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TECHNICAL CHANGE, LABOUR ABSORPTION AND LIVING STANDARDS IN ANDALUCIA, 1886-1936

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The economic backwardness of Andalucía in the period prior to the Civil War has traditionally been explained by the sub-optimal distribution of land (1). The various land reforms of the nineteenth century failed to change significantly a property distribution inherited, from earlier centuries, which resulted in 46% of the land belonging to only 0.5% of the owners in 1930 (2). Land was usually held in large estates, which provided most of the work opportunities for the local population, and most labour was contracted for short periods and for specific tasks. The lack of interest by the land owners in investment projects connected with raising productivity, but their readier desire to increase estate size, led to charges from one prominient agronomist of the period that the principal function of landownership was social rather than economic (3). The miserable conditions in which many agricultural labourers lived had been seen by many as the inevitable result of a land distribution and farming practices which led to low wages and high seasonal unemployment (4).

Concentration of agricultural property in the hands of a minority was far from unique in Andalucía however, and existed in some areas of Europe which experienced considerable economic growth during the eighteenth and nineteenth centuries (5). This has led some economic historians to advance other arguments to explain the relation between agricultural performance and economic backwardness in Andalucía. Prof. Tedde has suggested that Spain's protectionist cereal policy acted as a disincentive to farmers, as they could obtain sufficient profits in an assured market without having to change their production systems (6). Other researchers have made it clear that the region did witness changes in the fifty years prior to the Civil War, both in the types of crops cultivated and technology used (7). Behind these arguments is the belief that the large supply of under-utilised labour often acted as a disincentive to capital investment, and that traditional methods were not necessarily unsuitable, and certainly not unprofitable (8).

But two facts have not been questioned, firstly, that a large section of the population lived in poverty, and secondly that an appreciable number of people were attracted to radical politics, especially anarchism, to express their dissatisfaction with the social and economic system. Whereas a

number of historians have studied social protest, tracing both the development of coherent ideologies and organisation of action against landlords or state during the half century prior to the Civil War, little or no work has been done in attempting to show whether the plight of farm labourers improved or detoriated during this same period. This paper tries to remedy this gap by examining changes in the long run supply and demand for labour using census figures, and a detailed study of labour opportunities in agriculture. Finally, the implications of these changes on worker's living standards and agricultural profitability are considered. The study is based on the provinces of Cádiz, Córdoba, Jaén and Sevilla, which have been chosen as being representative of the region, both with respect to the type of agriculture (a predominance of dry cereal farming and olive plantations), and for containing the main centres of political and social unrest. The main conclusion is that, despite a 45% increase in population, there appears to have been no long term decline in either employment opportunities in agriculture or in real wages.

1. SUPPLY OF AGRICULTURAL LABOUR.

Assuming that the relation between the number of land owners and the labourers remained stable over time, a very rough estimate of changes in the size of the labour force can be obtained from the Census figures. As with all types of employment statistics in Less Developed Countries, the Spanish contain a number of features which makes them far from ideal to measure the size of the active labour force in agriculture. In the first place, it is clear that a comparison of information from one census to another can only give an approximation of the degree of change, because of differences in the description of activities (9). Secondly, two features of the agricultural labour market in Andalucía, the short term labour contracts, and the significant seasonal fluctuations in demand, make the exact definition of an individual's employment difficult. Because of the lack of alternative rural employment during this period, it seems unlikely that the employment statisitics in agriculture will have been biased upwards. Indeed, given the concentration of labour demand during the harvests, the labour force itself was supplemented for short periods by labour not only from other sectors, but also from other regions. The use

of female labour, a vital component in the short term supply of agricultural labour,is virtually absent in the employment statistics, representing only 4% of the total in 1887 and 0.4% in 1930. This understates significantly the participation of this group of workers, which performed important tasks such as weeding, binding and stooking during the cereal harvest, and collecting fallen fruit during the olive. Bearing these shortcomings in mind, it can be seen from Table 1 that the total population of the four provinces grew at a faster rate than the agricultural population for all periods. Between 1887 and 1920 the numbers employed in agriculture increased at the slow rate of 0.2% annually, against a population growth of 0.8%. However, in the decade prior to the Second Republic the numbers in agriculture increased much faster, reaching an annual 0.7% (10). At the same time, the sector's share of the total active population during the last decade fell from 59.3% to 55.5%. This is perhaps in part illusory, as a total of 101,293 workers, or 10.7% of the active population in 1930 (24% of the non agrarian) are simply unclassified (sección xv industrias varias; núm. 85 diversas industrias).

TABLE 1.

POPULATION AND ACTIVE LABOUR FORCE IN CADIZ, CORDOBA, JAEN AND SEVILLA.

	1887	1900	1920	1930
total population	1,833,257	1,946,870	2,409,133	2,656,730
total act. pop.	728,165	721,536	821,400	945,213
tot. employed in agriculture	456,018	475,948	487,204	524,356
% of total act. pop. in agric.	62.6	66.0	59.3	55.5

% annual growth -	Total Population	Employed in Ag. Sector
1887-1900	0.5	0.3
1900-1920	1.0	0.1
1920-1930	1.0	0.7
1887-1920	0.8	0.2
1920-1930	1.0	0.3
1887-1930	0.9	0.3

Calculated from Dirección General del Instituto Geográfico y Estadistico, Censo de la Población de España, 1887, vol.2, pp. 572-3; Ibid, Censo de la Población de Espana en 1900 (Madrid, 1907) vol.3; Min. de Trabajo, Censo de Población de 1920 (Madrid, 1929) vol 5 and Ibid. Censo de la Población de España.Region de Andalucía 1930 (Madrid,1943)

Another difficulty relevant to this paper is that the figures in Table 1 do not indicate the quantity of work carried out by those employed in the sector (indeed some did no agricultural work as such, just collected rents). Chayanov argued that a peasant family's economic behaviour was likely to be very different to that of a capitalist farmer's, as the former's labour input would be determined by the 'irksomeness of the extra work', and not the point where the marginal product equalled the wages that the capitalist farmer had to pay (11). In other words, a family might consider it worthwhile to carry out a particular agricultural operation which, on a larger farm, would have been regarded as unprofitable. Likewise, small farmers could cultivate crops profitably that were both labour intensive in their requirements and maximised total revenue per hectarea, but which would have been regarded as unprofitable on larger farms using wage labour (12). If this theory is correct, and a considerable body of development literature suggests it is, then those with access to land would theoretically have been employed more frequently than the jornaleros on the latifundios. In addition, the high level of property concentration in Andalucía implied that the possibility of the agricultural sector absorbing population growth satisfactorily was less than it might have been if smaller farms had been the norm. The reverse of this arguement is that while an unequal distribution of land, and hence income, might have restricted the growth in labour opportunities and the domestic market, it is likely to have facilitated the growth of savings available for productive investment. Unfortunately, there is not sufficient information to enable changes over time to be identified with respect to the numbers of small farmers, and for our purpose it has been assumed that the real supply of labour is accurately represented in Table 1.

2. AGRICULTURAL DEMAND FOR LABOUR.

The main crops grown in the region under discussion were wheat, barley and olive oil which, between them, covered 80% of the cultivated area and accounted for 70% of the the total value of agricultural output in the period 1922 (13). The region also had two specialised wine producing areas, the production of sherry in Jerez de la Frontera and adjacent lands, and a lesser 'fino' producing region around Montilla (Córdoba). However, viticulture only provided 3% of agricultural produce, and 2% of the area sown (14). Cattle, in general, were kept for farm work and transportation, rather than milk or meat. Finally, the planting of 'new' crops, such as cotton, rice, sugar beet etc., were relatively unimportant (see Table 2).

As both the type of crops grown, and methods of cultivation, changed little during the period, a reasonably acceptable estimate of labour demand can be obtained based on contemporary sources of labour requirements for individual crops, and changes in the area sown. This section is devoted to examining some of the difficuties involved in such a calculation, namely the different field rotations, geographical areas and short term fluctuations in demand. The following section examines in detail the specific question of technological change and labour demand for the main crops (cereals, legumes and olives), before the results are discussed. Full details of the sources used for the calculations for all crops are to be found in Appendix 2.

The long summer droughts encouraged an extensive agriculture based on dry farming techniques. At the beginning of the period, the predominant cereal rotation was one of three fields (al tercio), which consisted of a single sown field, usually wheat, an unploughed fallow (rastrojo or erial), and a ploughed fallow (barbecho). Within this general system there were large variations, depending essentially on the quality of the soil, and distance from product and labour markets. Part of the barbecho might be sown with chick-peas or beans and the rastrojo with oats, barley, or escaña (15). Another variant was to dedicate all the manure and fertilisers to a small area, perhaps 5% of the land found in the al tercio rotation and

TABLE 2. DISTRIBUTION OF CROPS, 1886/90 -1930/35.

in hectares

		dry farming				irrigation			
		1886/90	1905/10	1922	1930/35	1886/90	1905/10	1922	1930/35
Cereals	wheat	471614	514083	463204	461901		2106	4860	4380
	barley	176644	186795	237680	251220		2081	1360	1390
	rye	44165	17858	6082	5014		71	0	0
	oats	10533	58542	59150	60660		0	0	0
	maize	26273	15307	21219	47363		5950	6314	7005
	rice	0	0	0	0		5	0	377
	others	18799	19216	23457	22689		70	221	0
	sub-total	748028	811801	810792	848847	n/a	10285	12775	13152
Legumes	chick-peas	53802	47641	63965	73974		0	0	16
	beans	42670	59985	51146	55822		1792	1635	465
	yeros	16890	7546	9122	5051		0	0	0
	field peas	5098	13734	12586	3711		0	0	0
	others	9973	3502	10838	12284		609	1234	1039
	sub-total	128433	132408	147657	150842	n/a	2401	2869	1542
Olives		566028	675586	721915	828666	n/a	12135	21780	26666
Vines		55444	31257	35830	34436	n/a	n/a	0	0
Raw Materials									
	cotton		0	312	10802			0	366
	tobacco		0	125	237			0	74
	esparto		10140	11760	1031			0	0
	sugar beet		0	0	2269			0	5269
	others		3526	2982	2113			128	45
	sub-total	n/a	13666	15179	16451	n/a	0	128	5754
Roots, Tubers & Bulbs									
	potatoes		1884	503	1914		3500	6326	5916
	onions		784	140	476		1455	2201	1338
	others		890	620	581		1655	2216	775
	sub-total	n/a	3558	1263	2971	n/a	6610	10745	8029
Market Gardening									
	sub-total	n/a	4754	3915	5667	n/a	11927	9810	14218
Fruit Trees									
	oranges		0	0			2284	3264	
	others		2813	1557			n/a	1288	
	sub-total	n/a	2813	1557	0	n/a	2284	4552	0
TOTAL		1497923	1675843	1738168	1887882	n/a	45706	62659	68561

Sources: See Appendix 1

usually nearest the farm or town, and plant it annually. Traditionally, on poorer soils (16), a two field rotation (año y vez) was practised which alternated wheat and barley on the sown area, the other half being left fallow. However the period experienced a general decline in the area of fallow relative to the area sown, and in this respect the año y vez began to be regarded as a more intensive field rotation than al tercio, as little or no fallow was used (17).

Apart from the Avance estadístico del cultivo cereal y leguminosas asociados en España of 1886-90, there is no information avaliable on the amount of land to be found in the main crop rotations. However, in calculating labour requirements for each crop this is not a significant problem, as the effects of different rotations on labour demand can be separated into two distinct categories. The first contains operations which can be measured independently of rotations, either by the volume of inputs (such as fertilisers and manure), or directly associated with the size of the harvest. The second category is concerned with the timing of different ploughings and their nature. However, as can be seen in the case of Córdoba in Table 3, which for our purposes can be regarded as representative of the region, the total labour demand per hectare sown changed little with respect to the various rotations, although the quantity of land required to obtain a hectare of production of wheat, barley and chick-peas, was greater than in the case of al tercio.

A second consideration is that labour inputs were greater on the richer soils of the Campiña than those in the Sierra. To make an accurate adjustment for geographical location is difficult, as very few sources mention either the distribution of crops by area, which would allow a study of the changes over time, or the differences in labour requirements. Instead, for simplicity, an average figure for labour requirements has been calculated for tasks based on all rotations and areas. A different type of problem to be resolved is that the source material is frequently unclear about what exactly is being costed, as a particular agricultural operation might be excluded, or the costs found in a related activity. For example, if the source refers only to 'harvesting', a guess has to be made as to

whether this involved just cutting the standing corn, or if stooking and carting costs are also included.

A final problem concerns short term fluctuations in labour demand caused, for example, by unusual weather conditions, or changes in factor and commodity markets. When these factors directly influenced the area cultivated, or the size of harvests, they can be shown in the calculations. However, a non essential task such as hoeing or weeding, which frequently provided a large number of days work, was especially prone to significant annual variations, although in this study we have to assume there were no short, or long term change (18).

TABLE 3.

LABOUR REQUIREMENTS FOR CEREAL-LEGUMES IN CORDOBA.

in days/hectare

	1886/90		1934	
rotation ...	1/3	1/1	1/3 sierra	1/31/1 campiña
Fallow				
1st ploughing	3.00	/	3.10	5.00 /
2nd "	3.00	/	2.40	3.10 /
3rd "	2.00	/		
Sub total	8.00	/	5.50	8.10 /
Wheat				
sow. & prep.	5.00	9.50	5.20	5.20 11.20
Barley				
sow. & prep.	5.00	9.50	5.20	5.20 11.20
Chick-peas				
sow. & prep.	8.00	8.00		11.00 11.00
TOTAL	26.00 27.00	15.90	29.50	33.40

Sources: JCA, Avance cereal op.cit. Córdoba 1 pp.389-431 and Instituto de Reforma Agraria, Datos recopilados sobre las provincias de Ciudad Real, Toledo, Córdoba, Jaén y Sevilla (Madrid, 1934) pp. 177-183 (my thanks to I.Jiménez Blanco for locating a copy of this work in Madrid).

3. TECHNICAL CHANGE AND THE DEMAND FOR LABOUR.

The question of technological change is limited here to simply identifying the introduction of new machinery, attempting to assess its diffusion in the four provinces and, finally, to measure the effects on labour demand. Only technology concerned with the main crops (i.e. cereals, legumes and olives) is discussed, although this essentially covers most aspects of the region's agriculture. Given that the only full census of agricultural implements occurred in 1932, contemporary observations have to be used to complete the picture for the earlier period.

A. PLOUGHING AND SOWING. At the outset of the period, traditional ploughs (arado común or romano) were the most widespread in all parts of the region, although some farmers were changing to modern ploughs (19). The advantages to farmers of cheapness, low energy requirements, easy construction and maintenance of traditional ploughs, were offset by the lack of depth they worked at, and the fact that they could not lay a regular furrow, both of which made this plough unsuitable for the deeper autumn and winter ploughings (20).

To maximise crop output, agronomists suggested that the arado común be substituted for ploughs fitted with mouldboards (vertederas) to obtain the greater depth required. The común might still be used satisfactorily for spring ploughings (tercia), which needed to be shallow to minimise moisture loss. Attempts to introduce multi-furrow ploughs date from the 1880s (Sevilla), if not earlier, although numerically, these ploughs were relatively unimportant in comparison to the arado común or the vertedera (see Table 4; 21). By the Second Republic, the region's stock of ploughs had changed much more quickly than the rest of Spain's, with only some 35% of the total being of the traditional 'común' type, against a figure of 63% for the whole country (22).

The implications for labour demand with respect to these changes is complicated, as not just the type of ploughs have to be considered, but also the work animals employed, and the number of ploughings carried out. The number of ploughings itself was a function of both the quality (deeper

TABLE 4

FARM MACHINERY IN USE, CADIZ, CORDOBA, JAEN AND SEVILLA, 1934.

ploughs	común	61,728
	vertedera	110,934
	polisurcos	2,347
reapers		2,095
reaper-binders		2,810
combine-harvesters		47
threshers	ordinarios	14,434
	discos	17,862
	aventadoras	799
	trilladors	480
tractors		888

Source: Ministerio de Agricultura, Anuario estadístico de las producciones agrícolas Año 1932 (Madrid, 1933) pp.318-323.

TABLE 5

LABOUR REQUIREMENTS FOR PLOUGHING AND SOWING, SEVILLA.

	1886/90	1897			1934	
		1.	2.	3.	4.	5.
1st ploughing (alzar)	3.00	2.17	3.22	3.16	3.00	5.00
2nd " (bina)	2.50	1.85	2.85	2.70	2.50	4.00
3rd " (tercia)	2.50	1.66	2.23	2.40		
cohecho y sementera	5.00	3.32	3.32	4.83	3.00	4.00
Sub-total	13.00	9.00	11.62	13.09	8.50	13.00
sowing	0.50	n.a.	n.a	n.a	2.50	5.00
TOTAL	13.50				11.00	18.00

Notes:
1. traditional plough and mules.
2. vertedera (traditional plough for cohecho & sementera) and mules.
3. traditional plough and oxen.
4. Sierra
5. Campiña, using a vertedera for alzar and bina.

SOURCE: JCA Avance cereal, Sevilla 3 pp.124 and 130; Noriega la tierra labrantía, pp.109-15 and 120-32 and IRA datos. pp.315-325.

winter ploughings might reduce the numbers required in the spring), and the financial return on the cost of an extra ploughing (depending on wage labour costs, availability of animals, commodity prices, etc.). As shown in Table 5, the vertederas had greater labour requirements as they worked deeper, and therefore slower. However, there were productivity gains to be obtained by switching from using oxen to mules in plough teams. Complete information is only available for Sevilla and Córdoba, but this suggests that mule teams increased from 34.7% of the total in 1891, to 64.4% in 1933 (23). Although statistically it cannot be shown that the greater diffusion of the vertedera, with its greater labour requirements, was offset exactly by the increased numbers of mules (and consequently greater labour productivity), the evidence contained in Table 5 suggests that there was probably no significant change in labour demand, at least for ploughings.

B. HARVESTING. It can be safely assumed that in the nineteenth century, with very few exceptions, all crops were harvested by hand (24). The traditional methods of cutting corn with a curved hook, beating olives to the ground, cutting grapes from the vine with knives and collecting legumes by hand, would also continue in many places for decades. However, it is estimated in Appendix 2 that the 4,952 reapers of differing types to be found in the provinces by the Second Republic cut about a third of all small grains. Change, at least with cereals, appears to have been significant by the end of the period.

When organising harvest labour using traditional methods, the farmer had to choose between speed, which inevitably resulted in some damage to the crop and spillage, or to maximise harvest output at the expense of hiring more labour. As the harvest was a time-bound operation, lower yields and poor quality being obtained when the collection was too early or late, the collection method frequently depended on the quantity of work available (harvest size), and the available labour force. In general, the farmer appears to have wanted to harvest in the shortest time possible to protect the crop from disease, pests and theft, while the farm worker normally aimed to maximise his total harvest earnings, by working more

days, although at a lower hourly rate. As a result, worker militancy was frequently timed to coincide with the harvest (25).

The productivity of harvest labour therefore varied according to the form of labour contract established (piece work or day wage), the method of collection and the acquiesce of the labour force. It also varied according to harvest size. In Appendix 2 it is suggested that larger cereal harvests (or lower labour productivity, the situation is not clear) in the period 1930/5 in comparison with those at the beginning of the period implied an increase of approximately 2.5 days/ha in collecting time for costs. Consequently, the 807,254 hectares cropped with cereals in 1930/5 (rice and maiz are excluded), would have required an extra 2.02 million days to harvest if collecting methods had remained unchanged. However, the greater use of reapers and reaper-binders, which required only 3.5 days/ha and 0.5 days/ha of labour respectively, implied a saving of 2.24 million days work on the 265,655 hectares where they are calculated to have operated. By their nature, these figures are very approximate, but it would seem that changes in technology offset the greater labour requirements to collect the larger harvests at the end of the period in comparison with the begining.

With the olive no changes in technology or cultivation methods are apparent during the period. A recent study of traditional methods in the olive harvest has noted that when a harvest doubles from one year to the next (not unfrequent with this crop), a harvester is able to collect approximately fifty per cent more in an hour (26). From annual production figures, an attempt is made to calculate annually the time required to harvest a hectare in each province, based on the yields per tree. Total labour requirements are then obtained by multiplying the figure by the number of trees per hectare, and the total area in cultivation (27).

C. CARTING AND THRESHING. The form of transport used in carting depended on the economic situation of the farmer, state of roads and nature of terrain (28). The cost of transport also varied according to the distance travelled and the seasonal demand for animals. In general, animals were

used throughout the period, although motor transport was sometimes used to carry olives towards the end (29). Estimates of the costs of different types of transport are available for different periods, but sufficient infromation does not exist to give a satisfactory figure for different crops over time (30). Instead, a fixed figure of 1.25 days/sown hectare has been used for the whole period, which assumes implicitly that transport productivity increased in line with yields (31).

Four methods of threshing grains can be distinguished: treading under hoof, threshing boards, threshing machines and, very rarely, combine harvesters. The use of loose animals to seperate the grain occurred mainly on large horse breeding estates, where animal costs were low and labour not plentiful (32). However, the most widespread method involved the use of boards pulled by animals on threshing circles, the grain being seperated by either flints or iron rollers set into the boards. Threshing machines, although more costly and requiring a greater feed area than mechanical reapers, appear to have been more widely established in Andalucía at the start of the period, although that was not the case by the Second Republic. As has been argued elsewhere, the reason for their early appearance with respect to reapers appears to be that they were less likely to require repairs, the operation was less time-bound than harvesting, and savings were achieved on a relatively scarce resource at the end of the century, animal power, whereas reapers increased the demand (33).

By 1932, it is calculated that some 20% of grains were threshed mechanically (see Appendix 2). Given that crop yields increased by approximately the same amount, a singe figure based on the area cropped can be used for all years (this assumes, of course, that diffusion of threshing machines occurred at a similar rate as improved yields were obtained, and takes no consideration of changes in harvest size).

D. OLIVE OIL EXTRACTION. The century prior to the Civil War witnessed significant changes in the processing of olives in Andalucía. Manjarres y Bofarrull noted changes in the olive mills in the 1870's, with cylindrical shaped stones being substituted first by conical rulas, and later by rulos,

both leading to improved labour productivity (34). However, it was the changes that occurred at the end of the century, coinciding with the growth in exports of edible olive oil, that transformed the industry. The old wooden presses, especially the vigas, were replaced with ones worked by hydraulic systems, factories for the chemical extraction of oil from the orujos became more common after 1860 and a totally new operation, refining, took place on some oils, although the site of the refineries was more likely to be found near ports, rather than areas of production (35).

TABLE 6.

OLIVE OIL PRESSES ACCORDING TO TYPE, 1856-1930.

	1.	2.	3.	4.	5.
1856			202*	127	3477
1889/90	69	23		202	665
1905	209	99	58	222	514
1910	283	84	64	219	490
1922/3	615	128	166	197	324
1930	1458	132	283	249	209

Notes: (1) hydraulic -water,steam, gas driven
(2) -animal powered
(3) -human powered
(4) husillo
(5) rincón, torre y viga.

* Includes presses of 'double presion'. All have been assumed to be human powered.

Sources: Monlau,J. Tratado de olivicultura (Mallorca,1877), p.285; Dirección General de Contribuciones, Impuestos y Rentas: Estadística administativa de la Contribución Industrial y de Comercio. Years as above.

The speed of change in the region's presses can be seen by examining tax figures although, because of the nature of this source, they inevitably significantly underestimated the number (36). The hydraulic presses were preferred for their greater power, ease of operation and the better yields obtained from the olives (37). They also had important cost advantages and implications for labour demand. To calculate the effect of these changes on labour absorption, another excellent study written by Noriega in 1899 has been used. The estimated labour time to process a ton of olives was 2.38 days when using a single rula and viga press, and 1.52 days when

two rulos and a hydraulic press (38). The hydraulic press used in Noriega's calculations had a capacity of 75 fanegas/24 hours, which would appear to have been small by 1921, when the average productivity in Córdoba was calculated as 143 fanegas/day. However, the difference in labour requirements per unit of production was not very diferent, being 6.56QM of olives per labourer in the case of Noriega's hydraulic press, and 6.25QM in Córdoba. Total labour demand can therefore be calculated based on 2.21 days per tonne in 1886/90, and 1.6 days in 1921 as given for Córdoba (39).

4.LABOUR ABSORPTION AND STANDARD OF LIVING.

From the brief discussion above, it can be seen that changes did occur in the agriculture of the region, but their effects on labour demand were often offset partly or totally, by other factors. From this information, and changes in the area cultivated, it is possible to measure long term movements in work opportunities during the period (40).

TABLE 7

AN ESTIMATE OF MALE LABOUR OPPORTUNITIES IN AGRICULTURE

	agric. popul.	minus herdsmen	sub total	cereals	million maize	days legumes	labour olives	by crop vines	other crops	fert	TOTAL	man days /year
1886-90	457551	41756	415795	16,489	,473	2,54	17,82	4,436	2,444	,673	44,875	107,93
1898-00	474415	53640	420775	20,905	,413	3,482	18,08	3,384	2,444	,725	49,433	117,48
1901-05	477636	59582	418054	19,143	,45	3,047	20,6	2,343	2,444	1,011	49,038	117,30
1906-10	480450	67010	413440	18,642	,443	2,757	20,12	2,502	2,444	1,153	48,061	116,25
1911-15	483264	74437	408827	18,36	,448	2,686	22,07	2,763	2,483	1,306	50,116	122,58
1916-20	486078	80350	405728	18,419	,537	2,931	23,83	2,817	2,515	1,147	52,196	128,65
1921-25	498350	81720	416630	18,508	,613	3,448	24,64	2,861	2,822	1,475	54,367	130,49
1926-30	516927	82837	434090	18,744	,777	3,627	25,91	2,637	3,165	1,51	56,37	129,86
1931-35	535504	83954	451550	18,613	1,028	3,096	26,01	2,756	3,763	1,54	56,806	125,80

Man days/year achieved by dividing the total number of days labour by the net agricultural population (after substracting the numbers required to care for livestock).

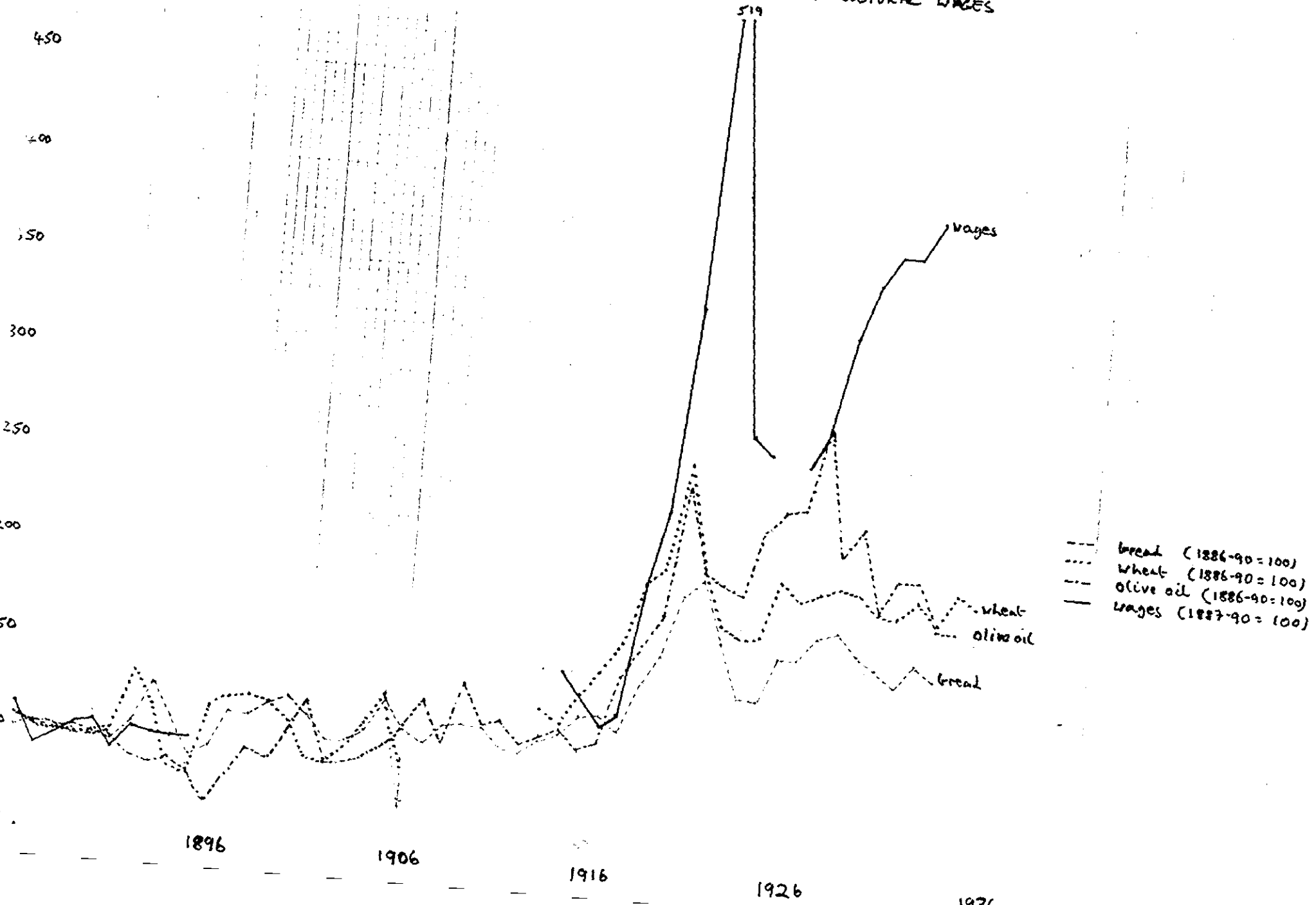
Sources: See text and Appendix 2.

The figure in Table 7 suggest that labour opportunities moved from a low of approximately 108 days/year to a high of 130 in 1921-5. These figures are on the low side, although by how much is difficult to establish as contemporaries, and historians, are far from agreed on a figure. Moriega estimated 280 days work for male workers, and 120 for female or children for Sevilla (1897) compared to a figure of only about 155 days by Fuentes Cumplido (1903)(41). The calculation in Table 7 excludes weeding of cereal and legumes, a task which traditionally employed large numbers of people, especially women, but that varied considerably in its intensity from year to year (42). If this task is included in the total at the rate of 7 days/ha/year, then the total labour demand can be increased by approximately 15 days annually. Also excluded are all tasks related to management (both active and passive), agricultural fixed investment (although olives and vines in plantations are included when given in the statisitics), forestry, fishing and hunting and scavenging (legal and illegal). The importance of cereals and olives in the local agriculture in providing employment outlets for the agricultural population is clearly seen.

Whereas the Table perhaps does not clarify the great differences in labour opportunities as noted by contemporaries, it does show some light on the long term trends. The changes in technology and areas cropped do not appear to have diminished labour opportunities over the fifty years prior to the Civil War, if anything, the reverse appears to be true. However, in the short term, landowners might well have reduced demand if factor or commodity prices moved adversely against them. Likewise, agricultural workers living standards depended not just on work opportunities, but the level of wages and the cost of living. To establish a general framework for discussion, the prices of wheat, bread, olive oil and agricultural wages are brought together in Graph 1 (details of sources and methods in Appendix 3).

In an article in defence of wheat farming and tariff policy, Manuel de Torres in 1934 drew attention to the fact that wheat prices, for every year since official statistics had begun (1913), were below that of the general price index, and graph 1 shows that wheat prices after 1913 moved

MOVEMENTS OF BREAD, WHEAT, OLIVE OIL PRICES, & AGRICULTURAL WAGES



higher than those of bread (43). This would have benefitted agricultural labourers in two ways, greater profitability for farmers (and thus more work opportunities), and lower food prices. In the first twenty years of the period the situation was mixed, thus the long term trend can be seen as generally favourable to wage labour. With respect to olive oil, prices showed a much stronger to rise than wheat towards the end of the period, but all price series are below those of wages from the First World War.

Between the mid nineteenth century and the start of the twentieth there appears to have been very little long term change in wage levels. This fact is suggested by the figure of 1.75 pesetas a day for hoeing in Sevilla contemporary studies in 1864, 1888 and 1904 (44). Likewise the encuesta of 1849-56 suggests a daily wage of between 1 and 1.5 ptas for all Andalucía, which is only slightly less than the 1.25-1.50 provided in the survey of the Comisión de Reformas Sociales en 1905 (45). Some time shortly prior to the First World War, wage levels started moving upwards slowly, but more spectacular increases occurred in the periods 1918-21 and 1927-34. Between these two periods wages fell back slightly, but not to the levels that they had been. As shown in the Graph, wages had a tendency to move ahead faster than other prices, and it can be supposed that living standards showed some improvement for those workers who enjoyed similar levels of employment as in earlier periods. However, farmers reacted in two ways to this increase in wage costs, either by reducing the number of agricultural tasks to save on their total wage bill, or they showed a greater interest in mechanisation (46).

It is clear that living conditions in Andalucía for the vast majority were extremely harsh, but from the evidence of wages, bread prices and work opportunities presented here, there does not appear to have been any long term deterioration. What is to explain the greater militancy of the workers after the First World War? A number of reasons can be put forward. Firstly, after a long period of comparative stability in prices and wages, the greater fluctuations and uncertainty in the twenty years prior to the Civil War can be regarded as a major cause of tension, as farmers reconsidered their production methods and labourers their attitudes in the face of new economic situations. Secondly, the level of political

consciouness of workers, while in part affected by living conditions, is also influenced by changes in expectations. Better organisation, events outside the region (Russia 1917), a reduction in repression and the declaration of the Republic can all be cited to explain a greater militancy.

Notes:

1. For example Brenan,G. The Spanish Labyrinth (1960 ed.) pp.121-6.
2. Carrión, P. Los latifundios en España (2nd.ed.,Madrid 1975) Cuadros 1 & 2, refer to Cádiz, Córdoba, Jaén and Sevilla, the provinces studied in this paper.
3. Ibid. p.303.
4. Carrión wrote 'la oferta de brazos es numerosa mientras la demanda es pequeña, no sólo por ser pocos los propietarios, sino porque la tierra se explota deficientemente' (Ibid. p.340).
5. Perhaps some 80% of the total acreage in England was in the hands of fewer than 7,000 proprietors in 1872-3. Beckett,J.V. "The Pattern of Landownership in England and Wales, 1660-1880", The Economic History Review , vol.xxxvi, no.1, Feb 1984. See also Thompson,F.M.L. English Landed Society in the Nineteenth Century (London & Toronto, 1963)ch. 5.
6. Tedde,P. "Sobre los orígenes históricos del subdesarrollo andaluz: algunas hipótesis" in Sánchez-Albornoz, La modernización económica de España 1830-1930 (Madrid, 1985) pp. 306 and 309.
7. A more optimistic picture of agricultural change is especially the hallmark of the work of the Grupo de Estudios de Historia Rural
8. Tedde, op.cit. pp.306-9; Bernal,A.M. "Señoritos y jornaleros: la lucha por la tierra" in Domínguez Ortiz (compil.) Historia de Andalucía, vol. 7 p.218 and Simpson, Agricultural Growth and Technological Change: The Olive and Vine in Spain, 1860-1936 (Ph.D. Thesis, London University, 1985, unpublished) esp. chp. 5.
9. In this respect, Table 1 includes for 1920 and 1930 categories such as 'rentistas', 'propietarios que viven principalmente del producto de la locacion de sus inmuebles' and 'pesca' which, for our study are not relevant. However, as they appear to be included within the figures for 1887 and 1900, their omission would hide the growth in the size of the agricultural work force.
10. Using a narrower definition of agricultural labour for 1920 ('forestales y agricolas') and 1930 ('explotación de montes, agricultura y ganaderia') the growth is 0.8%.
11. Thorner, cited in Booth & Sundrum, Labour Absorption in Agriculture (Oxford 1985) p.132.
12. These points are often implicidly found in the writings of contemporaries. See for example Carrión on the need for small holdings for irrigation and Bernaldo de Quiros to diversify crops which would employ labour which would otherwise be unemployed.Source?
13. This excludes livestock. Other cereals and legumes accounted for a further 11.7% of the value. Ministerio de Fomento Avance estadístico de la producción agrícola en España (Madrid, 1922).
14. What is being valued is must not the finished product. Blending and maturing increased significantly the value of the product.
15. JCA Avance cereal Cádiz, 1, p.287, Córdoba, 1, pp.423-4, Sevilla, 3, pp.110-11.
16. The poorest soils were to be found in the Sierra Morena, where a shifting cultivation was practised, know as rozas or celtico. Traditionally an area had been planted approximately once every ten years but, it was noted for Sevilla at least, the rotation had been reduced to five, thus reducing the 'preconizada ventaja de este sistema' (JCA Avance cereal Sevilla 3,109). Given the comparatively small areas

of sown land involved, this cultivation system can be excluded from our calculations.

17. GEHR,"Evolución de la superficie cultivada de cereales y leguminosas en España 1886-1935", Agricultura Y Sociedad, no.29, 1983, pp.285-325. According to this study, based on official sources, 63% of the rotation was sown in Cádiz, 57% in Córdoba, 61% in Jaén and 69% in Sevilla. If these figures are correct, the provinces would appear to have been relatively heavily croped.
18. These tasks were low paid and often carried out by women and children.
19. Puente y Rocha, J. Memoria que sobre el estado de la agricultura, industria rural y ganadería de la provincia de Córdoba (Córdoba 1875) p.12, and JCA Avance cereal, Córdoba p.406, Jaen p.181, Sevilla p.130.
20. Simpson, "La elección de técnica en el cultivo triguero y el atraso de la agricultura española a finales del siglo XIX", Revista de Historia Económica, Año V, No.2 pp. 279-281.
21. Noriega noted that some farmers were using them for all ploughing tasks, thus obtaining savings on human and animal labour, but at the expense of poor quality winter ploughings. Noriega y Abascal,E. La tierra labrantía y el trabajo agrícola en la provincia de Sevilla (Madrid, 1897) p.117 and JCA Avance cereal, Sevilla, p.130-1.
22. Ploughs include arado romano, vertedera fija, de doble vertedera y polisurcos. By province, the traditional ploughs represented Cádiz 67%, Córdoba 27%, Jaen 13% and Sevilla 45% of the total.
23. Only cattle and mules have been considered as horses were rarely used as yoke animals. Dirección General de Agricultura, Industria y Comerecio La Ganadería en España. Avance sobre la riqueza pecuaria en 1891 (Madrid, 1892), vol. 4, pp. and Ministerio de Agricultura "La ganadería en España" in Tres estudios económica (Madrid,1934) pp.75-84.
24. The first harvester was tested in the late 1850's, but they were still rare at the end of the century. Heran,F. Tierra y parentesco en el campo Sevillano: la revolución agrícola del siglo xix (Madrid, 1980), p.190, Simpson la eleción técnica en el cultivo triguero, p.285.
25. One estimate suggests that a worker spent approximately 6 days/ha to harvest cereals when paid by time, but less than 3 days when piece rates were used. Torrejón y Boreta,A. Economía y Valoración. Agrícola, Forestal y Urbana (Madrid, 1933) p.488.
26. Ministerio de Agricultura, Explotaciones Olivares Colaboradas, 2. Recolección, campaña 1973 y 1974, mecanización de la operación, Madrid 1976, cited in López Ontiveros, A. El sector oleícola y el olivar: oligopolio y coste de recolección Madrid 1978, pp.
27. For details and figures for the provinces of Córdoba, Jaén and Sevilla, see Simpson, thesis pp.236-40 and 409-17.
28. The cost of a pack horse might be two and a half or three times as much when the terrain was steep and dangerous than when it was flat. Noriega, la tierra labrantía, p. 139.
29. JCA, el aceite de oliva en España (Madrid, 1923) p. 345.
30. E.g. Ibid.pp. 280, 324, 336 & 345; Noriega, la tierra labrantía pp.139-47 and Ministerio de Fomento, Información Vinícola, Madrid 1886, pp.40-3.
31. The average time give to carry wheat and barley in Córdoba in 1886/90. JCA Avance cereal, Córdoba pp.418-9.
32. Ibid., Sevilla, p.145.
33. Simpson, la eleción técnica en el cultivo triguero, p.292-5. The figures from Noriega, la tierra labrantía, pp.105-6, 149-53 can be shown as follows:

method	daily output hl	no men	output per man	output per animal
animals -hoof	60.0	25	2.400	2.50
'trilla de cilindos'	7.5	4	1.875	3.75
threshing machine 'Ramsomes'	135.0	22	6.136	135.00

34. Manjarres y Bofarrull, R. El aceite de oliva (Madrid, 1896), p.105?.
35. In 1921 there were five large refineries in Malaga itself, and another in Antequera. JCA el aceite de oliva p.301. Other changes to be noted including the production of aceite fino, which involved a duplication of storage equipment to keep the oil from various pressings separate, and the use of laminated iron or tin for storage containers, instead of traditional materials which were difficult to clean and contaminated the oil. These changes occurred primarily in the twentieth century, and especially after the First World War. Simpson, thesis, pp.173-186.
36. Pequeño y Muñoz,J. Nociones acerca de la elaboración del aceite de oliva (Madrid,1879), p.333. Assuming the working speed of the presses in Córdoba provided by Ullastres Coste in 1921 is correct, and that all hydraulic presses in the province were 'large', then the average harvest for 1919-23 would have taken 210 days to have processed using the presses found in the 1922/3 tax returns, and not the 100 days as suggested by the provincial agronomist. Using the same speeds, but tax returns for 1910 and the average harvest for 1908-12, the figure reaches 298 days, although in 1911 alone it would have been 712 days. Calculated from Table 6, JCA el aceite de oliva pp.348 and 356, and Simpson, thesis pp.410-11.
37. JCA el aceite de oliva, p.282. The greater yield obtained is not apparent when annual production figures for the first third of the century are examined See, Simpson, thesis p.219.
38. Noriega also mentions a more advanced system in his study, worked by steam and requiring a capital outlay 7 or 8 times greater than the normal hydraulic press, with a capacity to handle 280 fanegas of olives daily, Noriega,E. "Memoria acerca de la fabricación de aceites en la provincia de Sevilla" (1901), reprinted in Agricultura y Sociedad, no.19, 1981, p.322. This appears to have been large even by 1921 standards, when the provincial agronomist in Córdoba separated hydraulic presses into two categories according to whether they processed 120 or 180 fanegas daily (20 hours, JCA el aceite de oliva p.348).
39. This assumes 80% of the olives were processed with equipment which had the productivity of Noriega's rula and viga, and 20% by rulos and hydraulic press, a ratio based on the figures given for 1889/90 in Table 6. Figures for other years are obtained by extrapolating those of 1889/90 and 1921, producing a figure of 1.32 days in 1935, reflecting the continual increase in the quality of presses.
40. Annual figures for individual cereals, legumes, olive and vines have been used, and the information from Table 2 for other crops. In this work only, tractors and rice have been excluded from the calculation.

41. Noriega la tierra labrantía, p.84, Fuentes Cumplido,F. Memoria que obtuvo el accesit en el Concurso del Instituto de Reformas Sociales de 1903 (Lema : El problema agrícola resuelto por los obreros agrícolas) (Madrid, 1904) p. . Bernal has suggested 180 days (in Domínguez Ortiz, op.cit. vol 8 p.86) and Gómez Mendoza, based on La crisis agrícola y pecuaria, uses an average for all Spain of 210 days, although, the figures are 260 for Cádiz and Córdoba, and 250 for Sevilla (Ferrocarriles y cambio económico en España, 1855-1913, Madrid 1982, pp.101-4).
42. In periods of drought, or other periods deemed unsuitable by landlords, this task was often excluded. See Díaz del Moral, Historia de las agitaciones campesinas andaluzas (Madrid, 1977 ed.) pp.206-7.
43. Torres, Manuel de, "El precio del trigo y del pan" in Agricultura. Revista Agropecuaria, vi, no.64, 1934 pp.231-233.
44. Hidalgo Tablada,J.Curso de Economía Rural Española (Madrid, 1864),1, p.297; La crisis agrícola y pecuaria,3, p.634 and Benítez Porral,C. Memoria que obtuvo el accesit en el concurso "El problema agrario en el Mediodía de España" (Madrid, 1904) p.139.
45. AMA Bancos Agrícolas, Leg.123,exp.4-4bis, quoted in Moral Ruiz, La agricultura española a mediados del s.XIX 1850-1870 (Madrid, 1979) p.119. Tuñon de Lara also gives a figure of 1.50 ptas. for agricultural workers in Andalucía for the period 1854-66, El movimiento obrero en la historia de España, 1832-1936 (Madrid and Barcelona, 1974), 1, p.100. Instituto de Reformas Sociales, Resumen de la información acerca de los obreros agrícolas en las provincias de Andalucía y Extremadura (Madrid, 1905). Out of 51,525 replies, 48% said the average wage was 1.50 ptas, 26% 1.00 and 14% 1.75%.
46. See for example the article by Quintanilla y Fabregas, "Difusión del material agrícola con miras a la reducción de mano de obra" in Boletín de agricultura tecnica y Economía xv, 1923, pp.918-22. The machinery on occasions could not be used. For example, El Progres Agrícola y Pecuario, no.1684, 30/4/31 reports that the Governor of Sevilla banned the use of harvesters in the regions of the province where there were unemployed workers.

APPENDIX 1.

DISTRIBUTION OF CROPS, 1886/90-1930/5. (for Table 2).

Notes:

1. 1886/90. Areas sown have been calculated by diving the total production in each partido judicial by the yield of the most appropriate crop rotation: al tercio in the cases of Cádiz, Córdoba and Sevilla, and a weighted balance of al tercio, año y vez and anual for Jaén. In addition:

Cádiz- the following yields have been used: rye 10 hl., oats 13 hl., maize 8.5 hl. and alpiste 7.5. As no crop figures are given for the districts of Cádiz and San Fernando, the totals of the other districts have been increased by 10%.

Córdoba- an estimate of 15,000 has of rye, 1,500 of maize, 4,000 oats, 600 alpiste, 100 zahina and 2,000 of yeros has been made, based on later studies for this province and other provinces examined here.

Jaén- the information for the partido judicial of Jaén looks particulary suspect, and consequently the area of barley has been reduced by 20,000 hectares, and that of wheat increased by the same amount.

2. 1905/10. The figures for Roots, tubers and bulbs and fruit trees refers to 1905/09, that of raw materials and market gardening 1906/10.
The figure for irrigation in Market Gardening has been obtained from the ratio in 1922, and for olives obtained from JCA, El Regadío en España (Madrid, 1904). The area of potatoes has been separated between irrigated and non-irrigated land using the ratio found in JCA, Noticias estadísticas sobre la producción agrícola Español..1902 (Madrid, n.d.), and those for onions and 'others' in this category obtained using the same ratio.

3. 1922. All oranges are assumed irrigated.

4. 1930/5. The figure for olives and vines includes areas still not in production when given.
Information in 'Roots, Tubers & Bulbs includes figures for potatoes and onions from 'Market Gardening'.
The figure for irrigation in Market Gardening has been obtained from the ratio in 1922,

SOURCES: 1886-90.Dirección General de Agricultura, Industria y Comercio, Avance estadístico (Madrid, 1888, 1889 and 1890).
1905/10. Ministerio de Fomento, Dirección General de Agricultura, Avance estadísitico de la riqueza ..en España (Madrid, 1913, 1914 and 1915).
1922. Ministerio de Fomento, Dirección General de Agricultura y Montes, Avance estadístico de la producción agrícola en España (Madrid, 1923)
1930/1. Min. de Agricultura, Anuario estadístico (Madrid, 1931-6).

APPENDIX 2.

1.PLOUGHING AND SOWING. CEREALS AND LEGUMES. The average labour requirement for planting the barbecho and sowing for cerals was 13.50 days/hectare in 1886/90, and 14.50 in 1934 (see Table 5), consequently the changes in plough types and draught animals can be regarded as small and excluded from the calculations. What is required is an average rate which can be regarded as representative of different geological areas and different rotations. For all cereal crops (excluding maiz and rice), and legumes, a figure of 10 days labour is used, being an approximate average for 1886/90 and 1934 as shown in Table 3.

OLIVES. Annual cultivation tasks with this crop were partically susceptible to short term changes in demand, as the farmer could hardly uproot his crop to plant another without incurring considrable expense. According to one survey (Sanz, et al. El paro estacional campesino, Madrid 1946 pp. 130-2) the annual labour requirements, excluding those related to the harvest and carriage of manure, varied from 28.6 days/ha on carefully cultivated palntations, to 13.95 on 'normal' and 9,0 on deficiently cultivated ones. These estimates have been regarded as as being on the low side, and it is noteworthy that this source is only concerned with male labour. The government enquiry of 1888 suggests 21.5 days/ha., and that of 1934, 24 days in the Campiña of Sevilla, 17.5 in the Sierra, and approximately 25 in the Campiña of Córdoba (JCA Avance estadistico sobre el cultivo y producción del olivo en España, 1888,Madrid 1891, pp.x-xv, and IRA, op.cit. pp.177-88 and 315-25). As short term trends are clearly impossible to determine, 20 days/ha has been assumed as the norm for all years.

2.HARVEST LABOUR. CEREALS. Traditional Methods. The 1886/90 figures for collecting wheat, paying by time, are Córdoba 8.00 days, Jaén 6.00 and Sevilla 6.68, although it is not clear if binding and stooking time is included (Avance, pp.144, 193-4 and 418). Collecting by destajo was quicker, and an average of 7.5 days has been assumed the norm. In 1934, the larger harvests suggest a suitable average might be 10 days, based on studies of Córdoba and Sevilla, which includes binding and stooking (Córdoba 13.0 and 9.3, Sevilla 13.0 and 8.0 for Campiña and Sierra repectively; IRA pp.183, 317 and 323). For barley the average is increased by 1.0 days for both dates, and oats reduced by the same figure (Ibid. p.183).

CEREALS. Modern Methods. No details of labour requirements are given in the Avance for the provinces being studied, although the Wood's reaper in Zaragoza required, on average, 4.8 man days/hectare, against 2.5 in Huesca, the corn being cut, bound and stook (Avance, 2, p.158 and 3, p.478). In Córdoba in 1934, to 'siega con maquina simple', required a labour force of 0.35 days, which suggests about 3 hectares were cut a day. If the reaper did not bind the corn, this had to be done by hand, requiring 3.25 days in the Campiña and 2.30 days in the Sierra (IRA p.183). There seems, therefore to have been little productivity increase over the period, although there must have been significant technical changes which improved the overall efficiency of the machinery. To calculate labour demand, it has been

assumed that labour requirements remained at 3.50 days/ha over the whole period for reapers, and 0.5 days/ha for reaper binders. Annual use is calculated as 52.5 has, based on a daily 3 has. and working 17.5 days a year (Revista Agricultura, no. 54, junio 1933, p.366 suggests 15 days for reapers and 20 days for binders). Of the 807.254 has of small grains sown in 1930/5, an estimated 265.655 has., or about a third, was cut by machinery. Using the productivity noted above, this implies 415,673 days labour to collect the harvest from 265,655 has., against 2,656,550 days using traditional methods.

LEGUMES. Yields changed little over the period, so labour demand for harvest is regarded as fixed. The figure for chick-peas and field peas (alverjones) is 4.5 days/ha, and for beans (habas) 6.0 days. Other legumes are assumed to have required 5.0 days/ha.

OLIVES. Two factors are used to calculate the labour requirements of this harvest, the area cropped and an estimate of labour productivity based on tree yields (Source: Ministerio de Agricultura, Explotaciones Olivares Colaboradoras, 2 Recolección, campaña 1973 y 1974, mecanización de la operación, Madrid, 1976 and López Ontiveros,A. El sector oleícola y el olivar: oligopolio y coste de recolección, Madrid 1978, pp.127-145). All olives have been assumed to have been collected by the vareo method and 10% windfall. Time includes moving groundsheets (mallas), collecting and sacking fruit. A minimum of 2,4 kilos/hour is assumed. The calculation is based on 90 trees/ha. in Cádiz, 100 Córdoba, 93 Jaén and 88 Sevilla (Ministerio de Agricultura, Anuario estadístico de la producción agrícola, Año 1926? (Madrid, 1927) pp.108-9. The working day used is 7.5 (after Noriega, la tierra labrantía p.111). The yield per tree in 1886/90 taken as 11.25 kilos, the same as the average for Sevilla between 1900-25, and the production of olives as 560,368 tonnes (see Simpson, 'La producción agraria en 1886-90; una enforque de la agricultura español del siglo xix', unpublished, pp.28-9). Transportation from the field is considered in the next section.

MAIZ. On non-irrigated land a figure of 17 days/ha is used for all operations, based on IRA datos, Sevilla pp.315-320. For irrigated land no figure has been found, and an estimated 30 days/ha has been used.

3.CARTING AND THRESHING. A simple 1.5 days/ha has been assumed for carting of all crops. As only about 20% of the cereal harvest appears to have been threshed mechanically, and crop yields had a tendency to increase by a similar amount, the quantity of labour to thresh the produce of a hectare is likely to have remained fairly constant over the period (Producticity of threshers taken as 124 QM/day and annual use, 30 days- Noriega, la tierra labrantía, p.150 and Revista Agricultura, op.cit. p.366). The following estimates are used, and include threshing, winnowing and 'cleaning' of the grain, (based mainly on the average between Sierra and Campiña in Córdoba in 1934 IRA p. 183): wheat 4 days/ha., barley 5, oats 2½, other cereals 4, chickpeas 3, beans 4 and other legumes 3.

4.VINES. The 1934 survey of the IRA suggests about 42 days/ha in Córdoba (Campiña) and 92 (Campiña) and 82 (Sierra) in Sevilla. For the earlier period the information from the JCA Avance of 1889 does not provide sufficient details, but Puente y Rocha for Córdoba gives a figure ranging from 150 days/ha in Montilla to 42 in the Sierra. As noted elsewhere, the quantity of labour required in Spanish vineyards frequently depended on short term movements of factor and commodity prices, as well as the type of wine being produced. Although is it dangerous to assume no change in the long term demand for labour, it is also difficult to arrive at a satisfactory figure. Given the generally higher labour requirements in viticulture than in most other crops (see Carrión, op.cit. p.), a figure of 80 days/ha has been used.

5.OTHER CROPS. COTTON. Assuming the deep ploughing in June required 12 days work when not done by tractor, the total labour requirements in Utrera in the 1930's was 53.5 days/ha for non-irrigated land. Of this women were traditionally employed for approximately 30 days (especially the harvest) which, if reduced by two thirds to produce male labour unit, implies a total of 43.5. Sumpsi gives a figure for the same period of 55 days/ha, and an average of 50 has been used here. On irrigated land, the total figure for Utrera was 144, or about 120 for male labour. Torrejón y Boneta, op.cit. pp.517-8 and Sumpsi,J.M. "Estudio de la transformación del cultivo al tercio al año y vez en la campiña de Andalucía" in Agricultura y Sociedad, 1978, no.6 p.60.

SUGAR BEET. Excluding time for carriage and distribution of fertilisers, it required approximately 134 male days/ha on irrigated land in Granada (Torrejón y Boneta, op.cit. pp.518-9), although another source suggests an average of 82.5 days, although without specifying which province (Sanz, et al. el paro estacional, p.51. As this figure is more in line with that for Córdoba (75 day, IRA datos, pp.) it has been preferred.

POTATOES. On irrigated land a figure of 76 days/ha is used (Sanz, el paro estacional p.52). For non irrigated land, half this quantity of labour is assumed.

ORANGES AND FRUIT TREES. A figure of 55 days/ha for all tasks has been assumed for irrigated trees based on Sevilla (IRA datos, pp.315-320). For non-irrigated trees an arbitary 9 days, similar to that of olives in 'deficient' cultivation ((Sanz, el paro estacional p.?) is used.

6.LIVESTOCK. Economies of scale could be achieved in some areas, for example a shepherd was able to look after equally well a flock of sheep of fifty or five hundred for normal duties. As no evidence is available for flock size, the following coefficients have been used, taken from Torrejón y Boneta, op.cit. pp.578-9:

horses, mules and cattle - 1 man + 1 zagal/ 20 animals*
sheep - 1 man + 1½ zagales/300 animals
goats - 1 man + 1 zagal /200 animals

pigs - 1 man + 1¼ zagales /100 animals

* refers to stable work for yoke animals.

The number of horses has been arbitarily divided into two to compensate for permanent non-agricultural work. The 1917 survey suggests that 75% of all mules worked (the above coefficients have been used), and the rest were either too young or for breeding, the quantity of labour for these categories being estimated as only a half of the above. The figures for vacuno creates many difficulties, as beef cattle required much less attention than milking cows or yoke animals. It is assumed that some 70% of the herd in 1891 required the above quantity of labour (based on the vacuno al labor for Sevilla and Córdoba), then falling constantly to 48% in 1933 (which represent those animals found in the category of leche and trabajo of the survey of that year). Finally, no figures are given for asses by Torrejón y Boneta, and this group has been treated identically as horses, i.e. one worker per animal.

DAILY LABOUR REQUIREMENTS FOR DIFFERENT ANIMALS.

	1891	1917	1933
horses	6,471	10,408	7,810
mules	5,272	12,157	16,050
cattle	14,015	26,630	20,798
asses	2,626	4,769	5,614
sheep	6,417	10,937	9,581
goats	2,749	4,515	4,697
pigs	4,206	10,963	19,404
TOTAL	41,756	80,379	83,954

Sources:See above

7.ARTIFICIAL AND NATURAL FERTILISERS.

An increase in the use of artificial fertilisers from the beginning of the century, although in much smaller volumes than natural fertilisers are two of the main features of this section, as recently Domingo Gallego has recently shown for Spain during this period ("Transformaciones técnicas de al agricultura Española en el primer tercio del siglo XX", in print. A coefficient of 5 kilos of manure for every kilo of live weight has been obtained by dividing the quantity distributed according to the JCA in 1919, by the livestock figures of 1917 (the weights used for animals are 3.26 QM for horses and mules, 3.71 vacuno, 1.72 donkeys, 0.77 pigs and 0.34 goats). This is less than half the figure calculated by Gallego for all Spain (10.?), which perhaps illustrates the low level of attention in this aspect of cultivation in these provinces. Sheep have been excluded from the calculation (as they spent a significant amount of time outside), and other types of manure such as urban rubbish, contents of cess pits and pidgeon coops have also been ignored. Using the livestock census of 1891, 1917 and 1933, an estimate of supply has been obtained which is extrapolated to other years (and tonnes respectively). For artificial fertilisers, an average of 12,168 tonnes in 1907/8, 63,134 tonnes 1919, and

83,543 tonnes in 1930/1 have been obtained, and prior to 1907 it has been assumed that the quantities involved were so small that they can be ignored. The only acceptable source to obtain an average figure for spreading fertilisers appears to be the Avance cereal of 1886/90, from which an average of 0.25 days/tonne is the time required to spread manure, and the cost of its transport 4 pts/tonne can be converted to 0.75 days/tonne (Avance Córdoba, 1,408; Jaén 2,182 and Sevilla, 3,132).

APPENDIX 3.

Sources for Graph 1.

BREAD PRICES. Average for the provinces of Córdoba and Jaén as given in Conard,P. and Lovett,A. "Le prix du pain en Espagne, 1850-1930" in Melanges de la Casa de Velazquez (Madrid, 1969) vol. 5, pp.436-9.

WHEAT PRICES. 1886-1906 an average of the four provinces. Sánchez-Albornoz,N. Los precios agrícolas durante la segunda mitad del siglo XlX (Madrid, 1975) p.162; Grupo de Estudios de Historia Rural Los precios del trigo y la cebada en España, 1891-1907 (Madrid,1980) p.185.
1913-1935. The figure is for all Spain, París Eguilaz,H. El movimiento de precios en España (Madrid, 1943) p.35.

OLIVE OIL. As no complete series exists for Andalucía, figures for Barcelona have been used which moved in a similar direction to those in the region under discussion. When the sources overlap, an average has been used: 1886-1916. Sánchez-Albornoz,N. and Carnero,T. Los precios agrícolas durante la segunda mitad del siglo XlX. Vol.2. El vino y el aceite (Madrid, 1982) p.181; Grupo de Estudios de Historia Rural Los precios del aceite de oliva en España, 1891-1916 (Madrid,1981) p.115. 1890-1924 for Andaluz corriente quoted from Memoria de la Camara de Comercio de Barcelona, in Instituto Geográfico y Estadístico, Anuario estadístico de España, 1920 vol 7, pp.190-2 and 1924/5, vol 11,pp.286-7. 1913-1935. The figure is for all Spain, París Eguilaz,H. El movimiento de precios en España (Madrid, 1943) p.41.

WAGES. For years 1887-1895, and 1891/2-1893/4, 1915/6 and 1921/2-1922/3 based on two estates in Sevilla, as given in González Arteaga,J. "Los salarios en Puebla del Rio (Sevilla) durante la crisis finisecular (1887-1923) in Revista de Historia Contemporanea, no.2 dic. 1983, pp.125-145.
1913-1931. Wages for male workers in Cádiz, Córdoba and Jaén (max. and min.averaged), quoted in Anuario estadístico de España, different years.