Globalisation and the Ottoman Empire: A study of integration between Ottoman and world cotton markets

Laura Panza
La Trobe University, Melbourne.

Abstract
The Ottoman Empire underwent a process of integration with the global economy during the second half of the nineteenth century, thus following the same pattern experienced by many regions of the world. This paper explores one aspect of this process, examining the linkages established between the cotton industries in Egypt and Western Anatolia, both of which we consider as part of the Ottoman Empire, and the international cotton market, during the time of the so-called first wave of globalisation (1850-1914). We undertake a quantitative exploration of the pattern of price transmission between the international cotton market and the Ottoman Empire markets over this period, connecting changes in the nature of spatial market integration between these markets to major economic and political developments. As far as we are aware, this is the first rigorous econometric analysis of cotton market integration between nineteenth century international and Ottoman Empire markets.

1. Introduction
The study of the process of market integration has engendered lively interest in the literature on historical and contemporary commodity markets, thus giving rise to a wide range of theoretical and empirical studies. Most economic historians analysing the political and socio-economic structure of the Ottoman Empire during the nineteenth century unanimously agree that it underwent a process of integration with the global economy, thus following the same pattern experienced by many regions of the world at the time of the so-called first wave of globalisation.

The vast majority of the available studies describe Ottoman international economic integration through the use of qualitative data, focusing on the surge in volumes of trade experienced by the Empire and in the ratios of exports to output. However, trade volumes, despite being instructive when it comes to understanding the changes in the economic structure of the Empire, can rise (or decline) owing to factors unrelated with integration (or the lack thereof); trade expansion can, in fact, be triggered by shocks in supply and demand not necessarily connected with “globalisation” effects.

The dramatic intensification of linkages with the global economy, visible through the exponential growth of Ottoman trade volume and value during the long nineteenth century,
represents an unequivocal sign of the Empire’s participation in the vast expansion of international trade. Together with other commodities, cotton was a key Ottoman export. Owing to the crucial significance it played in the world economy during this particular historical period, the analysis of cotton trade provides a useful aid to understanding the nature of the relationship between the Ottoman and the global markets.

In our analysis we consider Western Anatolia and Egypt as two Ottoman regions, the former located at the core of the Empire, the latter at its periphery. While there is common agreement among scholars that Western Anatolia belongs to the Ottoman realm, Egypt’s situation as member of the Empire is open to debate. In fact, most scholars treat Egypt as a separate entity with its own government and head of state. Even if Egypt increased its level of autonomy during the early nineteenth century in the administrative, political and financial spheres, we regard it as still nominally part of the Ottoman Empire from an economic perspective. From an international trade perspective, it was subjected to the same commercial conventions signed by Istanbul, hence it had no power to implement an independent trade policy; moreover, no direct taxes could be imposed on foreigners without the consent of Istanbul, because of the presence of Capitulations. On the other hand, the semi-autonomous province had complete control over domestic taxation.

In our study we undertake a quantitative exploration of the process of market integration between the Ottoman and the world cotton markets: our aim is to discover whether the extent of Ottoman cotton market integration changed (improved or worsened) over time and also to connect changes in the nature of spatial market integration between these markets to major economic and political developments.

It is important to acknowledge that the pace at which the Ottoman state was incorporated into the European-dominated world economy was gradual and at the same time uneven. The Empire was a heterogeneous entity, so that some regions were affected at an early stage of the

---

3 In the nineteenth century cotton production and trade played a pivotal role in the world economy owing to the critical importance the raw material assumed in the process of the industrial revolution. Cotton became “the core input of the world’s most important manufacturing industry, in terms of amount of labour employed, value of output and profitability” (Beckert 2004:1408). Moreover, many of the technological innovations of the nineteenth century first appeared in the cotton textile industry, thus leading to unprecedented increases in productivity and to a rapid reduction in prices, which transformed cotton into a mass commodity.

4 Alan Richards (1977) considers the beginning of Muhammad Ali’s rule as the crucial time when Egypt shifted from belonging to the “Ottoman world-system” to integrating into the capitalist system. This is when, according to the author, a dramatic change in the country’s social and technical relations of productions in agriculture occurred.

5 Muhammad Ali, recognized by Istanbul as the Ottoman governor of Egypt in 1805, transformed the region from a subordinated province to a military and politically autonomous power; nevertheless Muhammad Ali and his successors continued paying the yearly tribute and submitting the annual budget to the Sublime Porte for approval. The former was fixed at 40 million kurşun in 1841, but increased over time (in 1866 and 1873). Moreover, even after the British occupation in 1882, Egypt always recognised Ottoman suzerainty.

6 The Ottoman concept of capitulation was based on the Turkish ahd name, meaning treaty, and from the Arabic إمتياز أجنبى meaning privileges for foreigners. They refer to the agreements undertaken by the Sultan of the Ottoman Empire and European powers, which granted tax exemption and other privileges to foreigners. They recognised the status of conditional extraterritoriality for foreign subjects, while affirming the political sovereignty of the Ottoman state. The Capitulations were further extended to non-Muslim Ottoman citizens.
nineteenth century, while others remained comparatively untouched until the twentieth century.\footnote{See, for example, Donald Quataert, 1987: “A provisional report concerning the impact of European capital on Ottoman port workers, 1880-1909” in Kasaba Reşat (1988). See also Hossein Mahdavy (1970).} The main implication of the Ottoman Empire’s territorial vastness and its regional diversification was that commodity market integration took place at various speeds and magnitudes. We will therefore reflect upon this diversity and investigate whether the two major Ottoman cotton-exporting cities, Alexandria and Izmir, experienced different patterns and degrees of international price transmission.

Despite the multitude of quantitative studies investigating the intensity of price transmission and the degree of linkages of commodity markets among nineteenth century economies, most empirical analysis has directed its attention to developed countries. On the other hand, far fewer works\footnote{See, for example, the study of Marks Daan (2009) on rice price convergence in Indonesia and of Goodwin and Grennes (1998) on wheat price integration in Tsarist Russia.} have investigated developing countries’ levels of involvement and receptiveness to the new global phase spurred by the Industrial Revolution, when the volumes and values of commodities exchanged nationally and internationally expanded exponentially.

In a recent article Şevket Pamuk (2004) provides some evidence of the co-movement of commodity prices between the main Ottoman and European cities, thus attesting to the existence of market integration between the Empire and the global economy.\footnote{In another paper Özmucur and Pamuk (2005) test for commodity market integration between Istanbul and other European cities between 1500 and 1800 using the Law of One Price as a theoretical framework.} But the statistical analysis is quite elementary and the author himself suggests the need for further research using more sophisticated statistical techniques. Our study makes a worthwhile contribution by undertaking a more in-depth analysis of one aspect of the Ottoman Empire’s participation in the global commodity market.

The paper is structured as follows: after discussing the role played by the Ottoman Empire in the global cotton market in section 2, we illustrate in section 3 the analytical framework and the methodology utilized to explore the process of market integration based on the Law of One Price. We then proceed with an econometric analysis of international cotton market integration in Egypt and Western Anatolia in section 4. In the final section we discuss the implications of the statistical results outlining the different experiences of the Egyptian and Anatolian markets and present some conclusions.

2. The Ottoman Empire as a global cotton supplier

Raw cotton has been an important commercial commodity for the Ottoman Empire throughout the centuries. From the late sixteenth century until the end of the eighteenth century it represented an essential crop for the Ottoman economy, not only used in the domestic market but shipped in large quantities to Europe, mainly from the Western Anatolian port of Izmir. On the
other hand, in Egypt cotton cultivation did not begin to play an important role in the country’s economy until the beginning of the nineteenth century.\footnote{At the beginning of the nineteenth century, long staple cotton was introduced in Egypt as a major crop, after its discovery by a French engineer who was working with the government of Mohammed Ali, the ruler of Egypt at the time.}

With the advent of the industrial revolution and the consequent expansion of the British and Western European textile industries, Ottoman cotton production experienced a phase of decline due to cheaper and higher quality cotton substitutes coming from the slaves’ plantations in the U.S.

The relevance of Western Anatolia\footnote{Another area that increased in importance in the world market as a cotton supplier at the time of the American Civil War was the Adana region.} and Egypt as cotton suppliers revived at the height of the outbreak of the American Civil War (1861-65), which coincided with the suspension of raw cotton shipments from American ports to Europe. The crisis, which came to be known as the “cotton famine”, raised concerns about the U.S. as an interrupted source of supply and resuscitated interest in the Ottoman raw fibre. A true production boom took place in both areas, characterised by a considerable extension of the area under cotton cultivation and by a spectacular increase in output and exports.

At the end of the Civil War, once the cotton boom was over and when the effects of the price hike were reversed, cotton production in the two regions undertook two separate paths (see graphs 1 and 2): Western Anatolian cotton followed a declining trend until the end of the century, while Egyptian cotton exports continued rising, despite a slight initial decrease. In the 1870s Egypt’s output was two and a half times as large as it had been in the previous decade and cotton’s importance continued growing, until it eventually became the country’s major export commodity. Average yearly growth rates were of around 34.5 per cent between 1822-24 and 1855-59; they then rose to around 40 per cent between 1855-59 and 1880-4 and declined to 16.3 per cent between 1880-4 and 1910-3.

\textbf{Graph 1: Value of cotton exports from Izmir, 1862-1910.}

\begin{center}
\begin{tikzpicture}
\begin{axis}[
width=\textwidth,height=\textwidth,
axis y line*=left,
axis x line = none,
axis line style={thick},
xmode=linear,ymode=linear,
xtick={1863,1866,1869,1872,1875,1878,1881,1884,1887,1889,1892,1895,1898,2001},
xticklabels={1863,1866,1869,1872,1875,1878,1881,1884,1887,1889,1892,1895,1898,2001},
xticklabel style={align=center},
xticklabel style={font=\small},
ytick={0,500000,1000000,1500000,2000000,2500000},
yticklabels={0,500,000,1,000,000,1,500,000,2,000,000,2,500,000},
yticklabel style={align=center},
yticklabel style={font=\small},
]
\addplot[blue,mark=none,thick] table [x index=0, y index=1] {\inputdata.txt};
\end{axis}
\end{tikzpicture}
\end{center}

\textit{Sources:} Quataert (1973); Kurmus (1987); Mihci and Mihci (2002).
Graph 2: Annual average volume of exports of Egyptian cotton, in qantars (=98-9 lb), 1822-1913.


3. Analytical framework

The model utilised in our study follows the theoretical framework which describes the concept of market integration as the fulfilment of the Law of One Price (LOP). The empirical analysis, centred on the study of the cotton market in two areas of the Ottoman Empire, Western Anatolia and Egypt, from 1845 to 1914, is conducted as one example that may help us reach a deeper understanding about the level of Ottoman participation in the global economy during the so-called first wave of globalisation. More specifically, the analysis is aimed at examining the evolution of integration over time, and at relating its changes in pace and extent to broader economic and political developments.

According to the LOP, of which the cornerstone analysis is the Takayama and Judge model (1971), two spatially separated markets are considered to be integrated when changes in one market are transposed to the other, assuming that trade costs are constant.

Thus, the process of price transmission between the Ottoman cotton markets and the world economy (American cotton sold in Liverpool, as explained in section 4) can be described by the following two equations:

\[ P_{ALEX} = \beta_1 P_{LIVERPOOL} + \gamma_1 P_{IZMIR} + \varepsilon \]  \hspace{1cm} (1)

\[ P_{IZMIR} = \beta_2 P_{LIVERPOOL} + \gamma_2 P_{ALEX} + \varepsilon \]  \hspace{1cm} (2)

where \( P_{ALEX}, P_{LIVERPOOL}, P_{IZMIR} \) represent prices of cotton in Alexandria, Liverpool (global prices) and Izmir, respectively, while \( \varepsilon \) is the disturbance term.
The above described relationship would need to be verified by first determining the stationarity properties of the price series. This is to ensure that the regression results are not spurious. In addition, the model needs to assume a dynamic structure to accommodate both short-run and long-run dynamics in the interconnection among Ottoman and global prices (or the absence thereof).

The price movements of the three locations during the period under analysis are depicted in graph 3. A common pattern in the development of the series can be noticed: a slow rise from 1845 to 1858, followed by a price drop till 1861. This was caused by a rapid improvement in the productive capacity of cotton cultivation, which was not matched by the absorption capability of the textile industry. After the huge jump in the early sixties, coinciding with the American Civil War (1861-5), prices underwent a downward trend till the end of the century, corresponding to the global depression (1873-96). This was followed by a period of steady price increase until the First World War. Thus, a simple visual analysis of price co-movements reveals the presence of a common behaviour among the variables in the long-run, with Alexandria and Izmir cotton markets following global prices. At the same time, it is also noticeable that there are some specific points in time in which prices are diverging. Hence, the nature of the relationship and the degree of spatial market integration among the price series over time need further investigation.

Another important characteristic of the series can be observed in their price differentials: the price of Egyptian cotton was generally higher than that of American cotton sold in Liverpool owing to its superior quality; moreover, Egyptian long staple cotton was usually used in a blend with other more standard varieties to produce higher quality cotton cloth. On the other hand, Western Anatolian native cotton, known as “yerli” (a variety of Indian Gossypium herbaceum), was rough and short stapled. Owing to its lower quality, it was cheaper than both Egyptian and American cotton and was utilised to produce a coarser cloth.

---

12 The faster expansion of cotton supply compared with its demand (the harvest of 1859 had been the largest in the history of the U.S., reducing the price of cotton to its lowest level) led to a large accumulation of stocks in European ports and mills and led to a market crisis. The label “cotton famine” is therefore regarded as a misnomer by economic historians, as the crisis was not due entirely to the shortage of the raw material, even during the climax of the war in 1862 (when cotton imports from the United States fell by 96 per cent), but was rather a crisis of overproduction. See, among others, Henderson (1932), Brady (1963) and Farnie (1979).

13 The premium of the Egyptian staple over the American mounted to higher levels at the end of the 1890s, reaching 63 per cent in 1906-7.

14 After the American Civil War Britain was replaced as the main importer of Anatolian cotton by Austria and Spain whose mills utilised a coarser fibre and produced cloth of inferior quality.
The principal issue that needs to be addressed in order to conduct a thorough examination of the extent of integration between the Ottoman cotton market and the world economy is the analysis of the structure and characteristics of the cotton market, in order to understand what may have facilitated or obstructed the process of price convergence. We believe that five crucial factors related to the features of the cotton market need to be examined in order to assess the impact of the dynamics of price transmission:

1) The change in trade policy, i.e. the lowering of export tariffs in 1861-2;
2) The reduction in transport costs;
3) The improved exchange rate stability consequent to the adherence to the gold standard;
4) The market structure of the domestic cotton industry;
5) The relevance of the Ottoman Empire in the overall formation of world cotton prices.

We expect the first three factors to have facilitated the process of market integration, and the last two to have hindered it, as can be inferred from their analysis presented in the following paragraphs.

1) Export taxes.

Until 1861 the Ottoman government imposed a 12 per cent duty on all exports,\(^{15}\) as established by the 1838 Anglo-Turkish convention and the Hatt i-Serif (Imperial Script) of the following year (which also fixed import tax rates at 5 per cent and led to the gradual abolition of state monopolies). The major change within the Ottoman trade policy which has affected the

\(^{15}\) Export taxes were considered an important source of fiscal revenue by the Ottoman government.
cotton trade coincides with the reduction of export duties in 1862 from 12% to 1%; the value of this tax did not change until the dissolution of the Empire.

Export taxes constitute a form of trade cost and a cause of distortion in markets. Therefore, the developments in Ottoman trade policy, which saw a sharp reduction in export duties in 1861-2 (from 12 per cent to 1 per cent), represented a reduction in trade costs. For this reason we can expect that the reduction has had a beneficial effect on market integration and consequently eased the process of price transmission. It is important to specify that if the export tariff had remained unchanged at 12 per cent, markets could still have been integrated, provided that the tax was not prohibitive. The reduction in trade costs brought about by the lower export tax is then expected to have accelerated the speed of price transmission.

2) Transport costs.

In the Ottoman Empire as in the rest of the world, the major development that revolutionised the way in which commodities were moved, both by land and water, was the invention of the steam engine in the late eighteenth century and its further improvements during the nineteenth century. Thus, transport costs were sharply reduced and the unpredictability of travelling by sail was minimised. Moreover, with the increasing size of steamships over the course of the nineteenth century, maritime trade costs experienced further reductions.

Steamships began entering Ottoman waters in the 1820s and started replacing wind-powered vessels so that, by the end of the century, they captured the trade of the majority of all goods transported by sea. Such developments, together with the introduction of the telegraph in 1869 and the expansion of the railway system, represented a crucial turning point in linking the Ottoman lands with the global economy and were the basis of the significant expansion in the cotton trade. Furthermore, both the Izmir and Alexandria harbours underwent a process of modernisation in infrastructure: the port of Izmir was renovated between 1867 and 1875, thus endowing it with new facilities comprising a 4 kilometre-long quay and 32 hectares of dock space. In Alexandria new jetties, wharves and docks were built between 1869 and 1880, while a further stage of port development occurred at the end of the nineteenth century.

The biggest decrease in transport costs took place after the mid-century and costs continued undergoing a steady decline until the outbreak of the First World War. Such a reduction in transport costs led to a decrease of the wedge between global and Ottoman prices and consequently to an acceleration of the process of convergence. We would therefore expect the degree of integration of the Empire to increase after the 1860’s owing to the improvements in maritime transportation.

3) Exchange rate in the Ottoman Empire

In the 1880s the Ottoman Empire abandoned bimetallism and adhered to the gold standard.16 The latter has often been regarded by the literature as a crucial factor in facilitating

---

16 The Ottoman Empire and Egypt adopted bimetallism in the 1840s and the 1830s, respectively. The former entered the gold standard in 1881 and the latter in 1885.
trade expansion and market integration owing to the engendered reduction of exchange rate risk volatility. The gold standard was in fact a system of fixed exchange rates, under which countries agreed to exchange their currencies for gold at a fixed price. It can therefore be expected that the Ottoman adherence to this international financial system acted as a stimulus to the process of market integration with the global economy.

4) Market structure in the domestic cotton industry

The domestic cotton market in the Ottoman Empire was decentralised on the production side, but concentrated in the export sector. Cotton was cultivated by a vast number of farmers and sold to the international market by a small number of merchant houses. Thus, the domestic market can be characterised as an oligopsony, where multiple sellers supply a few buyers.

Graph 4: Ottoman cotton supply chain.

As depicted in graph 4, cotton was cultivated by a large number of fellahin (farmers), predominantly on their small land holdings and, to a lesser degree, in the big estates of a few powerful landowners. In the first case, farmers sold their produce (often through village sheiks) to an intermediary who, in turn, brought it to the ginnery and supplied it to export merchant houses. When cotton was cultivated in large landholdings (which were more widespread in
Egypt than in Western Anatolia), in most cases a direct agreement was established between landlords, ginneries and exporters. Thus, merchants played a pivotal role in the cotton trade as they represented an essential link between the domestic and the international market.

The existence of interactive, socio-economic networks among Ottoman merchants in various parts of the Empire and in Europe may have led them to share information about the market and to cooperate in their trade activities. Such collusive behaviour can be identified as a potential source of market power in the domestic market and the presence of this non-perfectly competitive market represents a distortion which can hinder price transmission.

5) The Ottoman Empire’s role in the global cotton market

While the domestic market was characterised by the presence of market power on the demand side due to the small number of buyers from producers, it is not immediately clear whether the Empire had any market power as a cotton exporter in the global market. Ottoman participation in the international cotton trade was relatively small, but increased considerably after the 1860s, following the American Civil War, as shown by its share in world production (Egypt was a much bigger player than Western Anatolia). As depicted in graph 5, between 1850 and 1914 global cotton production was dominated by the U.S.; nevertheless this does not preclude the possibility that the Empire had some degree of market power, particularly in the short-run. We will explore this further through our statistical analysis of price transmission. As in the case of monopsony/oligopsony, the presence of market power in the world market constitutes an obstacle to market integration.

*Graph 5: Average annual share in world cotton exports, 1850-1914.*

<table>
<thead>
<tr>
<th>Year</th>
<th>US</th>
<th>India</th>
<th>Egypt</th>
<th>Western Anatolia</th>
</tr>
</thead>
<tbody>
<tr>
<td>1850-9</td>
<td>80</td>
<td>17</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>1860-9</td>
<td>37</td>
<td>51</td>
<td>8.3</td>
<td>2.4</td>
</tr>
<tr>
<td>1870-9</td>
<td>65</td>
<td>26</td>
<td>7</td>
<td>0.4</td>
</tr>
<tr>
<td>1880-9</td>
<td>63</td>
<td>27</td>
<td>8.6</td>
<td>0.3</td>
</tr>
<tr>
<td>1890-9</td>
<td>64</td>
<td>25</td>
<td>9.2</td>
<td>0.2</td>
</tr>
<tr>
<td>1900-9</td>
<td>72</td>
<td>13</td>
<td>13</td>
<td>0.3</td>
</tr>
<tr>
<td>1910-4</td>
<td>72</td>
<td>18</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

*Sources:* Hanson (1980); Mitchell (1988); Todd John (1915); For Western Anatolia: Mihe i and Mihe i (2002).
To summarize, in the analysis of the process of Ottoman participation in the global cotton market three different forces can be considered as factors promoting and accelerating price convergence: decreased transport costs from mid-century onwards, a reduction in export taxes from 1861-2 and the adherence to the gold standard from the 1880s. We would therefore expect market integration to be stronger from the 1860s onwards. On the other hand, the existence of market power in the domestic market and possibly in the international market may have hindered or slowed down this process.

4. Methodology and data

The methodology adopted to study the dynamics of Ottoman cotton market integration and to verify the validity of our expectations for increased integration from the 1860s onwards, is based on the following procedure. First we estimate the order of integration of each cotton price series through the Augmented Dickey Fuller (ADF), Zivot-Andrews and Clemente, Montañés and Reyes unit root tests. These last two are univariate structural break tests which allow for the presence of one and two regime shifts respectively, within the single series. We then perform the autoregressive distributed lags (ARDL) co-integration test in a multivariate framework, coupled with the cumulative sum of recursive residual (CUSUM) andCUSUM square (CUSUMSQ) structural break tests, in order to assess the stability of the co-integration relationship. Finally, we construct and estimate an ARDL model to depict the short and long-run nature of the relationship among prices.

Price Data

The cotton price data were obtained from various sources. As they were expressed in different units of measurement (in Egyptian pounds per qantar in Egypt;\textsuperscript{17} in piastres per okke or per cwt in Turkey\textsuperscript{18}), they have been converted in metric tons per British pound, using exchange rates given by Pamuk (2000) for Turkey and by Owen (1969) for Egypt.

For Izmir, the main export harbour of Western Anatolia, wholesale domestic cotton prices have been acquired from both unpublished and published sources:

- 1845-1862: Consular Reports of the British Foreign Office consulted at the British National Archives in London:
  - FO 78/62; 701; 750; 795; 832; 868; 905; 954; 1020; 1108; 1209; 1307; 1447; 1687.
- 1863-76: Kasaba Reşat, 1988;
- 1859-1861: Owen Roger, 1981:
- 1876-1908: Quataert Donald, 1973;

\textsuperscript{17} One qantar is the equivalent of 98.9 lb.; one Egyptian pound corresponds to one British pound.

\textsuperscript{18} One okke equals 1.283 kg., while one cwt corresponds to 112 lbs; one British pound equals 1.10 Turkish lira, which in turn was made up of 100 piastres.

Prices for the years 1856 and 1883-4 could not be found, hence the missing data have been filled through interpolation.

For Alexandria, the principal Egyptian export location, domestic cotton prices have been found in the following published sources:
- 1845-1873: Owen, E.J.R., 1969;
- 1874-1913: Richards Alan, 1987,\(^20\)
- 1914: Johnson W. H., 1926.

American cotton prices sold in Liverpool, obtained from David Jacks, Kevin H. O’Rourke, Jeffrey G. Williamson, 2009, have been held as world prices: Liverpool was the principal global harbour for the import of raw cotton during the nineteenth century, and the U.S. the main global supplier. Hence, prices of American cotton in Liverpool have been used as a proxy for the Ottoman ones, owing to the lack of a complete series of Egyptian and Anatolian world prices in the period under analysis. For the years in which world prices for Ottoman cotton are available (from 1863 to 1875 and 1882 to 1914 for Egyptian cotton sold in Liverpool and from 1876 to 1908 for Izmir cotton export price) a clear co-movement among the series is observable, thus justifying the use of American prices as a proxy. Table 1 compares the price index for American cotton with the Egyptian and Turkish indexes.

**Table 1: Index of annual average prices for American Egyptian and Western Anatolian cotton (1901-05=100).**

<table>
<thead>
<tr>
<th></th>
<th>American</th>
<th>Egyptian</th>
<th>Western Anatolian</th>
</tr>
</thead>
<tbody>
<tr>
<td>1876-1880</td>
<td>119</td>
<td>-</td>
<td>124</td>
</tr>
<tr>
<td>1881-1885*</td>
<td>111</td>
<td>100*</td>
<td>117</td>
</tr>
<tr>
<td>1886-1890</td>
<td>107</td>
<td>93</td>
<td>102</td>
</tr>
<tr>
<td>1891-1895</td>
<td>78</td>
<td>71</td>
<td>82</td>
</tr>
<tr>
<td>1896-1900</td>
<td>69</td>
<td>73</td>
<td>75</td>
</tr>
<tr>
<td>1901-1905</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>1906-1910</td>
<td>107</td>
<td>133</td>
<td>106</td>
</tr>
</tbody>
</table>

Note: *1882-85 for Egyptian prices


---

\(^{19}\) "Osmanlı Dönemi tarım istatistikleri 1907-1914". Tarihi İstatistikler Dizisi Cilt 3. Tevfik Güran.

5. Application

The cotton price data for all cities have been transformed into their log values. The data showed a positively skewed distribution.\textsuperscript{21} Table 2 illustrates some descriptive statistics of the logs of the three prices.

*Table 2: Descriptive statistics*

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Variance</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liverpool</td>
<td>4.10</td>
<td>0.413</td>
<td>0.170</td>
<td>1.39</td>
<td>5.39</td>
</tr>
<tr>
<td>Alexandria</td>
<td>4.13</td>
<td>0.392</td>
<td>0.154</td>
<td>0.70</td>
<td>3.65</td>
</tr>
<tr>
<td>Izmir</td>
<td>3.90</td>
<td>0.393</td>
<td>0.154</td>
<td>0.90</td>
<td>4.39</td>
</tr>
</tbody>
</table>

The first step for understanding the relationship among variables in order to detect the presence of market integration is to test for the level of integration of each single variable. This procedure takes the form of stationarity tests. According to the augmented Dickey Fuller test for unit root,\textsuperscript{22} where the number of lags has been chosen following the Schwarz Information Criterion,\textsuperscript{23} all the variables are shown to be stationary. Table 3 shows that the null of unit root is rejected at the 5\% level of significance for Alexandria and Liverpool and at 1\% level of significance for Izmir.

*Table 3: ADF results (with drift).*

<table>
<thead>
<tr>
<th></th>
<th>Lags</th>
<th>Test statistics $Z(t)$</th>
<th>1% critical value</th>
<th>5% critical value</th>
<th>10% critical value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liverpool</td>
<td>1</td>
<td>-2.267*</td>
<td>-2.385</td>
<td>-1.669</td>
<td>-1.295</td>
</tr>
<tr>
<td>Alexandria</td>
<td>1</td>
<td>-2.307*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Izmir</td>
<td>1</td>
<td>-3.221*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: * = stationary.

Unit root tests may have low power if a structural break is present in the series as outlined, amongst others, by Leybourne and Newbold (2003). Moreover, if structural breaks are not taken

\textsuperscript{21} A logarithmic transformation is often useful for data which have positive skewness, as with the log values the approximation to a normal distribution is greatly improved. Moreover, the vast majority of studies centred on the issue of price convergence use logs in order to draw a conclusion about the elasticity of price transmission.

\textsuperscript{22} The ADF test showed the presence of stationarity with drift. The procedure to test for unit root followed the approach proposed by Seddighi, Lawler and Katos in: “*Econometrics: A Practical Approach*”. Ch 7.4, pp. 262-281.

\textsuperscript{23} Pesaran and Smith (1998) argue that the Schwarz Information Criterion should be preferred because it often has a more parsimonious specification. Verma Reetu (2007) adds that it is more suitable to small datasets.
into account, co-integration techniques may show misleading results. It has already been mentioned that, from the graphical inspection of the cotton data, a dramatic upsurge in prices affecting all three markets at the height of the America Civil War is noticeable. Moreover, the effects of the “great depression” of 1873-96, with the associated price deflation, are likewise clearly distinguishable. These events may give rise to single or multiple breaks in the series.

Therefore, unit root tests allowing for one structural break in both intercept and trend, following Zivot and Andrews’ procedure, are performed. The results, depicted in Table 4, show the presence of unit roots for Alexandria and Liverpool, while the Izmir price series is stationary at the 5% level of significance. The fact that these results are not consistent with those obtained from the ADF suggest that regime shifts in the series are highly probable.

Table 4: Zivot and Andrews test.

<table>
<thead>
<tr>
<th></th>
<th>Break</th>
<th>t-statistics</th>
<th>1% critical value</th>
<th>5% critical value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liverpool</td>
<td>1867</td>
<td>-3.147*</td>
<td>-5.57</td>
<td>-5.08</td>
</tr>
<tr>
<td>Alexandria</td>
<td>1867</td>
<td>-2.753*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Izmir</td>
<td>1862</td>
<td>-5.343</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: * = non-stationary.

The power of the Zivot and Andrews and other unit root tests detecting a single structural break have been questioned by Perron (1997), Lumsdaine and Pappel (1997), Clemente, Montañés and Reyes (1998), Lee and Strazicich (2003) and many others. One fundamental weakness the unit root procedure stems from its incapability to deal with more than one break. This criticism has led to the development of stationarity tests allowing for multiple breaks.

The Clemente, Montañés and Reyes test is, therefore, performed to determine the stationarity of the series allowing for two regime shifts: Table 5 reports the results of the test based on the Innovative Outlier (IO) model, where two changes in the mean are allowed to take place gradually, and on the Additive Outlier (AO) model, where the mean shifts happen suddenly. The cotton price series in Alexandria and Liverpool are shown to be non-stationary, confirming Zivot and Andrews’ procedure. However, the Izmir data prove to be stationary when tested using the IO model, but not stationary according to the AO model. Thus, the different outcomes of the tests based on the AO and IO models introduce uncertainty as to the true order of integration of the Izmir cotton price variable.

---

24 Gregory and Hansen (1996) and Gregory, Nason and Watt (1996) have shown empirically that co-integration tests which do not allow for regime shifts can generate spurious outcomes.
### Table 5: Clemente, Montañés and Reyes test.

<table>
<thead>
<tr>
<th></th>
<th>Break dates (IO model)</th>
<th>t-statistics</th>
<th>Break dates (AO model)</th>
<th>t-statistics</th>
<th>5% critical value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liverpool</td>
<td>1860-1863</td>
<td>-4.832*</td>
<td>1858-1872</td>
<td>-4.742*</td>
<td>-5.490</td>
</tr>
<tr>
<td>Alexandria</td>
<td>1860-1865</td>
<td>-4.851*</td>
<td>1858-1872</td>
<td>-4.206*</td>
<td></td>
</tr>
<tr>
<td>Izmir</td>
<td>1860-1871</td>
<td>-6.971**</td>
<td>1863-1869</td>
<td>-5.337*</td>
<td></td>
</tr>
</tbody>
</table>

Note: * = non-stationary, ** = stationary.

**ARDL Co-integration test**

According to the unit root test results the three variables under study show a different level of integration, therefore the conventional Johansen’s co-integration procedure cannot be applied as it requires all data series to be non-stationary. Furthermore, both unit root tests also suggested that some variables contain structural breaks. This finding further complicates the use of Johansen’s test owing to the fact that it does not take into account endogenous structural breaks. To overcome these difficulties, the ARDL approach to co-integration has been adopted to estimate the analytical model. This method has been supplemented with the CUSUM and CUSUMSQ analysis to detect structural breaks.

This methodology has been chosen as it allows a greater degree of flexibility, owing to its versatility in including both stationary and non-stationary data and in allowing additional variables that can represent structural breaks. Moreover, the ARDL bound testing is preferable when the sample size is small and allows the determination of different lag lengths for each variable, unlike vector error correction (VEC) and VAR models.

The ARDL framework which will be used to test the presence of co-integration in the Ottoman cotton market is specified by the following two models, which define the Alexandria and Izmir market, respectively:

\[ \Delta \ln P^{ALEX} = \alpha_0 + \sum_{j=1}^{n} b_j \Delta \ln P^{ALEX}_{t-j} + \sum_{j=0}^{n} c_j \Delta \ln P^{LIV}_{t-j} + \sum_{j=0}^{n} d_j \Delta \ln P^{IZMIR}_{t-j} + \delta_1 \ln P^{IZMIR}_{t-1} + \delta_2 \ln P^{LIV}_{t-1} + \lambda_1 \text{war} + \lambda_2 \text{gold} + \varepsilon_{1t} \]

\[ \Delta \ln P^{IZMIR} = \alpha_0 + \sum_{j=1}^{n} b_j \Delta \ln P^{IZMIR}_{t-j} + \sum_{j=0}^{n} c_j \Delta \ln P^{LIV}_{t-j} + \sum_{j=0}^{n} d_j \Delta \ln P^{ALEX}_{t-j} + \delta_1 \ln P^{IZMIR}_{t-1} + \delta_2 \ln P^{LIV}_{t-1} + \lambda_2 \text{war} + \lambda_2 \text{gold} + \varepsilon_{2t} \]

25 Although Engle and Granger’s (1987) original definition of co-integration refers to variables that are integrated of the same order, Enders (2004) argues that it is possible to find equilibrium relationships among groups of variables that are integrated of different orders. Lütkepohl and Krätzig (2004:89) also explain that: “Occasionally it is convenient to consider systems with both I(1) and I(0) variables. Thereby the concept of co-integration is extended by calling any linear combination that is I(0) a co-integration relation, although this terminology is not in the spirit of the original definition because it can happen that a linear combination of I(0) variables is called a co-integration relation.”
where

\[ P_{AEX} = \text{cotton price in Alexandria} \]
\[ P_{LIV} = \text{cotton price in Liverpool} \]
\[ P_{IZMIR} = \text{cotton price in Izmir} \]
\[ \delta_1, \delta_2, \delta_3 = \text{long-run multipliers} \]
\[ b_j, c_j, d_j = \text{short-run effects} \]
\[ war = \text{American Civil War (1860-65)} \]
\[ gold = \text{adherence to gold standard (1881 for Izmir, 1885 for Alexandria).} \]

Two dummy variables have been added to Equations 3 and 4, in order to take into account the effects of the American Civil War and the adherence to the gold standard. The latter has been included as it has been widely documented that the adoption of the gold standard, and the associated exchange rate stability, contributed to lowering trade costs, thus facilitating the process of market integration. Great Britain adhered to the fixed exchange rate system from 1870 till the outbreak of the First World War. The Ottoman Empire adopted it from 1881 and Egypt from 1885.

The choice of the lag structure is a crucial issue in this test. One lag has been chosen for \( \ln P_{AEX} \), \( \ln P_{IZMIR} \) and \( \ln P_{LIV} \), while no lags have been added to \( \Delta \ln P_{LIV} \) and \( \Delta \ln P_{IZMIR} \) and \( \Delta \ln P_{AEX} \) in regressions 3 and 4, as determined by the Schwarz Bayesian Information Criterion.\(^{26}\)

The ARDL co-integration procedure consists of testing the null of no co-integration \( H_0: \delta_1 = \delta_2 = \delta_3 = 0 \) against the alternative, i.e. the absence of a long run relationship between the dependent variable and the regressors. The validity of the null hypothesis can be examined comparing the F statistic obtained from the regression with the F-test critical values computed by Narayan (2005). Narayan calculated critical values for sample sizes ranging from 30-80 observations, diversified according to the number of regressors \( k \), following the methodology proposed by Pesaran, Shin and Smith (2001): the two computed sets of critical values provide a band that covers all possible classifications of the variables into I(0) and I(1). If the computed F-statistics is higher than the upper bound of the critical value, then the null will be rejected, while in the case where it lies under the lower bound, then the hypothesis of lack of co-integration is validated.

The results, reported in Table 6, suggest the presence of a co-integration relationship for both the Alexandria and Izmir cotton markets. The specifications we used here are with unrestricted intercept and no trend (case III in Narayan, 2005).

\(^{26}\) Pesaran and Shin (1999) have demonstrated empirically that the Schwarz Bayesian Information Criterion has shown a better performance with small samples.
Table 6: ARDL bound test for co-integration in the Ottoman cotton market

<table>
<thead>
<tr>
<th>Model</th>
<th>F-statistics</th>
<th>Critical values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1%</td>
</tr>
<tr>
<td>k=4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Izmir*</td>
<td>7.94</td>
<td></td>
</tr>
<tr>
<td>k=4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: *k* indicates the number of regressors.

The presence of a co-integration relationship for both the Alexandria and Izmir markets allows us to use the ARDL error correction approach to analyse the long and short-run relationship among domestic and world prices, following the model suggested by Pesaran et al. (1996, 1999), which is closely related to the bound testing approach.

The estimation of a long-run model is specified as follows:

\[
\ln P^{ALEX} = \alpha_0 + \sum_{j=1}^{n} \alpha_j \ln P^{ALEX}_{t-j} + \sum_{j=0}^{n} \alpha_2 \ln P^{LIV}_{t-j} + \sum_{j=0}^{n} \alpha_3 \ln P^{IZMIR}_{t-j} + \lambda_1 \text{war} + \beta_1 \text{gold} + \varepsilon_{1t} \tag{5}
\]

\[
\ln P^{IZMIR} = \gamma_0 + \sum_{j=1}^{n} \gamma_j \ln P^{IZMIR}_{t-j} + \sum_{j=0}^{n} \gamma_2 \ln P^{LIV}_{t-j} + \sum_{j=0}^{n} \gamma_3 \ln P^{ALEX}_{t-j} + \lambda_2 \text{war} + \beta_2 \text{gold} + \varepsilon_{2t} \tag{6}
\]

where

\[\alpha_1, \alpha_2, \alpha_3, \gamma_1, \gamma_2, \gamma_3\] embody the long-run coefficients describing the co-integrated relationship.

Following the Schwarz Bayesian Information Criteria, one lag was added to each variable, hence \(j_{\text{MAX}} = 1\).

Once the long-run relationship is established, we can apply the ARDL procedure for estimating the short-run relationship among domestic and world cotton prices. This is described through the computation of an error correction model within the ARDL framework and it is expressed as follows:

\[
\Delta \ln P^{ALEX} = \alpha_0 + \sum_{j=1}^{n} b_1 \Delta \ln P^{ALEX}_{t-j} + \sum_{j=0}^{n} c_1 \Delta \ln P^{LIV}_{t-j} + \sum_{j=0}^{n} d_1 \Delta \ln P^{IZMIR}_{t-j} + \lambda_1 \text{war} + \beta_1 \text{gold} + \theta_1 \text{ECT}^{1}_{t-1} + \varepsilon_{1t} \tag{7}
\]

\[
\Delta \ln P^{IZMIR} = \alpha_0 + \sum_{j=1}^{n} b_2 \Delta \ln P^{IZMIR}_{t-j} + \sum_{j=0}^{n} c_2 \Delta \ln P^{LIV}_{t-j} + \sum_{j=0}^{n} d_2 \Delta \ln P^{ALEX}_{t-j} + \lambda_2 \text{war} + \beta_2 \text{gold} + \theta_2 \text{ECT}^{2}_{t-1} + \varepsilon_{2t} \tag{8}
\]
where:

- $c_1$ ($c_2$) and $d_1$ ($d_2$) embody how much of a given change in cotton prices in Liverpool and Izmir (Alexandria) is transmitted to Alexandria (Izmir) within the first year. These parameters represent the initial adjustment or contemporaneous effect.

- $\theta_1$ and $\theta_2$ are the coefficients of the error correction term (ECT), which shows how fast variables converge to equilibrium and therefore describes the speed of adjustment effect.

Hence $\theta$ represents the short-run speed of adjustment to reach the long-run equilibrium, as it defines how much of the price difference among the three prices is eliminated in each subsequent period: the closer its value is to -1, the faster is the speed at which convergence takes place. The presence of a $\theta$ different from zero is a necessary condition for long-run price convergence. On the other hand, a significantly different from zero $c_1$ ($c_2$) or $d_1$ ($d_2$) is neither a necessary nor a sufficient condition for convergence to take place. Even if these coefficients are equal to one, which corresponds to perfect short-run adjustment, the series may still drift apart in the long-run.

The two ECT are defined as follows:

$ECT_1^t = \ln P_{ALEX}^t - \alpha_0 - \sum_{j=1}^{n} b_j \ln P_{ALEX}^{t-j} - \sum_{j=0}^{n} c_j \ln P_{LIV}^{t-j} - \sum_{j=0}^{n} d_j \ln P_{IZMIR}^{t-j} - \lambda_1 \text{war} - \beta_1 \text{gold}$

$ECT_2^t = \ln P_{IZMIR}^t - \alpha_0 - \sum_{j=1}^{n} b_2 \ln P_{IZMIR}^{t-j} - \sum_{j=0}^{n} c_2 \ln P_{LIV}^{t-j} - \sum_{j=0}^{n} d_2 \ln P_{ALEX}^{t-j} - \lambda_2 \text{war} - \beta_2 \text{gold}$

A further step in the analysis of the co-integration relationship consists of testing for the stability of the parameters which define it. This is to ensure that no structural break is present. Unstable parameters would, in fact, undermine the validity of the model and lead to misspecification and biased results.

The existence of structural breaks in the co-integrated cotton market of the Ottoman Empire has been tested for following the approach suggested by Pesaran and Shin (1998) and Narayan and Smith (2005). This is based on the CUSUM and CUSUMSQ tests, used to assess parameter constancy. According to this methodology, the short-run dynamics are fundamental in detecting the stability of the long-run coefficients and, therefore, it proposes the application of the CUSUM and CUSUMSQ tests to the residuals of the estimated error correction model. The CUSUM test is used for detecting systematic changes in the regression coefficients. It utilises the cumulative sum of recursive residuals based on the first observations and it is updated recursively and plotted against break points. The CUSUMSQ adopts the same procedure, but it is more suitable in detecting a sudden departure from the constancy of the regression coefficients.

The absence of structural breaks in the co-integration relationship is ensured if the plot of the CUSUM and CUSUMSQ remains within the 5% critical bounds. In this case, the null hypothesis that all coefficients are stable cannot be rejected.
In graphs 6 and 7 we will report the CUSUM and CUSUMSQ tests’ results for the Ottoman cotton market. In the case of Alexandria (graph 6), the plot lies outside the 5% critical value bounds in the CUSUMSQ test in 1898, indicating the absence of structural stability in the model during that year. In Izmir (graph 7) the CUSUMSQ plot lies outside of the bounds between 1862 and 1896. These outcomes, which reflect the existence of a major disruption in the market relationship in both cities, correspond to key economic and political events. The end of the 1890s marked the beginning of a favourable phase for Egyptian cotton production; domestic cotton prices experienced a spike upwards, contrary to world prices, which were decreasing. After 1898 prices rose steadily and prompted an upturn in cotton production, reversing the previous phase of relative stagnation, caused by civil unrest. In fact, in 1882 Egypt underwent major political turmoil initiated by a peasant revolt, the Urabi rebellion, which was suppressed by the British bombardment of Alexandria, signalling the beginning of the country’s occupation. In the successive years cotton cultivation was disrupted and it took the country around ten years to recover. During this time canals were blocked, ginning factories robbed and personal security uncertain so that many merchants became unwilling to go to the interior. As a result, cotton production shrank and received a negative shock with the sudden drop in prices in the early 1890s. This negative downturn was reversed in 1898 when a new phase started, marked by an increase in productivity which allowed a more intensive use of the land. Moreover, 1898 was the year when most farmers started to include cotton in their crop rotation every two rather than three years. But the main factors which contributed to these positive developments were connected with the rise in demand for Egyptian cotton, stimulated by an expansionary phase in the global economy and by new improvements in spinning techniques in Europe (mainly in Britain and Germany). This progress in spinning and weaving was prompted by the spread of the process of "mercerising",\(^ {27}\) which made the cotton fibre finer and of higher lustre so that it resembled silk. As a result of this invention, which revolutionarised the cotton industry, higher quality yarns and cloth could be produced and priced lower than silk. Egyptian cotton, being of superior quality, was one of the most suitable varieties for the production of mercerised threads and fabrics. The outcome of this series of improvements in Egyptian cotton production resulted in stronger linkages with the international market and in a consolidation of trade networks between Egypt and Europe. The end of the 1890s and the beginning of the new century saw an intensification of European involvement in the processing of cotton, characterised by a considerable increase in foreign investments in ginning and pressing.

\(^ {27}\) The process of mercerising was invented by John Mercer in 1844, but it was not widely adopted until H.A. Lowe improved it and patented it in 1890.
In the case of Izmir, the first break is located in 1861 at the start of the American Civil War, which represented a considerable supply shock. Moreover, in 1861-2 export taxes were lowered from 12 per cent to 1 per cent. Then, we have a second phase from 1862 to 1895, which includes a series of major political events including the default of the Empire (1875-76) and the subsequent establishment of the Public Debt Administration, i.e. the direct control of the Empire’s finances by European powers. Another crucial hallmark of this period is the Ottoman-Russian War (1877-78) which concluded with the Empire’s defeat and which marked the loss of important territories in the Balkans. The period after 1896 (i.e. the third phase) signals the end of the price depression, after which the Empire underwent a period of relative stability. Furthermore, a rise in global demand and the prices for cotton, at a time when most economies were flourishing, gave new impetus to the Anatolian cotton market.
The presence of instability in the co-integration relationship indicated by the CUSUMSQ tests renders a further investigation of the data necessary. This means that long and short-run parameters before and after the period of the breaks will be estimated, in order to compare the dynamics of the price movements in the various phases and to examine the changes in the market relationship between the two Ottoman regions and the global cotton industry.

**Alexandria**

The price relationship between Alexandria and the world market will be investigated in the two periods before and after the identified break (1845-1897 and 1898-1914).

From the results depicted in Tables 7 and 8 it can be seen that between 1845 and 1897 world prices had an impact on the behaviour of domestic prices both in the long and short-run, although they were significant in the short-run only during the 1898-1914 phase. The process of market integration, measured through the degree of price convergence between the Egyptian and the global cotton market, moderately accelerated from 1898, as shown by the coefficients of the error correction term, which increased from -0.64 to -0.72. This improvement can be associated with a set of factors: the consolidation of trade linkages between Egypt and Europe, the lowering of transport costs over time, the development in infrastructure (the Alexandria port underwent a process of modernisation) and to the stability effects prompted by the adherence to the gold standard. Nevertheless, the process of price convergence was never complete. We assume that this was due to the presence of market power among cotton traders both in the domestic market and possibly in the global market. No further structural break has been detected in the two periods.
Table 7: ARDL long-run coefficients for the Alexandria market 1845-97 and 1898-1914.

<table>
<thead>
<tr>
<th>Explanatory variable</th>
<th>Coefficient 1845-97</th>
<th>t-ratio 1845-97</th>
<th>P-value 1845-97</th>
<th>Coefficient 1898-1914</th>
<th>t-ratio 1898-1914</th>
<th>P-value 1898-1914</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.233</td>
<td>-0.70</td>
<td>0.488</td>
<td>0.95</td>
<td>0.68</td>
<td>0.515</td>
</tr>
<tr>
<td>lnP&lt;sub&gt;LIV&lt;/sub&gt;</td>
<td>0.843</td>
<td>4.81</td>
<td>0.000</td>
<td>0.96</td>
<td>0.90</td>
<td>0.468</td>
</tr>
<tr>
<td>lnP&lt;sub&gt;IZMIR&lt;/sub&gt;</td>
<td>0.222</td>
<td>1.29</td>
<td>0.071</td>
<td>-0.15</td>
<td>0.33</td>
<td>0.892</td>
</tr>
<tr>
<td>Gold</td>
<td>0.056</td>
<td>0.86</td>
<td>0.396</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>War</td>
<td>-0.193</td>
<td>-1.55</td>
<td>0.127</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Diagnostics

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjusted R-squared</td>
<td>0.93</td>
<td>0.10</td>
</tr>
<tr>
<td>LM test for autocorrelation</td>
<td>0.49</td>
<td>0.12</td>
</tr>
<tr>
<td>Multicollinearity test&lt;sup&gt;28&lt;/sup&gt;</td>
<td>8.80</td>
<td>6.31</td>
</tr>
</tbody>
</table>

Table 8: Short-run dynamics in Alexandria 1845-1897 and 1898-1914.

<table>
<thead>
<tr>
<th>Explanatory variable</th>
<th>Coefficient 1845-1897</th>
<th>t-ratio 1845-1897</th>
<th>P-value 1845-1897</th>
<th>Coefficient 1898-1914</th>
<th>t-ratio 1898-1914</th>
<th>P-value 1898-1914</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.005</td>
<td>-0.28</td>
<td>0.777</td>
<td>0.009</td>
<td>0.30</td>
<td>0.768</td>
</tr>
<tr>
<td>Δ lnP&lt;sub&gt;LIV&lt;/sub&gt;</td>
<td>0.915</td>
<td>8.10</td>
<td>0.000</td>
<td>0.814</td>
<td>2.59</td>
<td>0.025</td>
</tr>
<tr>
<td>Δ lnP&lt;sub&gt;IZMIR&lt;/sub&gt;</td>
<td>-0.109</td>
<td>-1.51</td>
<td>0.139</td>
<td>-0.211</td>
<td>-0.73</td>
<td>0.481</td>
</tr>
<tr>
<td>ECT&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>-0.639</td>
<td>-3.72</td>
<td>0.001</td>
<td>-0.723</td>
<td>-3.40</td>
<td>0.006</td>
</tr>
<tr>
<td>War</td>
<td>0.056</td>
<td>0.94</td>
<td>0.351</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Gold</td>
<td>-0.005</td>
<td>-0.17</td>
<td>0.864</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Diagnostic tests

<table>
<thead>
<tr>
<th></th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-squared</td>
<td>0.67</td>
<td>0.52</td>
</tr>
<tr>
<td>LM test for autocorrelation</td>
<td>0.77</td>
<td>0.83</td>
</tr>
<tr>
<td>Multicollinearity test</td>
<td>1.65</td>
<td>2.77</td>
</tr>
</tbody>
</table>

<sup>28</sup> The multicollinearity test performed is the variance inflation factor (VIF); values higher than 10 indicate the presence of multicollinearity.
**Izmir**

In the three phases identified earlier for the Izmir cotton market, world prices had an impact on domestic prices in the long-run while in the short run, the variable Liverpool was significant only in the 1862-92 period.

The process of market integration, embodied in the extent of price transmission, varied remarkably over time. In the first phase the error correction term had a large negative coefficient, thus indicating that prices were not converging. In fact, when the error correction parameter has a value smaller than -2 (or when it has a positive value), it implies that the dependent variable (Izmir) diverged from the long-run equilibrium. This outcome can be attributed to the fact that a large share of raw cotton production was used domestically and its export represented only a residual market. According to a consular report, in 1851 total output was around 30,000 bales, of which 12-15,000 were exported and the rest was used in the domestic market. The situation changed drastically in the 1870s, when cotton became, primarily, an export crop as domestic spinning and weaving activities shrank considerably. Another consular report in the 1870’s indicates total production at 60,000 bales, of which more than 51,000 were exported. Until the mid-nineteenth century, a large proportion of cotton textile production for use within the Empire was being undertaken by rural households for consumption within the village. One of the most widespread forms of cotton production was the “putting-out” system, whereby peasant women and children hand-spun raw cotton in their homes both for personal consumption and for the market. These market conditions help us explain the reasons why the raw cotton market responded more to domestic changes, rather than to global ones. Moreover, the lack of a good transport system and the existence of high taxes imposed on exports until 1861 (at 12 percent) may have hampered the process of price transmission.

During the second phase (1862-95) Izmir underwent a fast process of integration which can be attributed to the remarkable improvements in transport and infrastructure, particularly the development of the Izmir port and the construction of the Izmir-Aydin railway, which acted as a catalyst in strengthening market linkages. Furthermore, the effect of lowering the export tax (from 12 per cent to 1 per cent) may have contributed to the process of price convergence. The error correction coefficient is -0.91, indicating that 91 per cent of the disequilibrium in Izmir’s domestic cotton prices was corrected each year.

In the last phase, from 1896 to 1914, the computed error correction parameter is -1.61, thus indicating the presence of some factors which slowed down the process of market integration. When the error correction term has a value comprised between -1 and -2, it produces dampened fluctuations in the dependent variable about its equilibrium path: this means that the error-correction process oscillates around the long-run value in a dampening manner before converging to the equilibrium route relatively quickly.

---

29 See Arshad and Hameed (2009); Alam and Quazi (2003).


31 Pamuk (1987) claims that the extent to which hand-spinning and weaving of simple peasant cloth was organised under the putting-out system remains unclear.
This outcome can be related to the revived demand for cotton in the domestic market, spurred on by the needs of a growing textile industry. From 1896 several cotton spinning factories had been set up both in Istanbul, Izmir, and elsewhere in the Ottoman Empire with the raw cotton used in these mills being chiefly home-grown\textsuperscript{32}. By 1909-11 these factories produced almost a quarter of total yarn consumed in the Empire (Pamuk, 1987: 127). A portion of cotton cultivation thus started being shifted from the international to the domestic market. In 1905, when total output was 42,000 bales, around 24,000 bales were exported. In the light of these events it is possible to connect the slower speed of convergence with world prices to the augmented influence of the domestic market. This outcome suggests that the Izmir market, after a period of integration, became unlinked from the global cotton market at the end of the nineteenth century, as the degree of price transmission slowed down.

\begin{table}[h]
\centering
\caption{ARDL long-run coefficients for Izmir market 1845-61, 1862-1895 and 1896-1914.}
\begin{tabular}{lcccccc}
\hline
 & \multicolumn{3}{c}{Model 5: ARDL (1, 1, 1)} & \multicolumn{3}{c}{Model 6\*: ARDL (1, 0)} & \multicolumn{3}{c}{Model 7: ARDL(1, 1, 1)} \\
 & $lnP_{IZMIR}^{1845-61}$ & $lnP_{IZMIR}^{1862\text{ and }1895}$ & $lnP_{IZMIR}^{1896\text{ and }1914}$ & $lnP_{IZMIR}^{1862\text{ and }1895}$ & $lnP_{IZMIR}^{1896\text{ and }1914}$ & $lnP_{IZMIR}^{1896\text{ and }1914}$ \\
\hline
Explanatory variable & Coefficient & t-ratio & P-value & Coefficient & t-ratio & P-value & Coefficient & t-ratio & P-value \\
\hline
Constant & 4.511 & 1.14 & 0.285 & 1.088 & 3.14 & 0.004 & 1.107 & 1.29 & 0.220 \\
$lnP_{LIV}$ & 5.690 & 2.11 & 0.044 & 0.709 & 6.65 & 0.000 & 0.993 & 0.38 & 0.190 \\
$lnP_{ALEX}$ & -6.130 & 1.78 & 0.090 & - & - & - & -0.297 & 1.37 & 0.865 \\
War & -0.811 & -1.33 & 0.217 & 0.092 & 0.92 & 0.366 & -0.003 & -0.06 & 0.956 \\
\hline
\end{tabular}
\end{table}

\textbf{Diagnostic tests}

\begin{tabular}{lccc}
\hline
 & Model 5 & Model 6 & Model 7 \\
\hline
Adjusted R-squared & 0.67 & 0.92 & 0.73 \\
LM test for autocorrelation & 0.66 & 0.27 & 0.63 \\
Multicollinearity test & 5.87 & 4.34 & 9.19 \\
\hline
\end{tabular}

Note: * The variable $lnP_{ALEX}$ has not been included to avoid multicollinearity.

\textsuperscript{32} Issawi (1980: 310).
Table 10: ARDL short-run coefficients for Izmir market 1845-61, 1862-1895 and 1896-1914.

<table>
<thead>
<tr>
<th>Exploratory variable</th>
<th>Coefficient</th>
<th>t-ratio</th>
<th>P-value</th>
<th>Coefficient</th>
<th>t-ratio</th>
<th>P-value</th>
<th>Coefficient</th>
<th>t-ratio</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.043</td>
<td>0.22</td>
<td>0.828</td>
<td>-0.005</td>
<td>-0.02</td>
<td>0.985</td>
<td>-0.007</td>
<td>-0.19</td>
<td>0.850</td>
</tr>
<tr>
<td>$\Delta \ln P_{IZMIR}$, 1845-61</td>
<td>3.084</td>
<td>-1.73</td>
<td>0.118</td>
<td>0.780</td>
<td>5.98</td>
<td>0.000</td>
<td>0.961</td>
<td>2.11</td>
<td>0.054</td>
</tr>
<tr>
<td>$\Delta \ln P_{ALEX}$</td>
<td>0.830</td>
<td>0.70</td>
<td>0.501</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-0.031</td>
<td>0.14</td>
<td>0.977</td>
</tr>
<tr>
<td>$ECT_{t-1}$</td>
<td>-4.32</td>
<td>-2.32</td>
<td>0.045</td>
<td>-0.916</td>
<td>-6.98</td>
<td>0.000</td>
<td>-1.681</td>
<td>-2.85</td>
<td>0.014</td>
</tr>
<tr>
<td>War</td>
<td>0.063</td>
<td>0.09</td>
<td>0.930</td>
<td>-0.013</td>
<td>-0.16</td>
<td>0.837</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Gold</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.002</td>
<td>0.06</td>
<td>0.958</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Diagnostic tests

<table>
<thead>
<tr>
<th></th>
<th>Model 12</th>
<th>Model 13</th>
<th>Model 14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjusted R-squared</td>
<td>0.40</td>
<td>0.86</td>
<td>0.50</td>
</tr>
<tr>
<td>LM test for</td>
<td>0.76</td>
<td>0.57</td>
<td>0.40</td>
</tr>
<tr>
<td>autocorrelation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multicollinearity test</td>
<td>2.47</td>
<td>1.79</td>
<td>3.16</td>
</tr>
</tbody>
</table>

Note: * The variable $\Delta \ln P_{ALEX}$ has not been included to avoid multicollinearity

6. Conclusion

In this paper we demonstrate that the process of cotton market integration in the two different areas of the Empire, namely Egypt and Western Anatolia, had an uneven pattern and followed two separate paths. Despite the existence of a large body of literature which describes the first wave of globalisation as a period in which commodity markets became increasingly more integrated, our study indicates that the two Ottoman regions underwent different experiences. Through an analysis of market integration based on the LOP, our empirical findings suggest the existence of a co-integration relationship among Ottoman and international cotton markets. Using the ARDL approach to co-integration and multivariate structural break tests (CUSUM and CUSUMSQ), it emerged that the pace of price transmission varied over time.

The results show that in Egypt market linkages intensified over time, so that the domestic and the global cotton markets became more integrated: this outcome is in line with the analysis of other economic historians.33 The most significant factors which facilitated market integration identified by our study were lower transport costs, improvements in infrastructure (Alexandria harbour) and adherence to the gold standard. At the same time, price transmission was not complete, probably owing to the presence of market power both in the domestic and in the world

market. Another aspect of the co-integration analysis worth highlighting is that the American Civil War did not have any impact on the market relationship between the domestic and the global cotton market.

In Western Anatolia, cotton market integration started at a later stage, at the time of the so-called cotton famine, caused by the outbreak of the American Civil War. Also, this outcome coincides with the narratives of other Ottomanist economic historians, which indicate that cotton revived as a crucial export commodity during the boom of the early 1860s, as demonstrated by the outstanding increase in the volume and value of exports. According to our study, during the period between 1845 and 1861, the process of price transmission appeared to be quite weak. During this time, a large share of raw cotton was supplied to the domestic market and rural households produced themselves a considerable portion of cotton textiles used for consumption within Anatolian villages. It seems that the raw cotton market responded more to domestic changes, rather than to global ones. Furthermore, market integration may have also been hindered by the inadequate transport system and by high export taxes. This phase was followed by a period of stronger integration with the global market (1862-1895), when the degree of price transmission from the international to the domestic cotton market became quite high. The main factors driving the increased level of market integration are connected with lower transport costs (transition from sail to steam in the 1870s), improvements in infrastructure (Izmir harbour) and a decrease in export taxes. But, unlike the Egyptian experience, market integration did not intensify over time. In fact, from 1896 the linkages with the world market became weaker; the slower degree of price transmission between 1896 and 1914 can be ascribed to the development of a nascent mechanised textile industry in Anatolia. Thus, the reorientation of part of the cotton supply from external to domestic sources may have contributed to a weakening of the commercial linkages with the world market.

It thus seems that in Western Anatolia, although the domestic textile sector declined during the first wave of globalisation, it did not disappear, and it exerted some influence in the domestic cotton market. This evolution was similar, though to a lesser extent, to what occurred to the textile sector of other areas of the periphery, i.e. India and Japan. On the other hand, in Egypt attempts to start a domestic mechanised industry were not successful.

The different paths of industrialization taken by the Ottoman regions mirrored a broader trend involving the whole developing world: everywhere in the so-called periphery some form of de-industrialization took place, followed, in some regions, by a process of re-industrialisation. But these changes did not always proceed in a monotonic manner. The dynamics at the basis of such divergences are very complex and are still widely debated by both European and non-European economic historians.

So, why did Egypt not follow the same path as Western Anatolia? A series of reasons can be called into question. An important factor at the heart of the different experiences between the two regions is proposed by Pamuk and Williamson (2011:17-18) and is related to the terms of

---

trade movements during the long nineteenth century. Egypt’s terms of trade rose much faster than those of the rest of the Ottoman Empire, thus suggesting the possibility of a stronger de-industrialisation impact.

Another explanation can be attributed to the different geographical characteristics of the two regions. The Anatolian countryside was not well connected with the major ports (with the exception of the areas linked through the Izmir-Aydin, Izmir-Kasaba and the Anatolian railway), so that European imports could not easily reach large parts of the interior. In Egypt, the process of railroad building proceeded at a much faster pace and, coupled with a dramatic expansion of the canal network along the Nile, connected the majority of the populated areas of the country. This suggests that Egypt was more exposed to the penetration of imported goods.

References

Unpublished documents:
Consular Reports of the British Foreign Office, consulted at the National Archives, London:
- FO 24 (Political and Other Departments: General Correspondence with Egypt before 1906)
- FO 78 (Political and Other Departments: General Correspondence with the Ottoman Empire before 1906);
- FO 83 (Political and Other Departments: General Correspondence before 1906. Great Britain and General);
- FO 195 (Embassy and Consulates, Turkey (formerly Ottoman Empire): General Correspondence);
- FO 368 (Commercial and Sanitary Department: General Correspondence from 1906);
- FO 371 (Political Departments: General Correspondence from 1906-1966);
- FO 781 (Embassy in Constantinople, Turkey: General Correspondence).

Published documents:
Ottoman Agricultural Statistics, consulted at the British Library, London

Secondary Sources:

Inalcik Halil, Quataert Donald, 1996: “An Economic and Social History of the Ottoman Empire”. Cambridge University Press.


Quataert Donald, 1973: “Ottoman Reform and Agriculture in Anatolia, 1876-1908”. University Microfilms International. Ann Arbor, Michigan, USA.


Schanz Moritz, 1913: “Cotton in Egypt and in the Anglo-Egyptian Sudan”. German Colonial Economic Committee. Submitted to the 9th International Cotton Congress, Scheveningen.


