

During the nineteenth and early twentieth centuries, Spain enjoyed a significant increase in agricultural output, permitting a population which more than doubled to maintain, or even increase per capita food consumption. Of central importance for the economic historian, however, is to establish whether the rate of growth in output was faster than the use of factor inputs; in other words whether productivity increased or not. According to most theories of economic growth, an important, if not crucial requisite for industrialisation, is improved agricultural productivity, as this implies that resources can be released from agriculture to other sectors of the economy, without a fall in total agricultural output¹. Stagnation, by contrast is likely to lead to weak demand for industrial goods, partly because the farmer's consumption of capital goods is low, and partly because of his relatively low disposable income for consumer goods. Industry also suffers by relatively high food prices (thus the need to pay higher real wages).

This paper tries to establish the extent of changes in output and productivity in Spanish agriculture in the forty years or so prior to the Civil War. Any work of this type is indebted to the pioneering efforts of Eduardo de Sotilla, whose original work of 1911 appeared with a detailed commentary by Jesus Sanz in 1983, and, especially, to the paper of the Grupo de Estudios de Historia Rural (GERH), presented at the II Congreso de Historia Económica, and published in 1983. Our paper is divided into three parts. In the first, a new look is taken at the "Great Depression", and it is suggested that Spain suffered considerably less than other European countries. In the second

¹ Lewis suggests, however, that an increase in agricultural productivity is not essential as industry could theoretically overcome a stagnant agricultural sector by exporting its production abroad, and importing cheap foodstuffs and raw materials. In practice, governments in most pre-industrial societies are dominated by the landed interest, making the admission of cheap foods politically unacceptable to them. Lewis, 1978, 145.

section, a reconstruction of agricultural output, net of intermediate products, is made which suggests that land and labour productivity growth only really increased significantly in the twenty five years or so prior to the Civil War. Finally an international comparison concludes that Spain, despite respectable growth rates in the first third of the twentieth century, continued to have both low land and labour productivities.

1. SPANISH AGRICULTURE AND THE GREAT DEPRESSION.

The introduction of annual reporting of crop area and harvest size for wheat in the 1880s, the rest of cereals, legumes, olives, and vines from 1891, and most other crops from the turn of the century, allows more detailed comments on trends in agricultural output and productivity to be made than during the nineteenth century.² However the existence of greater statistical information has not clarified significantly the debate on the movement of agricultural output, as the sources themselves on occasions can lead to conflicting interpretations. In particular, the apparent increase in the area of cultivation and production of wheat from 1891, as is shown in the official sources, year in which a new protective cereal tariff became operational, can be identified, either as a recovery from the "Great Depression",³ or an improvement in statistical gathering by the government agencies (or both). Whereas it is clear that certain contemporaries did not have much faith in the official statistics, the exact depth, and length of the "Great Depression" in Spain is itself highly debatable and needs further

² For sources, see GEFK (1983), Sanz (1983) and Simpson (1989).

comment.⁴ As a recent study has shown, there exists marked differences in the performance of different crops in Spain to the problems presented by the greater integration of both national and international markets during the last quarter of the century (Garrabou ed. 1989). There is also likely to have been some redistribution of the rent in favour of tenants and labour (Robledo, 1984 and GEFK, 1988, cuadro 5). However, whatever the local peculiarities of the "Great Depression" in Spain might have been, at a national level its extent and timing appears to have been very different from other European countries. That at least is the impression given by price movements, the only statistical variable at present available for the whole period of the Depression (see also Garrabou, 1975 and Garrabou and Sanz, 1985).

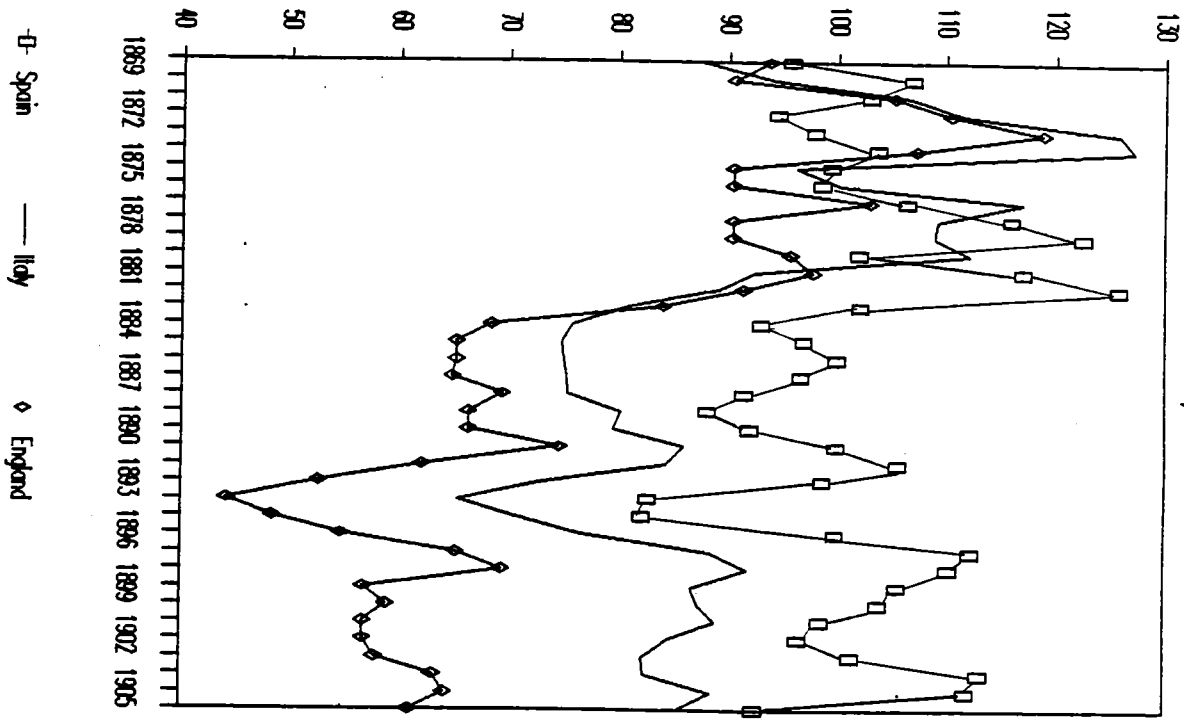
World commodity prices tended to move downwards between 1873 and 1895, and recovered partly between 1895 and 1913. According to Lewis, in the main industrial countries, agricultural prices fell faster than industrial prices during the recession, and thereafter rose faster.⁴ In Graph 2.1 it can be seen that for English farmers wheat prices peaked in 1873, and did not bottom out until 1894; in Italy the peak came a year later, but the recovery occurred in the same year. In Spain, by contrast, the fall in wheat prices was delayed until 1882, and the recovery started in 1895. Therefore the fall

³ One well informed contemporary noted in the mid 1870s that:

Cabe creer que las noticias tan cuidadosamente recogidas por los Ingenieros Agrónomos no son todo lo precisas que fueran de desear, y que este trabajo iniciado hace pocos años, está en vías de perfeccionamiento. Sentado esto, las cifras dadas de la producción de los años de 1870 a 1872, y aún de los siguientes, se explican por las dificultades de establecer un servicio de investigación, que tan penosamente se ha planteado en otros países en que los agricultores no tienen tanto recelo en facilitar noticias del rendimiento de sus cosechas. Arzacola, 1876, 10, cited in Sanz, 1983.

⁴ Lewis, 1978, 27. The industrial countries are Britain, the United States, France and Germany.

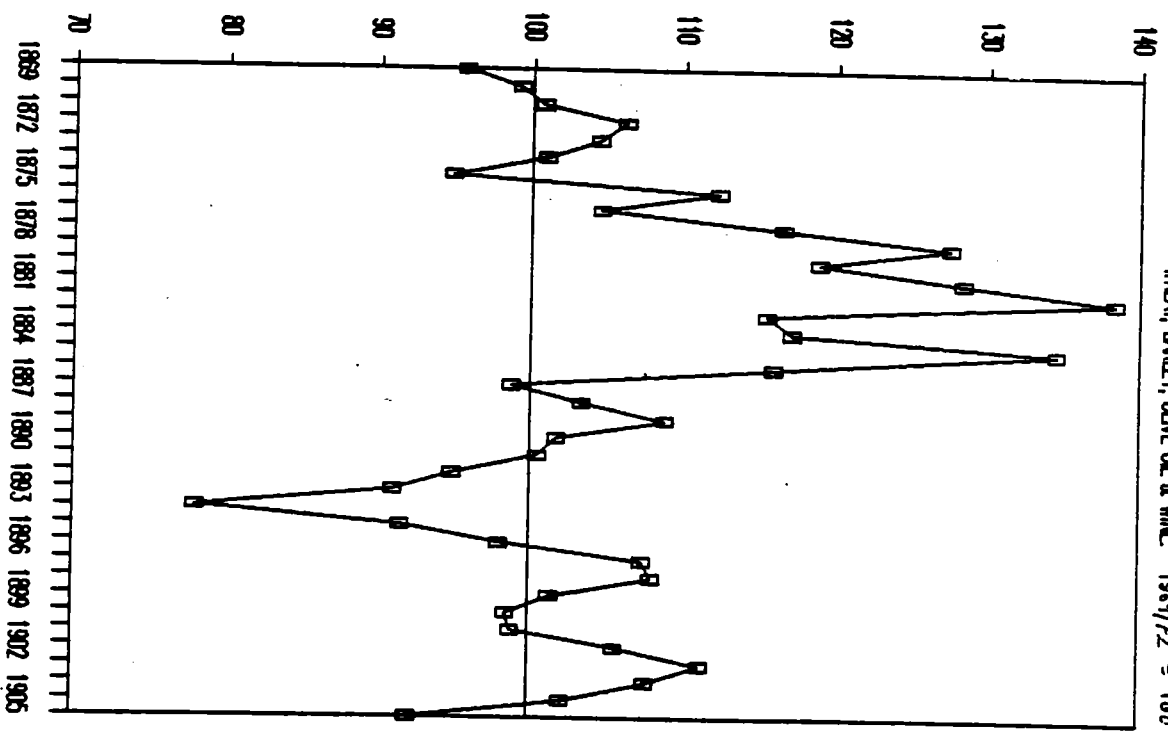
WHEAT PRICES IN SPAIN, ITALY, AND ENGLAND, 1869/1872 = 100



Sources: Sánchez-Albornoz, 1975 and GCHH 1980; Cassola 1988; Lewis 1978.

-4-

COMPOSITE PRICE INDEX FOR WHEAT, BARLEY, OLIVE OIL & WINE 1869/72 = 100



Source: Sánchez-Albornoz, 1975 and (all) 1981; GCHH 1980 and 1981; Balcells 1980 See text.

-5-

2. THE GROWTH IN AGRICULTURAL OUTPUT AND PRODUCTIVITY, 1891-1936.

For the first third of the twentieth century in general, a significantly greater body of statistical material makes it is much easier to determine the general trends in output, and most historians have suggested that not only did agricultural output grow, but that land and labour productivity also increased significantly. The most important study to date is that of GERH (1983) which suggest an annual increase of 1.4 per cent between 1900 and 1931. This figure however, is not without its own deficiencies. Firstly, it refers to gross output, and no attempt is made by the GERH to calculate output net of recycled items. Secondly, constant prices have been obtained by applying a general figure of inflation for the economy as a whole, rather than a constant unit price for each individual product ⁷ and, finally, the contribution of livestock is probably underestimated. The first two problems are relatively easy to correct, although the use of suitable coefficients in estimating recycled items has its problems (see Appendix 1 for methods followed here). The question of livestock production is now examined.

The best livestock census figures are for the years 1750 (the Crown of Castile only), 1865, 1917, 1929 and 1933 ⁸. Perhaps surprising, a rough estimate suggests that there was very little change in the total number between the different census figures, thus implying a significant decline in per capita production of meat, milk and wool (Zapata, 1985, 524 and Simpson, 1989). Other census figures exist for years such as 1799, 1857, 1911, 1905 etc., but these give much less information on how the figures were collected,

⁷ This problem is overcome in their more recent work (1987).

⁸ For general description of the census figures see GERH, 1976, Zapata 1985, and Simpson, 1989.

in wheat prices was late in comparison with other European countries, although the date of the recovery was similar. However, wheat was only one of many crops and, in the case of Spain, it is possible that other prices fell earlier. To establish the general trends, a wider price index of agricultural commodities has been compiled. In Graph 2.2 the national price of wheat, barley, and olive oil, together with a local price for wine have been weighted according to the crops relative importance in total output and used to calculate a single index of agricultural products ⁹. The price evidence in the graphs suggest that not only did Spain suffer less than most other European countries, but that the chronology of the Depression was very different. The years 1878/9 to 1886/7, far from witnessing price falls, were significantly above the level for 1873. Furthermore, only in one year, 1894/5, was the price level appreciably (i.e. 10% or more) below the 1873 level. This price behaviour was caused by the slower development of Spain's internal communications, the heavy protection that the State enforced, especially from 1891, and finally the abnormal behaviour of demand for wine. Although many farmers suffered at some time or other during the period 1873 and 1895, the term "Great Depression" appears in Spain, if not elsewhere, a misnomer ⁴.

⁹ Prior to 1870, the prices have been weighted according to the crops relative importance in the period 1871/5; from 1891, it has been assumed that the crops importance changed in accordance to our estimates for 1891/5, 1897/01, and 1907/13 in a linear fashion.

⁴ Amongst the extensive literature, see especially Lewis, 1978, and Saul, 1976, whose work is aptly titled The Myth of The Great Depression, 1873-1895. It should be noted, however, that even though agricultural prices fell only slightly in absolute terms, it is possible that their fall was much greater in relative to industrial prices. Price information to substantiate, or reject, this hypothesis is not yet available for Spain. A second factor is that for wheat, barley and olives, the price is the average of all provinces. If it was weighted by areas of consumption or production, then a different picture might arise. Once again information is not available to substantiate this point.

there is no breakdown by municipality (which might allow more vigorous

checking), and they are generally regarded as having been collected by less scientific means than for those years mentioned above. They also tend to give much lower estimates. Table 1 highlights this problem, and suggests two alternatives. The first column refers to the work of GER (1931), and shows a fall in livestock production from the already low figure of 1891 to a new low in 1900; the recovery is then rapid, some 2.5 per cent annually between 1910 and 1931. The second column has been calculated using the same census figures as GER and with roughly similar methods, although the constant prices have been calculated using unit prices of 1909/13 for meat, milk, and wool. These figures indicate a fall of 2.1 per cent annually between 1865 and 1900, and then a recovery of 3.0 per cent between 1900 and 1931. Finally in column 3 are the estimates used here. Important changes have been made for the years 1891, 1900 and 1910. Firstly, for 1900 and 1910, total numbers for cattle, sheep, goats and pigs are taken from the 1917 census, rather than the less reliable ones of 1905 and 1908/12 as used by GER.⁹ Secondly, the 1891 figure has been calculated assuming the decline in the value of output between 1865 and 1900 was constant. Output therefore now shows a slower decline between 1865-1900 (an annual 0.7 per cent) and a slower recovery after 1900 (1.5 per cent).

⁹ The 1905 census in particular seems low, and probably reflects the abnormal weather conditions of that period, a factor which was absent in 1900. Coefficients for milking cows have been calculated on the 1865 - 1929/33 census material as noted in the Appendix. Prices are those for 1909 and 1910.

TABLE 1

PRODUCTION OF LIVESTOCK PRODUCTS 1865-1929/33.
(Constant prices of 1910, millions of pesetas)

	(1)	(2)	(3)
1865	---	1,156	1,155
1891	736	716	953
1900	589	562	891
1910	883	888	1,090
1921	1,190	---	---
1931	1,311	1,426	1,426

(1) GER, 1933, Appendix 6.
(2) and (3) See text and Appendix 1.

What is the evidence to substantiate these new figures? In the important region of Galicia, Carmona and de la Puente have convincingly argued that it is extremely unlikely that there was a decline in cattle numbers between 1865 and 1891, as suggested in the census figures (1989, 193). Elsewhere in the country, the ploughing up of communal land and rough pasture perhaps did reduce livestock numbers, although a fall greater than 18 per cent as given in column 3 of Table 1 seems inconceivable. For the period 1891/5 - 1897/01, the cultivation statistics suggest that the fall in livestock probably was minimal. Between these two dates, the area devoted to oats, barley and maize increased by 426 thousand hectares, which more than compensated the decline of 679 thousand of poor quality pasture¹⁰. Conversely, if there is an underestimation of the 1891/5 crops area, then the slower growth in the area dedicated to fodder crops and bread grains would imply a reduction in the destruction of natural pasture. Only a significant fall in the production of fodder, the presence of abnormal cattle diseases, or a significant decline in

¹⁰ These 676 thousand hectares belong to the category *dehesas y matorrales*, which include significant areas of forestry. He suggested that, perhaps only a third of this figure can be regarded as pasture.

demand for animal products as a result of changes in incomes, could justify a fall in the order of 20 per cent as suggested by the census figures in column 1 during this "decade"¹¹. This does not appear to have been the case.

TABLE 2
GROSS AGRICULTURAL OUTPUT IN SPAIN 1891/5 - 1929/33.
net of recycled products.

	in millions of pesetas of 1991/13			% of the total		
	1891/5	1897/01	1909/13	1929/33	1937/01	1909/13
1. Cereals	788	944	1,139	1,303		
Legumes	103	104	107	124		
sub-total	891	1,048	1,246	1,427	32.3%	33.9%
2. Vines	525	433	323	484	13.1%	8.8%
3. Olives	279	270	254	409	8.2%	6.9%
4. Fruit	167	200	230			8.6%
5. Vegetables-	392	462	610	19.5%	20.8%	21.0%
Raw Materials	85	104	135			
sub-total	2,417	2,589	3,315	73.1%	70.4%	69.9%
7. Livestock products	953	891	1,090	1,426	26.9%	29.6%
TOTAL	3,308	3,679	4,741	100.0%	100.0%	100.0%

Source: Appendix 1.E.

With the new figures for livestock products, an estimate of total agricultural growth can be made. The variable chosen to measure these changes is gross agricultural output, net of intermediate products¹². These figures show that, during the first third of the twentieth century a marked increase in output occurred, from 3,308 million pesetas in

¹¹ In reality, fourteen years as the 1891 and 1905 census figures are the ones used. Prices refer to 1893 and 1900. See GEFH, 1983.

¹² Essentially total output, net of seedcorn and fodder. See Appendix 1.E for the methods used.

1897/01, to 4,741 in 1929/33 (Table 2). This represents an annual increase of 1.13 per cent, with the livestock sector growing appreciably faster than crop production (1.48 per cent against 0.99 per cent). Growth of total output, at 1.29 per cent, was faster between 1909/13 and 1929/33, than that achieved prior to the First World War (0.87 per cent), and was roughly equally divided between crop and animal products¹³. Perhaps surprisingly, the relative importance of traditional Mediterranean crops (cereal legume-fallow rotations, vines and olives), declined only slowly.

From a combined total of 53.6 per cent of output in 1897/01, they were still responsible for some 48.9 per cent just over thirty years later. "Other crops", which include such products as potatoes, oranges and sugar beet, saw their combined total remain at roughly a fifth, whilst livestock products increased to just over 30 per cent¹⁴.

The growth in agricultural output can be achieved in two ways, through an increase in the area cultivated, or by obtaining greater production per unit of land, either through improving crop yields, or by changing the crop mix from lower, to higher valued products. Table 3 suggests that the increase in production was obtained partly through a growth in the area cultivated, accounting for 28.7 per cent of the total. In fact, part of this figures hides an improvement in productivity, as Spain did not have inelastic supplies of land of equal quality to that cropped in 1897/01. The rest of the growth is accounted for by changes in crop mix and production methods. To a major extent, Spanish farmers increased output by increasing the area sown (75.9 per cent), which not only involved

¹³ 1897/01-1909/13, Crop production 0.56%, animal products 1.69, total, 0.87%; 1909/13-1929/33, crops 1.26%, animal products 1.75%, total 1.29%. Calculated for Table 2.

¹⁴ If intermediate products are included, the distribution is:
1897/01 traditional crops 60.7% 1929/33 55.6%
other crops 18.8% 22.4%
livestock 20.5% 21.9%
Source: Appendix 1.C. Rough pasture and forestry have been excluded.

bringing new land under the plough, but also a reduction in unsown fallow, which fell from 44.5 per cent of the cereal rotation in 1897/01, to 41 per cent in 1929/33¹⁵. This greater intensity of cultivation was obtained, partly at least, through the greater use of fertilisers and better farm equipment. Finally, the remaining 24.1% per cent is accounted for by other factors, such as better farming methods in increasing output, or switching to more valuable crops.

TABLE 3

CAUSES OF INCREASE IN OUTPUT.

	area cultivated thousands of hectares		annual rates of growth	
	1897/01	1909/13	1897/01- 1929/33	1909/13- 1929/33
sown	11,724	12,903	0.85	0.80
fallow	6,101	6,247	0.24	0.88
pasture	8,073	7,683	-0.64	-0.41
total	25,898	26,832	0.31	0.30

changes in gross output
millions of pesetas (1910 prices)

sown	3,764	4,229	5,314	1.08	0.98	1.15
fallow	17	17	18	0.18		
total	4,672	5,336	6,798	1.12	1.11	1.12

1897/01 - 1929/33:

- Growth in area cultivated 27.6%
- Growth in area sown 75.9%
- Other factors 24.1%

Source: Calculated from Appendix 1.A and 1.C. For pasture, see below.

The experience of individual crops naturally varied over the period. The large areas of cereals grown in rotation yielded only 139 ptas/ha in 1897/01, against an average for all crops of 194. Yet despite this low productivity, the area of cereals grew at roughly the same rate as the total area during the first third of the twentieth century. This was

¹⁵ Once again the accuracy of these figures has to be questioned, as in the 1960 the figure was still 41 per cent. *Anuario de Estadística*, 1980, 27.

caused in part by government intervention in the market through tariffs, which helped maintain profitability for cereal farmers, and encouraged them to plough up marginal land. A second factor, was that technical change allowed greater physical yields to be achieved on sown land, and at the same time caused the decline in the fallow requirements noted above.

Olives were another low value crop which saw a significant growth in the area cultivated¹⁶. Low international prices in the last third of the nineteenth century had halted an expansion which had gone on almost uninterrupted for over a hundred years. With the recovery of prices once more, especially from 1906, the introduction of better processing equipment, and the olive's relatively low labour requirements (and costs), a new expansion of the crop occurred. A significant part of this growth appears to have been on land previously used for rough pasture, or low yield cereals, although some was also on phylloxera diseased vineyards.

The history of the vine in Spain differed from other crops, being greatly influenced by external demand (especially France) and vine diseases (phylloxera, oidium, and mildew). From a maximum of roughly two million hectares of vines in the mid 1890s, the area fell to 1.27 million in 1909/13. Price recovery, linked to a growth in internal demand, contributed to a twenty per cent recovery in the area during the following two decades. However, the advantages of a relatively high output value per hectare (321 ptas/ha in 1929/33) in contrast with cereals and olives, was mitigated when the much heavier operating costs are taken into consideration.

Within the "other" categories, some products naturally grew faster than others. The older traditional crops, such as chestnuts, esparto, flax, hemp etc., tended to decline by

¹⁶ The output per hectare in contrast declined, from 237 ptas/ha to 221 between 1897/01 and 1929/33.

contrast significant growth in the area cultivated was achieved with sugar beet, citrus and soft fruits, nuts, vegetables. Productivity also grew, although in general it was no faster than that which was achieved with cereals¹⁷. There is no mystery to these changes. The growth of the market allowed Spanish farmers to increasingly specialise in those products where they had an international comparative advantage, and where demand was for products which were income elastic.

The major difficulties in estimating total land productivity is the problem of estimating what area should be included, as it is likely that almost every hectare of Spain's soil had some economic value, even if it only provided a solitary goat with a single meal a year. In concrete, the problem revolves on how to interpret the category *prados, dehesas y montes*, which reached 21,976 hectares in 1929/33. From 1973 this category includes *pastizales* (29.5%), *monte maderable* (29.8%), *monte abierto* (22.1%) and *monte leñoso* (18.5%), and here it has been assumed that this proportion was similar in earlier periods, and the share of *prados, dehesas y montes* dedicated to *pastizales* is included in the total agricultural area¹⁸.

Likewise, figures for active population in Spain, as in most countries in this period, cause problems in interpretation and almost certainly contribute to significant margins of error when attempting to measure labour productivity. One of the difficulties is caused by the need to classify each person employed in only a single activity in the census, when one of the features of a less developed economy is the low level of labour specialization.

¹⁷ Cereals-legumes-fallow increased by 0.58 per cent annually between 1897/01 and 1929/33, compared to 0.32% with oranges, 0.61% potatoes and a slight decline with sugar cane.

¹⁸ Even this underestimates the total area as the *montes*, or forestry, often included some areas of temporary pasture. However, the most important agricultural land is included, and it provides a better contrast with other countries than simply including the whole national surface, net of obviously non agricultural land, such as urban areas, rivers etc.

There are two further interrelated problems. The first concerns the female labour force, a group which, for example, apparently represented only seven per cent of those employed in the sector in 1930 in the Census. Strong regional differences would suggest at first sight that female participation was determined by the size of holding (small), type agriculture (dairying) and climate (high rainfall). However, it is clear from many sources that women played a vital role in agriculture over most of the country, allowing a significant increase in the labour supply in periods of peak demand, such as the harvest. Secondly, there is the question of underemployment and surplus labour in the sector, as agricultural workers were certainly more fully occupied in some regions/years than in others. In general, it seems probable that peasant farmers worked more than waged labour, and thus if labour productivity is to measure output per hour worked, adjustment need to be made to the official statistics. This has been rejected here, because if day workers in the south were employed less during the year than non-wage (family agricultural labour) in other regions, the farms in the south were also much more prone to significant influences of harvest labour, which are also unrecorded in the statistics. Therefore in Table 4, convention has been followed, and only male employment figures have been used.

TABLE 4 GROWTH IN PRODUCTIVITY

	(1)	Labour productivity			Land productivity		
	(2)	(3)	(4)	(5)	(6)	(7)	
1891/5	3,299*	4,033	818	109	23,924†	138	
1897/01	3,308	4,392	753	100	25,898	127	
1909/13	3,679	4,680	785	104	26,812	137	
1929/33	4,741	5,827	1,239	165	28,567	166	

1. gross output at 1910 prices, millions of pesetas
2. no of male agricultural workers (000s) in the 1887, 1900, 1920 and 1930 censuses.
3. output per male worker, pesetas
4. index of labour productivity, 1897/01 = 100
5. agricultural land, thousands of hectares
6. output per hectare, pesetas
7. index of land productivity, 1897/01 = 100

* assumes vegetables, fruit and raw materials represented 2% of output, as suggested for other years in Table 2, and area of these crops 7.5% of all cropped land, as in 1897/01. Sources: Active Labour, Table 2 and Nicolau, 1987. Agricultural Land, see text.

The results shown in Table 4 illustrate once again the difficulties in interpreting Spanish agricultural growth in the pre-World War period. The small decline in both land and labour productivity between 1891/5 and 1897/01 would be even larger if, as suggested above, the published figures of the early 1890s are biased downwards. The cause of the decline can be attached to the larger areas of unproductive vines on account of disease (phyllloxera) in the second period, and a small decline in livestock production (Appendix 1.A and 1.E). Some, although not all of this total decline, is recovered between 1897/01 and 1909/13. The overall picture of the period 1891/5 and 1909/13 therefore is stagnation in both land and labour productivity¹⁹. Between 1909/13 and 1929/33 there is a growth in both land and labour productivity, with the latter increasing almost twice as fast as the former²⁰.

3. AN INTERNATIONAL COMPARISON

To allow a comparison of international productivity, some common unit of currency is required. The method followed here is that used by Hayami and Ruttan, and consists of an international comparison of gross agricultural output, net of agricultural intermediate outputs²¹. The method consists of converting output in physical units into wheat units, based on conversion ratios calculated for 1937/52 from three different countries (United

¹⁹ This is in agreement with GER, although the methods to arrive at the figures are very different (1987, cuadro 15). They estimate a growth in production (which includes intermediate products), of 0.2%, of changes in area cultivated, 0.1% and agricultural labour force, 0.8%; here output (net of intermediate products) is 0.6%, area cultivated, 0.5%, and labour 0.8%. Gallego (1986, 1041-2) suggests a figure for the increase in agricultural output at constant prices of 1910, of 28% between 1891/5 and 1910, and Prados de la Escosura (1988, 127-8) 24% between 1886/95 and 1903/12. In these cases, Appendix 1.C suggests a growth of 9.5% between 1891/5 and 1909/13.

²⁰ Both figures are slightly below those of GER. This increase is in part the consequence of the rural exodus which started after 1910. However, it is quite possible that the 1930 census figures underestimate the agricultural labour force, in which case this productivity growth will be exaggerated (Simpson, 1988).

²¹ i.e., our Appendix 1.E. See Hayami and Ruttan, 1965, 447-491.

States, Japan, and India). The three results have then been combined into a single composite series by taking their geometrical mean (See Appendix 1.F).

Although it is possible that, for methodological reasons, the estimates for Spain are unduly pessimistic, there can be little doubting the country's low land and labour productivity²². Of the six countries, Spain had the worst land productivity and the second worst labour productivity in both 1900 and 1930. In terms of growth, however, the country was third behind Denmark and Japan.

The failure to increase land and labour productivity is the theme of another study, but it is worth noting briefly one factor which was indirectly responsible: the low endowment of land per agricultural worker. A comparison with the United States, two countries which, for all their differences, shared in having low population densities, low wheat yields, and large areas of dry farming²³. Using the material from Table 2.6, it can be shown that, if Spanish workers had had access to similar quantities of land as those of American farmers, and if at the same time land productivity was maintained, then labour productivity in Spain would have been a relatively respectful 9.6 wheat units in 1900, and 12.0 in 1930. In this case, it could be argued that a major problem in Spain was the lack of sufficient quantities of land per worker or, the argument reversed, too many workers were employed on the land. Thus as O'Brien and Keyder have noted in their comparison of the

relative backwardness of French agriculture, low labour productivity may be as much a "... reflection of lower rates of structural change and internal migration than inefficient farming per se" (1978, 108-9). In the case of Spain, low rates of internal migration area accompanied by a relative low rate of emigration (Torrella, 1981, 23-26).

²² For example, in a direct comparison between Spain and the United Kingdom for the period 1909/13, using individual product prices of each country to measure output, Spain's land productivity was 58% that of the UK's when measured in pesetas, and 43% when measured in pounds sterling; labour productivity was lower, at only 27% and 21% respectively.

²³ Population density in 1929 was 44.7 persons per sq. km. in Spain, and 15.7 in the United States; wheat yields 0.88 and 0.99 tonnes respectively.

TABLE 5

CHANGES IN AGRICULTURAL OUTPUT, FACTOR PRODUCTIVITY, AND FACTOR ENDOWMENTS IN VARIOUS COUNTRIES, 1880-1930.

	Spain	Japan	Denmark	France	United Kingdom	United States
agricultural output index	100	73	77	91	98	63
	1930	1900	1900	1900	1900	1900
	140	163	215	132	110	130
	1930	1930	1930	1930	1930	1930
agricultural output per male worker in wheat units	2.35	2.5	10.5	7.4	15.7	13.0
	1930	1900	1900	1900	1900	1900
	5.7	3.1	14.1	8.1	17.4	16.3
	1930	1930	1930	1930	1930	1930
	23.9	5.7	23.9	13.2	19.7	22.5
agricultural output per hectare of land in wheat units	0.3	3.3	1.2	1.1	1.1	0.5
	1930	1900	1900	1900	1900	1900
	5.8	4.1	1.5	1.2	1.1	0.5
	1930	1930	1930	1930	1930	1930
	2.9	2.9	2.9	1.5	1.2	0.5
agricultural land per male worker	5.94	0.66	8.91	6.96	14.7	25.4
	1930	1900	1900	1900	1900	1900
	7.41	0.71	9.33	7.01	16.6	32.2
	1930	1930	1930	1930	1930	1930
	8.18	0.91	8.18	8.80	17.0	40.5

Rates of change:

1880-1930		1880-1930		1880-1930		1880-1930		1880-1930	
agricultural output	1.62	2.07	0.76	0.21	1.44	1.44	1.44	1.44	1.44
output per worker	1.83	1.66	1.16	0.46	1.11	1.11	1.11	1.11	1.11
output per hectare	1.13	1.78	0.62	0.17	0.25	0.25	0.25	0.25	0.25
land per worker	0.64	-0.17	0.47	0.28	0.94	0.94	0.94	0.94	0.94
	1930	1930	1930	1930	1930	1930	1930	1930	1930
	1.18	1.64	2.56	0.93	0.32	0.88	0.88	0.88	0.88
	1.09	2.06	1.77	1.64	0.41	1.08	1.08	1.08	1.08
	1.12	1.16	1.07	1.07	1.07	1.07	1.07	1.07	1.07
	1.09	0.83	-0.44	0.76	0.98	0.77	0.77	0.77	0.77

Sources: Spain Appendix 1 and text. The years 1887/01 and 1929/33 have been converted to 1900 and 1930 by assuming constant rates of change. Other countries from Hayami and Ruttan, 1985, 447-491 and Ruttan, Binswanger, Hayami, Wade, and Weber in Ruttan and Binswanger, 1978, chapter 3.

A.1 Cereals and Legumes

1891-5 1897-01 1909-13 1929-33

wheat	3,220	3,733	3,864	4,486
barley	1,045	1,376	1,420	1,874
oats	416	374	516	776
rye	680	753	804	612
maize	328	465	459	432
rice	32	34	38	48
others	53	80	77	86
sub-total	5,774	6,815	7,178	8,314
chick-peas	145	167	180	232
habas	158	211	183	207
judias	219	236	265	213
lentils	16	15	17	25
carob bean	69	87	152	205
others	78	77	129	271
sub-total	685	793	926	1,153
unsown fallow	5,292	6,101	6,247	6,591
sub-total	11,751	13,709	14,351	16,058

A.2 Vines

1,460 1,429 1,274 1,531

A.3 Olives

1,123 1,197 1,427 1,952

A.4 Fruit trees

oranges	42	48	73	73
almond	41	104	138	138
carob	98	154	186	186
banana		3	4	4
chestnut		60	26	26
others		126	139	61
sub-total	307	508	488	488

A.5 Vegetables

potatoes	243	271	406	406
onions	03	03	27	27
others	118	116	124	124
sub-total	361	387	557	557

A.6 Raw Materials and forage

sugar beet	21	35	84	84
ground nuts	6	8	8	8
esparto grass		584	579	579
turnips	96	111	117	117
others	41	83	235	235
sub-total	684	819	1,023	1,023

A.7 Artificial pastures

	138	138	383	357
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A.8 Pasture & forestry

28,046 27,367 26,044 22,341

45,192 45,193 44,317

APPENDIX 1.B. VALUE OF OUTPUT AT CURRENT PRICES.
in millions of pesetas

	1891-5	1897-01	1909-13	1929-33
<u>A.1 Cereals and Legumes</u>				
wheat	762	997	1,117	2,193
barley	244	295	391	815
oats	65	60	92	220
rye	110	127	190	275
maize	117	137	161	304
rice	69	64	56	101
others	17	17	15	25
sub-total	1,375	1,697	2,022	3,933
chick-peas	43	49	58	109
habas	34	46	45	92
judias	50	43	63	157
lentils	3	2	3	14
carob bean	10	13	22	48
others	12	12	18	77
sub-total	152	165	209	497
unsown fallow	43	41	17	47
sub-total	1,570	1,903	2,248	4,477
<u>A.2 Vines</u>				
	452	418	340	748
<u>A.3 Olives</u>				
	204	223	268	589
<u>A.4 Fruit trees</u>				
oranges	51	69	69	252
almonds	25	49	49	108
carob	13	31	31	106
bananas	10	67	10	67
chestnuts	19	19	19	55
others	98	82	82	288
sub-total	187	261	261	876
<u>A.5 Vegetables</u>				
potatoes	199	271	271	920
onions	30	30	30	84
others	186	225	225	688
sub-total	385	526	526	1,692
<u>A.6 Raw Materials and forage</u>				
sugar beet	5	23	34	172
ground nuts	6	6	8	20
esparto grass	5	5	7	12
turnips	22	22	40	85
others	79	89	89	150
sub-total	135	135	178	439
<u>A.7 Artificial pastures</u>				
	66	82	156	319
<u>A.8 Pasture & forestry</u>				
	336	416	303	421
TOTAL AGRICULTURAL LAND	3,239	3,749	4,280	9,561
livestock	1,090	1,090	1,090	2,302
TOTAL	4,192	4,540	5,370	11,863

APPENDIX 1.C. OUTPUT AT CONSTANT PRICES (1909/13).
in millions of pesetas.

	1891-5	1897-01	1909-13	1929-33
<u>A.1 Cereals and Legumes</u>				
wheat	812	974	1,115	1,290
barley	241	319	391	545
oats	70	61	92	150
rye	117	142	190	157
maize	118	141	161	162
rice	42	46	57	78
others	17	17	15	14
sub-total	1,417	1,700	2,021	2,396
chick-peas	50	57	58	68
habas	38	45	45	52
judias	65	55	63	71
lentils	6	4	3	5
carob bean	9	11	22	25
others	13	13	17	40
sub-total	181	185	206	261
unsown fallow	14	17	17	18
sub-total	1,612	1,902	2,246	2,675
<u>A.2 Vines</u>				
	552	458	340	509
<u>A.3 Olives</u>				
	285	284	268	431
<u>A.4 Fruit trees</u>				
oranges	54	54	69	104
almonds	50	50	49	76
others	71	71	113	88
sub-total	175	175	231	268
<u>A.5 Vegetables</u>				
potatoes	201	271	271	408
others	238	238	257	398
sub-total	439	439	528	806
<u>A.6 Raw Materials and forage</u>				
sugar beet	19	19	34	75
ground nuts	7	7	8	11
esparto grass	6	6	7	7
turnips	37	37	40	71
others	81	81	85	75
sub-total	150	150	174	239
<u>A.7 Artificial pastures</u>				
	56	56	156	145
<u>A.8 Pasture & forestry</u>				
	325	317	303	259
TOTAL AGRICULTURAL LAND	3,547	3,781	4,246	5,332
livestock	953	891	1,090	1,426
TOTAL	4,500	4,672	5,336	6,758

NET OUTPUT AT CURRENT PRICES.
In millions of pesetas

	1891-5	1897-01	1909-13	1929-33
<u>A.1 Cereals and Legumes</u>				
wheat	498	720	808	1,661
barley	36	45	59	124
oats	7	7	11	29
rye	88	102	133	188
maize	52	61	73	135
rice	58	62	55	97
sub-total	739	997	1,139	2,234
chick-peas	33	37	48	91
habas	4	5	5	11
judias	42	36	52	132
lentils	2	2	2	11
sub-total	81	80	107	245
<u>A.2 Vines</u>	429	397	323	711
<u>A.3 Olives</u>	194	211	234	539
<u>A.4 Fruit trees</u>				
oranges	51	69	69	252
almonds	25	49	49	108
bananas		10	10	67
others	98	72	72	343
sub-total	174	200	200	770
<u>A.5 Vegetables</u>				
potatoes	152	207	30	704
onions	186	225	84	688
others	338	462		1,476
sub-total				
<u>A.6 Raw Materials and forage</u>				
sugar beet	23	34		172
ground nuts	5	6		16
others	58	62		102
sub-total	86	102		290
TOTAL	2,283	2,587		6,285

NET OUTPUT AT CONSTANT PRICES (1909/13).
In millions of pesetas

	1891-5	1897-01	1909-13	1929-33
<u>A.1 Cereals and Legumes</u>				
wheat	555	688	808	939
barley	37	50	59	85
oats	8	7	11	17
rye	90	107	133	108
maize	56	67	73	79
rice	41	45	55	75
sub-total	788	944	1,139	1,303
chick-peas	41	47	48	57
habas	5	5	5	6
judias	52	44	52	57
lentils	5	8	2	4
sub-total	103	104	107	124
<u>A.2 Vines</u>	525	435	323	484
<u>A.3 Olives</u>	270	270	254	409
<u>A.4 Fruit trees</u>				
oranges	54	69	69	104
almond	50	49	49	76
others	63	63	82	70
sub-total	167	167	200	250
<u>A.5 Vegetables</u>				
potatoes	154	207	312	312
others	238	255	298	298
sub-total	392	462	610	610
<u>A.6 Raw Materials</u>				
sugar beet	19	34		75
ground nuts	7	8		11
others	59	62		49
sub-total	85	104		135
SUB-TOTAL	2,417	2,589		3,315
livestock	953	891	1,090	1,426
TOTAL	3,308	3,679		4,741

SOURCES FOR APPENDIX ONE:

This appendix rests heavily on the pioneering works of Sotilla (1911) and the Grupo de Estudios de Historia Rural (1983). The main changes are:

- 1 an attempt to estimate output net of intermediate products
- 2 changes in the construction of constant prices
- 3 new estimates for livestock
- 4 a wider international comparison

The divisions of crops follows standard practice in Spanish official statistics of the period, with the exceptions of A.5 and A.6, "vegetables" and "raw materials and forage". A.5 include *Plantas hortícolas*, potatoes and onions. A.5 raw materials and forage crops, essentially turnips (*inabos*).

APPENDIX 1.A.

1891/5 A1, A2, and A3, Sotilla, 1911 except wheat for 1891, Simpson 1989, and unown fallow, GER, 1983. The same figures for 1897/01 have been used for categories A4, A5, and A6. A7 and A8, GER, 1983. For division of A8, see 1929/33 below.

1897/01 A1, A2 and A3 Sotilla. Ministerio de Agricultura, *Noticias estadísticas sobre la producción agrícola española, 1902*, for individual fruits, vegetables, raw materials and roots; this source does not give a specific year, and does not include all products in these categories. For totals in categories A.4, A.5, A.6 GER 1983; a rough estimate of half a million hectares of esparto grass is made. A7 and A8, GER, For division of A8, see 1929/33 below.

1909/13 JBA annual publications for A1 (except rice in 1911 - BAIEN), A2 and A3. AA BAIEN, with area of banana calculated by assuming all "other fruit trees" in the Canary Islands belonged to this category. A5 potatoes *Alvario Estadístico de España, Año 1915*, "other vegetables", GER. A6 Sugar beet as potatoes, rest BAIEN. A7 and A8 GER 1983. For division of A8, see 1929/33 below.

1929/33 *Alvario(s) Estadístico(s) de las producciones agrícolas*. The area devoted to potatoes and onions includes the relatively small area cultivated in market gardens, the "others" figure is the total area of market gardens and not the sum of the area sown by individual crops. The figure for natural pasture is as given in the text.

APPENDIX 1.B.

1891/5, 1897/01, and 1929/33 as above

1909/13 The JGA did not include any value for their annual crop estimates during this period, although they gave an average value for the main categories for different periods (i.e. cereals, legumes, vines, and olives between 1903/12; fruit and root crops 1910, vegetables and industrial crops 1911). The estimates here have been carried out using the unit prices for these years with the production figures for the period 1909/13 where possible. When not, the values given have been assumed to be equal to 1909/13. For "other" cereals and legumes, the average of 1909/10 has been used, Sotilla being the source. Unown fallow, and categories A7 and A8, GER, 1983.

APPENDIX 1.C.

A1. Individual cereals and legumes: calculated by multiplying grain and straw output by unit prices of 1909/13; "others" assuming the same share in sub-total as with current prices. A2 and A3. To obtain a coefficient, the total value of production has been divided by

wine and olive oil production for 1909/13. These coefficients (wine 22.57 ptas/hl. and olive oil 1,219 ptas/tol) have then been applied to wine production and olive oil production for other dates.

A4. Oranges and almonds, as individual cereals and legumes above, other fruit based on value per hectare in 1909/13, 317 ptas/ha. A.5 Potatoes, as individual cereal; *plantas hortícolas* based on value per hectare in 1909/13, 2,123 ptas/ha; and half of total for *factes, tubérculos y bulbos*, minus the potato and turnip. A.6 Sugar beet, ground nuts, relative to grass and turnips, as cereal; other *plantas industriales* assumed to have same relative importance in each period as with current prices; other root crops as A.5. A.7 and A.8, based on value of production by hectare in 1909/13, A7 407 and A8 11 pesetas/hectare.

APPENDIX 1.D.

The major difficulty in converting gross output into net output concerns the use of suitable coefficients for seed corn and the share of products re-employed on the farm. Information on seed corn usage is limited, with the exception of wheat, barley, rye, oats, and maize for 1909/13 (*Alvario Estadístico de España, Año, 1912*, 212-31). For off-farm sales, no information exists, and the estimates here have to be regarded as arbitrary. The following coefficients have been used:

	net of seed seed corn %	off-farm sales % of net harvest
wheat	86	100
barley	88	20
rye	86	100
oats	91	15
maize	95	50
rice	99	100
chick-peas	87	100
habas	86	15
judias	89	100
lentils	80	100
carob	84	15
potatoes	90	85

In general, it has been assumed that with those crops devoted to human consumption all production given by the agricultural statistics was for off-farm sales, whereas with those cereals and legumes normally associated with animal feed, the figure is only 15%. In the case of barley another 5% of the net harvest has been allowed for beer production, not an important industry in Spain in this period. A figure of 50% for off-farm sales for maize has been used, given that the crop was grown for both animal and human consumption. All hay, straw, and other animal fodder has been assumed for farm consumption. Finally, the by-products of the vine and olive are assumed for on farm consumption.

A.2 and A.3 net has been taken as 95 per cent of gross output. A4, A5 and A6 as Appendix 1.B, with produce of carob tree and turnips taken as cattle fodder and re-employed on farm.

APPENDIX 1.E.

As Appendix 1.C and 1.D.

LIVESTOCK.

Milk, cows - the 1929 and 1933 census figures provides, (a) the number of female animals within the total (75%), the share of these milked (45%), and gives an annual average yield of 1,146 litres/head. The 1865 census also divides animals by sexes (59% female), and it is assumed that the share of females increased in a constant fashion between these benchmarks. A yield of 730 litres/head a year is given by J. de Bona (1879) for 1877, which suggests an improvement in yields took place (see Chapter 6), and here it is assumed that the rate of increase was constant, except in the case of 1865. The following milk yields are used: 1865, 700 litres; 1891/15, 815; 1897/01, 875; 1919/13, 940; 1929/33, 1,146. Prices are as used by GER, 1983, 201.

-Sheep. As above, the number of female animals fell, from 69.5% of the total in 1865, to 62.7% in 1929/33; of these, 23.4% were milked at this later date. Yields were 25.8 litres/head/year in 1929/33, and no change is assumed during this period, as breeding changes appear to have been much less than with milking cattle. Prices, as GER, 1983.

-Goats. As sheep, female animals fell from 73.4% of the total to 65.2% between 1865 and 1929/33. The yields at the end of the period were 175 litres/head, and again no change has been assumed during the period. Prices as GER, 1983.

- MEAT. The 1930 census gives:
- a. number of animals in 1929
 - b. number sold in 1930 for meat
 - c. total live weight of these animals
 - d. farms prices obtained

From these figures, an estimate of the total number slaughtered of each type is made for 1929/30: cattle 28.0%, sheep 37.5%, goats 38.3% and pigs 59.6%. These coefficients have then been applied to the total numbers in each census. In theory, the categories could be disaggregated into bulls, ewes, cows, heifers etc., but it is likely that consumer tastes changed over the period (Gómez Mendoza and Simpson, 1988), and there is no way of measuring these changes, at a national level, for the present.

Average weights in 1930 were 260.5 kilos for cattle, 22.2 sheep, 21.1 goats and 96.2 pigs. Again, until more empirical evidence is available, no long term change can be assumed.²⁴ Prices for 1930 taken from census, and those for other dates GER, 201. However, while the 1930 are for live weights (and therefore farm gate prices), those for the other dates are wholesale, and probably refer to carcass/dressed meat (en canal). However, the difference is likely to be little, and no clear alternative exists.

Wool. The production figures for 1929/33 have been averaged, and applied to the flock sizes of the different census figures. Prices used have been for white wool, from GER, 1983, 201.

1.F. INTERNATIONAL COMPARISONS.

The international comparison is based on gross agricultural output, net of intermediate outputs (i.e. those products included in appendix 1.E). All values are measured in wheat equivalents, the conversion being made according to the relative value of different products in three countries, the United States, Japan, and India, in the period 1957/62 (see Hayami and Ruttan, 1985, Table A.1. These coefficients have then been applied to agricultural output in Spain for the periods 1897/01, 1909/13 and 1929/33. The three series obtained for each period have been combined into a composite unit, by taking their geometrical mean.

²⁴ Meat breeders therefore contrast with those milk producers that did introduce changes. For the pre First World War, see Carmona Bedis and de la Fuente, 1988 and García Fernández, 1975. For average weight slaughtered in Madrid, 1904-29 see Gómez Mendoza and Simpson, 1988, cuadro 3.

The list of wheat equivalents provided by Hayami and Ruttan covers most of the crops in our sample. The major exception is wine, and this has been calculated as "fresh fruit", using the total weight of the grapes produced. As it is clearly impossible to find suitable weights for all Spanish products in these periods, it has been assumed that the wheat equivalents consist of:

- 1. the proportional value of citrus fruit and almonds within total fruit remains the same as in Appendix 1.E.
- 2. the proportional value of potatoes within total vegetables remains the same as in Appendix 1.E.
- 3. the proportional value of sugar beet and groundnuts within total raw materials and forage remains the same as in Appendix 1.E.

Despite the most important of Spain's products appearing on Hayami and Ruttan's list, some distortions inevitably appear because of the wheat equivalents used. This can be best seen if we compare the rate of growth between 1897/01 and 1929/33, some 0.46 per cent using the methods described here, but 1.13 per cent in Appendix 1.E. The value of these estimates, however, is to enable a rough international comparison to be made.

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