PRICE AND QUANTITY INDICES OF FOOD IMPORTS IN MALTA: 1856 – 1938[¤]

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Abstract

In their annual Blue Books for the Maltese colony, the British kept meticulous records on both prices and quantities of every imported commodity, producing a rich and complete data set of imports for that period. This paper uses the data collected by the customs officers during the British rule in Malta, between 1856 and 1938, to calculate several indices to find the general price level of food imports, imported inflation, and the level of food quantities imported. The paper also attempts to compare the price level in the Maltese Islands with that in other countries.

Price and quantity indices are produced for a number of individual commodities and for aggregate imports. Three different index number formulae are employed in the paper, namely the Laspeyres, Paasche, and Fisher. Overall indices are constructed using two alternative methods: first using the basic specification of each of the three methods, and then using yearly updated expenditure weights - the chain-linked method.

Although the data set is simple and uncomplicated by today's standards, one notes that the indices provide an excellent insight in the computation of the price level of imported goods and standard of living in Malta during the British rule.

[¤]*The authors acknowledge excellent research assistance from Daniel Castillo and Daphne Vassallo.*

[*]*Research undertaken is not in any way related to the full-time employment of the co-author. Hence the views expressed in this paper are solely those of the authors and do not necessarily reflect the views of the Central Bank of Malta.*

1. Background and the Data Set

For most of the colonial period, the British produced an annual Blue Book (not necessarily referring to a calendar year) for the Maltese Islands. These Blue Books covered the years 1821 to 1938, and documented information and statistics on a number of economic and social aspects of the colony. To give some examples, one can find information on the population, wages, pensions, government workers, public revenue and expenditure, hospitals and disease, education, bank deposits, agricultural produce and prices, and data on imports and exports. In all there 81 Blue Books for the Maltese colony that are still available. The only edition that is missing in Malta is the almanac for 1916-1917.

This paper focuses on the quantities and prices of the commodities that were imported by the Maltese Islands. For each commodity the Blue Books list the total quantity imported, the quantity imported for home consumption, the value of total imports, and the total duty paid. The quantities used in this paper are those imported for home consumption, while the prices are the unit prices calculated by dividing the total value of imports by the total quantity imported.

It is worthwhile to note that for the period 1821 to 1855 the data on imports was very limited, available only for a few commodities. As a result, this period was not taken into consideration for the purposes of this study. In addition, data for the years 1856 to 1910 was only reported for imports of basic food commodities. From the year 1910 onwards one can find additional data on (i) other consumer commodities, (ii) industrial and raw materials, (iii) agricultural goods, and (iv) gold and silver. In view of the above and for the sake of having a standardised data set, this paper employs data for 67 different basic food commodities covering the period 1856 to 1938. Figure 1 plots the total yearly observations for prices. This shows that the total number of observations tended to increase in the later parts of the period under study, specifically after the start of the twentieth century.

Figure 1

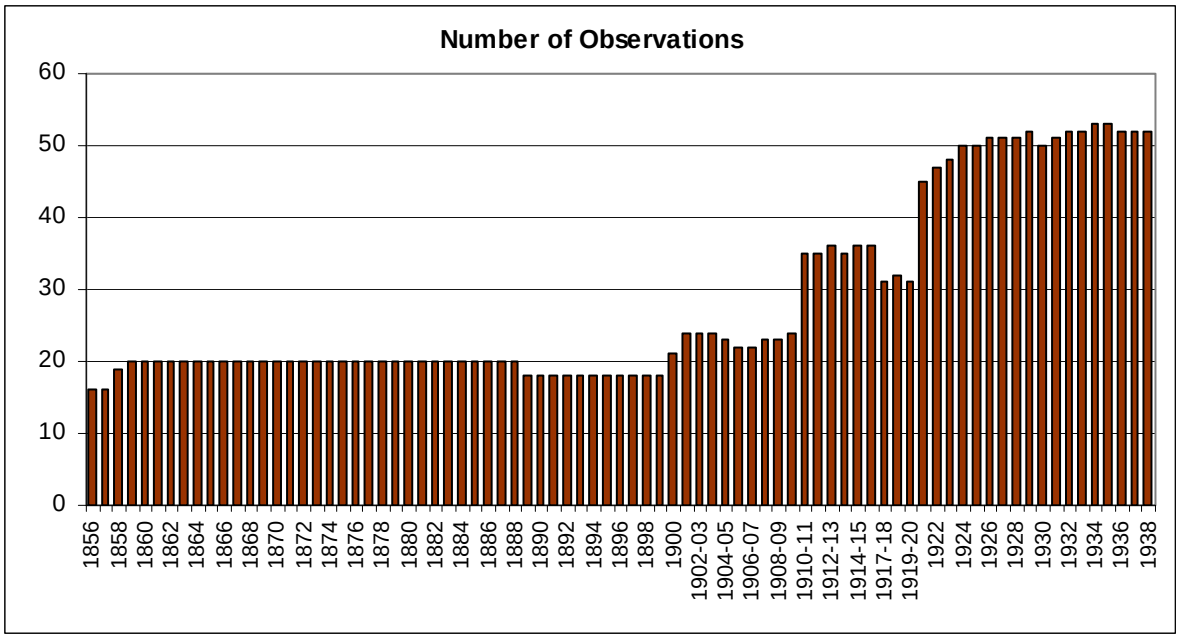


Table 1 lists the average proportion of total expenditure for each of the food commodities imported during our sample period. The table shows the 15 goods with the highest import expenditure (unit price multiplied by the total number of units imported) during three sub-periods. The establishment of the sub-periods emanates from the fact that the first period ending in 1879 preceded the era of the Classical Gold Standard (1880 - 1914). The years 1880 to 1914 are very important from an economic history point of view. In particular, as explained by Bordo (1981), this era featured swift economic growth, unrestricted movement of factors of production across countries, free international trade, and almost a total absence of wars across the globe. Flandreau *et al* (1998) put it clearly by stating that the Gold Standard developed during an era of globalisation.

Participating countries in the Gold Standard were committed to fix the price of their currency in terms of gold. Basically, this means that anybody could exchange money for gold at a fixed price. By way of example, Salvatore (2003) explains that during the Gold Standard a single British Pound was worth 113.0016 grains of gold, while one US Dollar was worth 23.22 grains. This implies that 1 US Dollar was worth 4.87 British Pounds (113.0016 divided by 23.22). Given that a number of countries had fixed their currency value in terms of gold, participating economies had implicitly adopted a fixed exchange rate regime. In practice this meant that price levels in different countries moved together over time.

Table 1

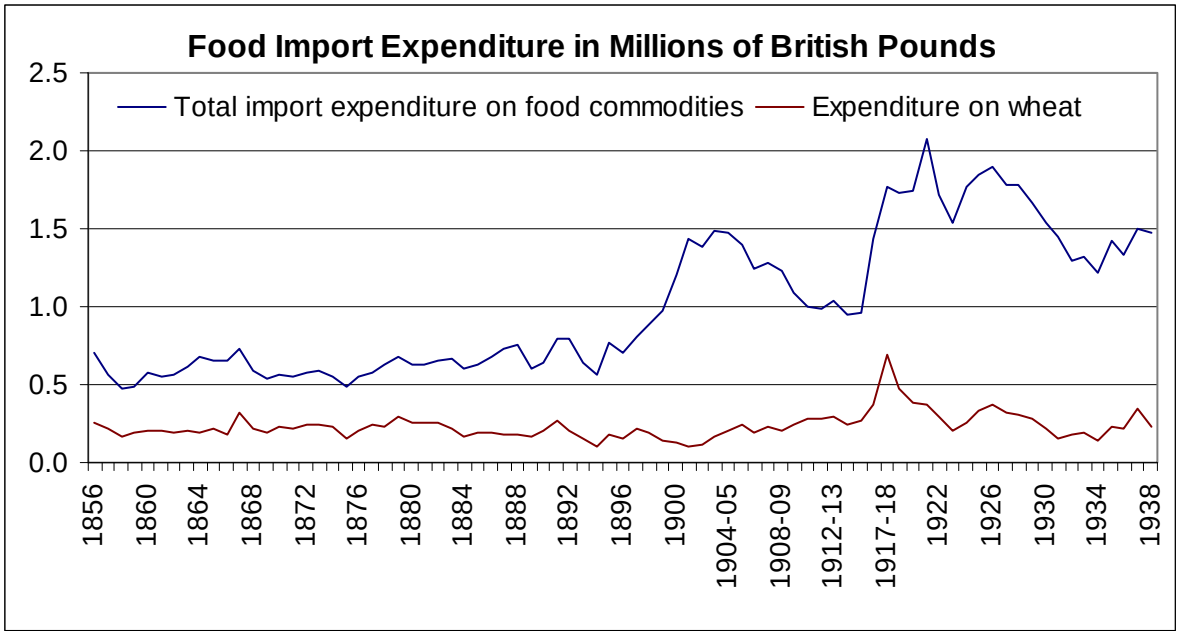
Average Proportion of Total Import Expenditure on Food Commodities					
Pre-Gold Standard 1856 – 1879		**Classical Gold Standard 1880 - 1914**		**WWI & the Interwar Years 1915 - 1938**	
Wheat	38.28%	Bullocks	26.36%	Wheat	18.82%
Inferior Wine	17.73%	Wheat	24.03%	Flour	8.53%
Bullocks	9.80%	Beer	9.61%	Sugar	6.89%
Oil	8.67%	Pulse	6.01%	Bullocks	6.75%
Pulse	5.79%	Manufactured Grain	5.44%	Wine in Casks	5.88%
Seeds	5.07%	Inferior Wine	4.33%	Petroleum	5.72%
Beer	4.11%	Oil	3.84%	Spirits	3.29%
Spirits	2.99%	Potatoes	3.02%	Cheese	3.15%
Potatoes	2.17%	Seeds	2.81%	Milk	2.93%
Barley	1.45%	Spirits	2.54%	Cotton Seed Oil	2.91%
Superior Wine	1.10%	Sugar	2.10%	Beer	2.70%
Manufactured Grain	0.69%	Saggina	1.27%	Butter	2.69%
Saggina	0.68%	Petroleum	1.25%	Saggina	2.41%
Horses	0.58%	Beef, Mutton & Pork	1.01%	Potatoes	2.37%
Damaged Grain	0.51%	Cotton Seed Oil	0.90%	Lard	2.25%
Other	0.38%	Other	5.48%	Other	22.71%
Total	**100.00%**	**Total**	**100.00%**	**Total**	**100.00%**

With this background in mind we can analyse the figures presented in Table 1. One notes that the top fifteen commodities in the pre-Gold Standard period represent 99.62 percent of the total import expenditure on food commodities, while the percentages for the Gold Standard period and the last period are 94.52 percent and 77.29 percent respectively. This emanates from the fact that a larger number of food commodities were being imported towards the end of our sample period. One can also observe that wheat and bullocks rank in the top four positions across all sub-periods. Additionally, it is also observable that alcoholic beverages made up a significant amount of the total import expenditure on food. For example, in the first period, inferior wine ranked second with 17.73 percent, beer ranked seventh with 4.11 percent, spirits ranked eight with 2.99 percent, and superior wine ranked eleventh with 1.1 percent. This yields 25.93 percent when combining all alcoholic commodities that are reported in the table. The respective percentages for the second and third period are 16.47 percent and 11.87 percent. In this context it is discernable that the main consumers of wine, beer, and spirits were the British soldiers and sailors that were stationed in Malta. In view of the high percentages attributed to the commodities topping Table 1, we can state that these commodities will be the drivers of the overall import price and quantity indices to be presented in the coming sections of this paper.

To conclude this section we now present Figure 2 showing the total food import expenditure for the period under consideration. The plot shows how total expenditure on imported food commodities was relatively stable during the first 40 years of our sample period. Until 1896, the average yearly

expenditure was around 0.6 million British Pounds. From this point onwards, expenditure on imported food items started to increase until it reached a maximum in 1921. From 1922 onwards, total expenditure retraced slightly downwards to end the period at around 1.5 million pounds. Figure 2 also shows the total expenditure on imported wheat. Interestingly, the plot reveals that the year 1918 saw the highest expenditure on imported wheat. This is obviously related the events that led to the riots of the *Sette Giugno* in 1919, where scarce international supply of basic food resulted in soaring prices of basic food items.

Figure 2



2. Relative Price and Quantity Indices for Individual Commodities

We now turn to presenting price and quantity graphs of three of most important commodities in the sample. Specifically we present price relative and quantity relative indices for wheat, bullocks, and beer. By price (quantity) relative we mean that each price (quantity) is divided by the price (quantity) prevailing in 1856. This yields an index whose value is unity in the base year 1856.

Figure 3 shows the relative price indices of beer, bullocks, and wheat. One can see that prior to the First World War the prices of the three commodities were relatively stable. During this period, prices were generally lower than those reported in 1856. This is demonstrated by the data points that are lower than one. At the start of World War I we can see a significant pickup in the relative price indices. This indicates that the year-on-year change in the price levels (inflation) was considerably high by today's standards during the First World War. Specifically, in the four years following 1914, the average annual import price inflation was 38.59 percent for beer, 32.72 percent for bullocks, and 33.3 percent for wheat. Additionally, we can note that during this period, the price of wheat increased by nearly three times that in 1913. It is also clear that following the year 1920 there was a precipitous

deflation in the price level of wheat. Having said this, it was only in 1930 when the relative price index of wheat reached the level that prevailed in 1913.

Figure 3

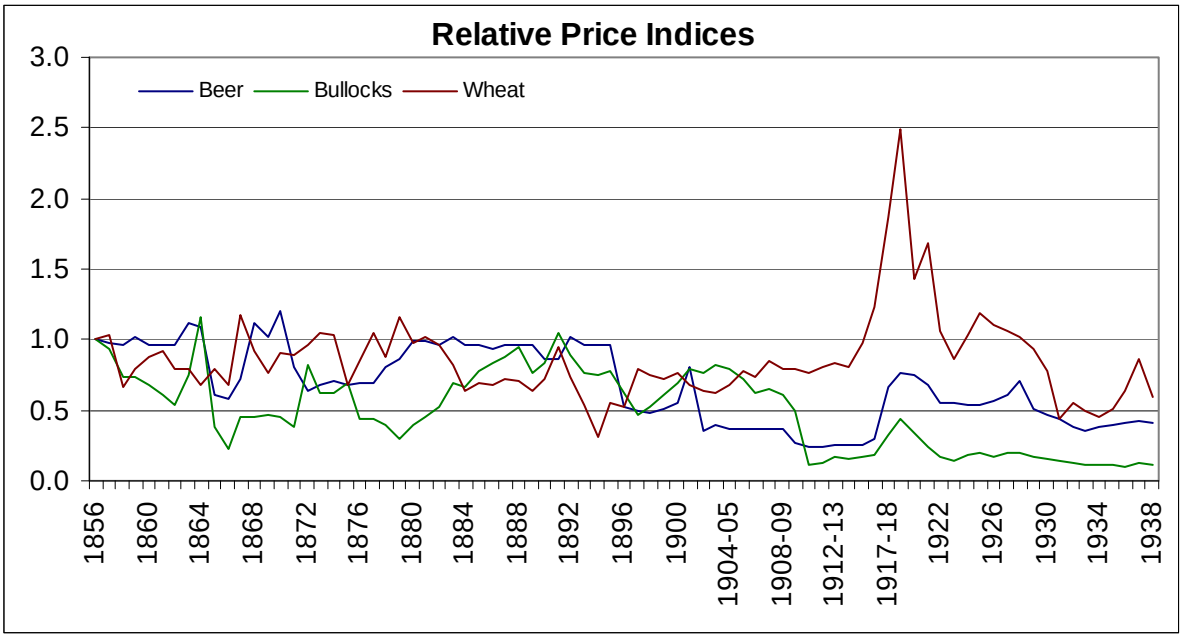
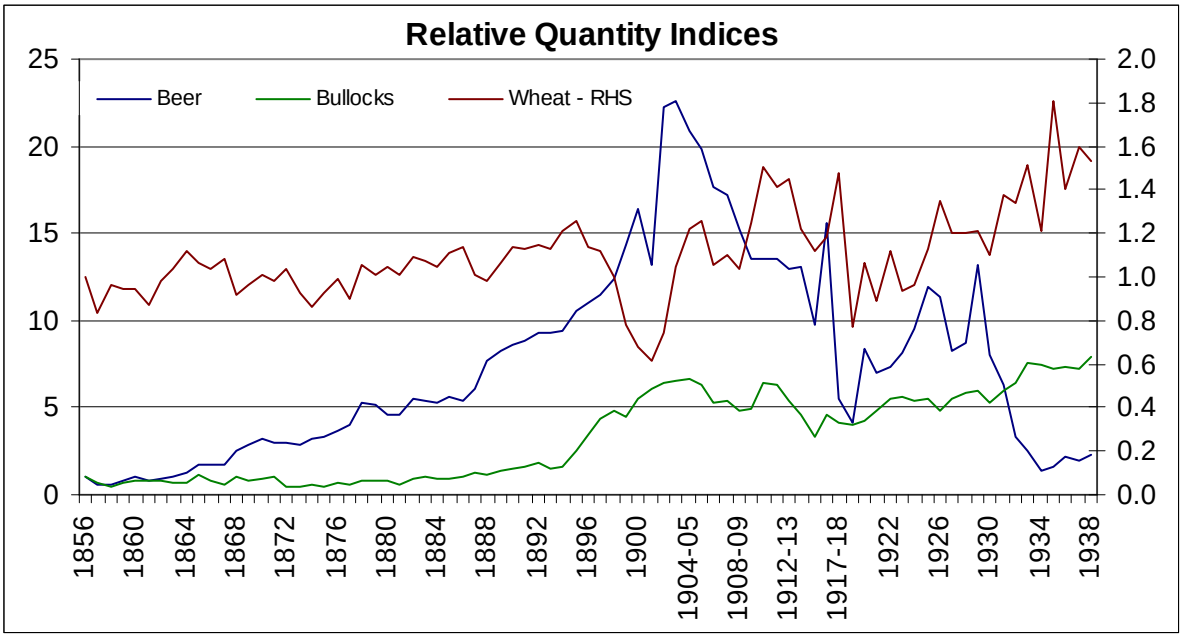


Figure 4 shows the relative import quantity indices for the three commodities presented above. It is important to highlight that the index for wheat is plotted on the axis on the right hand side (RHS), while the other two indices are conventionally plotted on the left hand side. Observing the plots in Figure 4, it is instantly apparent that the total quantity of imported wheat and bullocks (real imports) increased over the whole sample period. Specifically, the quantity imported of bullocks increased by 688 percent, while that of wheat increased by 54 percent. With regards to the real imports of beer, the index demonstrates that this product was prone to large fluctuations over the period. Specifically the index reaches a peak of 22.62 in 1904 but then retracts to end the period at 2.31. One has to mention that this drop in the quantity of imported beer might have been in part driven by the initiation of local beer brewing, particularly by the launch of Cisk Pilsner in 1928[1].

[1] http://www.cisklager.com/page.asp?p=17046&l=1

Figure 4



3. Theoretical Background to the Overall Indices

This paper utilises three price and quantity index formulae for overall indices. The formulae are those suggested by Laspeyres (1871), Paasche (1874), and Fisher (1922). In addition, this paper presents the chain-linked versions of the three types of indices. All price index formulas were obtained from the manual published by the ILO (2004).

Diewert (1987) provides an extensive review about the theoretical and economic justifications for using the Paasche and Laspeyres indices which have become the most widely used index number formulae for constructing price and quantity indices. The author lists ten tests, as considered in the literature, which are desirable properties for index numbers to satisfy. These include (i) the identity test, (ii) the proportionality test, (iii) the invariance to changes in scale test, (iv) the invariance to changes in units test, (v) the symmetric treatment of time (time reversal) test, (vi) the symmetric treatment of commodities, (vii) monotonicity, (viii) the mean-value test, (ix) circularity, and (x) the irrelevance to tiny commodities test.

The Laspeyres and Paasche indices fail two of the ten tests just listed, namely (v) and (ix), while the Fisher index fails only (ix). In view of this we consider the Fisher methodology to be slightly more appropriate in constructing price and quantity indices. This being said, we now turn our focus to show how the price and quantity indices are obtained.

The Laspeyres price index is a fixed-weight basket index widely used in the construction of cost of living indices such as the Harmonised Indices of Consumer Prices in EU countries[2], the Consumer Price Index in the United States[3], and the Retail Price index in Malta. The price index is given by

$$L_t = \frac{\sum_i p_{t,i} q_{0,i}}{\sum_i p_{0,i} q_{0,i}} \qquad \textbf{Equation 1}$$

where L_t is the Laspeyres value for period *t*, $p_{t,i}$ is the price in period *t* for the *i*th commodity; $p_{0,i}$ is the price in the base period for the *i*th commodity, $q_{0,i}$ is the quantity in the base period for the *i*th commodity, and t is the current period.

The Paasche price index formula is given by

$$S_t = \frac{\sum_i p_{t,i} q_{t,i}}{\sum_i p_{0,i} q_{t,i}} \qquad \textbf{Equation 2}$$

where S_t is the Paasche value for period *t*, $q_{t,i}$ is the quantity in period *t* for the *i*th commodity, and $p_{t,i}$ and $p_{0,i}$ are defined as in Equation 1. Note that to calculate the Paasche index, the researcher requires price and quantity data for each and every period. This results in many statistical bodies preferring the Laspeyres methodology to that suggested by Paasche.

The Fisher index is simply the geometric mean of the Laspeyres and Paasche price indices. This is given as

$$F_t = \sqrt{L_t * S_t} \qquad \textbf{Equation 3}$$

Having outlined the formulas to obtain the price indices, we now present the respective methods to obtain the quantity indices. In order to construct the latter, Diewert (1976) suggests interchanging the *p*s and *q*s in Equations 1 and 2 above. So the quantity Laspeyres index can be written as

$$L_t^Q = \frac{\sum_i q_{t,i} p_{0,i}}{\sum_i p_{0,i} q_{0,i}} \qquad \textbf{Equation 4}$$

While the Paasche quantity index is given by

$$S_t^Q = \frac{\sum_i p_{t,i} q_{t,i}}{\sum_i q_{0,i} p_{t,i}} \qquad \textbf{Equation 5}$$

It follows that the Fisher quantity index is simply the square root of the product of Equations 4 and 5 shown above. This is expressed as follows

$$F_t^Q = \sqrt{L_t^Q * S_t^Q} \qquad \textbf{Equation 6}$$

[2] http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/HICP_methodology#

[3] Shoemaker (1997)

In their analysis of the consumer price index, Wynne and Sigalla (1994) note that fixed-weight cost of living indices like the Laspeyres index suffer from a substitution bias. This occurs since the weights in a Laspeyres price index (the denominator in Equations 1 and 4) represent the expenditure share of each particular good in the base period. However, as seen in Figure 3, relative prices change over time. Hence if the price of beer increased relative to that of wine, one would expect to find relatively less beer and more wine imported and consumed in the country. Expenditure of beer (wine) would obviously become less (more) important in consumers' budgets. Clearly the Laspeyres formula does not allow us to capture these changing expenditure patterns. Wynne and Sigalla (1994) suggest that this problem can be tackled in one of two ways. The first alternative is to construct a Fisher index as we have just shown. The second option is to construct a chain-linked index. In view of this we now proceed by illustrating how the chain-linked Laspeyres, Paasche, and Fisher indices are calculated.

In a chain-linked index, each period is compared with the preceding one, with the weights being moved forward in each period. So for example, the chain-linked Laspeyres price index is given by

$$CL_t = \frac{\sum_i p_{1,i}q_{0,i}}{\sum_i p_{0,i}q_{0,i}} * \frac{\sum_i p_{2,i}q_{1,i}}{\sum_i p_{1,i}q_{1,i}} * \frac{\sum_i p_{3,i}q_{2,i}}{\sum_i p_{2,i}q_{2,i}} * \ldots \qquad \textbf{Equation 7}$$

Similarly, the chain-linked Paasche index can be expressed as

$$CS_t = \frac{\sum_i p_{1,i}q_{1,i}}{\sum_i p_{0,i}q_{1,i}} * \frac{\sum_i p_{2,i}q_{2,i}}{\sum_i p_{1,i}q_{2,i}} * \frac{\sum_i p_{3,i}q_{3,i}}{\sum_i p_{2,i}q_{3,i}} * \ldots \qquad \textbf{Equation 8}$$

It follows that a chain-linked Fisher index is simply obtained by taking the square root of the product of the chain-linked Paasche and Laspeyres indices as shown below

$$CF_t = \sqrt{CL_t * CS_t} \qquad \textbf{Equation 9}$$

As explained earlier, chain-linking the quantity indices would merely involve interchanging the *p*s and the *q*s in the chain-linked formulas, namely Equations 6 and 7 above.

4. Overall Price and Quantity Indices

Following the discussion in Section 3, we now turn to present the resulting indices as applied to the imports data in the British Blue Books for the Maltese Colony. For the sake of avoiding the substitution bias, here we limit our discussion to the results obtained by applying the chain-linked method. In addition, we give more prominence to the chain-linked Fisher indices as they are somewhat superior to their Laspeyres and Paasche counterparties. For a very concise discussion on the differences in the results obtained via the basic Fisher indices vis-à-vis the chain-linked Fisher indices, the reader is invited to refer to Annex I of this paper.

Figure 5 plots the Laspeyres, Paasche and Fisher chain-linked price indices for the overall imports. Five main facts emerge:

i) The price indices generally move together with an average correlation coefficient of 0.88 for the whole period. The close relationship between the indices appears to strengthen at the onset of the First World War. In fact, from 1914 onwards, the average correlation coefficient is 0.98;

ii) During the period before the Classical Gold Standard the indices were relatively stable, with the Fisher chain-linked index generally lying in the channel between 0.8 and 0.9;

iii) During the Gold Standard the index levels decreased, indicating an era of lower prices. Specifically, in 1910 prices were around 50 percent cheaper than those in 1856;

iv) Prices almost tripled during World War I, before pulling back at the beginning of the 1920s. However, it was only in the early 1930s when prices went back to the levels witnessed in 1910.

Figure 5

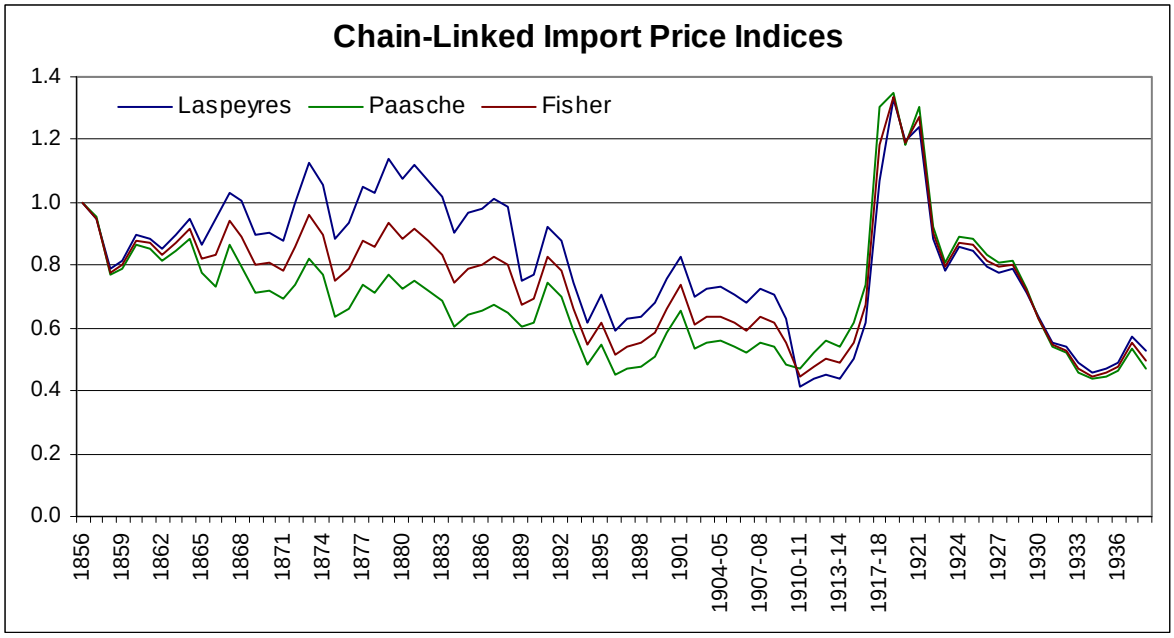


Figure 6 shows the Laspeyres, Paasche and Fisher chain-linked quantity indices for overall food imports. Five main observations materialize from this figure:

i) The chain-linked quantity indices move closely together with a correlation coefficient of 0.97. Again, the close relationship between the indices appears to strengthen just before 1918;

ii) The pre-Gold Standard period was highly stable in terms of the quantity indices, with the average Fisher index value being 0.95;

iii) The Gold Standard period proved to be highly beneficial for real imports in Malta, with the Fisher index increasing from 0.56 in 1880 to 2.69 in 1914;

iv) World War I appears to have reduced the level of quantities of food imports in Malta, with the year of the *Sette Giugno* riots registering the lowest Fisher index in the two decades preceding it. This obviously stems from the increase in prices that was depicted in Figure 5, and

v) From the 1920s onwards there was a significant pickup until the end of the period under study. During this time, quantities of food imports more than doubled.

We can compare the chain-linked quantity indices with the deflated total import expenditure (real import expenditure obtained by dividing the total expenditure by the chain-linked Fisher price index). Specifically, Figure 7 plots the chain-linked Fisher quantity index on the left axis while the real import expenditure denominated in British Pounds is plotted on the right hand side. The resulting plots almost overlap each other, corroborating the findings that emerged from Figure 6.

Figure 6

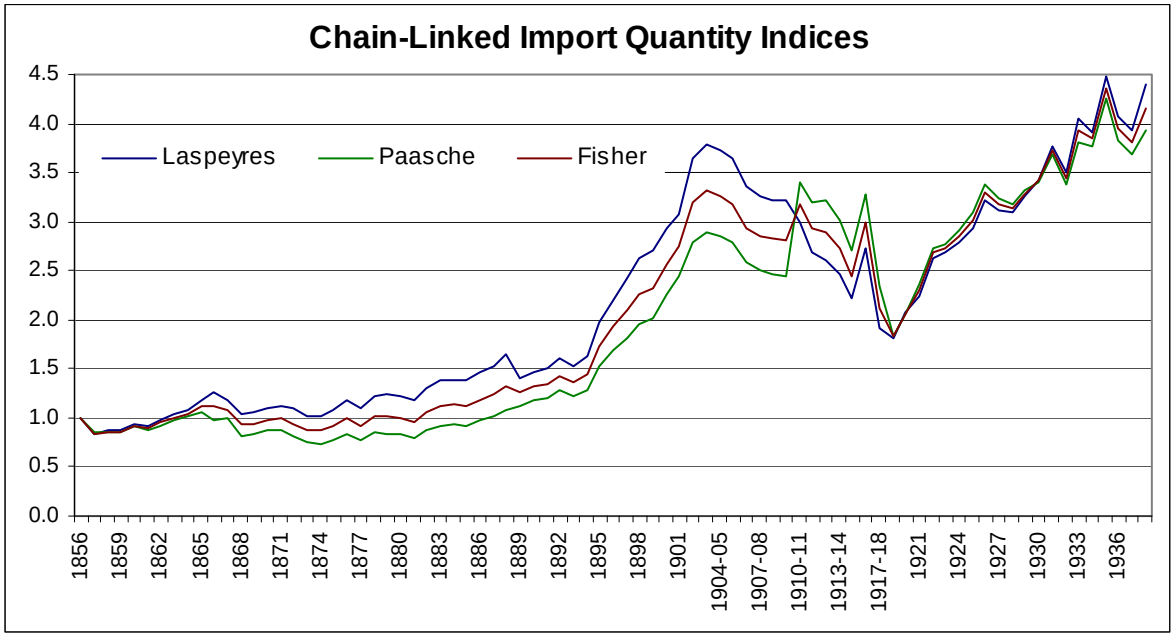
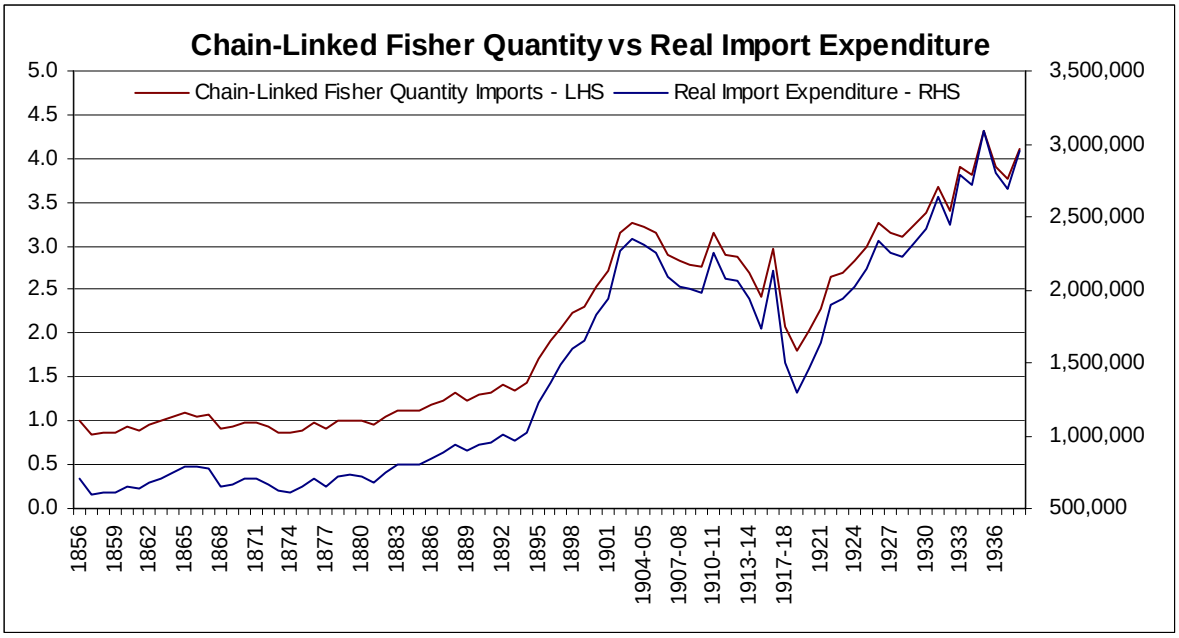


Figure 7

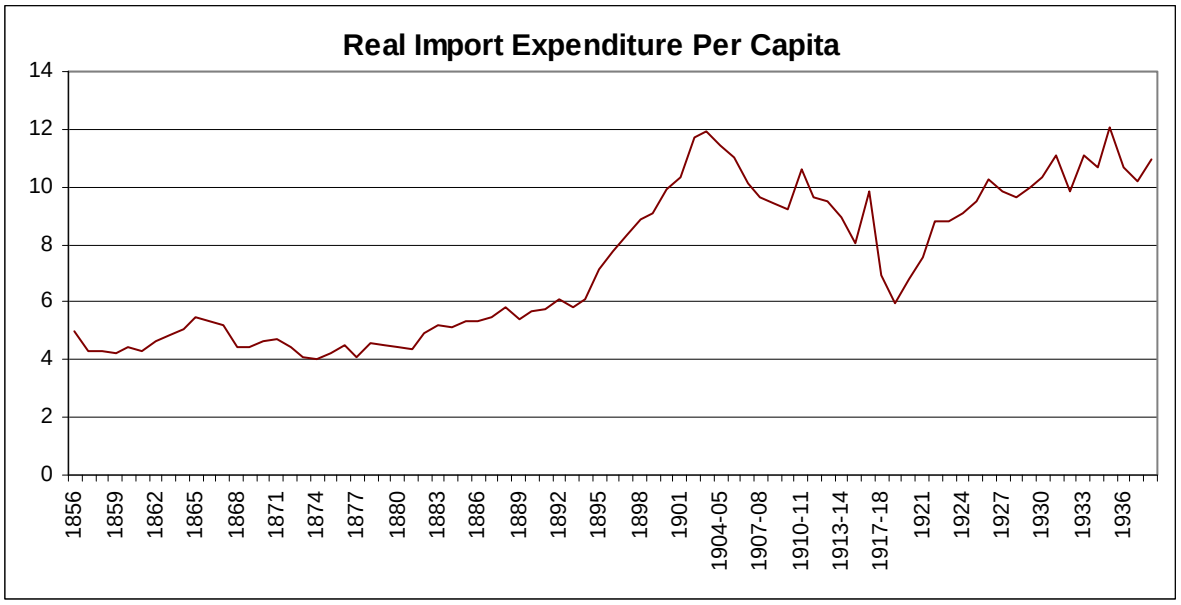


Summarising the above findings, one can say that by the end of 1938, the residents of Malta were enjoying around four times the quantities of food imports in 1856, at half the prices of 1856. Hence, as measured by the chain-linked Fisher import price and quantity indices, the overall standard of living was significantly higher by the end of our period.

The notion that the overall standard of living improved during the period under consideration can also be substantiated by diving the real expenditure on food imports (in 1856 prices) by the number of inhabitants (including British soldiers, sailors, and their families) in the colony of Malta[4]. This is shown in Figure 8, where the real food import expenditure per capita is plotted in British Pounds. Again, the plot shows that the per capita real expenditure increased during the Gold Standard before being severely retracted during the First World War until the riots of 1919. Specifically, the real import expenditure per capita increased from around five pounds in 1856 to 12 pounds in 1904. The hardship brought about during and after World War I resulted in per capita import expenditure falling to a low of six pounds in 1919. This trend was eventually reversed as per capita expenditure peaked at 12.07 British pounds in 1935.

[4] The reader is invited to see Annex II of this paper for a graph of the population of the Maltese colony.

Figure 8

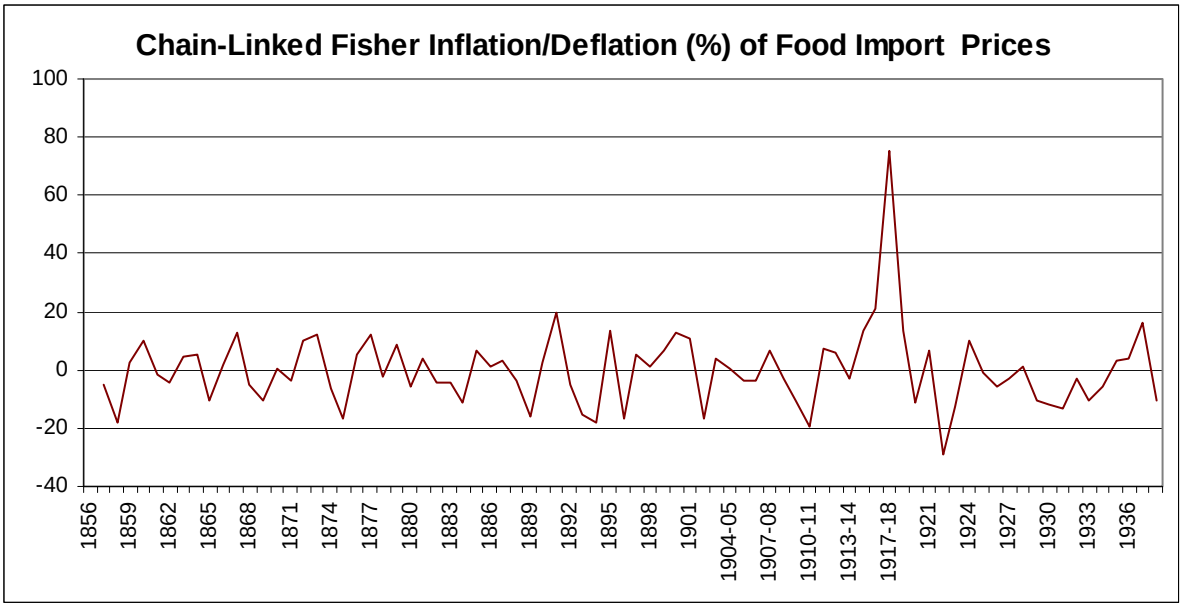


To conclude this section we present Figure 9 whereby we plot the yearly inflation (deflation) derived from the chain-linked Fisher import price index. This figure is very interesting for two reasons. Firstly, we can see that periods of inflation were generally followed by periods of deflation. In this spirit, inflation appears to have been a cyclical phenomenon. Secondly, it transpires that the instability emanating from imported food prices was inherent. For example year-on-year inflation or deflation rates of ten percent and above were somewhat common. Such fluctuations are deemed to be enormous by today's standards.

Figure 9 also shows the price instability of the 1910s, something that has already transpired from previous figures. Notably, the plot shows that in 1918, the price inflation of food imports stood at a staggering 75 percent. In other words, Figure 9 is the economic representation of the social situation which led to the historical riots of 1919.

As a concluding remark to this section, we note that the developments in the rate of inflation of imported food commodities can be considered to be representative of the overall price inflation in Malta. Most of the imported food commodities were the result of agricultural activities. Given that agricultural goods were also produced locally, and assuming that domestically produced goods were of the same quality as imported goods, one can infer that any commodity that was sold locally must have been exchanged at a uniform price, irrespective of whether it was coming from domestic production or from import activity. By way of a simple example, consider a farmer who is willing to sell potatoes at a particular price. Now assume that potatoes of the same quality as those sold by the farmer can be imported and sold at a lower price. It follows that in order to sell his produce, the farmer would have to settle for a lower selling price. The same argument would apply to any importer trying to sell a product at a dearer price than that of goods produced domestically. This implies that overall domestic prices must have behaved in a similar way as those reflected in the imports price index.

Figure 9



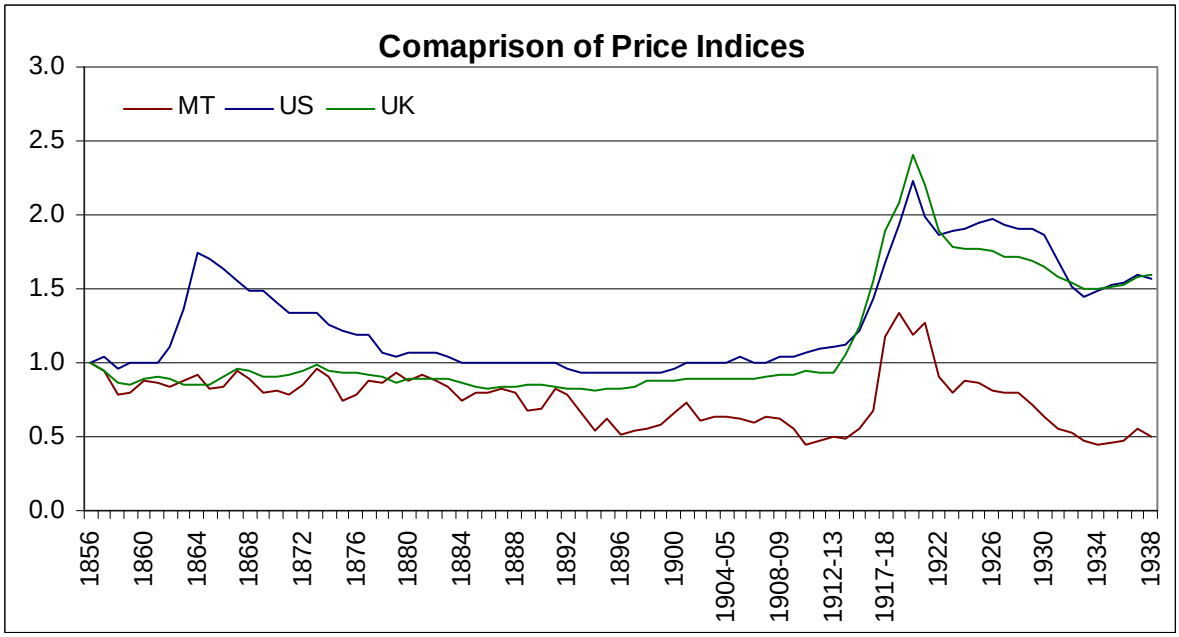
5. Prices in Malta Vis-À-Vis Those in Other Countries

Having analysed the import indices that were obtained for Malta, we now turn to compare the prevailing price level in Malta with that of the UK and the US. To do this we obtained a consumer price index estimated for the US that is made available by the Federal Bank of Minneapolis and an unofficial composite price index for the UK that is made available by the British Office for National Statistics. Both indices are available as from the year 1800, and were rebased to unity in 1856. This enables us to plot these indices together with our chain-linked Fisher imports price index in Figure 10.

Keeping in mind that (i) the index for Malta refers to food import prices, (ii) the US index represents consumer prices, and (iii) the UK index represents composite prices, a number of observations can be made on the obtained results:

1. The UK and US indices are smoother than that obtained in this paper. This reason behind this is that most probably smoothing techniques were used to even out fluctuations caused by the limitations of the primary data that was employed in estimating the indices;
2. The index for the US shows a significant departure from the other two indices during the 1860s and 1870s. This results mainly from the context of the American Civil War during the 1960s.
3. The movements in the three indices tend to highly mimic each other after the end of the Classical Gold Standard, specifically from 1914 up to 1938;
4. The indices for Malta and the UK both show a deflationary and relatively stable period until 1914, albeit Malta suffered more deflation than the UK during the said period; and
5. During the First World War the three indices increase, with the increase in the Maltese index being proportionately higher than that in the other two indices. Following their peak, the

Figure 10



Given these observations it transpires that during our sample period the Maltese economy was subject to the price fluctuations around the world. This should come as no surprise since the index represents food commodities that were imported from foreign markets.

6. Conclusion

This paper has shown how archived economic and social data can be used to produce a historic tome series of a particular important aspect of an economy. As discussed above this paper has produced a number of price and quantity indices for food imports in Malta for the period 1856 to 1936. The most relevant observations that resulted from the indices relate to three specific sub-periods. Distinctively, the pre-Gold Standard phase (1859 to 1879) was characterised by overall stable prices and quantities of food imports, albeit varying significantly from year to year. The era of the Gold Standard (1880 to 1914) was a period of economic prosperity and improved standard of living as overall import prices decreased, while quantities or real imports were on the increase. On the other hand, the beginning of the First World War imposed economic hardship on the residents of Malta as higher import prices resulted in fewer quantities of imports. This was also reflected in a deterioration of the real import expenditure per capita. The economic hardships culminated in 1919 as demonstrated by the *Sette Giugno* uprising. From then onwards the situation appears to have improved as import prices decreased while the quantity of imports picked up. This paper also made an international comparison of price indices. This showed that during the period under study, the developments in

import prices in Malta were closely related to the prevailing prices in the economies of the UK and of the US.

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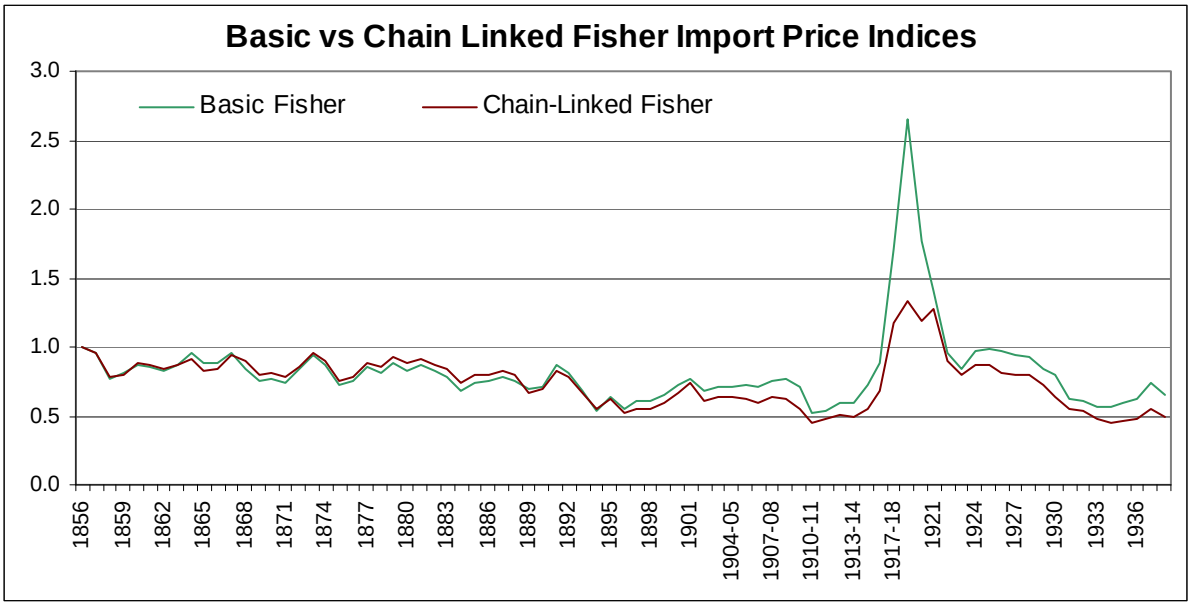
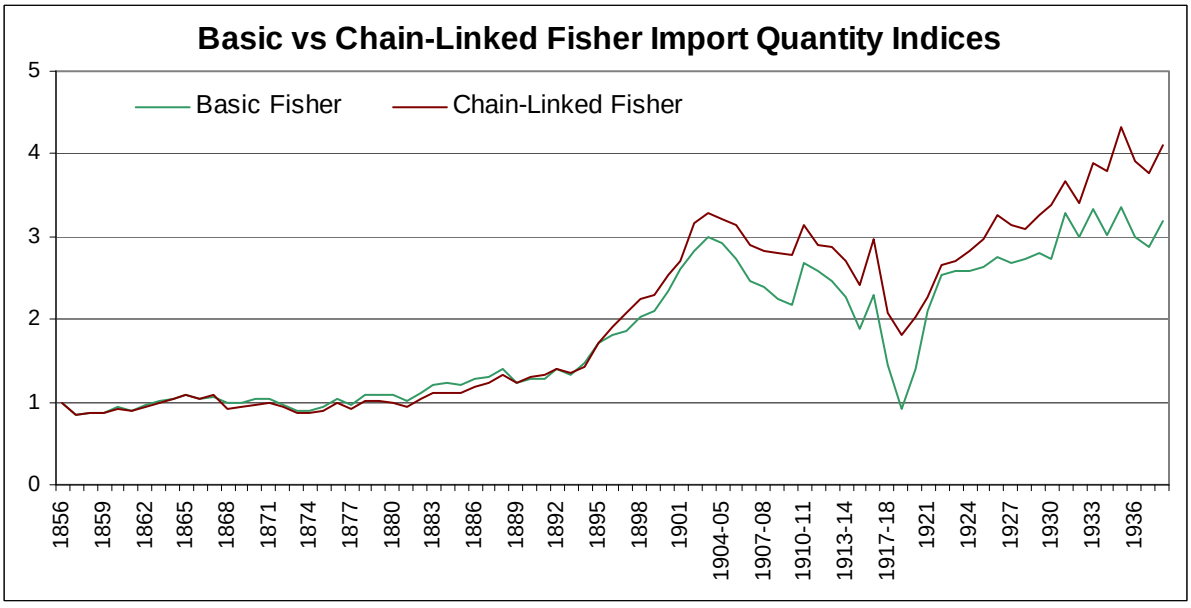
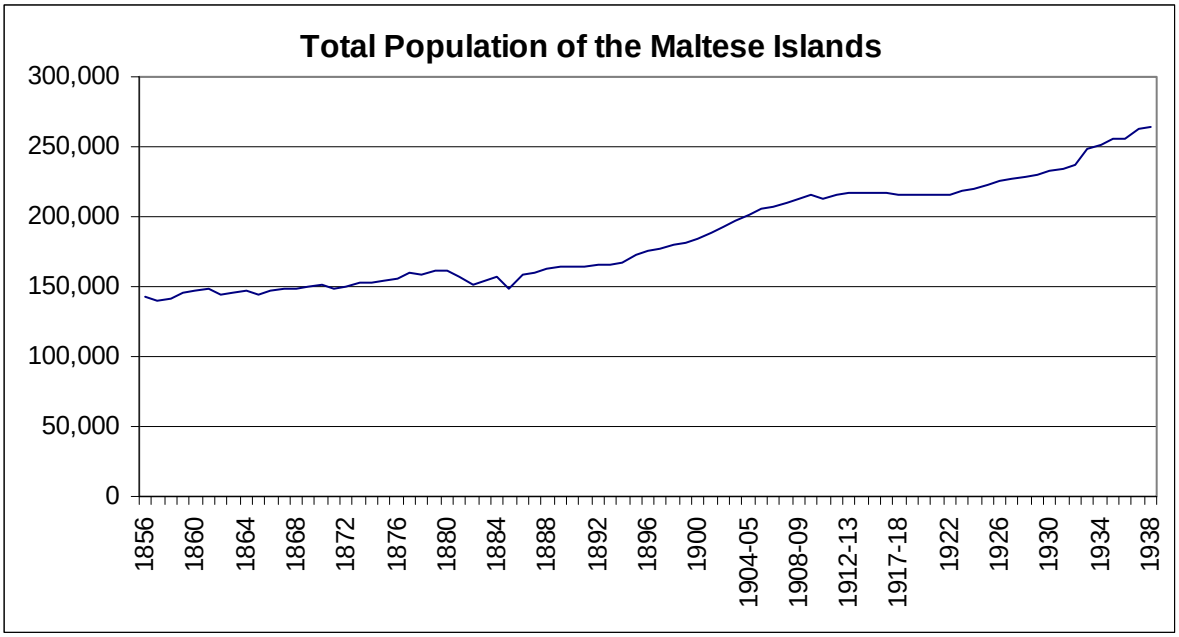
Annex I

Both figures show that the basic Fisher and the chain-linked Fisher indices move closely together. Specifically the correlation between the indices in the first chart is 0.82, while that for the indices in the second chart is 0.98. With reference to the two figures below, the only significant spread between the two indices appears to be during the second decade of the twentieth century. Specifically, during the said decade the basic Fisher price index suffers a proportionately higher increase than its chain-linked counterparty. In terms of the quantity indices, the basic Fisher suffers a more prominent decrease in quantities during the 1910s.





Annex II


Total Population of the Maltese Islands
300,000
250,000
200,000
150,000
100,000
50,000
0
1856
1860
1864
1868
1872
1876
1880
1884
1888
1892
1896
1900
1904-05
1908-09
1912-13
1917-18
1922
1926
1930
1934
1938