THE
ECONOMIC HISTORY REVIEW

Economic History Review, 66, 1 (2013), pp. 1–37

The rise and fall of Spain (1270–1850)[1]

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Two distinctive regimes are distinguished in Spain over half a millennium. The first one (1270s–1590s) corresponds to a high land–labour ratio frontier economy, which is pastoral, trade-oriented, and led by towns. Wages and food consumption were relatively high. Sustained per capita growth occurred from the end of the Reconquest (1264) to the Black Death (1340s) and resumed from the 1390s only broken by late fifteenth-century turmoil. A second regime (1600s–1810s) corresponds to a more agricultural and densely populated low-wage economy which, although it grew at a pace similar to that of 1270–1600, remained at a lower level. Contrary to pre-industrial western Europe, Spain achieved its highest living standards in the 1340s, not by mid-fifteenth century. Although its death toll was lower, the plague had a more damaging impact on Spain and, far from releasing non-existent demographic pressure, destroyed the equilibrium between scarce population and abundant resources. Pre-1350 per capita income was reached by the late sixteenth century but only exceeded after 1820.

The timing of and reasons for Spain's decline have been subjects of ongoing debate since Earl Hamilton's seminal contribution, and attempts have been made at quantifying Spain's relative position over time.[2] It has recently been suggested that Spain had attained affluence prior to its American expansion, and that this increased throughout the sixteenth century, so that by 1590 it was among the top countries in Europe in per capita income terms.[3] This finding raises the crucial question of when, and why, Spain achieved such early prosperity.

This article provides a tentative answer by examining Spain's comparative performance over the half-millennium between the end of the Reconquest (1264)

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[1] This article is written to honour Patrick O'Brien on his eightieth birthday. We thank Steve Broadberry, Liam Brunt, Bruce Campbell, Hilario Casado Alonso, Greg Clark, Regina Grafe, Paolo Malanima, Branko Milanovic, Gunnar Persson, Ulrich Pfister, Joan Rosés, Jacob Weisdorf, Jeff Williamson, Jan de Vries, and participants at the HI-POD Conference, Venice (April 2009), the 15th World Economic History Congress, Utrecht (Aug. 2009), the Economic History Society Annual Conference, University of Durham (March 2010), the Conference on Quantifying Long Run Economic Development, Venice (March 2011), the 7th BETA-Workshop in Historical Economics, Strasbourg (May 2011), the 9th European Historical Economics Society Conference, Dublin (Sept. 2011), and the 6th Sound Economic History Workshop, Norwegian School of Economics and Business Administration, Bergen (Sept. 2011) for their comments and suggestions. Maarten Bosker, Steve Broadberry, Joan Rosés, Bas van Leeuwen, and Jan Luiten van Zanden kindly shared their unpublished data, and José Antonio Mateos Royo provided invaluable references. Financial support from the HI-POD Collaborative Project (European Commission's Framework Programme for Research FP7 Grant agreement no. 225343) and the Spanish Ministry of Education and Sciences ('Consolidating Economics') is gratefully acknowledged.

[2] Hamilton, 'Decline'; Yun Casalilla, 'Proposals'; Carreras, 'Modern Spain'; J. L. van Zanden, 'Cobb-Douglas in pre-modern Europe. Simulating early modern growth', International Institute of Social History working paper (2005); idem, 'Estimación', p. 27; Maddison, *World economy*, pp. 249, 264.

[3] Álvarez Nogal and Prados de la Escosura, 'Decline'.

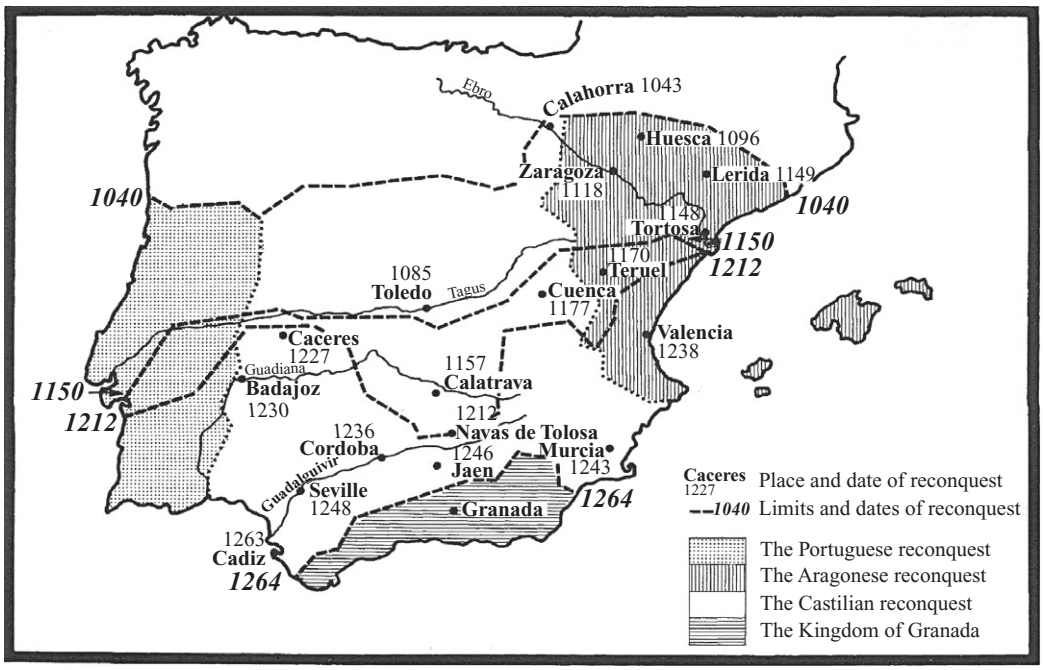

Figure 1. *The Reconquest: main phases*
Source: Mackay, *Spain in the middle ages*, p. xiv.

and the beginning of modern economic growth by the mid-nineteenth century.[4] It proceeds, first, by estimating trends in output. Specifically, movements in agricultural output are drawn using an indirect demand approach (section II), while those in industry and services are proxied through changes in urban population not living on agriculture (section III). Thus, trends in per capita output over the period 1280–1850 are obtained (section IV).[5] A re-examination of Spain's relative position within western Europe closes the article.

From our quantitative exercise we conclude that two distinctive regimes appear to exist in preindustrial Spain. The first one (1270s–1590s) corresponds to a high land–labour ratio frontier economy, largely pastoral, trade-oriented, and led by towns. Wage and food consumption levels were relatively high. Sustained per capita growth took place from the 1270s, after the de facto end of the Reconquest (figure 1), until the 1340s, when the Black Death (1348) and the Spanish phase of the Hundred Years War (1365–89) interrupted it. Growth resumed, then, only interrupted by late fifteenth-century political turmoil. The second regime (1600s–1810s) corresponds to a more agricultural and densely populated, low-wage economy, with growth occurring along a lower path.

[4] The Reconquest ended definitively with the fall of the Nasrid kingdom of Granada in 1492 but Christian–Muslim boundaries had remained stable since 1264.

[5] Álvarez-Nogal and Prados de la Escosura, 'Decline'. In addition to longer time coverage, the national yearly series approach differs from the regional output estimates at benchmark years over 1530–1850, from which national output was derived. Lack of data precludes a regional approach for the time span considered here.

Thus, Spanish relative affluence by 1492 can be tracked down to the pre-Black Death era. Unlike most of western Europe and the eastern Mediterranean, where the highest standards of living of the pre-industrial era were achieved after recovering from the plague by the mid-fifteenth century, in Spain the peak level of output per capita was reached in the 1340s. In pre-plague Spain, Malthusian forces were mostly absent except for a few, if any, areas along the Mediterranean coast. Sustained progress took place after the Reconquest in the context of a frontier economy, urban expansion, and openness to trade. Although its death toll was lower, the plague had a much more damaging impact in Spain than in western Europe since, far from releasing non-existent demographic pressure on land, it destroyed the equilibrium between scarce population and abundant resources. Pre-Black Death per capita income levels were temporarily recovered by the late sixteenth century, but were only exceeded after 1820.

Thus, the fall in output per capita in the late fourteenth century and, again, in the early seventeenth century represent two major steps in Spain's (absolute and relative) decline. Later, in the early nineteenth century, although demographic expansion was paralleled by an increase in GDP per capita, paradoxically the relative decline of Spain deepened.

I

Agricultural output for Spain as a whole has been estimated indirectly. Given the lack of hard empirical evidence for medieval and early modern Europe, alternative ways of deriving output trends have been put forward.[6] Wrigley's proposal assumes that, in the long run, food consumption per capita is roughly constant.[7] Because of this, output in agriculture evolves as total population adjusts for the agricultural trade balance.[8] The rationale for Wrigley's approach is that in a traditional economy workers try to maintain the stability of their per capita food consumption.[9] Recent research on developing countries argues that consumption per capita of food staples remains constant in aggregate terms even as per capita income rises.[10] In the absence of empirical evidence Wrigley's approach provides useful explicit quantitative conjectures. Wrigley's swift procedure, nonetheless, has some shortcomings. For example, the assumption of constant per capita food consumption can be criticized on the grounds that the values of price and income elasticities of demand for food in developing countries are significantly different from zero as per capita consumption of foodstuffs is sensitive to changes in disposable income per capita and in the relative price of food.[11]

[6] An alternative estimate on the basis of tithes is currently under construction.

[7] Wrigley, 'Urban growth'.

[8] This method has been used for late nineteenth- and early twentieth-century Japan (Nakamura, *Agricultural production*); eighteenth-century Britain (Deane and Cole, *British economic growth*; Overton, 'Re-establishing'); nineteenth-century Spain (Simpson, 'Producción'; idem, *Spanish agriculture*); and, recently, medieval Italy (Federico and Malanima, 'Progress').

[9] Lewis, *Economic growth*.

[10] Bouis, 'Income'.

[11] Kaneda, 'Changes'; Crafts, 'English economic growth'.

An alternative to estimating agricultural output indirectly is provided by the demand function approach.[12] A recent user of this procedure, Allen, derived agricultural output for a sample of pre-industrial European countries. He first estimated agricultural consumption per capita that, adjusted for net food imports, allowed him to derive output per capita and, then, multiplied by population, obtained absolute output. In the demand approach, real consumption per capita of agricultural goods (C) can be expressed as

$$C = a\, P^{\varepsilon} Y^{\mu} M^{\gamma} \tag{1}$$

in which P and M respectively denote agricultural and non-agricultural prices relative to the consumer price index (CPI), Y stands for real disposable income per capita; ε, μ, and γ are the values of own-price, income, and cross-price elasticities, respectively; and a represents a constant.[13] Taking rates of variation (denoted as lower case), we get:

$$c = \varepsilon\, p + \mu\, y + \gamma\, m \tag{2}$$

Since information on income per capita (Y) for pre-industrial Europe is usually lacking, Allen's suggestion of real wage earnings (W) per worker as a second-best alternative provides a most convenient solution. The rationale for Allen's claim is that as proprietors comprise a small share of population and therefore only consume a small fraction of total food, workers' returns provide a relevant measure of disposable income.[14] Hence, changes in real wage earnings (w) are suggested to proxy changes in real income per capita (y) in equation (2). However, the extent to which changes in real wages are representative of changes in workers' real earnings remains an unsettled issue. It is commonly accepted that wages were only a part of household incomes, especially in rural areas,[15] but the degree to which variations in household income are captured by those in real wage earnings is an unknown.[16] Nonetheless, identifying labour compensation with disposable income ignores 'the contribution of property income to the overall rise of national income' and implies the improbable assumption that the share of labour in national income remains stable over time.[17]

To complicate the situation further, the available evidence on wages in early modern Europe usually refers to wage *rates* (w) while what is actually needed is real wage *earnings* (W), that is, wage rates (w) times the number of days or hours (h)

[12] Crafts, 'Income elasticities'; idem, *British economic growth*. Crafts pioneered the demand approach to derive agricultural consumption and output. The method was later used for eighteenth-century Britain (Jackson, 'Growth'; Allen, 'Tracking') and nineteenth-century Spain (Prados de la Escosura, *Imperio a nación*; idem, 'Estimación'). It has been recently employed by Álvarez-Nogal and Prados de la Escosura, 'Decline'; Malanima, 'Long decline'; U. Pfister, 'German economic growth, 1500–1850', Historisches Seminar, Westfälische Wilhelms-Universität Münster working paper (2011).

[13] Allen, 'Economic structure', arbitrarily assigned the value of 1 to a. Note that Wrigley's proposal represents a particular case of a demand function for agricultural goods in which price and income elasticities are zero.

[14] Allen, 'Tracking', p. 214.

[15] García Sanz, 'Jornales'.

[16] The fact that, in times of hardship, authorities tried to regulate and control nominal wages suggests that the representativeness of wage labour is higher than commonly accepted; Bois, *Dépression*; Sanz Fuentes, 'Ordenamiento'; Vaca Lorenzo, 'Peste Negra'. It can be argued, however, that it is the non-monetary part of the wage that was usually adjusted while the money part was often quite sticky.

[17] Hoffman, Jacks, Levin, and Lindert, 'Inequality', p. 329.

worked per person-year.[18] Changes in work intensity affect yearly wage earnings per economically active person. In the early modern age, workers (men, women, and children) were prepared to increase their workload either because of the higher opportunity cost of leisure resulting from a wider range of consumption choices,[19] or to offset the decline in wages rates.[20] In fact, a more intense use of land appears to run alongside declining wage rates, implying a more intense use of labour.[21] The corollary is that long-run changes in real wage rates do not necessarily capture those in real returns to wage labour. In fact, we cannot know what the labour supply schedule looks like, because we do not really know if in good times people reacted to higher wages by offering more work or if in bad times people reacted to low wages by doing more work, and this is partly so because the opportunity cost of leisure changes over time with the availability of more consumption goods.

Given the dearth of direct estimates using contemporary data, the choice of values for price and income elasticities to be used in the calibration of the demand for agricultural goods presents another challenge. Studies of developing countries, not too dissimilar in income per capita from most countries in early modern Europe,[22] cast values of 0.7/0.8 for the expenditure elasticity for food (and own-price elasticity values of –0.5/–0.6).[23] However, it has been claimed that budget studies fail to include high-income consumers who, by Engel's law, have lower income elasticities of food demand.[24]

A relevant caveat is that, as an economy grows, the value added of food relative to its inputs (agricultural staple goods) increases by including services, raising, in turn, the income elasticity of demand for food.[25] Thus, adopting income elasticities of food demand for present-day developing countries in order to calibrate the demand of agricultural staples in the past may exaggerate the true value of their income elasticities.[26] Interestingly, Kaneda found income elasticity values of 0.3/0.4 for agricultural products in Japan over the period 1878–1940,[27] certainly low but not implausible values for a developing country.[28] Time series estimates of income elasticity of demand for Spain over the period 1850–1913 cast significantly different values for food (0.9) and for agricultural goods (0.4) and tend to confirm

[18] This procedure implies that using equation (2) with the variation in wage rates as a proxy for that in real disposable income per capita provides a measure of changes in daily (weekly) per capita consumption, so the challenge is to ascertain the extent to which working time varies in the long run and, hence, yearly consumption per capita.

[19] de Vries, 'Industrial revolution'; Voth, 'Time'; Allen, 'Britain's economic ascendancy'.

[20] van Zanden, 'Wages'; Malanima, 'Wages'.

[21] Boserup, 'Population'; Malanima, 'Wages'; de Vries, *Industrious revolution*.

[22] Maddison, *World economy*.

[23] Lluch, Powell, and Williams, *Household demand*. Moreover, direct cross-section estimates for late 1950s Spain still show high absolute values for income (and own-price) elasticity of food demand (0.9, and –0.7, respectively); Lluch, 'Elasticidades'.

[24] Clark, Huberman, and Lindert, 'British food puzzle'.

[25] The income elasticity of demand for these services is higher than that for staple food products. Ibid., pp. 234–5, point out, 'the value of food and beverage consumption rises relative to the value of foodstuff supplies over the course of economic development', while Kaneda, 'Changes', uses a similar argument to the one employed here to explaining why income elasticity of food demand was higher in the 1950s than in the previous decades.

[26] This does not necessarily mean that the share of the total value of food that comes from services in early modern Europe was lower than in today's developing countries. Probably the difference, then and now, lies between countryside and town, with lower services content of food in rural areas.

[27] Kaneda, 'Changes'.

[28] Cross-section estimates of income elasticities for aggregate food staples from household surveys are often in the 0.3–0.6 range; Bouis, 'Income'.

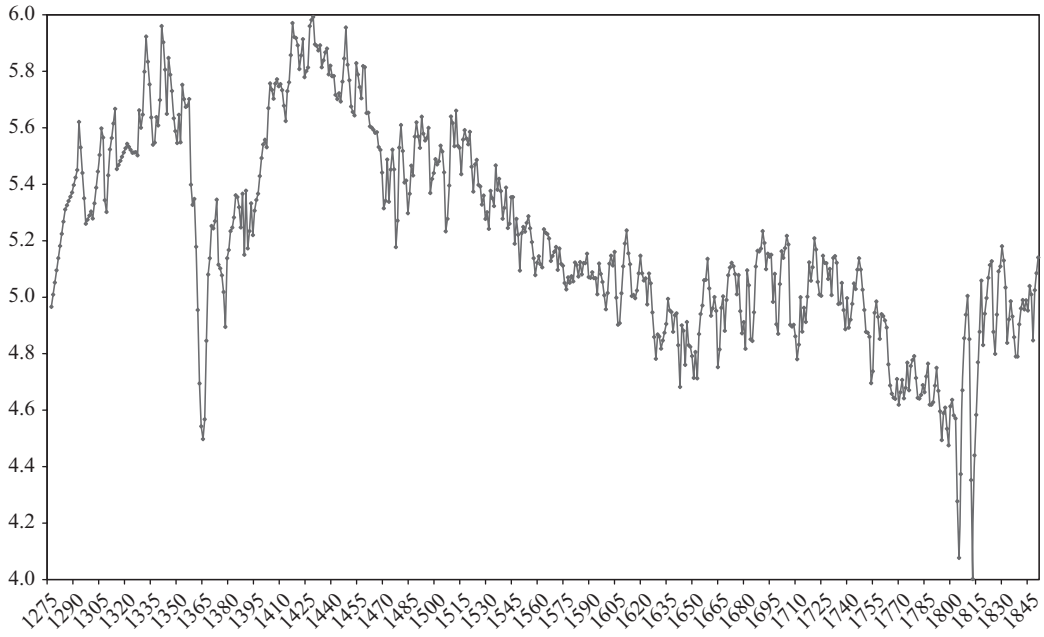

Figure 2. *Real wage rates, 1277–1850 (1790–9 = 100) (logs)*
Sources: See apps.

our hypothesis. If, in turn, real wage rates rather than per capita GDP are used, the income elasticity for agricultural goods falls to 0.3.[29]

For pre-1800 Europe Allen cautiously assumed values of 0.5 and −0.6 for income and own-price elasticities and used the Slutsky-Schultz relation to derive the cross-price elasticity of demand,[30] while Federico and Malanima adopted values of 0.4 and −0.5, for income and own-price elasticities, respectively, for early modern Italy.[31] Our preference for low absolute values of income ($\mu = 0.3$) and own-price ($\varepsilon = -0.4$) elasticities in the Spanish case is motivated by the fact that we are addressing the demand for agricultural staple goods, not for food itself which incorporates higher income-elastic services. Moreover, low values of income elasticity somehow capture the impact on the demand for food staples resulting from variations in working time as a response to changes in real wage rates. In other words, we are explicitly assuming that the *daily* wage elasticity of demand for foodstuffs is lower than the income elasticity of the demand for food.

Let us now look at the evidence available for our case (figure 2). Real wage rates experienced a rise between the late thirteenth and mid-fourteenth centuries, followed by a sharp decline until the end of that century and a recovery in the early fifteenth century, when the highest real wage rates for half a millennium were

[29] Estimates computed from data in Prados de la Escosura, *Progreso*.
[30] Allen, 'Economic structure'.
[31] Federico and Malanima, 'Progress'. The Slutsky-Schultz relation states that for the individual demand of any commodity, the income elasticity, with a negative sign, is the sum of own-price and cross-price elasticities, so it allows one to derive the value of the cross-price elasticity of demand from the assumed values for own-price and income elasticities.

reached. A long-term decline took place from the mid-fifteenth to the mid-seventeenth centuries, followed by a flat long-run trend to the early nineteenth century. However, it was not until the mid-sixteenth century that real wage rates fell below pre-plague levels.

Yet it is unclear that wage rates capture trends in wage earnings, as incentives to work harder increased over time. In the eighteenth century, for example, as population grew and trade expanded, relative prices changed, and a more intense use of land took place with a shift from extensive livestock rearing (sheep) to crops (cereals, vineyards, olives) and also to cash crops (such as fruit trees) along the Mediterranean coast.[32] Rising demand from an expanding population contributed to the increase in food prices that led, in turn, to a sustained fall in real wage rates as nominal wages were much more stable. Given the low number of days worked per economically active person, particularly in agriculture, the supply of labour was presumably rather elastic, and workers could make up for the fall in daily real wages by increasing the number of days allocated to work over the year. For example, in the Kingdom of Castile *c.* 1750, the Cadastre de Ensenada assigned 120 days of work per annum to day labourers (rural and non-rural), 180 to artisans, and 250 to servants, which, weighted by each sector's share in the economically active population (EAP), cast an average of 168 days per member of the EAP per annum.[33] This figure is almost identical to the one derived by Malanima for Italy (165 days on average for 1700–50) and significantly lower than those suggested by Allen for early modern Europe (250 days) and by Bairoch for the nineteenth century (196 days).[34] Scattered evidence for the construction industry suggests an increase in the number of days worked from the seventeenth to the eighteenth century.[35]

However, there is probably some asymmetry in the suggested inverse association between real wage rates and working time. For example, at times of high wages it seems unclear that an increase in real wage rates would lead to a reduction in days of work per active person. This would be a most plausible scenario for Spain in the middle ages, a frontier economy with presumably a low number of working days per economically active person.

The early nineteenth century provides a new scenario in which real wage rates followed an intensification of work as a result of wider access to property, following liberal reforms, in particular the *desamortización* (the disentailment of church and communal lands), and the increase in the variety of goods and services provided by the market. Thus, by 1850, each member of the EAP in agriculture worked an average of 240 days per annum.[36] During the first half of the nineteenth century

[32] Anes, *Crisis*. In Catalonia, the increase in trade stimulated the use of marginal, unexploited lands for vineyards and olive trees as a growing demand covered the cost of opening up new lands; Vilar, *Catalogne*.

[33] Ringrose, *Madrid*, p. 73; Vilar, 'Estructures', p. 19; Santaolaya Heredero, *Ciudad*. The low figure for days worked in agriculture is confirmed by Simpson, 'Technical change', for late nineteenth-century Andalusia on the basis of labour input requirements.

[34] Malanima, 'Long decline'; Allen, 'Great divergence'; Bairoch, 'Niveaux'; idem, 'Wages'.

[35] In Valladolid during the seventeenth century most workers were occupied for less than 150 days; Gutiérrez Alonso, *Decadencia*. In turn, during the late eighteenth century, Madrid masons only worked, on average, 3.5 days per week during winter and up to 4.4 days per week in summer; Nieto Sánchez, *Artesanos*, p. 428. Assuming, on average, four days per week, it represents 208 days per annum. The latter figures match closely those provided for Italy for 1750–1800, 200 days on average. See Malanima, 'Long decline'.

[36] The weighted average is computed from data on the labour force and days worked at the provincial level in Spain, *c.* 1850; Moral Ruiz, *Agricultura*.

EAP in agriculture multiplied by 1.5,[37] while according to Bringas Gutiérrez, the area of cultivated land multiplied by 2.4.[38] If we assume that labour effort per hectare (measured in days of work per person-year) remained constant over the same period, the number of working days in agriculture by 1800 would have been around 150 (=240*1.5/2.4), a figure consistent with that of 120 working days per annum at the time of the Cadastre of Ensenada (*c.* 1750), that is, prior to the agricultural expansion of the late eighteenth century. However, the scant evidence available is far from conclusive.[39]

Yet, before accepting changes in real wage earnings as a proxy for those in real disposable income per capita, the stability of the share of labour in national income needs to be established. Inequality was deep in early modern Spain. For example, *c.* 1750, the wealthiest 10 per cent outweighed the poorest 40 per cent by 15 to 17 times in Old Castile.[40] These ratios are similar to those found for contemporary England (14 times) and France (17 times).[41] Nonetheless, high levels of inequality can be compatible with stability in the share of labour in national income. Was this the case in pre-industrial Spain? Trends in relative factor returns provide a good test for stability of the income distribution.[42] One measure of income inequality, the land rent–wage ratio, shows a flat long-run trend between the early fourteenth and sixteenth centuries, then rises from the 1530s to the 1590s and, again, between the 1730s and the 1800s, but declines in the seventeenth and the early nineteenth centuries (figure 3).[43] Thus, it appears, in particular, for early modern Spain, that, unless returns to property are included in our proxy for disposable income, in phases of rising (declining) inequality our estimates may suffer a downward (upward) bias and, hence, provide a lower (upper) bound of the actual agricultural output.[44]

The demand for agricultural goods has been calibrated, then, using equation (2). The main challenge is posed by the choice of a proxy for changes in real disposable income per capita. One option, following Allen, is to use the variations in real wage

[37] Álvarez-Nogal and Prados de la Escosura, 'Decline'.

[38] Bringas Gutiérrez, *Productividad*, p. 86.

[39] Thus, conjectures about cultivated land suggest that it only increased by 20% between 1800 and 1860, which would imply that hectares per agricultural EAP fell during the early nineteenth century; Garrabou and Sanz Fernández, 'Agricultura'. Moreover, the low number of days worked per labourer in late nineteenth-century Andalusia hardly suggests any work intensification per EAP; Simpson, 'Technical change'.

[40] Computed from Yun Casalilla, *Transición*.

[41] Hoffman et al., 'Inequality'. Gini coefficients for income distribution at different Old Castile towns *c.* 1750 cast values ranging from 0.39 to 0.56, while similar estimates were obtained for Jerez (around 0.5); Álvarez-Nogal and Prados de la Escosura, 'Decline'. These figures are close to the 0.52 that Lindert and Williamson computed in their revision of Massie's Social Tables for England and Wales in 1759 (http://www.econ.ucdavis.edu/faculty/fzlinder/Massie1759rev.htm).

[42] Hoffman et al., 'Inequality', p. 325. They point out that real inequality was 'caused by the interaction of population growth with concentrated land ownership and the Engel's law'.

[43] Scattered evidence indicates that the incomes of the middle and upper classes grew in early modern Spain, while those of the lower classes stagnated or declined; Nader, 'Noble income'.

[44] As a test, we have estimated per capita consumption of food for Spain over the period 1850–1913 with a demand function and a common data set from Prados de la Escosura, *Progreso*, using real wage rates (Bringas Gutiérrez, *Productividad*), and GDP per capita, alternatively, as indicators of real per capita disposable income. The results confirm the downward bias introduced when wage rates are employed as a proxy for income per capita. Interestingly, when agricultural consumption per capita for eighteenth-century England is derived with a demand function, the use of per capita income (Crafts, *British economic growth*) also shows a faster pace of growth than when real wages rates are employed (Jackson, 'Growth'; Allen, 'Tracking').

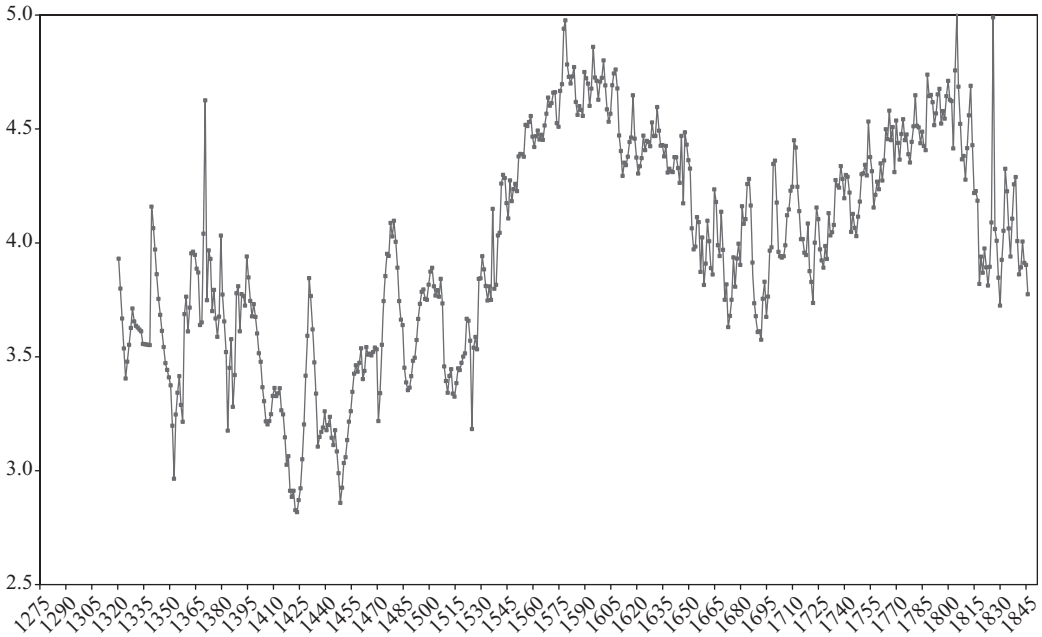

Figure 3. *Land rent–wage rate ratio, 1320–1845 (1790–9 = 100) (logs)*
Sources: See apps.

rates (estimate I).[45] A second option is to assume that workers reacted to declining real wage rates by working extra days, so real returns to labour remained stable over time. This assumption, which seems plausible for eighteenth-century Spain, implies that changes in the consumption per capita of agricultural staples would only depend on the relative price of agricultural and non-agricultural goods weighted by their own-price and cross-price elasticities (estimate II).

A third option results from a more comprehensive proxy for disposable income per capita in which, in addition to a crude measure of labour earnings, the returns accruing to proprietors are also taken into account. We have been able to construct a crude proxy of real disposable income as a weighted average of real wage rates and real land rents,[46] in which the shares of labour (0.75) and property (0.25) in Spain's national income during the 1850s are used as weights (estimate III).[47] Nonetheless, this alternative estimate suffers from the same weakness as estimate I, since no allowance is made for changes over time in the number of days worked per economically active person and in the amount of land exploited.

As regards the values of demand elasticities, we have explored alternative sets, ranging from –0.4 to –0.7 (own-price elasticity, ε) and 0.3 to 0.6 (income elasticity, μ) with cross-price elasticity (γ) always equal to 0.1, but finally opted deliberately for

[45] Allen, 'Economic structure'. It is worth noting that the use of unskilled wages does not alter our results significantly since most workers were unskilled.
[46] Lack of long run series for interest rates precluded its inclusion in our proxy for disposable income.
[47] Prados de la Escosura and Rosés, 'Sources'.

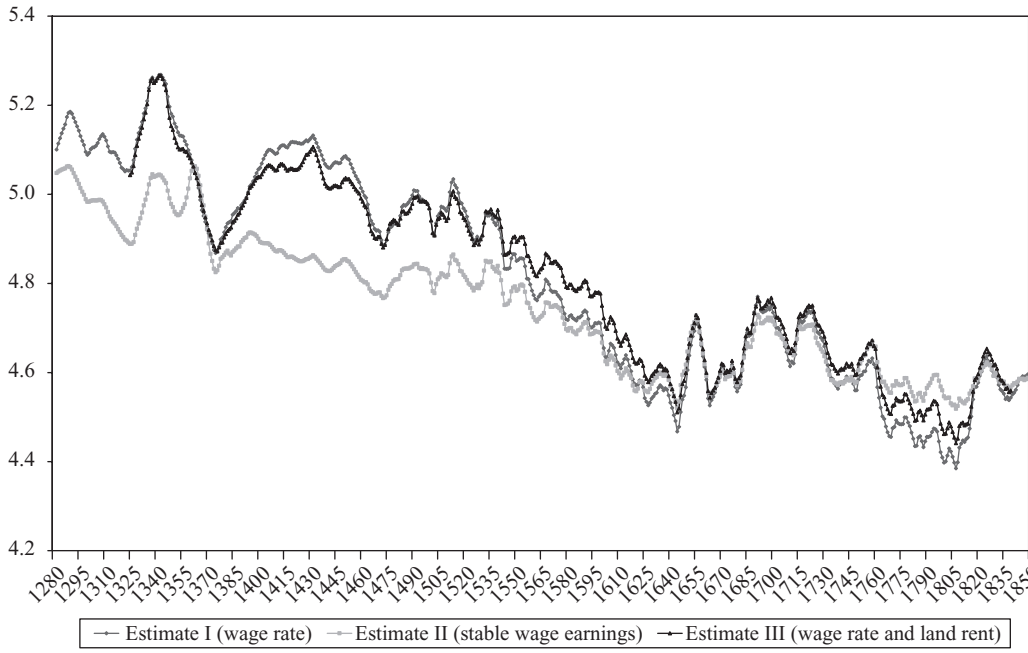

Figure 4. *Real consumption per capita of agricultural goods, 1277–1850: alternative estimates (11-year moving averages) (1850–9 = 100) (logs)*
Sources: See text.

low absolute values: $\varepsilon = -0.4$; $\mu = 0.3$; $\gamma = 0.1$.[48] As discussed above, the adoption of lower values for income and own-price elasticities for pre-industrial Spain than those computed for countries at similar levels of development allows for the fact that we are addressing the demand for agricultural staple goods. Furthermore, by choosing a low value for the income (wage) elasticity we allow for the fact that the demand for agricultural food staples was affected by changes in the number of days worked per person-year in response to real wage rate variations.[49]

In figure 4 and table 1 the three alternative estimates of agricultural consumption per capita are provided and implicitly compared to Wrigley's assumption of a constant consumption per capita of agricultural goods (a constant value of 4.6 expressed in natural logs). It clearly appears that Wrigley's approach proves inadequate since, even when real disposable income is assumed to remain unaltered (estimate II), the demand for agricultural staple goods reacts to changes in relative prices and, hence, consumption per capita is far from stable. In fact, the decline in

[48] Allen, 'Economic structure', and Malanima, 'Long decline', used similar values for own-price ($\varepsilon = -0.6$ and -0.5), income ($\mu = 0.5$ and 0.4), and cross-price ($\gamma = 0.1$) elasticities of demand. It is worth mentioning that elasticities should be adjusted over time as income per capita changes. However, since presumably per capita income in preindustrial Spain was low and varied within narrow limits, the range within which expenditure and own-price elasticities could fluctuate is rather narrow, and so is the range for the output estimates obtained using alternative elasticities.

[49] The use of low elasticity values, by biasing our estimates against the hypothesis that the demand for food staples reacts to changes in disposable income and relative prices, will allow us to show that Wrigley's approach is off the mark. The sources for real wage rates, real land rents, agricultural and non-agricultural prices, and consumer price indices are detailed in app. I.

Table 1. *Consumption per capita of agricultural goods: growth rates (%)*

Real per capita income proxied by:	*Estimate I Wage rates*	*Estimate II Stable wage earnings*	*Estimate III Wage rates and land rent*
1280–9 to 1340–9	0.22	–0.03	0.19
1340–9 to 1370–9	–1.33	–0.71	–1.29
1370–9 to 1590–9	–0.07	–0.06	–0.04
1590–9 to 1660–9	–0.28	–0.22	–0.35
1660–9 to 1810–19	–0.05	0.00	–0.04
1810–19 to 1850–9	0.42	0.18	0.33
1280–9 to 1850–9	–0.09	–0.08	–0.09

Sources: See text and app. tab. A1.

real per capita consumption observed for the demand estimate which includes the real wage rate as a proxy for disposable income (estimate I) is confirmed, but for a milder slope, in estimate II. Another interesting finding is that the inclusion of land rent as a proxy for returns to property in our measure of disposable income (estimate III) confirms the declining trend in per capita consumption of food staples.

Interestingly, estimates I and II match each other closely after 1550, in particular between the mid-sixteenth and mid-eighteenth centuries, and then in the early nineteenth century, but not before the mid-sixteenth century, and especially not during the fifteenth century, when estimate II exhibits a much lower level. This raises the issue of the extent to which, at a time of high wages, people forgo food consumption in order to reduce their working time. In an economy with a high land–labour ratio and with extensive use of natural resources—mainly livestock rearing—it seems unlikely that peasants would cut down their already low number of working days per annum. In the urban-led repopulation of the fourteenth and fifteenth centuries it also seems improbable that those employed in industry and services would reduce their working effort as their wages increased, particularly since trading networks linking towns within Spain and to the European markets catered for their demand. Thus, it can be inferred that estimate I offers a more plausible representation of trends in per capita consumption of agricultural staples than estimate II.

The close coincidence between estimates I and III confirms the decisive role played by relative prices in determining trends in per capita consumption as they offset the differing behaviour of real wage rates and land rent. Nonetheless, higher levels can be observed for estimate III during the late sixteenth and eighteenth centuries, as land rents partly offset the dramatic decline of real wage rates. Conversely, during the early fifteenth century the rise in real wage rates was mitigated by a trendless real land rent. Given the matching of estimates I and III, and the fact that estimate III is more comprehensive—in so far as it is derived using not just wage rates but also land rent to proxy disposable income—we decided to use estimate III in our computation of aggregate output. However, since estimate III only covers the years 1320–1845, we assume its evolution was identical to that of estimate I before 1320 and after 1845.

The consumption per capita of food staples presents two distinctive phases: high levels up to the 1550s, and thereafter significantly lower ones, which largely matches the evolution of real wage rates. The highest per capita consumption levels

of food staples corresponds to the pre-Black Death era. The recovery in the early fifteenth century fell short of the peak levels of the 1330s–1340s. The reason is that the advance of the Reconquest in the thirteenth century provided large areas of land which were not matched by demographic expansion.[50] In fact, the colonization of new land was far from complete on the eve of the Black Death, and southward migration flows from northern Spain continued.[51] Consumption levels of agricultural staples declined from the mid-fifteenth to the mid-seventeenth century (although still remained high in the early sixteenth century) and then stabilized at a low level (despite a recovery episode in the late seventeenth to early eighteenth centuries, followed by a sharp decline) until the mid-nineteenth century.

Due to lack of data for most of the considered period, we had to assume, as Allen did for most European countries, that agricultural foreign trade was balanced.[52] The available evidence for the late eighteenth and early nineteenth century indicates that trade represented a small share of agricultural output.[53] Thus, output per capita (q) equals, by construction, per capita consumption (C), and total agricultural output can then be derived with population figures (N) as:

$$(Q)_{agr} = qN \tag{3}$$

II

The dearth of data from which to infer trends in industrial and services production in pre-industrial Spain is even more dramatic than for agriculture and renders the use of crude indicators necessary. The association of urbanization, for which reliable evidence is available, with the level of economic development is not new.[54] Historical parallels are suggested between changes in urbanization rates and per capita GDP growth.[55] In pre-industrial economies, increases in real per capita

[50] This occurred even though large numbers of Muslims did not migrate and stayed, especially in the east, the Valencia region in particular. Nonetheless, in areas along the Mediterranean coast the situation was often not too dissimilar from that in western Europe; Mackay, *Spain in the middle ages*.

[51] Ibid., pp. 67–71.

[52] Allen, 'Economic structure'. The first official computation of trade flows corresponds to 1792 (Prados de la Escosura, 'Comercio exterior'), and reconstructions of Spain's trade with its major partners in the eighteenth century do not provide the trade balance for agricultural goods. (Romano, 'Documenti'; Prados de la Escosura, 'Comercio hispano-británico'). Nonetheless, it is not the size of exports or imports of agricultural goods that really matters, but its balance, which can be easily assumed to be a small share of total consumption.

[53] It can be reckoned that Spain was a net food importer in the late eighteenth century up to, at most, 5% of GDP and no more than 10% of agricultural output; Prados de la Escosura, 'Pérdida', pp. 271–3, 276. By the mid-nineteenth century, however, Spain was a net exporter of foodstuffs, though no more than 5% of agricultural output; idem, *Imperio a nación*; idem, *Progreso*. This suggests that in order to represent the increase in agricultural output per capita between the late eighteenth and the mid-nineteenth century the improvement in per capita consumption should be raised by around 15%. As a consequence, our agricultural output estimates are downward biased for the early nineteenth century.

[54] Urbanization represents, according to Kuznets, *Modern economic growth*, p. 271, 'an increasing division of labour within the country, growing specialization, and the shift of many activities from nonmarket-oriented pursuit within the family or the village to specialized market-oriented business firms'. Cf. also Acemoglu, Johnson, and Robinson, 'Rise', p. 552; Reis, 'Economic growth', p. 198; Temin, 'Economy', p. 135.

[55] Craig and Fisher, *European macroeconomy*, p. 114. This approach is supported by van Zanden, 'Early modern economic growth', p. 71, who claims that 'differences in *levels* of development . . . are perhaps best approached via variations in the urbanization ratio'.

income have been linked, *ceteris paribus*, to those in the proportion of the population living in urban centres.[56] More cautiously, here we have accepted urban population (excluding those living on agriculture) as a proxy for non-agricultural output and hence have assumed that trends in the rate of *adjusted* urbanization—that is, the share of non-agricultural urban population over total population—capture those in per capita output in industry and services.[57]

In early modern Spain, urbanization rates have usually been considered upwardly biased as a result of the existence of 'agro-towns'. Towns provided security and lower transaction costs in a frontier economy during the repopulation process that followed the Reconquest, and again after the Black Death. After the third wave of the Reconquest in the thirteenth century, Christian settlers from Aragon, Catalonia, and southern France acquired farms but preferred to live in towns.[58] Moreover, the impact of the Black Death resulted in urban expansion in southern Spain as towns were more secure and provided better services, which attracted immigrants from the northern countryside.[59] At the same time, the acceleration in the pace of the Reconquest and the plague encouraged the formation of large landholdings.[60] Thus, 'agro-towns' in southern Spain seem to be the legacy of a highly concentrated landownership which resulted in a large proportion of landless agricultural workers.[61]

Notwithstanding the existence of 'agro-towns', a large proportion of urban economic activity was associated with industry and services. In sixteenth-century Old Castile, Yun Casalilla reckons that agricultural employment represented, on average, 8 per cent of the urban labour force.[62] In late eighteenth-century Spain most urban day labourers were employed outside agriculture, and farmers (*labradores*) only represented 7.6 per cent of the urban population in the 1787 population census.[63]

Although keeping a constant threshold over time, while population grows, is rather questionable,[64] we have adopted the definition of 'urban' population as dwellers of towns with 5,000 inhabitants or more, to maintain consistency with the estimates of Bairoch, Batou, and Chèvre so that international comparisons can be carried out.[65] We have used the urban population adjusted downwards by exclud-

[56] Wrigley, 'Urban growth'.

[57] Malanima, 'Long decline', follows a procedure similar to the one used here.

[58] Mackay, *Spain in the middle ages*, p. 69.

[59] Cuvillier, 'Population catalane'; Ladero Quesada, 'Población'; Mackay, *Spain in the middle ages*; Pladevall, 'Disminució'; Rodríguez Molina, *Jaén*; Rubio Vela, 'Crisis'; Santamaría Arández, 'Peste Negra'.

[60] Vaca Lorenzo, 'Manifestación'; Valdeón Baruque, *Enrique II*; Cabrera, 'Medieval origins', qualifies this view and attributes the rise of *latifundia* to the generalization of the seigniorial regime during the fourteenth and fifteenth centuries.

[61] Casado Alonso, 'Economía'; Reher, *Town and country*. It seems clear that the higher the threshold to be deemed as an urban centre, the lower the probability of including people employed in the agricultural sector. In order to mitigate the inclusion of 'agro-towns', in which most of the population is employed in agriculture, Malanima, 'Cities', proposed a lower limit for being considered urban, 5,000 inhabitants, for the north and centre of Italy, and a higher one, 10,000, for the south of the country.

[62] Yun Casalilla, *Marte contra Minerva*.

[63] Pérez Moreda and Reher, 'Demografía urbana', p. 129.

[64] Wrigley, 'Urban growth'.

[65] Such a definition is arbitrary, and alternative thresholds of 10,000 (de Vries, *European urbanization*), or 20,000 inhabitants have been used (Flora, 'Historical process'; Bairoch, Batou, and Chèvre, *Population*). Bairoch et al. employed alternatively 2,000, 5,000, 10,000, and 20,000 inhabitants as measures of urbanization.

Table 2. *Adjusted rate of urbanization* (%)*

1000	8.0
1300	8.8
1400	7.8
1530	9.9
1591	14.5
1700	11.1
1750	13.5
1787	17.4
1857	23.2

Note: * Share of population in towns of 5,000 and over, excluding those living on agriculture.
Sources: Pre-1530: see text and app. I. Post-1530: Álvarez-Nogal and Prados de la Escosura, 'Decline', p. 337.

ing those living on agriculture (see app. II).[66] Spanish 'adjusted' urbanization rates, at benchmark years over the period 1000–1857, are presented in table 2, and their rates of variation have been accepted to proxy those in non-agricultural output per capita.

However, efficiency changes resulting from variations in the composition of labour by economic sectors and in the dependency rate could affect our proposed index. We have, therefore, carried out a sensitivity test by estimating the intersectoral shift effect that results from changes in the shares of industry and services in non-agricultural employment and in the productivity gap between industry and services. Furthermore, we allowed for changes in the potentially active to total population ratio (PAP/N) that could also affect our index. Fortunately trends in the proposed index of output outside agriculture do not appear to be significantly altered by either demographic or output composition changes during the early modern era.[67]

Before proceeding to estimate aggregate output, it is necessary to confront an apparent contradiction between a declining consumption of agricultural staples per capita and a rising urbanization (adjusted) rate, which implies, under our previous assumption, an increasing consumption of industrial goods and services (tables 1 and 2 and figure 4). How could it be solved? A possible explanation is that the decline in the consumption of food staples per capita is exaggerated by the use of real unskilled wage rates as a proxy for real income per capita (estimate I)

[66] We follow here Álvarez-Nogal and Prados de la Escosura, 'Decline'. A more stringent definition of 'urban' centre is proposed by E. Llopis Agelán and M. González Mariscal, 'La tasa de urbanización en España a finales del siglo XVIII: el problema de las agrociudades', Asociación Española de Historia Económica working paper, no. 0602 (2006).

[67] Services increased relative to manufacturing in terms of output and employment in early modern Spain (García Sanz, 'Población'; López-Salazar Pérez, *Estructuras*; Reher, *Town and country*), probably as a consequence of the Dutch disease provoked by the inflow of American silver (Forsyth and Nicholas, 'Decline'; Drelichman, 'Curse'). Given the lack of national data, we arbitrarily assumed that the evolution of the internal composition of non-agricultural employment in Spain was captured by the shares in non-agricultural economically active population (L_{i+s}) of industry (L_i/L_{i+s}) and services (L_s/L_{i+s}) in a New Castile town, Cuenca (Reher, *Town and country*). As regards the productivity ratio between industry and services, lack of data forced us to accept a fixed ratio (1.4) derived from the Cadastre de Ensenada for the Kingdom of Castile, *c.* 1750. The resulting intersectoral shift effect [$IS = (L_s/L_{i+s}) + (1.4^* (L_i/L_{i+s}))$] shows a mild decline over time. If alternatively the productivity gap for the 1850s were used (Prados de la Escosura, *Progreso*) the productivity index would rise slightly over the period 1750–1850. Changes in the potentially active to total population ratio (PAP/N) can also affect our index of output outside agriculture. Alas, we only know the evolution of the PAP/N ratio for the case of New Castile from 1586 onwards, which does not exhibit major changes over time (Reher, 'Dinámicas').

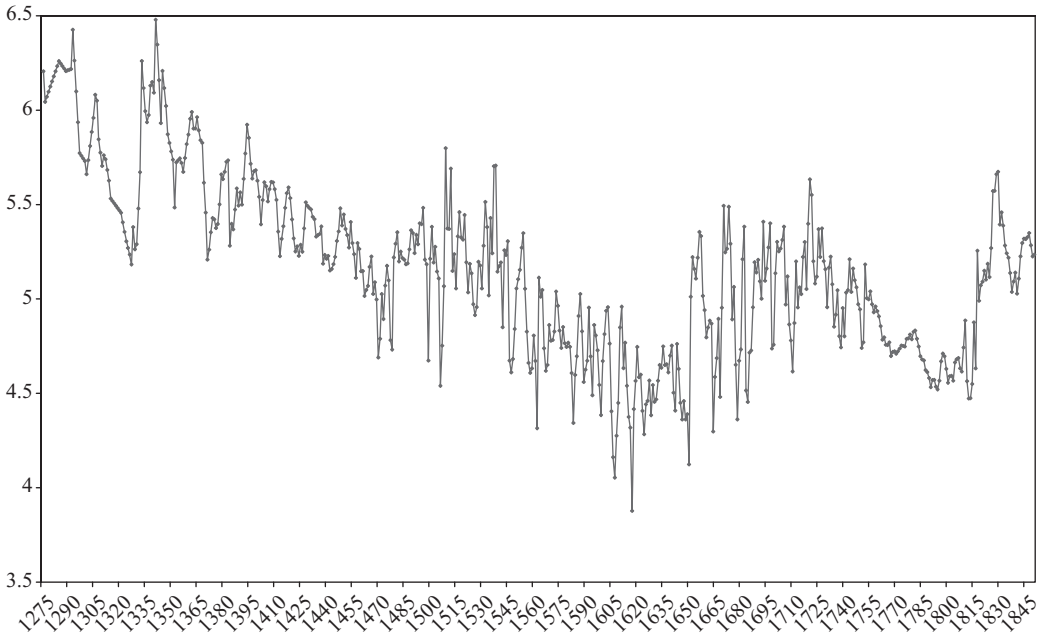

Figure 5. *Ratio of industrial to agricultural prices, 1277–1850 (logs)*
Sources: See text.

since it introduces a downward bias in the estimates (at least when income inequality increases and work intensifies). However, the alternative results obtained by assuming stable real wage earnings per worker (estimate II) and by using jointly unskilled wage rates and land rents per unit of cultivated land as a proxy for real income per capita (estimate III) cast similar declining trends. An alternative interpretation would be, then, that the opportunity cost of food staples consumption rose as a result of wider consumption choices and, hence, the amount of non-agricultural goods consumed increased at the expense of food staples. This scenario seems to be confirmed by the steady decline in the prices of industrial goods relative to agricultural goods, in particular, for the sixteenth and eighteenth centuries (figure 5). Lastly, it could be argued that such a contradiction evidences the fact that rising urbanization in pre-industrial societies fails to capture increases in economic activity outside agriculture as it simply results from rural immigrants expecting to live on charity.[68] However, even if this were the case, feeding an increasing idle urban population would imply the existence of a surplus to be distributed among the poor. Such a surplus could only result from either a redistribution of income, with the consequence of an inequality decline, or from an output increase in industry and services. Since the available evidence suggests that inequality increased during both the sixteenth and eighteenth centuries (figures 3 and 8), the surplus resulted necessarily from the increase in non-agricultural production. Thus, the contradictory trends in per capita consumption of agricultural foodstuffs and increasing urbanization would be reconciled.

[68] We owe this hypothesis to Paolo Malanima.

III

To reach an estimate of aggregate output we need to combine our indicators of agricultural output and economic activity outside agriculture. Therefore, we have computed a Divisia index for real GDP per capita by weighting yearly variations in output per capita in agriculture (proxied by estimate III of agricultural goods consumption) and in industry and services (proxied by the 'adjusted' urbanization rate) by the average, at adjacent years, of the shares of agriculture and non-agricultural activities in current price GDP and then obtaining its exponential.[69] That is,

$$lnQ_t - lnQ_{t-1} = \Sigma_i \left[\bar{\theta}_Q (lnQi_t - lnQi_{t-1}) \right] \tag{5}$$

Where share values are computed as:

$$\bar{\Theta}_{n_i} = 1/2 \left[\theta_{ni}(T) + \theta_{ni}(T-1) \right], \quad (i = 1, .. i, .. n). \tag{6}$$

Current price estimates of GDP have been obtained by reflating each sector's real output with its corresponding price index (both expressed as 1850/9 = 1) times the sector average value added in the 1850s, and then adding them up. In the case of agriculture, a price index was already available; in the case of non-agricultural activities, rates of variation for manufacturing prices, the CPI, and nominal wage rates were arithmetically averaged and its exponential computed to obtain a non-agricultural price index.[70] Thus current GDP estimates were obtained and the share of each sector derived. A crude estimate of the share of agriculture in national income at current price is presented in figure 6. These conjectural results tend to confirm our intuition of a relatively small agricultural sector—given the significant role of towns and commerce—in both the pre-Black Death era and the sixteenth century, before seventeenth century 'ruralization' took place. From the late eighteenth century, agriculture's share in GDP declined gradually.

But to what extent do our estimates proxy GDP or just 'market income', leaving aside home, non-marketed production? Our conjecture is that we fall short of

[69] Álvarez-Nogal and Prados de la Escosura, 'Decline', derived aggregate output (O) by combining agricultural output ($q\ N$) and the indicator of economic activity outside agriculture (namely, adjusted urbanization, $N'_{urb\text{-}nonagr\ it}$), expressed in index form with 1857 as 100, with their shares in GDP in 1850–9—the earliest dates for which national accounts are available (Prados de la Escosura and Rosés, 'Sources')—as weights.

$$O_{.t} = Sa_{.1850/59}(q_{.t}N_{.t}) / (q_{.1857}N_{.1857}) + (1 - Sa_{.1850/59}) * (N'_{urb\text{-}nonagr.t} / N'_{urb\text{-}nonagr.1857}) \tag{4}$$

where $Sa_{.1850/59}$ represents the average share of agriculture in GDP in the 1850s (0.404).

However, such an approach to derive output estimates for over half a millennium introduces an index number problem, since relative prices change over time and, consequently, fixed mid-nineteenth-century weights are not representative. Furthermore, it also implies the strong and unrealistic assumption that the productivity differential between agricultural and non-agricultural sectors remained stable over time. Malanima and Pfister's estimates suffer from this shortcoming. See Malanima, 'Long decline'; Pfister, 'German economic growth' (see above, n. 12).

[70] This amounts to allocating one-third of the weight to industry (the industrial price index) and two-thirds to services (nominal wage and consumer price indices), which is a good approximation to the sector shares within non-agricultural output in the 1850s; Prados de la Escosura, *Progreso*.

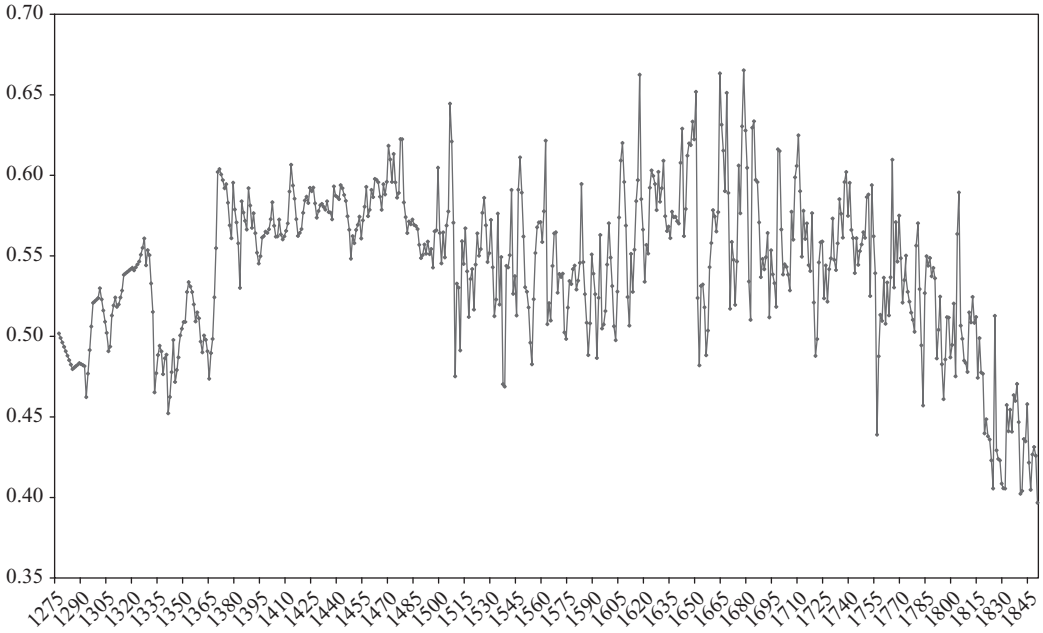

Figure 6. *Share of agriculture in GDP, 1277–1850 (current prices) (%)*
Sources: See apps.

covering non-market production and that its inclusion in our output estimates would probably have a counter-cyclical effect, moderating the intensity of both the decline and rise of output over time that we present here.[71]

Trends in product per capita are offered in figure 7 and table 3 (in which our favoured series—derived using estimate III of agricultural output—is confronted with those derived using estimates I and II). Over the long run, real output per capita increased very mildly, by less than one-fifth, between the late thirteenth and mid-nineteenth century. Three phases of sustained expansion can be distinguished, though, each one with a similar trend growth, but along successively lower paths, separated by the late fourteenth- and early seventeenth-century crises.

Two clearly differentiated epochs can be distinguished in the economic performance of pre-industrial Spain: 1270s–1590s and 1600s–1810s.[72] In the first one, sustained progress—which can be tracked down to the eleventh century—was interrupted by the Black Death and then resumed from the 1390s. By the early fourteenth century, Castile and, to a large extent, the whole of Spain, was a high land–labour ratio economy whose primary sector had a relatively small size. Repopulation was driven by urban centres, and, helped by the relative abundance of specie, trade networks linked towns in the Douro valley and the Camino de

[71] For agricultural output, it is unclear that this is the case in our demand approach estimates. As for output in industry and services, a non-negligible share was contributed by the active population employed in agricultural activities and we fail to capture it, although an early use of the market even for the more remote regions of Spain has been documented; Domínguez Martín, 'Mercantilización'. Furthermore, the so-called 'agro-towns' tended to facilitate production for the market.

[72] A third epoch of modern economic growth from the early nineteenth century to the present is outside the focus of this article; see Prados de la Escosura, 'Growth'.

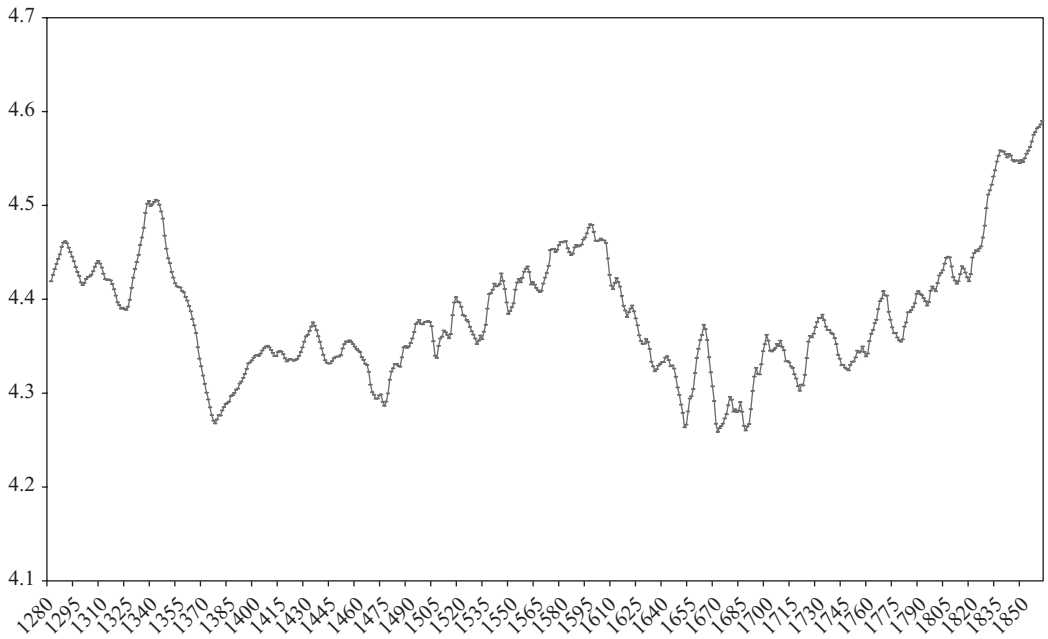

Figure 7. *Real output per capita, 1280–1850 (11-year moving averages) (1850–9 = 100) (logs)*
Sources: See text.

Table 3. *Real output per capita growth (%)*

	Computed with agricultural estimate I	*Computed with agricultural estimate II*	*Computed with agricultural estimate III*
1280–9 to 1340–9	0.12	–0.02	0.11
1340–9 to 1370–9	–0.79	–0.48	–0.77
1370–9 to 1590–9	0.08	0.09	0.09
1590–9 to 1660–9	–0.27	–0.23	–0.31
1660–9 to 1810–19	0.13	0.16	0.13
1810–19 to 1850–9	0.44	0.31	0.39
1280–9 to 1850–9	0.03	0.04	0.03

Sources: See text and app. tab. A2.

Santiago with Andalusia's cities. A commercial society, initiated with the Camino de Santiago in the eleventh and twelfth centuries, developed with Castilian trade expansion and the creation of a Hansa-type network in northern Spain, the spread of Catalan economic interests in the Mediterranean, and the opening of the Strait of Gibraltar to southern trade.[73] All this resulted in a high income society with an expanding population, which was able to defeat Islam and extract large tributes.

The relatively mild demographic impact of the Black Death is in contrast with its dramatic economic effects. The plague hit Spain in 1348, and most historians agree that its impact was milder than elsewhere in western Europe. The regional

[73] Mackay, *Spain in the middle ages*, pp. 74–5, 127.

impact of the plague varied substantially.[74] In the Kingdom of Castile, despite recurring plague outbreaks, its effects were less devastating than in the Kingdom of Aragon, Catalonia in particular.[75] In Teruel (Aragon), the loss of population reached 35 per cent, although part of it represented plague-led emigration,[76] while in Navarre it represented between 25 and 40 per cent.[77] In Castile, the loss of population was probably below 25 per cent and is partly explained by migration to southern Spain, since Andalusia was the most plague-ridden region of the Kingdom of Castile.[78] However, the economic impact of the plague seems to have been much more dramatic than the demographic one, with real per capita income contracting by one-fourth between the 1340s and the 1370s. It is our hypothesis that, in a frontier economy—such as was the case for most of Spain—the Black Death's demographic shock destroyed commercial networks (national and international) and isolated an already scarce population, and consequently reduced the ability to maintain per capita production levels.

A phase of long-term growth opened after the Black Death and the Spanish phase of the Hundred Years' War (1350–89) and lasted until the end of the sixteenth century. Economic expansion largely happened on the basis of a staple (wool), whose production adapted well to the relative abundance of land, and on a dynamic trade sector which supplied not only international markets but also domestic ones as increasing living standards stimulated the creation of an urban industry.[79] Declining relative industrial prices during the 1390s to 1470s (figure 5) reinforced the allocation of resources to livestock rearing, taking advantage of the closing of European markets to English wool during the Hundred Years' War. Castilian transhumance expanded once Extremadura and La Mancha grasslands were won, and the demand for wool grew both internationally, in the Low Countries, Italy, and then England,[80] and domestically, as the local textile industry grew.[81] American colonization and international trade expansion contributed to the stimulation of economic activity during the 1490s to 1590s. Thus, by the end of the sixteenth century, real output per capita was close to pre-Black Death levels, while Spain had built an empire and become an economic centre which connected Europe and the New World.

The second epoch, ranging from the 1600s to the 1800s, had significantly different features, and the foundations of growth of the previous epoch—wool, trade, and urban activity—would no longer be in place. The beginning of this epoch was marked by a sustained fall in per capita income until the mid-seventeenth century, of about one-fifth. The decline in wool exports after 1570 and the contraction in the purchasing power of American silver from the early seventeenth century forced an inward-looking re-orientation of the Spanish economy.[82] The Dutch disease brought by American silver apparently reinforced low produc-

[74] Doñate Sebastiá, 'Peste Negra'; Vaca Lorenzo, 'Peste Negra'.
[75] Verlinden, 'Grande peste'; Pérez Moreda, 'Población'; Sobrequés Callicó, 'Peste Negra'.
[76] Sobrequés Callicó, 'Peste Negra'.
[77] Monteano, 'Peste Negra'.
[78] Iradiel Murugarren, Moreta, and Sarasa Sánchez, *Historia medieval*.
[79] Mackay, *Spain in the middle ages*, p. 75.
[80] Childs, *Anglo-Castilian trade*.
[81] Iradiel Murugarren, *Industria textil*.
[82] Flynn, 'Fiscal crisis'.

tivity and competitiveness in tradable production.[83] The rising cost of the empire fell on Castile, its richest and most populated kingdom. Growing taxation from 1575 led towns to increase their indebtedness, which had a negative effect on urban activity, at the time of a decline in wool exports and the disappearance of the Medina del Campo fair.[84] The fiscal system collapsed, as did cities.[85] Ruralization, however, did not imply a significant improvement in the efficiency of agriculture. Economic recovery only took place in the late eighteenth century. Population pressure led to the extensive cultivation of land. Crops (cereals, in particular) took the lead over livestock. The population, who lived mostly in interior Castile and the Guadalquivir Valley in the fifteenth century, shifted their balance towards the periphery where a more commercial agriculture developed. When in the early nineteenth century Spain's per capita income again reached the level of the 1590s, it was no longer an empire and a link between Europe and the New World.

These two distinctive regimes also translated into significant differences in terms of well-being. A crude inequality indicator of income distribution, the ratio of nominal output per capita to nominal wage rates, expressed in index form—known as the Williamson index—has been computed. The rationale of such an indicator is that while the numerator captures returns to all factors of production per occupied person—and here we assumed that the labour force expanded at the same pace as the total population—the denominator represents the returns to raw labour, so the bottom of the distribution is compared to its average. It is worth recalling, however, that since wage rates might underestimate wages in the long run—as the number of hours worked possibly increased in the late eighteenth and early nineteenth century—our index could exaggerate inequality for this period. Some interesting results derive from figure 8. Low inequality goes hand in hand with high income levels during the first epoch (1270s–1590s), while high inequality corresponds to low output per capita after 1600. It could also be suggested that in the early modern era phases of expansion (depression) tended to be accompanied by rising (declining) inequality, except for the early seventeenth century.[86] This result is largely confirmed by another inequality measure, the land rent–wage ratio (figure 3). In the early nineteenth century, when population expansion was accompanied by a sustained increase in output per capita, inequality stabilized according to the Williamson index, while it declined in terms of the land rent–wage ratio.

IV

Half a century ago, John Elliott proposed 'to compare Spanish conditions with those of other contemporary societies, and then, if it is possible to isolate any

[83] Forsyth and Nicholas, 'Decline'; Drelichman, 'Curse'.

[84] Ruiz Martín, 'Banca'.

[85] Gelabert, 'Urbanisation'; Andrés Ucendo and Lanza García, 'Estructura'. Monetary alteration (fiat currency, vellón) and debt default (1635–58), together with war with France and revolts in Catalonia (1640–53) and Portugal (1640–68), help to explain the new situation. It is worth noting that, contrary to the experience of the late fourteenth and fifteenth centuries, fiscal revenues fell and the primary sector gained importance while urban centres declined.

[86] The different evolution of consumer price indices for lower and upper social classes constitutes an additional source of inequality in early modern Europe; Hoffman et al., 'Inequality'.

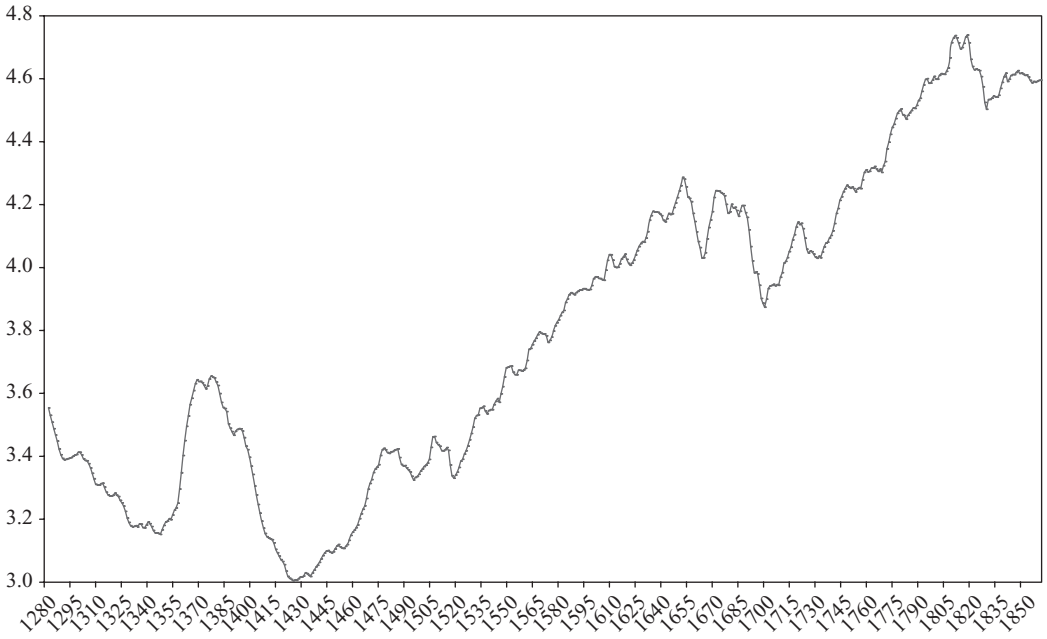

Figure 8. *Inequality (Williamson index), 1277–1850 (11-year moving averages) (1850–9 = 100) (logs)*
Sources: See text.

features which appear unique to Spain'.[87] Since then, views of Spain's relative performance in early modern Europe have been put forward with hardly any empirical support.[88]

The fact that a quantitative comparison is fraught with difficulties explains why no attempts have been made to establish, even at a conjectural level, Spain's relative position in pre-industrial Europe. Although the number of countries for which trends in output per capita can be drawn has increased lately, comparable per capita incomes at current prices and adjusted for differences in price levels—that is, expressed in purchasing power parity (PPP) terms—are lacking. Therefore it is necessary to resort to crude, indirect methods that necessarily produce questionable results. The most common method, pioneered by Maddison, is to carry out the comparison in 1990 international prices, which result from projecting backwards per capita GDP levels in 1990, expressed in 1990 'international' dollars (PPP), with volume indices taken from historical national accounts.[89] Although Maddison's figures are widely used as they represent the most convenient procedure, his approach has been seriously criticized. Perhaps its most obvious shortcoming is the severe index number problem that it introduces, that is, the fact that the basket of goods and services produced and consumed in

[87] Elliott, 'Decline', pp. 55–6.
[88] Kamen, 'Decline'; Cipolla, *Before the industrial revolution*; Israel, 'Decline'.
[89] Maddison, *Monitoring*.

1990 becomes less and less representative as one moves back in time, as preferences and relative prices change as a result of modern economic growth and technological change. However, the available datasets that attempt to provide a solution by comparing current price per capita incomes, PPP adjusted, are also contentious due to their limited commodity and country coverage and to the indirect,[90] short-cut procedure used in their construction.[91] Nonetheless, a reason to favour the results from a short-cut approach is that using a current price benchmark for 1850 mitigates—though far from eradicates—the formidable index number problem introduced by the use of 1990 international dollars. Although the year 1850 is still too remote for the half a millennium considered here, modern economic growth had not yet made much progress in many European countries, as the available evidence (real wages, life expectancy, output per capita growth) suggests.

In an eclectic exercise, table 4 provides per capita GDP levels for a sample of European countries, including Spain, relative to that of the UK in 1850, which have been projected backwards to 1300 with the available national indices of real output per capita. In panel A, the benchmark estimates for 1850 are derived through a short-cut approach and expressed in 1850 US relative prices.[92] In panel B, the 1850 benchmark is provided by Maddison's estimates expressed in Geary-Khamis 1990 dollars.[93] Thus the reader will be able to decide which set of results seem more plausible (see app. II).

Before discussing the results, a word is needed about the way the national indices of real output per capita are derived.[94] Estimates for Italy, Germany, and France have been constructed with a similar method to that used for Spain, namely, a demand approach for agricultural output and economic activity outside agriculture proxied by urbanization. Due to lack of data, the relative income level for Italy in 1850 has been projected backwards with output estimates for north and central regions.[95] For Germany, estimates derive from Pfister.[96] As regards France, we carried out our own estimates on the basis of Allen's data on population,[97] agricultural output, and urbanization for 1400–1800; Bairoch for urbanization in 1850;[98] and Toutain for agricultural output estimates, 1790–1850, and sector shares in GDP in 1850.[99] We used direct output estimates for Holland and the

[90] M. Ward and J. Devereux, 'New perspectives on international standards of living in the late 19th century', paper presented at the XIV International Economic History Congress, Session 41 (Helsinki, 2006).

[91] Prados de la Escosura, 'International comparisons'.

[92] Ibid.

[93] Maddison, 'Statistics'.

[94] We opted to choose the UK rather than Britain or England, and the Netherlands rather than Holland, since we are looking at whole countries, not regions, and a major purpose of our article is to establish trends in Spain, not just in Castile, and to compare Spain to other nations; Allen, 'Economic structure'; van Zanden, 'Early modern economic growth'.

[95] Malanima, 'Long decline'.

[96] Pfister, 'German economic growth' (see above, n. 12).

[97] Allen, 'Economic structure'.

[98] Bairoch, *Cities*.

[99] Toutain, 'Produit intérieur'. As in the cases of Pfister, 'German economic growth' (see above, n. 12), and Malanima, 'Long decline', for Germany and Italy, this is a slightly different and inferior estimate to the one for Spain, since the use of fixed weights over such a long time span creates an index number problem. In the case of Spain, though, the results derived from using a Divisia index are not substantially different from those obtained with a fixed weighted index.

Table 4. *Output per capita in western Europe (UK in 1850 = 100)*

	UK	*Netherlands*	*Germany*	*France*	*Italy*	*Spain*	*Sweden*
Panel A. Relative per capita GDP in 1850 at current US relative prices (PPP) (UK = 100)							
1300	25				72	51	
1348	26	22			67	54	
1400	38	31		52	78	48	
1500	39	37	49	50	68	50	
1570	39	37			64	54	35
1600	37	68	34	50	60	53	
1650	34	69			62	41	
1700	55	54	40	54	65	48	
1750	61	60	45	55	68	46	
1800	75	67	42	56	60	54	41
1850	100	79	61	78	66	64	52
Panel B. Relative per capita GDP in 1850 at 1990 international prices (PPP) (UK = 100)							
1300	25				66	37	
1348	26	29			62	39	
1400	38	39		46	72	35	
1500	39	48	49	44	63	36	
1570	39	47			60	39	29
1600	37	88	35	44	56	38	
1650	34	89			57	29	
1700	55	69	40	47	60	35	
1750	61	78	45	48	63	34	
1800	75	86	42	49	56	39	34
1850	100	102	61	69	61	46	44

Notes and sources: Per capita GDP levels relative to the UK in 1850, at current US relative prices (panel A) from Prados de la Escosura, 'International comparisons', and at 1990 Geary-Khamis international dollars (panel B) from Maddison, 'Statistics'. In panel A, Italy's relative level in 1850 was assumed to be that of 1860. In panel B, Italy's level in 1850 was obtained by projecting Maddison's estimates for 1913 with Malanima's ('Long decline') real output per capita series. 1850 levels were projected backwards with national real output series. For Spain, see text. For Italy, see Malanima, 'Long decline', assuming that Italy as a whole evolved as the north and central regions. For Germany, see Pfister, 'German economic growth' (see above, n. 12). For Holland and the Netherlands, see van Zanden and van Leuwen, 'Persistent'. For England and Britain, and Sweden, see Broadberry et al., 'British economic growth'. We assumed that real per capita income in the Netherlands evolved in the same way as Holland's over 1400–1800 and that real per capita income in the UK grew at the same rate as Britain's over 1700–1850 and, then, as England's, over 1300–1700. For France we carried out our own estimate on the basis of Allen's ('Economic structure', pp. 9, 17) data on population, agricultural output, and urbanization for 1400–1800; Bairoch, *Cities*, p. 221, for urbanization in 1850; and Toutain, 'Produit intérieur', pp. 16–17, 30, for agricultural output estimates, 1790–1850, and sector shares in GDP in 1850.

Netherlands,[100] and for England and Britain.[101] We assumed that the Netherlands grew at the same rate as Holland during 1400–1800 and that the UK grew as Britain over 1700–1850 and as England over 1300–1700. For Sweden we have used the estimates by Schön and Krantz.[102]

Two main results emerge from placing Spain's performance into a European perspective (table 4). The first is the existence of two distinctive phases, with 1600 as a turning point. In the first phase, Spain appears, according to panel A, as part of the top per capita income countries along with France but below Italy. By 1600 Spain was only behind Italy and the Netherlands. Similar, though milder results are derived from panel B. Up to the Black Death, Spain was second only to

[100] J. L. van Zanden and B. van Leuwen, 'The character of growth before "modern economic growth"? The GDP of Holland between 1347 and 1807', Utrecht Univ., Centre for Global Economic History, working paper ser., no. 4 (2011).

[101] Broadberry, Campbell, Klein, Overton, and van Leuwen, 'British economic growth'.

[102] Sweden's estimates by Schön and Krantz cited in Broadberry et al., 'British economic growth'.

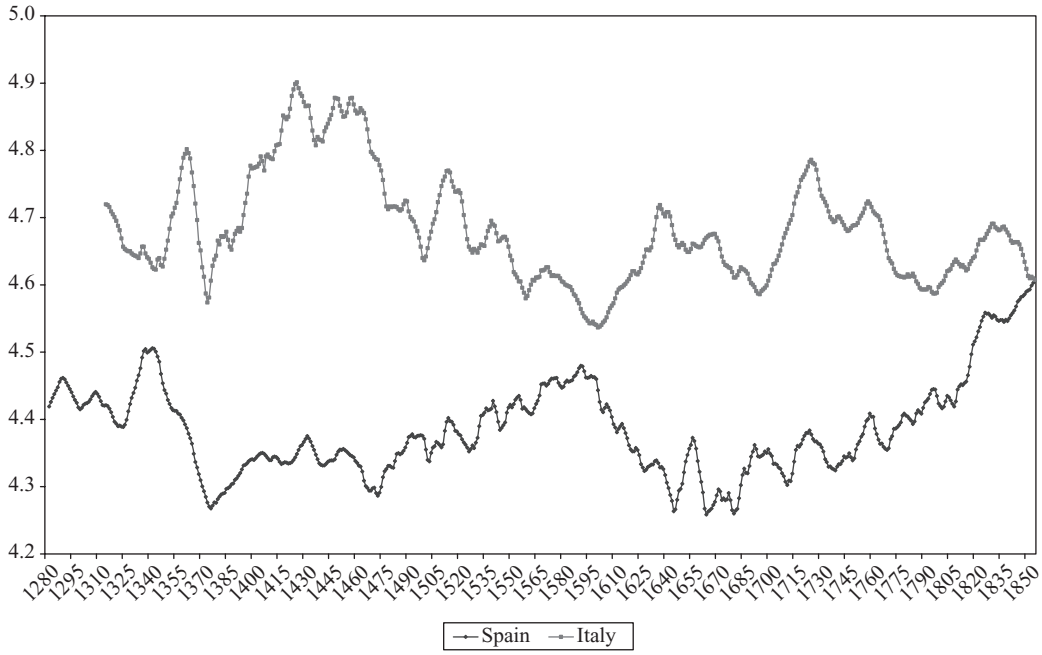

Figure 9. *Real output per capita in Spain and Italy, 1280–1850 (11-year moving averages) (1850–9 = 100) (logs)*
Sources: See text.

Italy and belonged to the same per capita income range as the Low Countries, France, and Britain during the fifteenth and sixteenth centuries. In the second phase, Spain fell gradually behind, and the moderate recovery since the eighteenth century, intensified in the early nineteenth century, did not suffice to stop the relative decline, so by the mid-nineteenth century Spain had joined the laggard countries of western Europe.

The second result is that, contrary to most of pre-industrial Europe, an association is found in Spain between population expansion and positive per capita output growth, as can be observed in the pre-Black Death period and during the sixteenth and eighteenth centuries. Conversely, during phases of population decline or stagnation, namely the late fourteenth and early seventeenth centuries, real income per capita fell.

The contrast between pre-industrial patterns of development in Spain and western Europe can be highlighted by a comparison with Italy. Italy appears as Spain's mirror image (figure 9). During phases of demographic stagnation or decline, relaxing the population pressure on resources in Italy facilitates an improvement in per capita income levels, whereas in Spain sluggish or negative population growth goes along with falling output per capita and vice versa. Such different behaviour evidences the low demographic pressure on resources that corresponds to the high land–labour ratios of a frontier economy such as Spain up to the sixteenth century and, then, to an economy in which cultivated land can expand at the expense of pasture land.

V

During the fourteenth and fifteenth centuries, Spain exhibited a contrast to most countries in Europe and the Eastern Mediterranean, in which the recovery from the Black Death is associated with the highest output per capita of the early modern era.[103] Contrary to the Spanish neo-Malthusian literature,[104] the forces underlying economic performance in western Europe—namely, population pressure on increasingly scarce resources after more than two centuries of demographic expansion, with the consequence of diminishing returns and hunger—did not affect Spain.[105] On the contrary, most of Spain was a frontier economy with a manpower shortage and land abundance, which implied high land–labour ratios and, most probably, increasing returns to labour.[106] This explains why once the Reconquest was over and only the Nasrid Kingdom of Granada remained under Islamic control, sustained progress took place. Empty lands, as the Moorish largely escaped from Christian rule, had to be populated and exploited in southern Spain. In achieving relatively high living standards prior to the Black Death, a high land–labour ratio was no doubt an important constituent. However, openness to goods and ideas from abroad also mattered, as it allowed Spain to take advantage of its privileged position at the crossroads of the European and African economies. This combination explains how Spain managed to achieve a relatively affluent position in Europe prior to its expansion in the Americas.

Date submitted *11 April 2011*
Revised version submitted *2 October 2011*
Accepted *3 January 2012*

DOI: 10.1111/j.1468-0289.2012.00656.x

[103] Pamuk, 'Black Death'; Clark, 'Macroeconomic aggregates'; Broadberry et al., 'British economic growth'.
[104] Valdeón Baruque, 'Aspectos'.
[105] The Malthusian interpretation of fourteenth-century Spain has been rejected by García Sanz and Sanz Fernández, 'Agricultura'; and Casado Alonso, 'Crisis'.
[106] Mackay, *Spain in the middle ages*.

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APPENDIX I: DATA SOURCES AND PROCEDURES FOR OUTPUT ESTIMATES

All prices, wage rates, and land rents used are quoted in silver. Original regional series have been converted into grams of silver with the silver content of coins.[107] Unweighted Divisia indices were built for the prices of agricultural and industrial goods, land rent, and wage rates for the Kingdoms of Castile and Aragon. Thus, we computed an average of equally weighted yearly variations in provincial price indices (*Pi*) (wage rates and land rents) and then obtained its exponential (*P*). That is,

$$lnP_t - lnP_{t-1} = \sum_i (lnPi_t - lnPi_{t-1})] \quad \text{(A1-1)}$$

Aggregate indices for Spain were obtained by assigning weights of two-thirds and one-third to the price indices of the Kingdoms of Castile and Aragon, respectively, as a crude way to capture their relative size in terms of population.

The index for agricultural prices (wheat, barley, rye, oats, straw, wine, olive oil, chicken, mutton, rabbit, and cheese) was constructed on the basis of local indices built with original data from the following sources: for the pre-1500 era, Lérida, 1361–1500;[108] Aragon, 1276–1429[109] and 1429–97;[110] and Valencia, 1413–1501[111] (in the Kingdom of Aragon); Toledo, 1401–75;[112] and Burgos, 1352–1501[113] (in the Kingdom of Castile). For the period 1501–1800 price indices were constructed for Catalonia,[114] New Castile, Andalusia, Valencia,[115] and Old Castile.[116] Lastly, for the years 1800–50, an index for Spain has been used.[117]

An unweighted Divisia index of manufacturing prices (building materials—timber, plaster, lime, tiles, nails; fuel—coal, wood; paper, parchment; textiles—cloth, linen, silk; wax) for 1276–1500 was constructed on the basis of those we previously built on the basis of original data for Aragon, 1276–1429[118] and 1429–1500;[119] Toledo, 1401–75;[120] and Burgos, 1390–1500.[121] For the period 1501–1860, we used an aggregate manufacturing price index kindly supplied by Joan Rosés.[122]

A CPI for 1276–1501 was constructed as the weighted average of agricultural (0.75) and industrial (0.25) Divisia price indices, except for Valencia.[123] For 1501–1860, a

[107] Casado Alonso, 'Producción agraria'; Mackay, *Money*; Hamilton, *American treasure*; idem, *Money*; idem, *War and prices*; Feliu, *Precios y salarios*.
[108] Argilés Aluja, *Preus i salaris*.
[109] Zulaica Palacios, *Fluctuaciones económicas*.
[110] Hamilton, *Money*.
[111] Allen, 'Great divergence'.
[112] Izquierdo Benito, *Precios y salarios*.
[113] Casado Alonso, 'Construction'; idem, 'Producción agraria'; idem, 'Crisis'.
[114] Feliu, *Precios y salarios*.
[115] Hamilton, *American treasure*; idem, *War and prices*.
[116] Llopis Agelán, Jerez, Álvaro, and Fernández, 'Índices de precios'; Moreno Lázaro, 'Capitalismo agrario'.
[117] Bringas Gutiérrez, *Productividad*.
[118] Zulaica Palacios, *Fluctuaciones económicas*.
[119] Hamilton, *Money*.
[120] Izquierdo Benito, *Precios y salarios*.
[121] Mackay, *Money*; Casado Alonso, 'Construction'; idem, 'Producción agraria'.
[122] J. R. Rosés, K. H. O'Rourke, and J. G. Williamson, 'Globalization, growth and distribution in Spain 1500–1913', NBER working paper 13055 (2007).
http://www.nber.org/papers/w13055.
[123] Allen, 'Great divergence'.

Divisia index was derived from regional CPIs: Catalonia, 1501–1807[124] and 1830–60;[125] Valencia, 1501–1785;[126] New Castile, 1501–1860;[127] Old Castile, 1518–1650[128] and 1751–1860.[129]

Unweighted Divisia indices for nominal wage rates for masons, bricklayers, tilers, and carpenters were computed from the following sources: Aragon, 1277–1423[130] and 1423–97;[131] Lérida, 1361–1500;[132] Valencia, 1413–1500[133] (in the Kingdom of Aragon); Toledo, 1401–75;[134] and Burgos, 1390–1500[135] (in the Kingdom of Castile). For 1501–1860, the sources used were: Catalonia,[136] New Castile,[137] Old Castile,[138] and Valencia.[139]

Unweighted Divisia indices for land rents were built from data in the following sources: Aragon, 1318–1416;[140] Catalonia, 1520–1800[141] (in the Kingdom of Aragon); Burgos, 1320–1520;[142] western Andalusia, 1504–1845;[143] Jaen, 1520–1672;[144] Old Castile, 1569–1835;[145] Segovia, 1651–90 and 1780–1817;[146] Avila, 1790–1841;[147] and Zamora, 1683–1840[148] (in the Kingdom of Castile).

[124] Feliu, *Precios y salarios*.
[125] Maluquer de Motes, 'Consumo y precios'.
[126] Allen, 'Great divergence'.
[127] Reher and Ballesteros Doncel, 'Precios y salarios'.
[128] Llopis Agelán et al., 'Índices de precios'.
[129] Moreno Lázaro, 'Capitalismo agrario'.
[130] Zulaica Palacios, *Fluctuaciones económicas*.
[131] Hamilton, *Money*.
[132] Argilés Aluja, *Preus i salaris*.
[133] Allen, 'Great divergence'.
[134] Izquierdo Benito, *Precios y salarios*.
[135] Casado Alonso, 'Construction'; idem, 'Producción agraria'; Mackay, *Money*.
[136] Feliu, 'Aproximació'; Maluquer de Motes, 'Consumo y precios'.
[137] Reher and Ballesteros Doncel, 'Precios y salarios'
[138] Moreno Lázaro, 'Capitalismo agrario'.
[139] Allen, 'Great divergence'.
[140] Zulaica Palacios, *Fluctuaciones económicas*.
[141] Duran i Pujol, 'Evolució de l'ingrés'.
[142] Casado Alonso, *Señores, mercaderes y campesinos*; idem, 'Crisis'.
[143] Ponsot, *Atlas*.
[144] Coronas Vida, *Economía agraria*.
[145] Sebastián Amarilla, 'Renta de la tierra'.
[146] García Sanz, *Desarrollo y crisis*.
[147] E. L. Llopis (private communication, 27 July 2006).
[148] Álvarez Vázquez, *Rentas*.

Table A1. *Consumption per capita of agricultural goods: alternative estimates (decadal averages) (1850–9 = 100)*

Per capita income proxied by:	*Estimate I* *Wage rate*	*Estimate II* *Stable wage earnings*	*Estimate III* *Wage rate and land rent*
1280–9	170	157	172
1290–9	173	153	175
1300–9	166	147	168
1310–9	164	140	165
1320–9	156	133	155
1330–9	182	148	181
1340–9	194	154	192
1350–9	169	141	164
1360–9	152	158	153
1370–9	130	124	131
1380–9	141	130	139
1390–9	150	136	150
1400–9	163	133	158
1410–9	165	130	158
1420–9	166	127	157
1430–9	166	128	161
1440–9	159	126	151
1450–9	158	127	153
1460–9	144	121	141
1470–9	132	118	132
1480–9	144	125	142
1490–9	147	126	146
1500–9	140	122	139
1510–9	151	128	147
1520–9	137	121	135
1530–9	142	128	143
1540–9	125	115	129
1550–9	130	122	136
1560–9	118	113	125
1570–9	119	116	127
1580–9	113	109	120
1590–9	111	109	119
1600–9	103	102	110
1610–9	103	100	108
1620–9	97	97	102
1630–9	96	99	101
1640–9	88	93	92
1650–9	110	113	112
1660–9	91	93	93
1670–9	100	99	100
1680–9	105	104	107
1690–9	114	111	115
1700–9	112	110	114
1710–9	105	106	107
1720–9	114	110	115
1730–9	99	98	102
1740–9	99	98	102
1750–9	100	104	104
1760–9	91	98	95
1770–9	90	98	94
1780–9	85	94	90
1790–9	88	99	93
1800–9	83	93	88
1810–9	85	93	87
1820–9	102	101	103
1830–9	95	97	97
1840–9	97	98	98
1850–9	100	100	100

Table A2. *Real GDP per capita: alternative estimates (decadal averages) (1850/9 = 100)*

	Estimate I	*Estimate II*	*Estimate III*
1280–9	83	78	84
1290–9	84	77	85
1300–9	82	76	84
1310–9	82	75	83
1320–9	80	73	80
1330–9	87	77	88
1340–9	89	78	90
1350–9	83	74	82
1360–9	78	77	79
1370–9	71	67	72
1380–9	73	68	73
1390–9	75	69	76
1400–9	78	68	77
1410–9	78	66	77
1420–9	78	66	77
1430–9	79	67	79
1440–9	78	67	76
1450–9	79	68	78
1460–9	75	67	75
1470–9	72	67	73
1480–9	77	70	77
1490–9	79	71	79
1500–9	77	70	78
1510–9	81	73	81
1520–9	78	72	78
1530–9	81	76	82
1540–9	78	74	80
1550–9	82	78	85
1560–9	80	77	83
1570–9	83	81	87
1580–9	83	81	86
1590–9	83	82	87
1600–9	79	78	82
1610–9	78	76	81
1620–9	75	75	78
1630–9	74	75	77
1640–9	70	71	72
1650–9	78	79	79
1660–9	69	70	70
1670–9	72	72	72
1680–9	74	73	75
1690–9	76	75	77
1700–9	76	75	77
1710–9	74	75	76
1720–9	79	78	80
1730–9	75	74	76
1740–9	76	76	77
1750–9	78	79	80
1760–9	76	79	79
1770–9	79	82	81
1780–9	79	83	81
1790–9	82	87	85
1800–9	81	86	84
1810–9	84	88	86
1820–9	93	94	95
1830–9	93	94	94
1840–9	96	97	97
1850–9	100	100	100

Note: GDP estimates I, II, and III are constructed using agricultural output (consumption) estimates I, II, and III, respectively.
Sources: See text and app. tab. A1.

APPENDIX II: ESTIMATING ADJUSTED URBAN POPULATION

In order to distinguish the shares of those employed in agricultural and in non-agricultural activities for both the total urban and rural population, an arithmetical exercise has been carried out along the lines suggested by Wrigley and, more recently, by Allen.[149] Wrigley assumed that the whole agricultural population lives in rural areas so the crucial distinction to make is between the agricultural and non-agricultural shares of rural population.[150] However, since the existence of 'agro-towns' is accepted in the case of Spain, our challenge has been to establish the share of population employed in agriculture in both the rural and the urban populations.

In order to do so, we could start by comparing the share of the economically active population (L) occupied in agriculture (L_{ag}/L), with the share of total population (N) living in rural areas (N_{rur}/N). If the ratio between the two shares [$(L_{ag}/L):(N_{rur}/N)$] is above one, it can be claimed that part of the population living in towns worked in agriculture. Conversely, a ratio below one suggests that some of those living in the countryside worked for industry and services. Thus we could divide rural and urban population into agricultural and non-agricultural. However, a further adjustment is required to allow for urban–rural differences in the proportion of the total population (N) of working age, or potentially active population (PAP), and in the share of the working age population (PAP), which is economically active (L). Thus comparing the agricultural and the rural economically active populations (L_{ag}/L_{rur}) provides a more accurate test.

Fortunately, we have information on the PAP/N ratio in both rural and urban areas by region for 1787.[151] This ratio (computed—due to data restrictions in the early modern population censuses—as population aged 16 to 50 over total population) differs for each region (i) between urban $(PAP/N)_{urb\ i\_1787}$ and rural $(PAP/N)_{rur\ i\_1787}$ areas, being larger in the former, but with a low dispersion in both cases.[152] The implication is that using rural and urban population without a previous adjustment for age composition would bias our results against agricultural employment, as, on average, the rural PAP/N ratio is 87.5 per cent of the urban one. Unfortunately, there are no data on the PAP/N ratio over time, except for New Castile, computed by Reher from the late sixteenth century onwards.[153] Thus, we were forced to approximate long-run changes in Spain by those in New Castile (NC) $(PAP/N)_{NC\_t}$.[154] Therefore, we derived the urban and rural working age at each benchmark year t (= 1530, 1591, 1700, 1750, 1787, 1857) as follows:[155]

$$PAP'_{urb\ it} = N_{urb\ it} * (PAP/N)_{urb\ i\_1787} * \left((PAP/N)_{NCt}/(PAP/N)_{NC\_1787}\right) \quad \text{(A2-1)}$$

$$PAP'_{rur\ it} = N_{rur\ it} * (PAP/N)_{rur\ i\_1787} * \left((PAP/N)_{NCt}/(PAP/N)_{NC\_1787}\right) \quad \text{(A2-2)}$$

[149] Wrigley, 'Urban growth'; Allen, 'Economic structure'.

[150] Wrigley, 'Urban growth'. Allen, 'Economic structure', p. 4, accepts the difficulties involved in estimating the number of urban farmers, but claims that 'their number was small as is the error from assuming it was zero'.

[151] Marcos Martín, 'Viejos'.

[152] They were, on average, 55.7% and 48.8% in urban and rural areas, respectively. The urban and rural coefficients of variation are 0.056 and 0.023, respectively, and are computed from ibid. The regional dispersion in the activity rate (EAP/PAP) is also low, 0.113.

[153] Reher, 'Dinámicas'. The sample used by Reher consists of 26 villages, from which only five belong to the province of Madrid.

[154] Regional dispersion was low for PAP/N in 1787 but we do not really know if this was the case in previous epochs. In New Castile, the PAP/N ratio, computed for the share of population between 15 and 50 years old, was rather stable over time with less than a 5% variation around the 1787 ratio; ibid., pp. 70–4.

[155] In expressions (A2-1) to (A2-11)' means an approximated estimate, as opposed to the actual value, since some simplifying assumptions were needed in order to facilitate the computation.

Then, in order to arrive at figures for economically active urban ($L_{urb\ it}$) and rural ($L_{rur\ it}$) populations at each benchmark we needed to derive the relevant *L*/*PAP* ratios. Unfortunately, we were only able to compute the *L*/*PAP* ratio for 1787 without distinguishing between urban and rural ratios. Thus, we were forced to estimate figures of urban and rural EAP for every benchmark year as:

$$L'_{urb\ it} = PAP'_{urb\ it} * (L/PAP)_{i\_1787} \tag{A2-3}$$

$$L'_{rur\ it} = PAP'_{rur\ it} * (L/PAP)_{i\_1787} \tag{A2-4}$$

Next, we compared the economically active population occupied in agriculture (L_{ag}) with that living in rural areas (L'_{rur}). If $L_{ag} > L'_{rur}$ it can be presumed that part of the population living in towns worked in agriculture. Conversely, if $L_{ag} < L'_{rur}$ the implication is that those living in the countryside allocated part of their working time to industry and services. Thus we distributed the rural (L'_{rur}) and urban (L'_{urb}) economically active populations into agricultural ($_{ag}$) and non-agricultural ($_{nonag}$) occupations and reached a figure for urban non-agricultural labour ($L'_{urb\text{-}nonag\ it}$).

$$L'_{rur\text{-}nonag\ it} = L'_{rur\ it} - L_{ag\ it} \text{ if } L'_{rur\ it} > L_{ag\ it}, 0 \text{ otherwise} \tag{A2-5}$$

$$L'_{rur\text{-}ag\ it} = L'_{rur\ it} - L'_{rur\text{-}nonag\ it} \tag{A2-6}$$

$$L'_{urb\text{-}ag\ it} = L_{ag\ it} - L'_{rur\ it} \text{ if } L_{ag\ it} > L'_{rur\ it}, 0 \text{ otherwise} \tag{A2-7}$$

$$L'_{urb\text{-}nonag\ it} = L'_{urb\ it} - L'_{urb\text{-}ag\ it} \tag{A2-8}$$

Thus, the economically active population outside agriculture is obtained as:

$$L'_{nonag\ it} = L'_{rur\text{-}nonag\ it} + L'_{urb\text{-}nonag\ it} \tag{A2-9}$$

Moreover, we can estimate the adjusted population in towns of 5,000 or more inhabitants (excluding those living on agriculture) by re-scaling the resulting figures for urban economically active population outside agriculture with the activity rate (*L*/*N*):

$$N'_{urb\text{-}nonag\ it} = L'_{urb\text{-}nonag\ it} / \left(L'_{urb\ it} / N_{urb\ it}\right), \tag{A2-10}$$

Thus, we can obtain an *adjusted* rate of urbanization (Ua_{it}) that partly offsets at least the upward-biased effect of the agro-towns:

$$Ua_{it} = 100 * N'_{urb\text{-}nonag\ it} / N_{it} \tag{A2-11}$$

Regrettably, though, we lack data to compute the share of labour in agriculture (L_{ag}/L) at each benchmark year. For L_{ag} evidence can only be obtained from the Cadastre of Ensenada for the Kingdom of Castile in the 1750s[156] and from Floridablanca's population census for the whole of Spain in 1787.[157] Wrigley and Allen also faced this shortcoming.[158] Wrigley assumed that, in early sixteenth-century England and France, up to 80 per cent of the rural labour force was in agriculture and reduced this figure arbitrarily over the three

[156] GRUPO '75, *Economía*.
[157] Reproduced in Llopis Agelán, 'Legado'.
[158] Wrigley, 'Urban growth'; Allen, 'Economic structure'.

following centuries. Allen accepted the same percentage for most European countries *c.* 1500 and interpolated the years up to the first one (1800) for which he had estimates. In our case we followed Wrigley and Allen and assumed a fixed 80 per cent share of the EAP in agriculture as the starting point in 1530 and interpolated log-linearly the shares between 1530 and 1787.[159] A sensitivity test was carried out assuming that the 1787 L_{ag}/L remained unchanged for the entire time span considered. Although slightly different, the results exhibited the same trends for the adjusted urbanization rates.[160]

Spanish urban population, adjusted to exclude persons living on agriculture, computed at benchmark years during 1530–1857 was, then, projected backwards to 1420, 1300, and 1000 with an estimate of urban population on the basis of Bairoch et al. [161] The data set was corrected for 1000 and 1300 with estimates by Glick and Bosker et al. respectively.[162] Adjusted urbanization rates have been computed for 800–1420. Annual 'adjusted' urbanization rates, namely, the ratio of adjusted urban population to total population were derived by dividing the results from log-linear interpolation of urbanization and total population[163] benchmark estimates.

APPENDIX III: ALTERNATIVE PRICE LEVELS FOR 1850

The comparison of countries' implicit price levels for 1850 derived from the alternative estimates—Maddison's constant price estimates in 1990 Geary-Khamis international dollars and Prados de la Escosura's current price estimates at US relative prices—is very revealing and lends support to the latter's estimates.[164]

The price level [PPP/ER]—that is, the PPP exchange rate (PPP) divided by the trading exchange rate (ER)—can be easily derived as the ratio between nominal income per capita (NY), that is, per capita income in domestic currency (DY) converted into a common currency with the trading exchange rate (ER), [NY = DY/ER], and purchasing power parity or 'real' per capita income (RY), namely, domestic currency income converted into a common currency with the purchasing power parity exchange rate (PPP), [RY = DY/PPP].

In a Balassa-Samuelson framework one should expect that the price level would follow the level of development for similarly open economies, so the inference would be that countries of similar development should have PPP exchange rates close to their trading exchange rates, so their price levels would be similar. Meanwhile, for countries with less development their PPP would be lower than the ER and, hence, their price level.

The results indicate that, relative to the UK (= 100), the price level for Spain would have been 109 according to Maddison's estimates, and only 79 with Prados de la Escosura's (PPP-adjusted current price estimates.[165] A similar comparison generates levels of 99 and 75 for Italy (in 1860), and 78 and 65 for Sweden, respectively. It is our view that the implicit price level in Maddison's estimates is too high and, hence, unrealistic for Spain and Italy. Conversely, in the case of the Netherlands, the price level implicit in Maddison's

[159] The share of EAP in agriculture in regions of the Kingdom of Castile is systematically higher in the Floridablanca Census (1787) than in the Cadastre de Ensenada (1752). We opted for the former as it provides an upper bound for our L_{agr} estimates and, hence, we bias downwards the adjusted urbanization rates.

[160] The adjusted rates of urbanization for Spain resulting from accepting the 1787 share of labour force in agriculture as fixed over 1530–1787 are only different from those obtained by assuming that, initially (in 1530), 80% of the labour force was occupied in agriculture, for the sixteenth century. Thus, the alternative results are: 12.0%, instead of 9.9%, for 1530; and 16.5%, instead of 14.5%, for 1591.

[161] Bairoch et al., *Population*, pp. 15–21.

[162] Glick, *Islamic and Christian Spain*; M. Bosker, E. Buringh, and J. L. van Zanden, 'From Baghdad to London. The dynamics of urban growth in Europe and the Arab world, 800–1800', CEPR discussion paper, 6833 (2008).

[163] Pérez Moreda, 'Población'; Álvarez-Nogal and Prados de la Escosura, 'Decline'.

[164] Maddison, 'Statistics'; Prados de la Escosura, 'International comparisons'.

[165] From data in Maddison, 'Statistics'; Prados de la Escosura, 'International comparisons'.

1990 $ estimates is 60 while in the current price estimate reaches 77. It seems hard to accept that the price level was so low in the Netherlands compared to Britain when these economies were open and not very different from each other in structural terms.

SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

Table S1. Agricultural and industrial price indices and CPI, 1276–1850 (1790–9 = 100).
Table S2. Real wage rates, 1277–1850 (1790–9 = 100).
Table S3. Real land rent, 1320–1845 (1790–9 = 100).
Table S4. Inequality measures: Williamson index and land rent–wage rate ratio, 1282–1850 (1790–9 = 100).
Table S5. Real agricultural consumption per capita, 1282–1850: alternative estimates (11-year moving averages) (1850–9 = 100).
Table S6. Real output per capita, 1280–1850: alternative estimates (11-year moving averages) (1850–9 = 100).