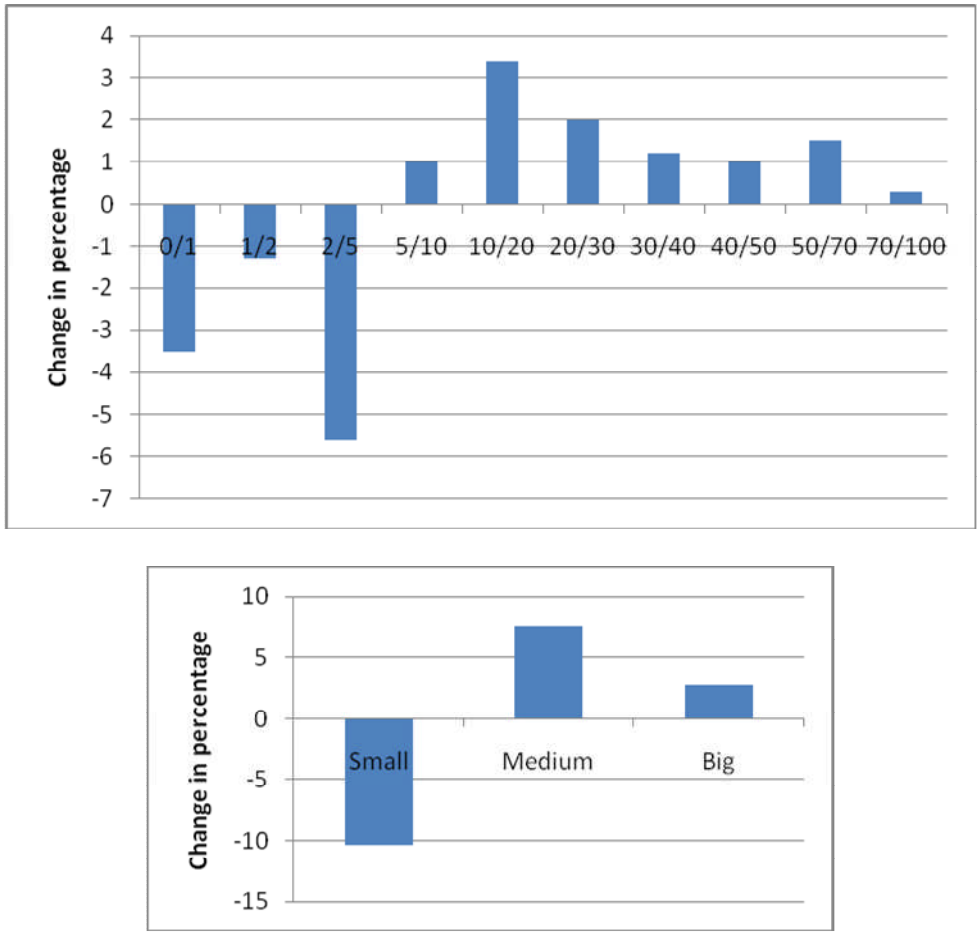
Figure 13: Changes in the distribution of the production 1740/1770



Source: see appendix

The last period between 1770 and 1800 shows a convergence between producers, with the Gini coefficient falling four points from 0.51 to 0.47. The situation in 1770 was reversed and inequality reached its absolute minimum in 1800. The number of small producers was reduced by more than 10 per cent while the number of medium producers grew by 7 per cent. As in the case of the first half of the century, the fall in inequality was mainly a consequence of very small producers improving their positions and many of them probably joining the group of medium producers. The biggest fall happened in the 2/5 and 0/1 percentiles while the biggest rise took place in the 5/20 and 20/30 percentiles.

Figure 14: Changes in the distribution of the production 1770/1800



Source: see appendix

The internal dynamics of inequality changes

Although the Gini coefficient is a good way of measuring the changes in total inequality, it also has limitations. A different way of measuring inequality levels is the use of generalized entropy measures like the Theil Index, a measurement that has also been widely used in the literature of income inequality (Steckel and Moehling, 2001 and Mora Sitja, 2006). Although the properties of the Theil Index are very similar to those of the Gini coefficient, it allows deeper analysis of the data and it can be easily decomposed. In other words, if we divide our sample of producers in different groups by village, by production, etc. the Theil index will show us if the changes in inequality identified are a consequence of changes of inequality within those groups or between them. Its calculation is defined by the formula:

$$T = \frac{1}{n}\sum_{i=1}^{n}\frac{w_i}{\mu}\ln\left(\frac{w_i}{\mu}\right) \qquad (2)$$

In our case, n would be the number of producers, w_i the production of the individual i and μ the arithmetical average of the sample. If we divide the observations of a sample in different groups, the Theil index can tell us what the changes in inequality within and between each group are. In our case we decided to divide the producers in the sample by villages grouping them by size. Therefore, three groups were created with small, medium and big villages. There are good reasons to support this division, as the size of the village also defined its economic and social structure. Small villages were mainly occupied by a homogenous group of small peasants that were owners, while big villages included also manufactures producers and workers that did not own land. We can therefore expect differences in inequality between the three groups that can be explored by the Theil index. Following the methodology presented above, for every group g, μg is the average production, ng the number of producers and Tg is the Theil index for that specific group. The new formula for the Theil index is:

$$T = \sum_{g=1}^{G}\frac{n_g\mu_g}{n\mu}T_g + \sum_{g=1}^{G}\frac{n_g\mu_g}{n\mu}\ln\left(\frac{\mu_g}{\mu}\right) \qquad (3)$$

Being

$$T_g = \frac{1}{n_g}\sum_{i=1}^{ng}\frac{w_i}{\mu_g}\ln\left(\frac{w_i}{\mu_g}\right) \qquad (4)$$

The first term in (3) corresponds to the weighted addition of the Theil indexes of every group and therefore presents inequality within each group, in other words it measures inequality within small, medium and big villages. The second term shows inequality between the three groups.

Finally, the Theil index can be also decomposed into three elements; changes in the proportion of the population of the groups (4), changes in the relative average of the groups (5) and finally changes in the dispersion of the production within groups (6)

$$\Delta T_n^{t,s} = \Delta T_{within,n}^{t,s} + \Delta T_{between,n}^{t,s} = \sum_{g=1}^{G}\left[\left(\frac{n_g^t}{n^t} - \frac{n_g^t}{n^s}\right)\frac{\mu_g^t}{\mu^t}T_g^t\right] + \sum_{g=1}^{G}\left[\left(\frac{n_g^t}{n^t} - \frac{n_g^s}{n^s}\right)\frac{\mu_g^t}{\mu^t}\ln\left(\frac{\mu_g^t}{\mu^t}\right)\right] \quad (4)$$

$$\Delta T_\mu^{t,s} = \Delta T_{within,\mu}^{t,s} + \Delta T_{between,\mu}^{t,s} = \sum_{g=1}^{G}\left[\left(\frac{\mu_g^t}{\mu^t} - \frac{\mu_g^s}{\mu^s}\right)\frac{n_g^s}{n^s}T_g^t\right] + \sum_{g=1}^{G}\left[\frac{\mu_g^t}{\mu^t}\ln\left(\frac{\mu_g^t}{\mu^t}\right) - \frac{\mu_g^s}{\mu^s}\ln\left(\frac{\mu_g^s}{\mu^s}\right)\right]\frac{n_g^s}{n^s} \quad (5)$$

$$\Delta T_T^{t,s} = \sum_{g=1}^{G}\frac{n_g^s \mu_g^s}{n^s \mu^s}\left(T_{gs}^t - T_g^s\right) \quad (6)$$

Table 5: Inequality changes decomposed by size of village

	1710-1740	1740-1770	1770-1800
Inequality within groups	69.23%	40.00%	106.25%
Small	-5.00%	-4.69%	-4.69%
Medium	71.67%	73.44%	73.44%
Big	-26.67%	37.50%	37.50%
Inequality between groups	30.77%	60.00%	-7.81%
Total inequality	**100%**	**100%**	**100%**

Source: see appendix

Table 5 shows that during the period 1710-1740 the reduction in inequality was mainly driven by the decrease of inequality within groups, mainly in those villages of medium size. Therefore, it was within medium villages that a process of convergence took place between small and big producers. The period 1740-1770, was characterised by increasing inequality that was based on increasing divergence between small and big villages. Finally, during the period 1770-1800 the reduction of inequality was mainly driven by group convergence, especially in medium and big villages. On the other hand, there was a small increase in the inequality within small villages. The reason was that in small villages inequality levels were already low in 1770, while high inequality levels in medium and big villages were reduced during the following three decades.

Overall the eighteenth century was a period of convergence in the three groups of villages, although the intensity of the catching up was stronger in those bigger where the Theil Index fell by 5 points. On the other hand, the decline of inequality in small and medium villages was more moderate with a reduction of 1 point. Most of the reduction in big villages took place during the late eighteenth century when the Theil index in the group fell by 10 points. The study of the Gini coefficient shows very similar results with a fall of 1 point in medium villages between 1710 and 1800, 2 point in small ones and

again a considerable decrease in big villages where the Gini coefficient fell by 3 points during the same period.

In summary, inequality between grain producers in Guadalajara fell during the eighteenth century mainly thanks to the decline that took place from 1770. The process was characterised by a reduction in the proportion of very small producers that became medium producers in medium and big villages. But how was this possible? The eighteenth century is considered by the literature a period of increasing inequality when the differences between rich and poor increased. What was different in Guadalajara and what was the trigger behind the changes? The answer can be found in the land reforms that were carried out by the central governments during the late 1760s.

The success of institutional change

The last third of the eighteenth century in Spain was a period dominated by the introduction of agrarian reforms. One of the most important goals of the government was the creation of a pool of medium producers that would become the fiscal core of the country. In order to increase the protection of land tenants, new legislation was introduced by the government in 1763. The main purpose of the reform was to imitate the English model increasing the security of the tenant in the long run. In 1785 the government regulated the requirements necessary for a landowner to terminate the contract with his tenant, with the idea of avoiding random unjustified expulsions.[26]

Price instability and the capacity to guarantee the supply of food were also issues in the agenda of the authorities. The price of grain in Spain increased substantially during the 1750s, a situation that the government attributed to the lack of internal trade. To incentivise the commercialisation of grain, on July 11th 1765 the government liberalised grain trade freeing its price that had been controlled until then. The new law also allowed the reselling of grain that had been forbidden until then. The importance of internal trade was highlighted by contemporary politicians like Jovellanos, who wrote that it would benefit regions with a surplus of grain. According to Jovellanos, with the new revenues those regions could serve as market for national manufactures (Jovellanos, 1744-1788).[27] The growth of prices encouraged the increase of grain production during the 1750s, mainly consequence of an increase in the number of producers. This situation was probably the cause behind the increase in inequality between grain producers in Guadalajara during the period 1740-1770, when we observe that the number and proportion of very small producers increased. This created a problem for many of these very small producers that in years of bad harvests had to rely on the market to command enough food (Llopis, 2002:142).

[26] González Enciso (1992:237)

[27] Jovellanos addressed several economic issues in his *Informe Sobre la Ley Agraria* (*Report on the Agrarian Law*) where he also pointed out to the importance of increasing competition in the grain market.

In 1766 the rise of the price of bread in Madrid acted as a catalyst for the Esquilache riot that forced Carlos III to flee Madrid. The revolt worked as a warning signal for the government that immediately adopted measures to increase food production and to distribute land more equally. In May 1766 the first orders were issued to begin the redistribution of common lands owned by the local councils in Extremadura. The measure was extended to Andalusia in June 1767 and to the rest of the country on May 20th 1770.[28] The reform gave preference to those with no land (*jornaleros*) but in reality rural workers had little chances of obtaining a piece of land. The law was clear stating that the new owner had to prove having enough funds to pay for the tools, seeds, and other inputs required to use it, imposing *de facto* a barrier impossible to break for many workers.[29] The fact that such tight conditions were imposed explains why the reform failed in those areas where the proportion of poor rural workers was high, like Andalusia in the South. On the other hand, small owners and tenants were among the most benefited by the reform. In exchange for the land, the peasant had to pay a rent based on the harvest and had to exploit the plot directly.

The result was that many common lands that had been used as pastures were put under cultivation to produce grain. In certain parts of Spain the power of local oligarchies tried to sabotage the reform and in many cases succeeded. This was particularly important in areas where the amount of rural workers was high, and the power of big landowners more patent. This however was not the case of Guadalajara, where the extremely low level of rural workers reflected a society where the bargaining power of big landowners was limited. The consequences of the reform in Guadalajara were important and from 1770 until 1800 the number of grain producers increased by 24 per cent.[30] However, not only the number of producers grew, as explained above, the levels of inequality between grain producers diminished showing that the reform improved indeed the access of small producers to land. The fact that most of the reduction in inequality levels took place in medium and big villages reinforces the hypothesis of the land reform as cause. In small villages the availability of common lands was more reduced than in villages of bigger size. According to our calculations before the reform common lands that could be potentially arable represented in small villages 15 percent of the total, while in villages of bigger size the proportion increased to 40 percent. The average coincides with Garcia Sanz's estimations who argued that in 1750, between 20 and 30 per cent of the land in Spain was controlled by local councils. [31] The effects of the reform were also clear in population, while the rest of the interior of Spain suffered stagnation and even decline, demographic series show that population increased in Guadalajara. Therefore, the agrarian reform that failed in other parts of Spain was a success in Guadalajara, where the ideals of the enlightened government of creating a class of medium producers

[28] González Enciso (1992:237)
[29] The rules that regulated access to common lands were published in the Real Providencia of May 23th and 24th, 1770. Artola (1982:143)
[30] Own estimations from tithe books.
[31] García Sanz (1980)

that would encourage demographic growth worked. In this sense the unique characteristics of Guadalajara were fundamental to explain the success of the reform. The relationship between the socioeconomic characteristics of a society and the success of its institutions has been extensively studied in the literature. Engerman and Sokoloff showed that the egalitarian societies of small grain producers in North America were the key for the development of an efficient institutional framework. On the other hand, the unequal societies of the Caribbean encouraged the creation of more dictatorial regimes that conduced to economic underdevelopment. The existence of social elites that controlled the institutions and modelled them to favour their interests was the key, for the authors, to explain the lack of economic performance in the economies of Central and South America (Engerman and Sokoloff, 2002). Applying the same idea to eighteenth century Spain it is not strange that some authors argued that inequality increased. In the southern half of the country the power of big landowners was strong and therefore the privatisation of common lands probably reinforced their privileged positions. However, Guadalajara included the best of the two agricultural systems of Spain; the low demographic pressure of the south and the lack of rural workers of the north. Both factors combined explain why the redistribution of common lands in Guadalajara worked better than in the rest of the country. Therefore, following Engerman and Sokoloff's ideas, the lack of powerful pressure groups worked in favour of the agrarian reform.

Conclusions

Three important conclusions can be drawn from the paper. The first one is that trade was seen by the producers of Guadalajara as an opportunity, and that that they took full advantage of it. When the economies of the interior of Spain increased their integration during the second half of the eighteenth century, land-abundant Guadalajara was ready to act as a supplier of food to the demands of urban areas like Madrid. The increase of grain prices and the collapse of real urban wages, acted as an incentive to a ruralisation process that affected to the province and to a certain extent to the rest of New Castile.

However, the early stages of this process of economic integration had negative consequences in inequality levels. The results show that until 1770 most of the new producers attracted to the countryside were very small peasants that suffered during periods of harvest failures. The second important finding of the paper consists on the reversal of this trend. The period 1770-1800 in Guadalajara is an age of decreasing inequality, when not only the number of grain producers increased, but also when the differences between them diminished. Taking the period 1700-1800 as benchmark we observe that against what is suggested by the literature in the case of Spain, the eighteenth century was a period when inequality was reduced in Guadalajara. The study of the Gini Coefficient and the distribution of grain producers, indicate that this convergence was characterised by a significant reduction in the number of very small and small producers. Small villages enjoyed low levels of income inequality during

most of the century and therefore there was almost no room to catch up. However, in larger municipalities inequality levels were higher and there was still room to reduce the gap between big and small producers. A detailed analysis of changes in inequality shows that this was the case and that most of the reductions of income inequality were based on catching up of small producers in big villages. Following Sen's theories, the change had significant effects on the demographic trends of Guadalajara where population continued growing while in the rest of the interior of Spain it stagnated and even declined.

The third and final finding explains how this unexpected behaviour took place. Small peasants were able to increase the size of their exploitations by having access to the privatisation of common lands promoted by the central government. Unlike the period 1740-1770, the availability of the new lands (normally pastures) made possible the absorption of new producers in better conditions. The redistribution of common lands allowed many small peasants to produce above subsistence level and therefore to take advantage of trade and high grain prices. The proportion of common lands was higher in larger villages, a situation that explains why the reduction in inequality was more intense in this sort of municipalities. The reform that failed in other parts of Spain was successful in Guadalajara thanks to the lack of bargaining power of pressure groups, result of the unique characteristics of the population in Guadalajara. These characteristics combined the best features of the two models of agricultural production in Spain; the high proportion of producers (and lack of rural workers) of the north and the low pressure on natural resources of the south. Therefore, there was land to share and peasants able to fulfil the conditions imposed by the government to access it. In addition, the similar characteristics that existed between grain producers in Guadalajara reinforced the process. In other words and following Engerman and Sokoloff's arguments, the existence of an egalitarian society made possible the adoption of an economically successful reform. As Sen would argue, the new institutional framework provided grain producers in Guadalajara the chance to take full advantage of the increasing trade with the rest of the interior, and that was an opportunity that they did not let escape.

Bibliography

Ardit Lucas, M., 1989. Recaudación y fraude diezmal en el siglo XVIII valenciano. In Estructura agrarias y reformismo ilustrado en la España del siglo XVIII. Ministerio de Agricultura y Pesca, Madrid, 391-410.

Arizcun Cela, A., 1989. Series navarras de precios de cereales: 1589-1841. Banco de España, Madrid.

Artola, M., 1982. La economía española al final del antiguo régimen. Alianza Editorial, Madrid.

Benitez Sanchez-Blanco, R., 1982. Diezmos andaluces: series malaguenas del diezmo del trigo. In Goy J. and Le Roy Ladurie, E. (Eds.): Prestations paysannes, dîmes, rente foncière et mouvements de la production agricole à l'époque pré-industrielle. Mouton, París, 295-312.

Bilbao, L.M. and Fernández de Pinedo, E., 1982. Evolución del producto agrícola bruto en el País Vasco peninsular, 1537-1850. In Goy J. and Le Roy Ladurie, E. (Eds.): Prestations paysannes, dîmes, rente foncière et mouvements de la production agricole à l'époque pré-industrielle. Mouton, París, 313-327.

Engerman, S.L., and Sokoloff, K.L., 2002. Factor endowments, inequality, and paths of development among new world economics. NBER Working Paper Nº 9259.

Erias Roel A., and Gelabert J., 1975. Contabilidades hospitalarias como Fuentes de los transportes internos: costos de transportes del Real Hospital de Santiago. Actas de las I Jornadas de Metodología Aplicada de las Ciencias Históricas, Vol. 3.

Eiras Roel, A., 1982. Dîme et mouvement du produit agricole en Galice, 1600-1837. In Goy J. and Le Roy Ladurie, E. (Eds.): Prestations paysannes, dîmes, rente foncière et mouvements de la production agricole à l'époque pré-industrielle. Mouton, París-La Haya, 341-358.

Feliu, G., 1991. Precios y salarios en la Cataluña moderna, Banco de España, Madrid.

Fernandez de Pinedo, E., et al. 1980, Centralismo, ilustración y agonia del antiguo régimen (1715-1833). Editorial Labor, Barcelona.

García Sanz, A., 1980. Bienes y derechos comunales y el proceso de su privatización en Castilla durante los siglos XVI y XVII: el caso de tierras de Segovia. Hispania, nº. 144.

Garcia Sanz, A., 1982. La produccion de cereales y leguminosas en Castilla la Vieja. Los diezmos del Obispado de Segovia de 1570 a 1800. In Goy J. and Le Roy Ladurie, E. (Eds.): Prestations paysannes, dîmes, rente foncière et mouvements de la production agricole à l'époque pré-industrielle. Mouton, París.

González Enciso, A., 1992. Historia económica de la España moderna. Actas, Madrid.

Goy, J and Ladurie, E., 1982. Prestations paysannes, dîmes, rente foncière et mouvement de la production agricole à l'époque pré-industrielle. Mouton, París.

Hamilton, H.H., 1947. War and prices in Spain, 1651-1800. Harvard University Press, Cambridge.

Hybel, N., 2002. The grain-trade in Northern Europe before 1350. Economic History Review.

INE, 1994-1995. Censo de población de la Corona de Castilla "Marqués de la Ensenada," 1752: mandado formar por el Conde de Valparaíso mediante las reales órdenes de 31.7.1756 y 9.7.1759, basándose en los datos recopilados entre 1750 y 1754 para el catastro del Marqués de la Ensenada. INE, Madrid.

Jovellanos, G., (1744-1788) Informe sobre la ley agraria. Madrid

Kessler, D., and Temin P., 2007. The organization of the grain trade in the early Roman Empire. Economic History Review, 60/2, 313–332.

Lacomba, J.A., 1999. Las desigualdades interiores en Andalucia en perspectiva historica. Una aproximación, Estudios regionales, Nº54, 315-334.

Lemeneunier, G., 1982. Approche méthodologique des dîmes de Murcie à l'époque moderne. In Goy J. and Le Roy Ladurie, E. (Eds.): Prestations paysannes, dîmes, rente foncière et mouvements de la production agricole à l'époque pré-industrielle. Mouton, París, 341-358.

Llopis, E., et al 2000. Índices de precios de la zona noroccidental de Castilla y León, 1518-1650. Revista de Historia Económica, Año XVIII, nº. 3, 665-684.

Llopis, E., and Jerez, M., 2001. El mercado de trigo en Castilla y León, 1691-1788: arbitraje espacial e intervención. Historia Agraria, nº. 25, 13-68.

Llopis, E., 2002. Expansion, reformismo y obstáculos al crecimiento (1715-1840) in Comin, F., Hernandez, M., and Llopis, E., (Eds) Historia economica de España. Critica, Barcelona.

Llopis E., 2004. El crecimiento de la población española, 1700-1849: índices regionales y nacional de bautismos. Revista de ciencias sociales (24), 9-24.

Llopis, E., and Sotoca, S., 2005. Antes, bastante antes: la primera fase de la integración del mercado español de trigo, 1725-1808. Historia Agraria, 36, 225-262.

Lopez-Salazar Perez, J. and Martin Galan, M.M., 1982. La produccion cerealista en el arzobispado de Toledo: 1463-1699. Cuadernos de historia moderna y contemporánea, 21-104

Macías Hernández A., 1986. Fuentes para el estudio de la producción agraria en las islas Canarias: el Diezmo en la diócesis canariense (1480-1820). Anuario de Estudios Atlánticos, 32.

Madrazo, S., 1984. El sistema de transportes en España, 1750-1850. Ediciones Turner, Madrid.

Mankiw, N.G., Romer, D., and Weil, D.N., (1992). A contribution to the empirics of economic growth. Quarterly Journal of Economics, 407-37.

Miller, J.A., 1999. Mastering the market: The state and the grain trade in Northern France, 1700-1860. Cambridge University Press, New York.

Mora Sitja, N., 2006. Exploring changes in earnings inequality during industrialization: Barcelona, 1856-1905. Discussion Papers in Economic and Social History, University of Oxford, N.61.

O'Rourke, K., 1997. The European grain invasion. Journal of Economic History 57, 775-801.

O'Rourke,K., and Williamson, J.G., 2002. When did globalization begin? European Review of Economic History, 23-50.

Palop Ramos, J.M., 1982. El producto diezmal valenciano durante los siglos XVII y XVIII. Aproximación a su estudio. In Goy J. and Le Roy Ladurie, E. (Eds.): Prestations paysannes, dîmes, rente foncière et mouvements de la production agricole à l'époque pré-industrielle. Mouton, París, 407-416.

Persson, K.G., 2000. Grain Markets in Europe, 1500-1900: Integration and Deregulation. Cambridge University Press, Cambridge.

Ponsot, P., 1969. En Andalousie occidentale. Les fluctuations de la production du ble sous l'Ancien Regime. Études rurales, No. 34, 97-112.

Ringrose, D.R., 2983. Madrid and the Spanish economy. University of California Press, Berkeley-Los Angeles.

Roses, J.R., 2003. Why isn't the whole of Spain industrialized? New economic geography and early industrialization, 1797-1910. Journal of Economic History, 995-1022.

Sebastián Amarilla, J.A., 1992. Agricultura y rentas monásticas en tierras de León: Santa María de Sandoval(1167-1835), Doctoral Thesis. Universidad Complutense de Madrid, Madrid.

Shiue , C.H., 2000. Grain trade and storage in late imperial China. The Journal of Economic History, June 2000, 60(2), pp. 511-515 (Dissertation Summary, selected for the Alexander Gerschenkron Prize Panel).

Simpson, J., 1989. La produccion agraria y el consumo español en el siglo XIX. Revista de Historia Economica, Año VII, Nº2, 355-388.

Soler Pascual, E., 2000. Viajes y acción política del intendente Beramendi Tesis Doctoral 1993 Universidad de Alicante . Biblioteca Virtual Miguel de Cervantes, Alicante.

Steckel, R.H. and Moehling, C.M., 2001. Rising inequality: trends in the distribution of wealth in industrializing New England. Journal of Economic History, 160-183.

Sen, A., 1981. Ingredients of famine analysis: availability and entitlements. The Quarterly Journal of Economics, Vol. 96, No. 3, 433-64

Sen, A., 1981. Poverty and famines: an essay on entitlement and deprivation. Clarendon Press, Oxford.

Sen, A., 1977. Starvation and exchange entitlements: a general approach and its application to the great Bengal famine.Cambridge Journal of Economics, 33-59.

Uriol, J.I., 1977. Apuntes para una historia del transporte en España. Los caminos de ruedas del siglo XVIII. Revista de obras publicas, 145-168.

Uriol, J.I., 1978. Apuntes para una historia del transporte en España (II) Las carreteras y los canales de navegación en los reinados de Fernando VI y Carlos III. El auge de la construcción de carreteras y canales. Carlos III. Revista de obras publicas, 625-636.

Uriol, J.I., 1980. Los transportes interiores de mercancías en el siglo XVIII y en los primeros años del siglo XIX. I. Transportes a lomo y en carro. Revista de Obras Publicas, 641-652.

Uriol, J.I., 1985. Las calzadas romanas y los caminos del siglo XVI. Revista de Obras Publicas, 553-563.

Uriol, J.I., 2003. Guia de caminos de Pedro Ponton. Revista de Obras Publicas, 59-62.

Vidal, J.J., 1978. La evolución de la producción agrícola en Mallorca durante la Edad Moderna. Fuentes y problemas de su estudio. Moneda y crédito, 67-99.

Data appendix: description of sources

This section explains in detail the primary and some secondary, as well as the methodology to transform them in the variables used in the paper that have not been described in the text.

The series of wheat and barley prices for Madrid were extracted from the accounting books of the parish of Santa Maria Magdalena in Getafe. The books are located in the historical diocesan archive of the bishopric of Getafe. The creation of price series is complicated because prices tend to fluctuate during the year following a cycle that normally begins with the harvest of the grain when prices reach low values that increase in time.[32] However, the source consulted in this paper is extremely reliable, every year at the same month the parish sold the grain that was collected in tithes at market prices. This price is the one that has been collected and used in the paper avoiding the problem mentioned above. As we said before prices were low around the harvest season and increased in time, therefore the prices presented in the paper probably undervalue the average price during the whole year. However, the price series are used to measure their integration with the other series presented in the paper. Therefore, what is important is not the value of the grain but its changes in time, and in this sense the source is extremely reliable. The other grain price series used in the paper were extracted from secondary sources.[33] To study the levels of economic integration between the different grain price series we used the methodology followed in Llopis and Jerez (2001) by measuring the correlation coefficients of the logarithmic variation rates.[34]

The paper also includes the creation of a consumer's price index (CPI) for New Castile during the period 1700-1800. The index includes information about wheat (30%), barley (18%), beef (8%), lamb (7.5%), chicken (3.5%), fish (5%), oil (2%), charcoal (3.5%), candles (2%), textiles (4%), cheese (3%) and wine (14%). The choice of the products and the weights given to each one follows the methodology in Llopis ().[35] The prices for each one of the products were extracted from Hamilton (1947).

The average prices by province in central Spain presented in table 3 were extracted from the *Catastro de la Ensenada*. The *Catastro* is a primary source that consisted on a survey that all the municipalities of Castile had to submit for fiscal purposes. Each municipality answered 40 questions related to economic and social aspects of the place and question 14 asked about the price of the different goods produced by its inhabitants. The dataset includes information about 1,118 towns and villages and contains the average price of wheat in the 5 years previous to the visit of the authorities of the *Catastro*. The coefficients of variation presented also in table 3 measure the variation of the prices within each one of the six provinces.

The information presented in table 2 has been extracted from several sources. Population density was calculated from *Censo de población de la Corona de Castilla*

[32] Paper sobre ciclos de precios
[33] Toledo (Hamilton 1947), Barcelona (Feliu 1991), Navarre (1989) and Majorca (Ardit 2003).
[34] Llopis, Enrique and Jerez, Miguel (2001): "El mercado de trigo en Castilla y León, 1691-1788: arbitraje espacial e intervención", Historia Agraria, nº. 25, pp. 13-68.
[35] Llopis precios

"Marqués de la Ensenada.[36] The number of rural workers and poor people were extracted directly from the manuscripts in the *Catastro de la Ensenada,* and more exactly from questions 35 and 36. The population of the municipalities was extracted from question 21. Combining the information from both we calculated the proportions showed in the table.

Nominal unskilled and skilled wages in New Castile were extracted from Hamilton (1947). Real wages presented in figure 7 were deflated using CPI for New Castile described before. Transport costs showed in figure 2 were taken from (Erias Roel and Gelabert 1975). Nominal values were deflated by using the CPI.

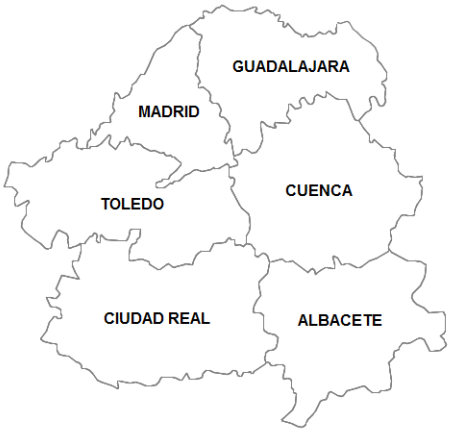
The total production of wheat in Guadalajara was extracted from the manuscripts in the *Catastro de la Ensenada.* Question 15 asked about the taxes that existed in each municipality. We took the information related to the ecclesiastical tithe that represented a 10% of the total harvest. We gathered the information for all the municipalities of Guadalajara, and by using these data we estimated total production of wheat. We also estimated the population of Guadalajara gathering the answers to question 21 multiplying the number of vecinos (households) by 3.92, following the methodology in *Censo de población de la Corona de Castilla "Marqués de la Ensenada*.[37] Then assuming a yearly consumption of 6 fanegas per inhabitant (Simpson 1989) we estimated the surplus of wheat in the region.

The calculations of inequality were based on the analysis of the production of wheat, barley, rye and oats from around 15,000 producers that is contained in the tithe (*tazmias*) books. The grains were weighted depending on the prices of each one. These books were consulted in the Historical Diocesan Archive of Sigüenza-Guadalajara. The sample of municipalities is described in the text.

Appendix: Geography of central Spain:

We aggregated data using the current geographical boundaries that are displayed in the following maps.

[36] INE (1994-1995)
[37] INE (1994-1995)


GUADALAJARA
MADRID
CUENCA
TOLEDO
CIUDAD REAL
ALBACETE