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“From horn to corn”:
the two regimes of portuguese agriculture, 1250-1850.

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Abstract: The purpose of this paper is to account for the changes undergone by Portuguese agriculture from 1250 to 1850, from the Reconquista to the Regeneração. We identify two clearly different agrarian regimes. One, in which pastoralism played a major role, was characterized by high land/labour ratios, high-wages, and high levels of living standards. Under the pressure of demographic growth, it transitioned, over the course of the sixteenth century, to a second regime, in which land-labour ratios fell significantly, arable took the lead over pastoral production, and farming systems became considerably more labour-intensive. After a shift to lower levels, labour productivity, real wages and per capita food consumption stabilized all along the seventeenth and eighteenth centuries. We analyse the reasons for this evolution bearing in mind in particular that population during this period roughly doubled. Technological change in two key agricultural sectors underpinned the emergence of this remarkable (non-Malthusian) situation by fostering an agricultural ‘industrious revolution’ based on wine and in grain. The former built on a long productive tradition, while the latter – the massive shift from other grains to maize- was an outstanding case of a Columbian exchange. We resort here to newly-constructed variables (real wages, per capita food consumption, labour intensity and productivity, land yields, per capita agrarian output) in order to obtain a unified and consistent perspective over these six centuries. These variables are constructed from a new data base (PWR) of prices, wages and rents in Portugal which covers the period under examination.
1. Introduction

“Grain or meat: the choice depends on the number of men”,
Braudel, Material Civilization and Capitalism

The performance of Portuguese agriculture in the pre-modern period is hardly unimpressive. Between the end of the Reconquista and 1850, it was able to feed, from a fixed stock of natural resources, a population that grew from about 700,000 to 3.4 million. This fivefold demographic increase, during a time when European population had merely doubled (Malanima 2009: 20), was accommodated by the Portuguese farm sector without a drastic sacrifice in living standards. At least it never fell persistently below the subsistence level.

This paper borrows from a recent article by Álvarez-Nogal and Prados de la Escosura (2013; henceforward ANPE). Like them, we argue that Portugal, and the rest of Iberia, experienced two successive and distinct agrarian regimes, which enabled it to adjust successfully to major changes in its environment. The first one, chronologically, was a “frontier economy”, in which a high land/labour ratio favoured high-wage agriculture, and pastoralism played a major role. This regime was capable of sustaining historically high levels of per capita output and living standards. In the present study, we consider that it extended from our starting point of 1250 to sometime in the 16th century.

The second was the contrary of the first in all respects considered. It was characterized by a significantly lower land/labour ratio, which led in turn to a shift to a predominance of arable over pastoral production, and to a far more labour-intensive farming system than before. Labour productivity, in the meantime, declined appreciably. Real wages and agricultural consumption deteriorated too and to a similar extent.

This paper has three aims. First of all, it seeks to fill the present void represented by Portugal in European and Iberian agrarian history by means of a quantitative analysis of these two regimes. Secondly, it tries to determine the timing and nature of the transitional process which linked them, a point which was overlooked by ANPE. In the third place, it focuses on the long-run nutritional implications of this development of Portugal’s agriculture in two stages and, in particular, their consequences in terms of living standards.

Our narrative is divided into five parts. Following this introduction, part II discusses the phase described by ANPE as the “frontier economy”, from the end of the 13th century to the late sixteenth century, and assesses the heuristic value of this concept in the historical context we are examining. Notwithstanding the Black Death (1348) and the ensuing social and economic turmoil, we find it useful to treat this era as a homogenous period, the main characteristic of which was the generous natural resource endowment then enjoyed by society. Part III concentrates on the shift from this state of affairs to the type of agriculture which became prevalent throughout Europe in the Early Modern period (Malanima, 2009: ch.8). It tries also to pinpoint the timing of the transition, stressing its gradualness rather than its abruptness.

1 In measuring land we follow the tradition which assumes that despite changes over the few last hundreds of years, the number of hectares in some sort of use has not changed much until the nineteenth century. In this perspective, what matters is the potential resource base, upgrades or changes of usage being assigned in the model to changes in “technology”. This procedure has been adopted by Williamson and O’Rourke (2005), Federico and Malanima (2004) and Allen (2003). We do the same for Portugal and assume that by 1500 all usable land was under some form of husbandry, even if not necessarily the most intensive. This would include rough grazing and prolonged fallows. We take this stock of land to have been equal to the area of “agricultural land” as measured by the UN-FAO in its 1958 Yearbook, namely 4.13 million hectares.
The fourth part explores the nutritional issues associated with this transformation and shows that besides the important innovations which shook this agrarian regime, others of a social and cultural nature were needed too, in order to make these alterations possible. The fifth part concludes.

This paper is based on a considerable amount of empirical evidence gathered and processed in the course of the “PWR- Prices, wages and rents in Portugal, 1260-1910” project, hereafter PWR. A significant proportion of these raw materials are already partly available on line. They have also been transformed into a collection of macro-economic variables for use in a number of companion papers to this one, where full explanations are given for how they have been constructed. These are cited in the present text.

2. The last phase of the Portuguese Reconquista ended in 1249, with the capture of Faro and of the last Moorish strongholds in the Algarve. In the years between 1217 and 1249, the surface of the country increased 33%. For Portugal, the spoils of this victory came in the form of vast quantities of land, largely abandoned by their former Muslim owners.4

During and after the Reconquista, those “empty lands” were generously distributed among landless inhabitants of the old realm. The availability of land prompted a migration from the northern lands. Settlement, however, proceeded at a slow pace as the country on the whole was sparsely populated. By 1329, in the words of a knight, the south west was ‘new land, with much scope for improvement’. Half a century after the conquest, by 1300, population density in Portugal was still only about 12 inhabitants per square km, a figure below European overall density and far below the core countries of the continent (Malanima 2009: Table 15).

Low density was coupled with an uneven distribution of the population. One decade after the fall of the Algarve, the lands south of the Tagus had about 10% of the population. By 1300, one-third of the country’s inhabitants were cornered in the northwestern lands, which corresponded to about one-eighth of surface, with the exactly the inverse situation in the southern, recently-conquered which corresponded to 35% of the territory but held only 13% of population. Nearly three centuries after the conquest of the Algarve, this imbalance had only been mildly attenuated, as the data from the 1530 census show in Table 1.

This significant redistribution of “empty lands” helped to promote a greater degree of inter-regional equalization of population densities, but did not achieve complete equality, so that different land/labour ratios persisted across the country. This in turn created growing opportunities for productive specialization and therefore for internal trade (stimulated by pacification and other transactions costs improvements). It also fostered greater unity of the polity, which may have made it cheaper for the state to enforce public order.

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2 The Fundação para a Ciência e Tecnologia has generously funded this research through two projects: PTDC/HAH/70938/2006 and PTDC/HIS-HIS/123046/2010.
3 They can be accessed at http://pwr-portugal.ics.ul.pt/.
4 While there is some scope for discussion about the fate of Muslim population, there is little ground to doubt that only a fraction of it remained and that it became demographically overwhelmed by their enemies during the conquest. Constant fighting and Christian incursions had worn Muslim settlements thin even before conquest. Archaeology has made clear that many Moorish rural settlements were abandoned around the time of the Christian conquest, some of them never to be occupied again. On the whole, no large pockets of moriscos remained.
5 TT, Ordem de Santiago/Convento de Palmela, DR, 1, 25.
6 For a distinction between ‘core’ and ‘periphery’ in the European contexto, Bartlett 2003, p. 20.
In the context of fourteenth-century Europe, land/labour ratios were decisive for the productivity of the agriculture (Henriques 2015). Measuring ‘land’ and ‘labour’ for such an early period requires some simplifications. Here we assume throughout that ‘land’ is a constant and that despite changes over the few last hundreds of years, the number of hectares in some sort of use did not change much until the nineteenth century. For “labour” we adopt the value of total population, as is generally done in the literature, given the lack of more precise information and in the knowledge that in a pre-modern society “population” and “labour force” were largely indistinct.

As shown in Fig. 1, from the end of the Reconquista to the early sixteenth century Portugal’s land/labour ratio was higher than it would become anytime in the following centuries. This freed the country from the fate suffered by most European core countries where, in the period before 1348, ”all usable land with the prevailing agricultural techniques had been taken up and a considerable part of the rural population was surplus to the economy” (Benedictow 2012, p. 35). This relatively favourable situation was improved when, the heavy death toll wrought by the Black Death allowed for 8 hectares of agricultural land per capita. Thus, Portuguese agriculture of this period appears relatively protected from resource constraints.

Portugal contained what can be called a frontier, i.e. a low-density territory that, through settlement, trade and religious conversion, was being integrated into its denser core areas. However, the existence of a frontier territory is a necessary but not sufficient condition to describe it as “frontier economy”. The concept of the latter requires a set of stabilised institutions that ensure easy access to land, freedom of mobility for the labour force and efficient markets. Was this the case of post-Reconquest Portugal?

The institutions that emerged during the Reconquista did not prevent either access to land nor internal labour mobility on behalf of Portuguese labourers. Feudal rules did not prove strong enough to block labourers to move southwards, or to avoid the large-scale abandon of seigniorial properties in the Northwest (Viana 2007). While adequate sources for assessing the integration of the markets are hard to come by, mid-thirteenth-century annual shepards’ wages north and south of the country were practically the same, hinting at a remarkable degree of integration of the labour market. Labour freedom was part and parcel of then current legal doctrines. In the Cortes of 1454, when required by a municipality to force wealthy farmers to use their oxen in ploughing rather than trading, King Afonso V answered that:

We do not deem this [demand] according to reason because men are to keep their liberty for using their bodies and properties as they see fit.

Labour mobility was matched by relative freedom from feudal ‘banalities’ that were so detrimental to the agrarian economy (Campbell 2005, p. 41). A ‘feudal’ setting, in which lords
exploit their ‘banalities’ and ban farmers from building mills or other capital goods in order to preserve their rents, does not apply to the present case. From the outset, even if some lords secured limited privileges, Portuguese common law was contrary to such monopolies (Marques 1978). The custom followed in Estremadura, the foro de Santarém, stated in no uncertain terms the freedom to build water mills and olive or wine presses. By an undated edict from Afonso III (1248-79), this liberty to erect mills became the norm throughout the kingdom. Even the most powerful abbey of the country, Alcobaça, had to comply with this law and let new watermills to be built by individual farmers (Gonçalves 1989: p. 189).

The tenurial institutions that emerged in twelfth-century jus communis encouraged the “conquest of ownership through labour”, as described by legal historian MJA Costa (1982). Access to property in the first generation after the Reconquista ensured that a sizeable portion of the farmers became landowners and those that remained were able to negotiate better terms for their tenurial contracts. This released the demand for tenurial land in the more densely-settled northern areas (Viana 2007).

The real wage of unskilled labour (see figure 2) is a critical variable for this type of study insofar as it reflects the efficiency of raw labour. The trajectory of the real wage shown in Fig. 2 indicates a strong, if irregular, rise from the 1260s to the early sixteenth century. This rise is certainly coherent with the wide availability of land shown in Fig. 1 and with the adequate institutional background exposed earlier. As noted, in the context of post-Reconquista Portugal, natural endowments might lead to increasing returns if combined with institutions that allowed labour mobility.

[Fig 2 here]

The rise of real wage before the Black Death was made possible by the presence of a large stock of yet unused agricultural land. Regional monographs provide diverse instances of wasteland converted into arable land until the middle of the fourteenth century (Boissellier 1999 and 2003; Coelho 1989: p. 18; Conde 2000: p. 229; Gomes 2004; Fernandes 1991, p. 71; Oliveira 2008, pp. 308, 324-5; Pontes 2006; Viana 2007). It could be added that the natural context was also helpful. The Reconquista and the subsequent settlement coincided with the so-called “Medieval Warm Period” than ran from 900 to 1300 in the Northern Hemisphere (Brazdil 2005). In this context, the ecological limits of the vine and olive, two demanding species, were wider than in present-day (examples in Durand 1983: p. 183; Henriques forthcoming).

Naturally, this was a “calamity-sensitive” (Bruce Campbell) agriculture and, as shown in Figure 2, day wages experienced strong fluctuations, mainly caused by changes in prices. The violent downswings of 1330-50 and 1380-90 can be related with the market disturbances brought by the 1333 famine and run-up to the Black Death and the wars that were fought with Castile between 1382 and 1401. These crises, nonetheless, did only temporarily halt this trend, which continued until the 1520s, when a succession of crop failures raised prices hitting Portuguese population hard (see also Fig. 6).

Despite these swings, it is possible to identify a plateau in the century that ran from 1410 to 1520 as a period of high day wages. The levels attained in this era were not bettered until the second half of the nineteenth century. Like elsewhere in Europe, the scarcity of labour induced

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10 See also Rau 1965.
11 In order to achieve satisfactory levels of consistency, we deflate nominal wages by an indicator based on the well-known “bare-bones” consumption basket, given that we lack sufficient data to reconstruct Allen’s “respectability” index all the way back to 1300.
12 For a discussion of the relationship between climatic change and the Reconquista, see Henriques, forthcoming.
by the Black Death and other diseases (‘the Golden Age of the bacteria’ Benedictow 2012, p. 30) paved the way to a *Golden Age of the Labourer* in the middle decades of the fifteenth century. That the rise in wages stemmed from the scarcity of labour is confirmed by non-qualitative sources, namely by the grievances presented to Duarte I (1433-8) and Afonso III (1438-82) in parliament (*Cortes*) by individual municipalities.\(^{13}\)

Interestingly, this fifteenth-century high plateau provides a contrast to the trajectory in real wages in neighbouring Spain. In this country, the 1420s real wage merely recovered the peak in the 1340s (ANPE, Fig. 2); while in Portugal the level in 1420s is considerably higher. One explanation is that the impact of the Black Death and in the late fourteenth-century was less disruptive in Portugal than Spain, because the latter was more advanced, i.e. more urbanised and specialised, and hence more vulnerable to the destruction of commercial networks. Portugal, in the other hand, had a considerable low level of urbanisation and, as far as sources indicate, the fifteenth century was a period of increasing specialisation (Rodrigues, forthcoming).

ANPE (p. 13) also venture that pestilence further “encouraged the formation of large landholdings. Thus, ‘agro-towns’ in southern Spain seem to be the legacy of a highly concentrated landownership which resulted in a large proportion of landless agricultural workers.” These institutional conditions seem not to apply to the present case, at least not with the same strength. The *rent/wage* ratio, as shown in figure 3, gives some substance to this claim, insofar as the levels attained in the early fifteenth century are considerably more favourable to labourers, hinting at a distribution of income that was becoming more, rather than less, equal.

\[\text{Fig.3 here}\]

The main forces that were raising real wages and living standards already before 1348 continued to work across the Black Death with renewed strength. Given the demographic losses, it was possible to increase specialisation in two, otherwise contradictory, directions: through the expansion of the pastoral area and through the expansion of cash crops. By emptying villages and hamlets, most of all in the colder, higher grounds, the Black Death resulted in the territorial expansion of the pastures (Coelho 1983: I, p. 235). Also, by reducing the overall demand for wheat, the pestilence provided an opportunity to convert marginal wheatfields into vineyards and olive groves.

Intensification mostly took the form of a “from grain to grape” transition, in which Lands assigned to grains, whose demand was inelastic, were converted to vineyard, an income-elastic commodity (Henriques 2015, Table 6). This trend has long been noticed by the arch-pessimistic agrarian historian Oliveira Marques (1986: p. 99).\(^{14}\) The expansion of cash crops did not start with Black Death but after 1348 it ceased to be limited to the marginal soils. The high land/labour ratios combined with the thinness of feudal strangleholds on labour mobility meant that there was considerable room for specialisation even before the Plague. Nonetheless, the post-Plague conditions allowed for a more efficient resource allocation and distribution of the population. This can be seen through urbanisation, which is certainly correlative to specialisation. In fact, the advance in urbanisation is noticeable for the 1300-1500 period, an era of decreasing urbanisation for some important European economies

\(^{13}\) See, for instance, the local grievances presented in 1440, 1454 and 1455 by the municipalities of Monforte, Leiria and Montemor-o-Velho against the dearth of wages (Coelho 2009, doc. 5; Moreno 1985, p. 120; Gomes 2004: doc. 222). The latter required that the king’s crossbowmen did the all-important digging work in the aluvial fields to compensate for the extravagant wages journeymen (*braceiros*) were demanding.

\(^{14}\) This issue is discussed in Barata and Henriques (2013:264-5).
(Malanima 2009, Table 5). Although external markets were unlikely to have major effect in the national aggregates, they certainly help Lisbon and other major port towns to urbanize and hence contributed to this specialization of agriculture (Melo 2009).

Assessing, let alone quantifying, the role of the pastoral economy in Portuguese agriculture is extremely hard. Given the existing sources, livestock remains far more elusive to the historians than wheat or wine. Nonetheless, commercial cattle-raising had been the default land use of the post-reconquered territories (Boissellier 1999: 364–8; Fernandes 1991) and kept a considerable weight in the older lands, with entire farms still dedicated to livestock from the mid fourteenth to the late fifteenth centuries (Azevedo 1905: docs. 1 and 2; Rodrigues 2006). The post-1348 growth appears distinctively in the centre of the country (Coelho 1989). The considerably more abundant sixteenth-century sources indicate some instances of specialization in cattle-raising in entire villages in the Serra da Estrela (Pina 1998: p 56) and in Montemuro (Fernandes 2001). Portuguese kings granted access to mountain pastures (Serra da Estrela and Campo de Ourique for Castilian herds), a decision which only attracted criticism in the sixteenth-century (Pina 1998: 56–8; Galhardo 1548), presumably because the pastures were being reclaimed for crops (Medeiros 1993).

These trends within Portuguese agriculture can be assessed through the Land Yield. This indicator is the gross agrarian product divided by the constant agricultural area and thus measures the productivity of the invariant natural resources. As Fig. 4 shows, the yield per hectare was at an all-time low in the post-Plague period, reflecting the abundance of land. This figure provides a mirror image of the trajectory of the real wage. Nevertheless, demography does not tell the whole story. When we compare the land yield for 1310s and the 1510s, two decades in which the population levels were similar (1,01 and 1,02 million, respectively), we see that the latter was twice the level of the former. Thus, in this two-century interval Portuguese agriculture doubled land productivity. 

[fig.4 here]

As population pressure crept upwards land yields increased. The demand for grain, which grows proportionately to population, signified the decline of pastoral agriculture. Also, the demographic recovery of the mid fifteenth century also contributed to lessen the scarcity of labour and, hence, a more intensive use of the land. This is visible in the evolution of the prices of the three main sectors within agriculture as can be seen from relative prices in figure 5. Meat/wheat price ratios surged forward in the 1560s and never returned to their earlier levels, whilst the fluctuations of wine/wheat price ratios appear far more restrained. This is perhaps the clearest illustration of the “horn to corn” transition, insofar as “horn”, i.e. land-intensive products, became more expensive relative to labour-intensive goods like wheat or wine. The timing of this change is roughly similar to the downswing detected in real wages (1540s). In fact, the former are also a valuable metric for assessing changes in the standards of living of the mass of the population. Likewise, the reduction of real wages took place in the middle of the sixteenth-century. 

[fig 5 here]

As displayed in figure 6, the real per capita and gross agricultural product provide a synthetic view of Portuguese farming during this period. As seen, the per capita level peaked in 1450. This decade appears as the optimal point, placed after bacteria and battles had ceased to

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15 One of the ‘grievances’ at the Cortes of 1490 was that the sons of farmers preferred to leave home and parents and rent three casais (farms). On two of them they would raise cattle for the market, and on the third they would raise crops to pay for their rents (Oliveira 1965).
disturb the markets and before population levels implied additional pressure on resources. Nevertheless, abstracting from these swings, the 1310-1530 interval saw a 1.5 times rise in per capita agricultural product. Population levels, as revealed by the 1527-32 census, were then only slightly higher than in 1310. Seemingly, at 1.3 million Portuguese farming had hit an ecological ceiling that it could not transcend with existing technology.

3. According to ANPE perspective on long term Iberian growth, the second agrarian regime of the pre-industrial era in Portugal should have emerged sometime towards the end of the 16c. and stabilized thereafter until the middle of the 19c. This was indeed the course followed and, once again, demographic growth was the main influence on the structure and performance of this sector. Whereas before 1500 population had only barely exceeded a million inhabitants, after this date it rose persistently to an unprecedented 3.4 million at the end of our period. This increase, by a factor of 3.9, placed Portugal second only in Europe to Great Britain in this respect. Unsurprisingly, this time the direct and indirect consequences of this performance were entirely different, to the point that Portuguese agriculture, became the very opposite of how it was defined in its previous stage of development.

Earlier, Malthusian pressures had been felt already during the time of the frontier economy, for example, during the early 1300s. Nevertheless, natural endowment per capita was then never anything less than generous and its implications were hardly negative. As a result, the country was able to initiate an early demographic recovery in the first half of the 15c., after the end of a spell of wars and major epidemics, so that less than a century later it was already back to its pre-Black Death population level. Beyond this point, however, the demographic recovery became a vigorous population expansion instead. In the context of a fixed supply of usable land, the stress on resources caused by this became ever more problematic for this society as a whole.

Figure 1 displays the standard measure for this situation, namely the land-labour ratio, which fell by almost 50 per cent in the course of the first hundred years now under consideration (1500-1600). It declined again to almost the same extent during the next two centuries and, by 1850, was close to one hectare per inhabitant, roughly eight times less than the 1350 peak of this variable. Such a tremendous alteration in factor proportions unavoidably shifted the nature of Portuguese agriculture in one important aspect at least: from the traditional low-labour intensity of the medieval era to the far more labour-intensive agriculture typical of the Early Modern period. Concurrently land yields over the three hundred and fifty years in question doubled (as increasing amounts of labour (and some capital) were combined with the constant amount of land disposable for agriculture, as can be seen in figure 4.

On the other hand and in accordance with the principle of diminishing returns to labour (Williamson and O’Rourke, 2005), this was accompanied by a severe reduction in labour productivity, which was reflected through the action of market forces, leading in turn to a long-term downward movement in real wages. Figures 7 and 2 show impressive declines, by roughly one half in both cases, between 1500 and 1850, respectively in real output per worker and in the real wage of unskilled labour, probably then the most common form of wage labour in this sector and indeed in the economy at large.

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16For the Portuguese population from 1500 to 1850, see Palma and Reis (forthcoming). For equivalent European data, see Malanima (2009).
Given the adjustment observed in factor proportions during this period of erosion of the Portuguese frontier economy, it is to be expected that the relative prices of agricultural commodities should have done so also. Animal products, which were more intensive in the scarce input, i.e. land, ought to have become dearer over time relative to those such as grain, which were more intensive in the more abundant factor, i.e. labour. As figure 5 reveals, the ratio between these two prices conspicuously trended upwards, from the era of the frontier to that of the “Early Modern European model of agriculture”. Indeed, the level corresponding to the interval 1300-1500 was half of what it became between 1600 and 1850. In the meantime, the ratio of wine to grain prices, both of them labour-intensive, varied little, although the former satisfied a basic need and the latter was income-elastic. We presume therefore that as land became increasingly sought after, arable production gradually crowded out animal husbandry, and this led to a re-structuring of this economy and a significant shift in the product mix.

Although all this appears plausible, it is not easy to find satisfactory empirical support for this view, in contrast with what happens in the cases of Britain or Holland, for which direct quantitative information on the components of total agriculture is plentiful (Broadberry et al, 2015; van Zander and van Leeuwen, 2012). What we know about Portugal, however, does corroborate the picture we have been drawing of a slow but persistent slide, over these three and a half centuries, from a pastoral to an arable prevalence. A simple proof rests on the comparison between two rare but fairly detailed benchmarks describing this composition and fortunately situated at the opposite ends of the period under consideration. In table 3, we can observe the shares, estimated at current prices, of the four traditional branches of the country’s agriculture - grain, wine, olive oil and animal products – over this stretch of time. The shift during this period is substantial, albeit covering a long period. Aside from documenting a slight rise in the share of wine and olive oil, it illustrates the transfer of purchasing power from expensive, protein-rich to cheap and carbohydrate-rich foodstuffs and presumably of a transformation of the productive structure in the same direction.

The second proof, this time of a qualitative nature, comes from the miscellany of studies on the agrarian history of Portugal which have focused on these issues. Impressions from this literature converge towards emphasizing two aspects. One is that animal husbandry was always a major sector of the rural economy, like in the rest of Europe. The second is that as the country moved steadily from one regime to the other, it became increasingly locked into a persistent social, political and economic conflict opposing interests of pastoralists and cultivators, with the latter gradually winning the upper hand and gaining ground at the expense of the former.  

In the scenario we have depicted above and given the limited possibility of resorting to external foodstuff supplies in order to sustain the population (Costa and Reis, forthcoming), it is tempting to conclude that, in terms of welfare, the impact of this long-run evolution should have been quite negative. Taking into account the centrality of food consumption in this concept and assuming that agricultural production in Portugal was overwhelmingly destined for the table, it seems logical to employ the trend performance of real agricultural output per

17 For a valuable overview, see Costa et al. (2011). The majority of these authors incline, erroneously in our view, towards the idea that grain production was always the largest sector and in the earlier centuries pay relatively little attention to its pastoral component.
capita to gauge this effect.\textsuperscript{18} Figure 6 displays this variable and brings to light the reduction in living standards which befell the mass of the population during the Early Modern period. By the mid-19th century, the average Portuguese inhabitant consumed, in real terms, just under half the food that their early 16\textsuperscript{th} century ancestors fed on. If the comparison is taken further back, to the mid-15\textsuperscript{th} century peak of material wellbeing of the Portuguese, then the fall comes to just over 60 per cent.

Such a reduction in living standards, even if spread over a considerable time span, may seem remarkable, not only because of its magnitude but, more importantly, because it seems to clash with a central tenet in the Malthusian analysis of pre-modern societies (Galor, 2005). The question raised is how could the Portuguese population grow without interruption during such a long time and, particularly, at the high historical rates it exhibited at times, when conditions of subsistence seemed set instead on driving a downward movement of the population?

Recent research on long-term Portuguese demographics and economic growth (Palma and Reis, 2015) suggests an approach to this conundrum. It can be grasped by examining figure 8 in which population, the real wage and the median of the real wage are displayed. While it is obvious that the real wage endured long spells of decline, even when it fell to quite low figures it never appeared in association with drawn-out moments of demographic retreat. The implication would appear to be that Early Modern Portuguese society must never have been, by definition, beneath the Malthusian “subsistence requirement”. Probably, this occurred because of the very high standards of living in the early economic frontier so that even after a marked real wage decline, a still reasonable margin was left for survival and maintenance of the population. The implication would be therefore that there should be no contradiction, in our analysis, with Malthusian principles, even in their canonical version.\textsuperscript{19}

[fig 8 here]

Thus far, our analysis of Portugal’s second agrarian regime has been based on a bird’s eye view of the period we are contemplating. A closer look at the evidence suggests, however, that there were significant variations within this time span which are worth taking into account. One of them is the issue of the changeover between these two stages of long-run agrarian development. Two others relate to critical transformations in Portuguese farming brought on by exogenous shocks in the 17\textsuperscript{th} and 18\textsuperscript{th} centuries, which greatly mitigated the impact caused by changing factor proportions. We turn now to the first of these three.

In their seminal account of the “Rise and Fall of Spain”, ANPE (2013: 17) claimed that the periods corresponding to the two “clearly differentiated” Spanish agrarian regimes were, respectively, 1270s-1590s and 1600s-1801s. In this optic, the transition between them would thus have been very short, perhaps a decade long, and located around the turn from the 16\textsuperscript{th} to the 17\textsuperscript{th} centuries. In the Portuguese case, the equivalent data point towards a far more protracted process, such as one might expect of any major change in the agrarian domain. They suggest as well that it may have started a good deal earlier.

We identify the transition of the frontier economy to its successor regime by looking at when each of their essential characteristics started to change appreciably relative to earlier, representative values. For instance, regarding the land-labour ratio (figure 2), the threshold which most interests us here, is when this statistic breached its lowest level of the frontier era, which was 4 ha per capita and occurred around 1500. After this point, its values fell by half.

\textsuperscript{18} Allen(2001: 421)’s respectability basket for the 18\textsuperscript{th} century sets the expenditure on food at 80 per cent of total consumption of a working family.

\textsuperscript{19} See the discussion of the level of subsistence as reflected by the food consumption estimates in Reis, Before the industrial era (forthcoming).
until 1600 and subsequently more slowly but still inexorably. In the case of labour productivity, the onset of its long term decrease was in the late 15th century. After a contraction of some 40 percent, it steadied itself at this new much lower level around the start of the seventeenth century (figure 3). The same is true with the downward trend in the real unskilled wage (figure 4) – and then experienced a recovery after 1680 for reasons to be explained later. The per capita consumption of real agricultural output (figure 6) is not far from this profile either. Its decline began in the middle of the fifteenth century and trended down irreversibly to the start of the industrial era.

Altogether, a reasonable though approximate conclusion is that the regime switch started around 1500 and lasted for roughly a century, by which point the main agrarian regime descriptors had stabilized though at a significantly different level from before. During this time span, the mainly agrarian base of Portuguese society was subjected to growing Malthusian pressures and, as a result, a substantial drop in per capita food consumption – by some 33 per cent – was felt. Since this was distributed over several generations (and a hundred years), though strong the impact was probably not severe enough to be perceived as economically or even socially calamitous. Even so, it represented undoubtedly a fairly massive welfare contraction.

The response to this appears to have been to leave the agricultural configuration unchanged and try to intensify the traditional system based on “horn and corn”, in a weakly-integrated combination of arable and pastoral activity. This had two dimensions. One was to improve land and thus make it suitable for better uses. It involved for example the drying of wetlands and the conversion to arable of often under-utilized acreage formerly employed in pastoral or extractive activities (e.g. honey, wax, firewood, pasture). Crop output was thus increased to meet the market’s rising food demand from a rapidly growing population, but without noticeable change in the production process. It should be noted that improvements were expensive and required a lot of capital, which at the time may not have been either abundant or cheap (Costa et al: 92). The literature concerned with this century points to a number of episodes of this kind but fails to convey a picture of a vast movement of this type across the width and breadth of the country (Gil 1965; Costa et al 2011; Lisbeth Rodrigues 2013; Magalhães 1993).

It cannot be said at present that much in the way of efficiency gains can have come from this quarter.

A far more significant change in the landscape may have been the progressive, often conflict-marred shift from animal husbandry to cropping, which became an enduring feature of the countryside in the course of the Early Modern period. It was carried out by abrogating grazing or extraction rights and replacing them with an arable land status. It was mostly achieved using the law, ancient custom, force or legal chicanery, all of which were cheaper and more effective methods, at least for those endowed with social, political or economic influence (Neto 2012). On the other hand, the alternative of leasing land in order to clear it “fairly”, for cultivation, also developed during this century and beyond, though to an unknown extent and declining extent as untitled available land ran out. The productive possibilities offered by all these developments were not insignificant and would continue persistently throughout the country as time passed and an increasing portion of the national territory was diverted away from land-intensive pastoralism to labour-intensive cropping.

Thus, by 1600 a flagrant contradiction had emerged between expanding productive opportunities in arable agriculture and the need to evade Malthusian checks to population growth. This can be seen in two ways. One is that land for leasing to peasant cultivators to clear and sow was becoming scarcer and seemingly of a declining quality (Oliveira 1979; Maia 1991; Neto 1997; Campos 1989; Silva 1994; and Amorim 1994). The other was that the price of
grain - “the staff of life” – by this time was reaching unprecedented heights relative to the earning power of the mass of the population. As can be judged from figure 9, after a steady climb during the fifteen hundreds, the ratio of the price of wheat to wages had become twice as high as in 1500. This was a propitious context for the introduction of a technical novelty which could break this stranglehold and help redefine the terms of this second agrarian regime.

[fig. 9 here]

The innovation was American corn (*zea mays*), a plant known since the early 1500s and whose post-1600 diffusion has been glorified by Portuguese historiography as a “revolution”\(^{20}\). Once a garden ornamental plant, after its first century in Europe spent in adaptation, it appears to have mutated sufficiently that it could now be grown with ease by peasants accustomed to cultivating different varieties of “medieval maize”, e.g. millet (Revilla et al., 1998; Dubreuil et al., 2006; Mir et al., 2013). In Early Modern times, maize was an “inferior good” among grains. Numerous indications show that it was unappetizing and only eaten by people who could not avoid doing so, like prisoners or the poor. From the consumer’s point of view, however, it had other important advantages. Its price per litre was on average 60 percent of that of wheat, and its caloric content per volume was 30 per cent higher. This meant that a calorie from maize cost half of one supplied by wheat. In Portugal, where natural conditions were frankly suitable for this plant, its merits from the producer’s side were not inconsiderable either. As an irrigated and heavily weeded crop, its yield was a good deal higher compared to wheat. Moreover, it was less susceptible to inter-annual harvest fluctuations and could be grown in association with cabbages and other vegetables. At the end of the season, it was used as animal fodder. From an overall economic perspective, maize was beneficial too in that it was a more labour-intensive crop than any other cereal. This meant that, per hectare, it generated a far higher demand for labour and thus stimulated other sectors. In a rural society, in which there had always been prolonged intervals of forced idleness, the spread of this plant represented a considerable accrual in the amount of employment per year and per worker (see figure 10). It thus became the engine of an agriculturally-based “industrious revolution” such as Portugal had never seen before and which had a decisive effect on its long-term macroeconomic performance (Palma and Reis 2014).\(^{21}\)

[fig. 10 here]
[fig. 11 here]

The timing of the spread of maize in Portugal is not well known. It seems clear that around 1600 its share in total grain output was very small but that by 1800 it had reached its long term ceiling, with a share of 70 percent of national grain production (Lains and Sousa 1998). Between these benchmarks, evidence from local histories points to a fairly rapid spread all through the 1600s and the first half of the 1700s, followed by stagnation from the middle of the eighteenth century until 1850s. The tithes of the bishopric of Viseu, in table 11, afford us the only detailed information over a fairly long period (1700-1850) and in a large region, and confirm this portrayal. Later, a national survey of parishes in 1756 shows, qualitatively, that maize had by then come to play a leading role in more than half the country: wherever

\(^{20}\) See Almeida (1992) and Ribeiro (1986). For a broader view on this plant, see Langer (1975) and Messer (2002). For the history of maize in the Spanish region of Cantabria, see Lanza Garcia (2010).

\(^{21}\) Importantly, maize, unlike wheat, required irrigated fields. Thus, it took hold of irrigated meadow and thus displaced animal husbandry from it to marginal territories (Silva 1983). This further reinforced the change in the sources of food that we have alluded to earlier on.
conditions were suitable and water was plentiful\textsuperscript{22}. At this time, it was the main fare of some three quarters of the population. This explains how, with the population continuing to grow, albeit at a lower rate after 1600, and with a land-labour ratio which did not stop falling, living standards real wages nevertheless were able to stabilize and even grow during the eighteenth century.

[fig. 11 here]

The second technological shock to Portuguese agriculture came during the eighteenth century. This time the driver was the growing of grapes and the production of wine. This was hardly a technical novelty given that it had been present in Portugal since time immemorial and had begun to spread as a meaningful cash crop in the late seventeenth century. The timing of its expansion is well known and reaches from the late 17\textsuperscript{th} century to its heyday in the 1750s, with a subsequent deceleration down to circa 1800. Total output doubled between 1700 and 1800 (Martins 1998). Wine was similar to maize in its effects, although on a lesser scale because it involved altogether fewer people and less land. On the other hand, in some ways it was even better since it offered the advantage of using the poorest, mountainous, un-irrigated land to produce one of the highest value-added crops, while absorbing possibly an even higher input of labour per hectare. Thus it significantly counteracted Malthusianism pressures, which in the meantime were continuing to build up in what was by-now a heavily populated country with a slender resource endowment.

The expansion of wine was impelled by two critical exogenous factors. The first was a sustained market expansion on the international front, which permitted a vigorous development of the most expensive wines in the Douro valley.\textsuperscript{23} This was the consequence of a “fortuitous” change in military and diplomatic relations which gave Portuguese wine a signal commercial advantage in the valuable English market for most of the eighteenth century (Cardoso et al. 2003). The second was the Brazilian gold boom which started circa 1700 and deluged with liquidity the Portuguese economy for a similar period (Costa, Sousa and Rocha 2013). This helped, to an as yet unknown extent, not only to pay for the heavy investment requirements for building vast hill-side vineyards, but also to do so under very attractive financial conditions (Costa, Rocha and Brito 2014).\textsuperscript{24} A third endogenous motor of agricultural change comes in the form of wine farmers showing themselves unusually receptive to the wave of technical progress which occurred in grape-growing and processing, as well as in marketing and distribution (Serrão 2009). Lastly and as in the case of maize, it is worth stressing how well rural society adapted to the socio-economic adjustments required by these developments, namely in field systems and resource management. It was thanks to this that the pronounced productive cash-crop specialization – some districts in north Portugal became practically mono-cultural – became possible. Institutional barriers did not appear to have been irksome to long-term economic growth.

\textsuperscript{22} Entre-Douro-e Minho, Beira, and parts of Estremadura.

\textsuperscript{23} Despite the growth of export wines during the eighteenth century, most production was for internal consumption.

\textsuperscript{24} This may have been equally instrumental in the promotion of many maize irrigation projects during the 18\textsuperscript{th} century, though obviously not earlier. The financing of these infrastructures has hardly been studied but is being currently researched. See Mangas and Reis (forthcoming).
4.

The decline of a frontier economy and its replacement by a more intensive agrarian model could have been, in social and economic terms, a costly transformation for Portugal. But the country was able to accommodate a far larger population than ever might have been expected thanks to its ability to integrate effectively two major technological innovations, while lessening somewhat the demographic pressure. In this section we show that this transition to the modern era also required another sort of adaptiveness, of a cultural nature, which enabled this society to convert to a radically different nutritional pattern and to shift its alimentary preferences in terms of what was then considered “superior” and “inferior” goods. In doing so, we try to move away from the tendency, rooted in much of the Economic History of convergence and divergence, of perceiving diets and consumption baskets as givens, rather than as constructs which can change and are in fact endogenously determined. This exercise has the additional advantage of allowing us to verify the consistency of some of our earlier conjectures concerning factor proportions and product mixes in Portuguese agriculture over the six and a half centuries after 1300.

To achieve this goal, we have compiled a number of quantitative estimates of per capita food usage for certain epochs and places, which can be deemed, with some confidence, to represent clearly-defined economic segments of society. In particular, we seek to select them so that, through their similarities, they can be compared over the long run and give us a reliable time line for human behavior from the point of view of food consumption. Within this, we concentrate on the lower and more numerous ranks of society, in order to anchor our findings as much as possible on the bedrock of the national population which we are observing. We therefore avoid employing evidence from the tables of the high and mighty, of the wealthy, of rich convents and monasteries, even of boarders in educational establishments. We give preference instead to the humbler members of society: workers, the impoverished, women fallen on hard times, prisoners, hospital patients and the like. For reasons of comparability across the ages, we restrict our analysis to food alone, considering that for most of the population it represented something like seventy to eighty percent of the expenditure of families (Malanima 2011; Allen 2001, 2009 and 2013). Given the paucity of detailed information and to ensure homogeneity among observations, we focus entirely on the three essential foodstuffs in Portuguese history: grain, meat and wine (Veloso1992).

The present analysis is concerned with three types of record. One is a set of benchmarks, at long intervals, for total agricultural output at current prices, and which are decomposable into the main categories of staples. The second is a compilation of types of diets pertaining to different elements of the country’s humbler social strata at different points in time and which furnish information of the same kind as above, namely per capita yearly volumes for the different victuals. The third consists of a collection of costs, at current prices, of feeding individuals who were under some form of institutionalization (prisoners, hospital inmates). They can be deflated by a CPI in order to generate a picture of what Portuguese society regarded the basic minimum in order to sustain its least fortunate members. The first two categories allow us to estimate nutritional levels measured in the standard way, the third only permits a comparison over time using a non-physical indicator of welfare.

Table 4 displays the per capita yearly volumes of the three broad categories of foodstuffs at three benchmarks: at the start of our period (1315); at the start of the transition from the frontier economy to Early Modern agriculture (1515); and at the end of our period (1850).

25 For examples, see Allen (2001 and 2009) and Federico and Malanima (2004).
26 Olive oil has been excluded from this analysis because it is often missing from the records and because its share in total expenditure was a very few percentage points.
Several conclusions and confirmations can be drawn from it. The first is that in the early part of these 650 years living standards were historically high, matching the abundance of natural resources. This was a time when considerable quantities of food of all kinds were being eaten and the nutritional content of the fare was remarkable in historical terms. The average Portuguese (including children) ingested half a pound of meat a day and almost half a liter of wine, in addition to three quarters of a kilo of bread. As a result, calories per day and per capita exceeded the “subsistence” diet estimated for Early Modern Europe by almost a third and its “respectability” counterpart by almost a fifth. It corresponded to an agrarian regime in which the pastoral element was relevant and arable production was in second place, as was noted above in section two.

[Table 4]

At the end of the next stage of agrarian development, farming had changed a great deal and diets too. By the mid nineteenth century, the average inhabitant of Portugal had “lost” a third of the bread his medieval forefathers had eaten, though it still remained, naturally, the “staff of life”, and two thirds of the wine they had drunk. Meat had ceased to be something quite ordinary and had undoubtedly become a “superior” good for the mass of the population – expensive and scarce. The level of overall nutrition was by now becoming problematic, with daily calories down to 60 percent of the golden days before (and probably also after) the Black Death. This was also below the “bare bones” diet assumed by Allen (2009) for 18th century Europe. Given its association with human stature, it is noteworthy how far animal protein per capita had fallen during this time span, from 50 to 19 grams per day. As is now known, the statures of military recruits in 19th century Portugal was some 2 centimetres shorter than it was in the 18th, and this likely to be an effect, in part at least, of this long term meat deprivation (Stolz, Baten and Reis (2013).

Conditions in 1515 are interesting to consider here too since, as we conjectured in section III, this may have been the moment when the frontier economy began to give way to a more arable and less pastoral agriculture and to lower living standards in general. Assuming these data of this benchmark are correct, caloric intake was at this point already down 15 percent relative to 1315 (and probably more still if it could be compared to the early 15th century). Further confirmation for the supposition that the transition between regimes was already under way comes from the fact meat consumption per person was now one third lower than two centuries earlier but grain consumption was very similar to that of 1315. Seemingly pasture land had retreated the arable had not gained yet much ground.

Tables 5 and 6 follow the same approach as the above but represent work in progress and suffer from a certain degree of data insufficiency. The findings suggested by them run in the same direction. The latter’s estimation of calories per person per day reinforces our earlier impression of the plentiful consumption allowed by the economy of the frontier up to the sixteenth century, even for paupers and manual labourers. They also display the ample availability of meat products in the diet of all categories, along with wine, a “superior good”. But the data are not sufficient to compare this with the post 1600 agrarian regime. The observations we use represent an effort to consider the food intake of groups at the bottom of the income pyramid: manual labourers, those fallen on hard times and hospital inmates. At present however it is uncertain whether sufficient homogeneity is assured to make the result meaningful.

[Table 5 here]
[Table 6 here]
Table 5 balances this chronological deficiency with data from the sixteenth/seventeenth centuries but lacks the earlier data which would allow us a full view of the entire period under observation. It also does not offer a breakdown by classes of foodstuffs. It is interesting, nevertheless, to note that the maintenance costs of the poor prisoners of the Inquisition in cash weathered the inflationary pressures of this period and ensured that in real terms there was no erosion of their standard of living, in contrast with the general trend in the country.

This paper extends to Portugal ANPE’s notion that from the pre-Black Death era to the beginnings of industrial society, two quite distinct agrarian regimes were present in Iberia. These reflected demographic trends, the imprint of the country’s early history and its capacity in the seventeenth and eighteenth centuries to adapt to technological and institutional shocks. In the case of the first two of these factors, Portugal and Spain resemble each other. In terms of the third, they diverged.

From the early fourteenth to the early sixteenth centuries, Portugal was a “frontier economy” in which high productivity and high living standards were possible. This was so thanks to a generous resource endowment and a pattern of consumption predicated on a salient role for pastoralism in the agricultural system.

Increasing demographic pressure, already mounting in the late fifteenth century, led to a gradual erosion of this regime, as the population neared its critical threshold of about 1.3 million inhabitants. The result was its replacement by another one in which pastoralism lost considerable ground to arable activity. As the country moved towards an apparent Malthusian ceiling, it was met by a spate of agricultural innovation which, along with the attendant reorganization of the productive system, created conditions for arresting the decline in living standards and actually inverted this trend for a while.

By the end of the eighteenth century, Portugal was very different compared to what it had been at the beginning of this narrative. In particular, it was now a densely populated country with a population and a low land-labour ratio which continued to grow at a fast pace. To arrive at this point it had to absorb important technical changes, not the least of which was a drastic alteration in the consumption pattern of its population. This was something akin to another great episode in the history of Columbian exchanges – the potato invasion of Ireland – but perhaps more far-reaching. None of this however was sufficient to restore Portugal to its early relative affluence so that it entered the era of Kuznetsian growth at a clear disadvantage relative to Spain and other non-core nations of Europe.

And also Italy. See Federico and Malanima (2004).
Notes:
Sources: Appendix I

**Fig. 2 – Real Wage for unskilled labour (barebones basket)**

**Fig. 3 – Rent-unskilled wage ratio**
Fig. 3 Rent-unskilled wage ratio

Fig. 4 - Land yield

Fig. 5 Relative Prices: Meat/Wheat and Wine/wheat ratios
Fig. 6 – Real per capita and Gross Agricultural Output (100=1300)

Fig 7- Real agricultural output per worker
Fig 8 – Portuguese Demography and Economic Growth, 1500-1800

Fig 9 – Wheat price to unskilled wages ratio
Table 1 – Regional Distribution of Portuguese Population (1260, 1300, 1530)

<table>
<thead>
<tr>
<th>Region</th>
<th>Area (%)</th>
<th>Hab/km²</th>
<th>Population (%)</th>
<th>Concentration (%Population-%Area)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1260</td>
<td>1300</td>
<td>1530</td>
<td>1260</td>
</tr>
<tr>
<td>Entre Douro e Minho</td>
<td>13</td>
<td>29</td>
<td>32</td>
<td>27</td>
</tr>
<tr>
<td>Interior</td>
<td>32</td>
<td>8</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td>Estremadura</td>
<td>21</td>
<td>7</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>Sul</td>
<td>35</td>
<td>2</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>9</td>
<td>12</td>
<td>14</td>
</tr>
</tbody>
</table>
Notes: the regions are modelled upon ecclesiastical borders; Entre-Douro-e-Minho corresponds to the dioceses of Braga (except for the eastern part), Porto and Tuy; Interior to the dioceses of Guarda, Lamego, Ribacoa (in 1300 and 1530; in 1260 it was part of Castile) and Viseu, plus the eastern part of Braga; Estremadura to the dioceses of Coimbra and Lisboa and Sul to the dioceses of Évora and Silves.
Source: Henriques, forthcoming.

Table 2: Nominal interest rates in rent charges in Europe, 1251-1350 (in %)

<table>
<thead>
<tr>
<th></th>
<th>England</th>
<th>France</th>
<th>Germany</th>
<th>Holland</th>
<th>Italy</th>
<th>Portugal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1251-1300</td>
<td>10.2 (43)</td>
<td>11.1 (88)</td>
<td>10.8 (5)</td>
<td>10.0 (5)</td>
<td>-</td>
<td>4.8 (29)</td>
</tr>
<tr>
<td>1301-1350</td>
<td>11.2 (3)</td>
<td>-</td>
<td>10.1 (56)</td>
<td>11.2 (20)</td>
<td>7.3 (3)</td>
<td>6.2 (12)</td>
</tr>
</tbody>
</table>

Notes: the numbers are in parentheses.
Sources: Clark 1988; Zuiderduijn 2009: appendix.

Table 3 - Portugal: structure of agricultural output, 16th - 19th centuries

<table>
<thead>
<tr>
<th></th>
<th>GRAIN</th>
<th>WINE</th>
<th>OIL</th>
<th>MEAT</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1315</td>
<td>52</td>
<td>17</td>
<td>na</td>
<td>27</td>
<td>100</td>
</tr>
<tr>
<td>1515</td>
<td>38</td>
<td>15</td>
<td>3</td>
<td>43</td>
<td>100</td>
</tr>
<tr>
<td>1850</td>
<td>45</td>
<td>19</td>
<td>5</td>
<td>30</td>
<td>100</td>
</tr>
</tbody>
</table>

Sources: Godinho (1978); Reis (2000); Henriques (2015)

Table 4 - Per capita product of agriculture: volume and nutritional content

<table>
<thead>
<tr>
<th></th>
<th>Bread kg</th>
<th>wine litres</th>
<th>meat kg</th>
<th>Calories per day</th>
<th>Protein gms per day</th>
<th>Animal protein gms per day</th>
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</thead>
<tbody>
<tr>
<td>1315</td>
<td>276</td>
<td>155</td>
<td>91</td>
<td>2838</td>
<td>126</td>
<td>50</td>
</tr>
<tr>
<td>1515</td>
<td>280</td>
<td>49</td>
<td>61</td>
<td>2405</td>
<td>110</td>
<td>33</td>
</tr>
<tr>
<td>1850</td>
<td>205</td>
<td>45</td>
<td>35</td>
<td>1723</td>
<td>75</td>
<td>19</td>
</tr>
</tbody>
</table>

‘Barebones’ diet Europe

<table>
<thead>
<tr>
<th></th>
<th>Calories</th>
<th>Protein gms per day</th>
<th>Animal protein gms per day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1938</td>
<td>89</td>
<td>3</td>
</tr>
</tbody>
</table>

‘Respectability’ diet Europe

<table>
<thead>
<tr>
<th></th>
<th>Calories</th>
<th>Protein gms per day</th>
<th>Animal protein gms per day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2500</td>
<td>112</td>
<td>14</td>
</tr>
</tbody>
</table>

(Allen 2009: 36-7)
### Table 5 - Maintenance costs of prisoners and others

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Hospital poor patients</th>
<th>Inquisition poor prisoners</th>
<th>Other</th>
<th>Real costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1510</td>
<td>Lisbon</td>
<td>10</td>
<td></td>
<td></td>
<td>0,10</td>
</tr>
<tr>
<td>1571</td>
<td>Lisbon</td>
<td>30</td>
<td></td>
<td></td>
<td>0,18</td>
</tr>
<tr>
<td>1573</td>
<td>Lisbon</td>
<td>40</td>
<td></td>
<td></td>
<td>0,24</td>
</tr>
<tr>
<td>1594</td>
<td>?</td>
<td>50</td>
<td></td>
<td></td>
<td>0,23</td>
</tr>
<tr>
<td>1645</td>
<td>Coimbra</td>
<td>30</td>
<td></td>
<td></td>
<td>0,13</td>
</tr>
<tr>
<td>1655</td>
<td>Lisbon</td>
<td>55</td>
<td></td>
<td></td>
<td>0,26</td>
</tr>
<tr>
<td>1750</td>
<td>Almada</td>
<td>30</td>
<td></td>
<td></td>
<td>0,16</td>
</tr>
</tbody>
</table>

### Table 6 – Rations and diets of low strata

<table>
<thead>
<tr>
<th>Date</th>
<th>Institution</th>
<th>Bread</th>
<th>Meat</th>
<th>Wine</th>
<th>Total calories yearly</th>
<th>Calories per person and per day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>kg</td>
<td>kg</td>
<td>litres</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1328 Coimbra</td>
<td>genteel paupers</td>
<td>412</td>
<td>200</td>
<td>467</td>
<td>1906350</td>
<td>5223</td>
</tr>
<tr>
<td>1349 Coimbra</td>
<td>genteel paupers</td>
<td>376,8</td>
<td>100</td>
<td>200</td>
<td>1343160</td>
<td>3680</td>
</tr>
<tr>
<td>1365 Grijo</td>
<td>vine workers</td>
<td>222,4</td>
<td>80</td>
<td>139</td>
<td>863030</td>
<td>2364</td>
</tr>
<tr>
<td>1477 Lx</td>
<td>merceeiras</td>
<td>236</td>
<td>73</td>
<td>511</td>
<td>1195050</td>
<td>3274</td>
</tr>
<tr>
<td>1504-1570s HTS, Lx</td>
<td>hospital inmates</td>
<td>463,2</td>
<td>168</td>
<td>383</td>
<td>1879140</td>
<td>5148</td>
</tr>
<tr>
<td>1520s-1570s</td>
<td>Caldas Rainha hosp. inmates</td>
<td>424,8</td>
<td>207</td>
<td>244</td>
<td>1765660</td>
<td>4837</td>
</tr>
<tr>
<td>1669 Porto</td>
<td>Inmates SCMPo</td>
<td>166,4</td>
<td>167</td>
<td>128</td>
<td>933980</td>
<td>2559</td>
</tr>
</tbody>
</table>
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