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## The chronic food deficit of early modern Portugal: curse or myth?

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**The chronic food deficit of early modern Portugal: curse or myth?** Two historiographic currents have debated whether early modern Portugal was cursed by an excessive dependence on agricultural imports due to being unable to feed its population. In this short paper, the first long-run systematic quantitative study of this question, we show that the former view is a myth and therefore could not be a curse. Throughout the entire period, a certain amount of grain was in fact imported but cereal purchases abroad never represented more than a diminutive percentage of total food consumption. More importantly, the country carried out a diversified trade in foodstuffs which was seldom seriously out of balance. Portuguese agriculture showed itself consistently capable of specializing in different foodstuffs for export. It was thus not hopelessly inefficient and succeeded reasonably well in meeting the basic nutritional needs of the population.

KEYWORDS: food deficit; agriculture; foreign trade; Portugal.

**Um déficit crónico na balança alimentar de Portugal de Antigo Regime: maldição ou mito?** Duas correntes historiográficas têm debatido se Portugal, durante o período moderno, se confrontou com a maldição de uma crónica dependência de importação de bens agrícolas para satisfazer as necessidades alimentares básicas da população. Neste artigo, que é uma primeira tentativa de estimar na longa duração uma balança alimentar, mostra-se que essa dependência é um mito, pelo que não seria uma maldição. Ao longo do período moderno, entre 1550 e 1850, certas quantidades de cereais foram, na verdade, importadas regularmente, mas tais importações não corresponderam a uma parte relevante do consumo doméstico. Além disso, e ainda mais significativo, verifica-se que o reino desenvolveu um comércio diversificado de bens agrícolas que equilibrou as importações. Daqui se conclui que a agricultura portuguesa foi suficientemente dinâmica para desenvolver uma especialização em diferentes bens alimentares para exportação. Não seria, portanto, irremediavelmente ineficiente; e foi razoavelmente capaz de responder às necessidades alimentares da população.

PALAVRAS-CHAVE: déficit alimentar; agricultura; comércio externo; Portugal.

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## The chronic food deficit of early modern Portugal: curse or myth?

### THE PROBLEM

The need to produce reliable estimates of the exports and imports of the main foodstuffs in Portugal during the interval 1550-1850 arises from two circumstances.<sup>1</sup> First, it serves to verify whether food output and consumption were roughly equal, as is now being claimed for other early modern economies. The relevance of this arises when seeking to estimate agricultural output indirectly by using a food demand function and assuming this equality.<sup>2</sup> In the specific case of Portugal, a second reason for this concern is the strongly held view that for centuries the country suffered from a pronounced food deficit owing to its inability to meet the dietary requirements of its population. A popular topic since the early 1500s, this issue has been taken up in every century thereafter by the many writers and historians who have pondered the causes of the country's alleged decline and stressed the chronic need to import cereals as a symptom of this economic failure (Leão [1610] 2002; Faria[1655] 2003; Sérgio, 1984).

More recently, however, doubts have arisen as to the significance of this relationship. Silbert (1978) has suggested that after all Portugal was not as reliant on imported grain as had been previously thought. Following this intuition, Serrão (2005; 2017) has established, with considerably greater accuracy, that in the period 1776-1795 national cereal dependence represented less than

1 The findings of this paper reinforce recent perspectives on the long-term agricultural development of early modern Portuguese agriculture. See Serrão (2017) and Reis (2017).

2 The studies that launched this approach are Wrigley (1985) and Allen (2000).

10 percent of consumption and was therefore “not a dramatic problem”.<sup>3</sup> No study, however, has met two essential conditions for achieving a complete clarification of the issue. One is the need for a multi-secular perspective when dealing with a “structural” question. The other is the failure to consider the topic of grain scarcity in the broader framework of agricultural supply as a whole. Our aim here is to present a study that includes these dimensions of the analysis.

Owing to the scarcity of data, continuous time-series are out of the question and as the basis for this exploration, we have had to constitute a set of seven benchmarks placed at fifty-year intervals, from 1550 to 1850. For each, we have gathered the available information concerning the international trade in the products of agriculture that were both consumed at home and imported or exported to a significant extent. This enables us to calculate, for each benchmark and for each commodity, the country’s external surplus or deficit at current prices. By aggregating these results and comparing the figures obtained with rough estimates for total agricultural consumption, we are able to obtain the ratio of domestic agricultural production to consumption for every benchmark.

Inevitably, this effort is not exempt from shortcomings. Portuguese early modern foreign trade data are sparse and not wholly reliable, and those we are able to obtain do not always coincide with our benchmark years. Until the late 18<sup>th</sup> century, there are no Portuguese official trade statistics. Moreover, the earlier sources at our disposal form a disparate and not always congruous collection made up of official reports, accounts by travellers and consuls, and petitions and remonstrances to the authorities. To these we can add the foreign trade statistics of Portugal’s principal commercial partners. In view of this, we have chosen to focus on only the three most important items that fit the requirements of this study – grain, wine, and olive oil. Other commodities such as almonds, figs, wool, fresh fruit, cork, and hides are ignored, given their lesser economic importance and weak or erratic representation in our sources. Two further items – livestock and codfish – are also neglected, despite their nutritional importance as key sources of protein, for the same reasons.<sup>4</sup>

3 Serrão (2016). A more detailed treatment of this argument can be found in Serrão (2005).

4 Movements of livestock across the border were always easy and naturally common, but quantifying them nationally is problematic due to the ease of smuggling and the flow of flocks to and fro in search of pastures (Jiménez, 1999). The first official record available, for 1776, puts this item net at 4 per cent of total imports. The impact on food consumption would, however, be of an order of less than one tenth of a percentage point. Codfish might be on our list also because although not “agricultural”, it might impact our results since it was a partial substitute for other foodstuffs, namely meat and, at a stretch, grain. Its commercialization is signalled in →

All things considered, we believe that the present analysis is not without utility. Not only is it the first to permit a different answer to the centuries-old question of Portugal's external food dependency; it also contributes toward elucidating the relative importance of international food balances in the economic history of Europe generally and, in particular, their role in the emergence of the early modern era in this region.

### CONTEXT AND MOTIVATION

The historiographic origins of the topic addressed in this paper lie in the expansion since the 16<sup>th</sup> century of the trans-European bulk commodity trade and of the shipping that carried it. This was fully addressed by Braudel in his pioneering 1949 work *The Mediterranean and the Mediterranean World at the Time of Philip II*. In it he showed the centrality, in this process, of the growing economic complementarity between northern Europe and the regions bordering on the Mediterranean. This was the theme that World-Systems Analysis was to bring up again some time later (Mauro 1961; Wallerstein, 1976) when it stressed similar foundations for a gradual but irreversible reallocation of the capitalist centers of the Western World from the Italian to the North Atlantic states, first the Dutch Provinces in the 17<sup>th</sup> century and Britain thereafter.

The ultimate explanation for the start of this long-term shift in economic geography lay in the crisis of the 14<sup>th</sup> century. The recovery from the Black Death brought about changes in factor allocation that caused a new and broader division of labor on the European continent. Based on the reinforcement of serfdom, central European areas entered into a large scale production of cereals, while demographic recovery in the southern areas brought about decreasing returns in agriculture. Regular imports of foodstuffs to feed urban centers thus became structural. The dependence of semi-peripheral economies on grain from central Europe stimulated the competitive development of shipping and financial services provided by the powers that eventually would become the core regions of the system.

In Portugal a similar debate has held the intellectual stage for almost as long. From early on, Portuguese researchers kept up with these historiographic trends and sought to fit the country's past into the same scheme of ideas. The notion that primary products were essential to the country's

institutional accounts from at least the earliest 16th century. Annual figures dispersed throughout the 18th century (Fisher, 1984) suggest a annual importation then of *circa* £100,000 sterling, or the equivalent of 3 per thousand of total foodstuffs consumed.

supra-national economic integration was soon adopted by Virginia Rau (1954), a pioneer in this field. Her study of the salt trade and foreign shipping in Portuguese ports showed the considerable weight of Portugal's regular importation of grain. By the 17<sup>th</sup> century all of this was becoming a part of a wide and complex web of maritime routes, which via the Sound linked shipping from the Baltic with the west coast of Portugal and back. In her analysis, the predominance of primary products in Portugal's intra-European trade reflected the inefficiency of a major sector – grain – but also, paradoxically, the considerable efficiency of another primary sector – salt extraction – which supplied, competitively, an immense market stretching from the Low Countries through to Scandinavia.

Two other outstanding Portuguese economic historians in this epoch followed in Rau's steps, though with two significant modifications. In the mid-1950s, Godinho (1955) proposed an approach that downplayed Portugal's "salt connection" as a significant determinant of the pattern of the country's foreign trade. Instead, he focused on the grain deficit as "une des constantes les plus indiscutables et plus importantes de l'histoire économique portugaise" and reinforced this by shifting the origins of the problem deeply into the middle ages, as far back as the 13<sup>th</sup> century. Later Oliveira Marques (1972), returned to the theme with similar claims. The medieval roots of grain insufficiency were reaffirmed but it was in the early modern period that the necessity for wheat imports became "chronic" and a "normal" part of collective life.

A recent international literature has challenged several aspects of the legacy of the World-Systems Analysis. This includes downplaying the importance of the sea-borne trade in foodstuffs among nations. The grounds for the latter claim are that often in the early modern era the production of agricultural goods tended to equal their consumption (Allen, 2000). Initially, this was proposed as a general assumption, with Britain and the Netherlands as two exceptional cases for which there was empirical support. In the Netherlands, the most open of these economies, the ratio of agricultural imports to production was quantified at almost 10 per cent on either side of the point of equilibrium. In Britain, this was close to 5 per cent (Allen, 2000, p. 14). More recently, new research has further supported this view. For Spain, the ratio has been estimated at around 10 per cent in the late 18<sup>th</sup> century, a "small share of agricultural output" (Alvarez-Nogal and Prados de la Escosura, 2007, p. 344). For Germany, between 1500 and 1850, it oscillated between 0.9 and 3.6 per cent (Pfister, 2008, p. 23).<sup>5</sup>

5 For Italy, as yet there is no evidence, but Malanima (2011) has accepted the assumption of equality between consumption and output.

In contrast, Portuguese historiography has not reconsidered the question of Portugal's dependence on food imports in light of these revisions. The closest it has come to this are Serrão's recent studies (2005 and 2017), which focus on Portugal's grain importation as a percentage of the domestic output of this commodity, but which are confined to one century only – the 1700s. In the present study we go further and assess the significance of all major foodstuffs in the broader framework of total agricultural supply and report this for an interval of three centuries.

### THE METHOD

Table 1 shows the results of our estimation, while the appendix at the end of the paper provides information on the sources and how the data were processed. For each benchmark, we calculate the annual values at current prices of the exports and imports of the agricultural items we are considering, expressed in tons of silver (cols. 1, 2, and 3, respectively for wine, olive oil, and grain). Depending on the years, these may be available either directly from our sources or obtained by multiplying volumes (when provided by the sources) by their respective market prices in Lisbon. They are added up to give us, in col. 4, the net aggregate value of foreign transactions in food for each benchmark, again in tons of silver.

In the present state of research, statistics for total agricultural consumption at current prices are unobtainable directly. The best solution is an indirect one and employs a recently constructed annual series of Portuguese gross domestic product at current prices expressed in tons of silver (Palma and Reis, 2016). We multiply this for each benchmark year by an average propensity to consume food and obtain figures for yearly total food consumption at current prices, also in tons of silver. Obviously, the accuracy of this estimate depends on being able to find realistic values for this parameter. Thanks to recent research, a few are now accessible for a number of early modern economies. While Malanima (2011, p. 181) has claimed that 60 per cent was “plausible” for Italy, Alvarez-Nogal and Prados de la Escosura (2013, p. 17), basing themselves on the annual share of agriculture in GDP, have produced for Spain a more robust value which is not far off. It oscillates between 50 and 60 per cent. In the case of England/Britain, Broadberry et al. (2015, pp. 335-339) suggest a range from 71 to 84 percent. By combining these figures, we are able to include in column 5 of Table 1, respectively upper and lower bounds for total food consumption in Portugal over the period considered. We are thus able to determine the ratio of the food trade surplus/deficit relative to food consumption in columns 6 and 7.

TABLE 1  
Portugal's external food balance, 1550-1850

	1	2	3	4	5	6	7
	Wine exports	Olive oil exports	Grain imports	External food balance	Total food consumption bounds	External food balance/ /total food consumption	Grain import/ /total food consumption
<b>1550</b>	0.0	0.6	16.8	-16.2	1102.6 - 1764.2	-(0.015 - 0.009)	0.015 - 0.009
<b>1600</b>	1.9	3.6	25.0	-19.5	2785.9 - 4457.6	-(0.007 - 0.004)	0.009 - 0.006
<b>1650</b>	3.9	6.5	14.9	-4.5	2788.6 - 4461.9	-(0.002 - 0.001)	0.005 - 0.003
<b>1700</b>	18.2	21.4	14.8	24.8	1272.9 - 2036.7	0.019 - 0.012	0.011 - 0.007
<b>1750</b>	20.4	6.1	23.0	3.5	1825.6 - 2921.0	0.0 - 0.0	0.012 - 0.008
<b>1800</b>	128.5	8.3	151.6	-14.8	2291.2 - 3666.0	-(0.046 - 0.004)	0.066 - 0.041
<b>1850</b>	115.2	10.3	10.0	115.5	2385.4 - 3816.7	0.048 - 0.030	0.004 - 0.003
<b>total</b>	<b>288.1</b>	<b>56.8</b>	<b>255,7</b>	<b>89.2</b>			

Notes: col. 4=col. 1+col. 2-col. 3; col. 6=col. 4/col. 5; col. 7=col. 3/col. 5.

Units: cols 1, 2, 3, 4, and 5 - tons of silver.

Sources: see text and appendix.

## CONCLUSIONS

The results in Table 1 point to five conclusions regarding the integration of Portugal's early modern agriculture into the international economy.<sup>6</sup>

The first one confirms that the country's net grain importation (col. 3), as has been so often claimed, was a permanent feature of economic life from the 16<sup>th</sup> to the 19<sup>th</sup> centuries. Moreover, it shows that in absolute terms this flow was not insignificant and played a non-trivial role in feeding the population, particularly that of the major cities along the coast (Serrão, 2017). For the rest of the country, where most of the Portuguese lived, its relevance was probably

6 Readers must be cautioned not to read too much into the contents and analysis of Table 1. These lend themselves to broad generalizations, as carried out here, but should not be used for longitudinal treatment, given the heterogeneity of the sources, the data, and the procedures employed.

modest. The ratio of imported cereals to national food consumption (col. 7) only once (1800) reached a considerable mark (6.6% to 4.1%) and this was during an unusual time of war and poor harvests. Any counterfactual suggestion that without wheat imports the country would have starved seems difficult to uphold.

Our second finding is reached when we broaden the context and consider together all the major foodstuffs traded internationally by Portugal, i. e. those that were imported (grain and flour) and those that were the object of exportation (wine and olive oil). The picture now changes in the same direction as before but in a more pronounced fashion. Over the long run, net external food trade balances (col. 4) were almost as often surpluses as deficits and, in the three centuries as a whole, the result is positive.

The third outcome of this study is that it casts doubt on the presumed equivalence between Portugal's "external grain dependence" and the ineffectiveness of its agriculture. On the basis of the data compiled, Portuguese dependence on imports of cereals may arguably be seen, not as a problem of inefficiency of its agriculture, but as the contrary. It reflected the latter's capacity to diversify, specialize, and achieve levels of productivity that enabled it to export sectoral surpluses to other economies. In addition, it signals an ability to adjust to shifting patterns in international demand, exemplified by primacy going to olive oil in the 16<sup>th</sup> and 17<sup>th</sup> centuries and wine in the 18<sup>th</sup> and 19<sup>th</sup> centuries.<sup>7</sup>

The fourth conclusion is that the numbers collated here sit awkwardly with the Modern-World System analysis of the role of North-South trade in the decline of the countries of the south during the period considered. The scale of the grain flows to Portugal from the Baltic and Mediterranean and of the shipping they required was too small, macro-economically, to plausibly account for the economic backwardness that supposedly cursed this "semi-peripheral nation" during the 16<sup>th</sup>, 17<sup>th</sup> and 18<sup>th</sup> centuries<sup>8</sup>.

A final implication of our exercise is of a practical nature. Modern estimates of early modern gross agricultural product which use a demand-for-food function and assume that the output and consumption of agricultural products are roughly equal can be accepted with reasonable confidence in the Portuguese case too.

In sum, the chronic grain deficit of early modern Portugal, although clearly a part of historical reality was far from having the economic significance that conventional wisdom has attributed to it. It was neither a myth nor a curse.

7 It should be noted that the bulk of Portuguese agricultural exports went to European markets, not to highly protected colonial ones.

8 Research presented in Costa, Palma, and Reis (2015) questions the "curse" of economic backwardness often espoused in the Portuguese economic history literature.

## STATISTICAL APPENDIX

ESTIMATES OF AGRICULTURAL EXPORTS AND IMPORTS<sup>9</sup>

## A1. 1550

Agricultural exports from Portugal during the 16<sup>th</sup> century were small compared to re-exports from the empire, and went mainly to northern Europe via Antwerp. Total agricultural exports at current prices for the years 1535-7 amounted to 8.2 million reais<sup>10</sup> or, 0.68 tons of silver (Costa, Lains and Miranda, 2016). In the absence of any data for 1550, they are used here for this benchmark.

**Wine** exports, later a key item in Portuguese foreign trade, was an insignificant part of trade and amounted to a mere 18,425 liters inferred from total values of exports and current prices. The remainder was mostly **olive oil** worth 0.60 tons of silver.<sup>11</sup> For want of a better solution, we have assigned these data to our 1550 benchmark.

**Grain** imports during the 16<sup>th</sup> century are also shrouded in mystery despite frequent references by foreign and national observers to their substantial scale and the concern of rulers to ensure adequate supplies, particularly for Lisbon and other cities. Rebelo da Silva cited by Godinho (1963-1965, vol. II, p. 279), claimed that between 1525 and 1562 yearly grain imports cost on average 500,000 cruzados or 16.8 tons of silver.<sup>12</sup> This result is preferred to Godinho's (1955, p. 147) other estimate of 100,000 *moios* per year (equivalent to 828,000 hectoliters) of grain for *circa* 1550 for which the empirical support is weak.<sup>13</sup>

9 All volumes are expressed in metric liters. Total values of exports and imports are expressed in tons of silver. For details on monetary and physical units of measurement and their conversions, see "Prices, Wages and Rents" (PWR) database at <http://pwr-portugal.ics.ul.pt/>, in particular its "user guide".

10 The real was the basic monetary unit for Portugal since 1430. In this year, the content of one real in silver was 0.255 grams but by the mid 17th century this had fallen to about 0.05 grams.

11 All valuations are carried out using current prices from the "Prices, Wages and Rents" (PWR) database. Olive oil represented 88 percent of total exports, and figs, the next largest item, 7 percent (Costa, Lains and Miranda, 2016).

12 This is the equivalent to 200 million reais. At current prices this would have represented a volume of 36.2 million liters of wheat.

13 One moio equalled 60 alqueires. We have converted the latter to the metric system at a rate of 13.8 liters per alqueire since this was the measure in Lisbon, Portugal's principal port. Godinho's first reference to this figure, in 1955, was taken from Barros (1941, p. 115). The latter, however, was a citation of a mid-17th century document produced by Lisbon's municipality which has never been traced.

## A2. 1600

Given the absence of any agricultural export figures for olive oil and wine exports for this benchmark, we have interpolated them from two other benchmarks for which evidence exists, namely 1550 and 1650.

For **wine** we obtain, by this method, a volume of 0.22 million liters worth 1.9 tons of silver at current prices.

For **olive oil** and using the same procedure, we have inferred a volume of 3.6 tons of silver.

For **grain**, and again for lack of better alternatives, we have taken the mean of the import volumes of grain in 1550 and 1650, i. e. 25.0 million liters, and multiplied it by the current price of 1.0 grams of silver per liter. The result is 25.0 tons of silver.

## A3. 1650

Direct evidence for **wine** and **olive oil** exports for this benchmark is non-existent and we have to make do with the best inferences we can manage. For **wine**, the closest we get are the data provided by Shillington and Chapman (1907, appendix II) for Portuguese wine exports to Britain, Portugal's main client for this commodity. In the period 1675-1679, this represented an annual average volume of 2.8 million liters which, at 1650 prices, would have been valued at 3.9 tons of silver. For **olive oil** we base our estimate on British imports from Iberia through London in 1663-9, which were worth £131,000. We assume, in accordance with Davis (1954), that 40 per cent were from Portugal. At an exchange rate of £0.42 = 1,000 *reais* and an equivalence of 19 *reais* to one gram of silver, this would amount to a total value of 6.5 tons of silver.

According to trade figures inferred from Rau's (1954) 17<sup>th</sup> century shipping estimates, we calculate that during the period 1641-1649 the yearly average number of ships landing **grain** in Lisbon was 21. Since their mean load was an average of 300 shipping tons, this would imply an entry at this point of 10.4 million liters. For the entire country, an adjustment must be made that raises this to 14.9 million liters.<sup>14</sup> At current prices, it represents a value of 14.9 tons of silver, the figure we accept for 1650. This result is corroborated by an independent source - an estimate by the *juiz do povo* of Lisbon in 1632 (Godinho, 1965, p. 280) - who also estimated the value of grain imports at 14.9 tons of silver in that year.

## A4. 1700

Data for **wine** exports at this date are available only for shipments sent to Britain. Since this country was then the overwhelming purchaser of this article from Portugal (more than 90 percent according to Martins (1990, p. 48), we consider these data as representative of the entire trade. According to Martins (1990, p. 79), in the period 1700-1704 the average yearly volume was 7.2 million liters, which at current prices would have

14 According to Rau (1954, pp. 256-257), 77% of the total import of grain went through Lisbon. The remainder was processed by lesser ports and Porto.

fetches a total value of 18.2 tons of silver.<sup>15</sup> Significantly, similar values – 7.2 million liters and 11.5 tons of silver – are reported by Fisher (1981).

Thanks to Costa, Lains and Miranda (2016) we are able to estimate the foreign sales of Portuguese **olive oil** shipped from Lisbon and Porto. In total this amounted to 7.1 million liters in 1690, the closest available year to 1700 and consequently the one we adopt. Their total worth was 21.4 tons in silver.

Quantitative information on **grain** imports at this precise time does not exist. Britain's commercial predominance in this trade – more as an intermediary than as a supplier of its own produce – would appear to justify using its sales to Portugal as a proxy for total imports. Evidence of this kind from three British sources from both sides of 1700, namely Fisher (1984), Francis (1960), and Hanson (1981) are therefore tempting to use but would involve significant biases which we are unable to correct. Instead, we have turned to Rau (1954) and Serrão (2017) for this information because they include both British and non-British imports, and because we are able to correct its totals for lack of data on small ports and for omitting cereals other than wheat.<sup>16</sup> The volumes of all grain entering the country were in 1685 (Rau, 1954) and 1729 (Serrão, 2016), respectively, 14.0 and 18.9 million liters, making an average for 1700 of 16.45 million liters. In tons of silver, this would amount to 14.81.

#### A.5 1750.

As in the preceding section (A.4), **wine** exports are obtained in volume from Martins (1990) and came to 14.8 million liters. Only the price of port wine was employed this time to value them given that by then this beverage represented around 90 per cent of all wine exports. The total value of this item amounted to 20.4 tons of silver.

As no data are obtainable for the export of **olive oil** for this benchmark, we use the closest evidence available on volume and price, which is for 1776. This is the year of publication of the first *Balança Comercial da Nação Portuguesa*, an official annual compilation in manuscript form of Portugal's foreign trade statistics.<sup>17</sup> The figure it provides us with is a total shipment in volume terms of 2.5 million liters and, at 1750 prices, a market value of 6.1 tons of silver.

In the absence of direct information on the consumption of foreign **grain**, we have adopted the mean of the years 1729 and 1776, taken, respectively, from Godinho

15 In this case the price employed is a composite of the prices, respectively, of ordinary wine in Lisbon and the price of port in Porto, their proportions then being 49 and 51 percent (Martins, 1990, p. 254).

16 The corrections thus carried out are based on 1) Lisbon imports representing 88.5% of all imports and 2) wheat imports representing 71.1% of all types of grain. See Rau (1954) and Serrão (2017).

17 Of use to us here, the *Balanças Comerciais da Nação Portuguesa* were produced by the Portuguese state in the following years: 1776, 1777, 1783, 1789, and 1796 to 1807. They are kept in the Arquivo Histórico do Ministério das Obras Públicas (Lisbon). In 1776 the quantity shipped was 146,532 almudes, which in the metric system converts to 2.5 million liters. This was worth 8.5 tons of silver.

(1955, p. 148) and the *Balança Commercial* for 1776. The results are a total volume of 37.1 million liters and a total value of 23.0 tons of silver, the latter using 1750 Lisbon prices.

#### A.6 1800.

The value and volume of **wine** exports are again from Martins (1990) for this year. The volume is 23 million liters and its value comes to 128.5 tons of silver.

The figure for the export of **olive oil** is the average of the amounts drawn from the *Balanças Comerciais* for three years – 1796, 1797, and 1799. They include sales to foreign countries, the colonies (mainly Brazil) and the islands of Madeira and the Azores. In volume this comes to 1.3 million liters, which are valued at the 1800 price of 6.5 grams of silver per liter, thus representing a total of 8.3 tons of silver.

The amount of **grain** imported into the country is from Serrão (2005) and is averaged over the interval 1796-1810. It comes to 89.0 million liters per year. The annual value of grain exports at this time was 151.6 tons of silver.

#### A.7 1850.

This is the only benchmark relative to which we have data for total values of agricultural exports and imports in *reais*, without need for volumes (Fontoura and Valério, 2001). The shares of the respective values of wine, olive oil, and grain in either total exports or imports are obtainable from Lains (1995). They can be converted into *reais* and then into tons of silver. The corresponding volumes can be derived using current prices.<sup>18</sup>

**Wine** exports represented 44.7 per cent of the value of total exports, in other words 4,246.5 million *reais*, the equivalent of 115.2 tons of silver. In volume this corresponded to 64.0 million liters.

On the other hand, **olive oil** exports were 4.1 per cent of the value of total exports, that is, 380 million *reais*, or 10.3 tons of silver. In volume, at current prices this amounted to 1.3 million liters.

**Grain** imports for this benchmark were 3.9 per cent of total imports by value and reached a value of 10 tons of silver, or 370 million *reais*. Using current prices, we infer that this would have represented a volume of 9.1 million liters.

18 All figures representing this benchmark are obtained by averaging data for the decades 1840-1849 and 1850-1859.

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