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

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ABSTRACT

The Ottoman Empire underwent a process of integration with the global economy during the second half of the Nineteenth Century. This paper explores one aspect of this process, examining the linkages established between the cotton industries in Egypt and Western Anatolia, which we consider as part of the Empire, and the international cotton market during the first wave of globalisation. We undertake a quantitative exploration of the pattern of price transmission between the Ottoman and the international cotton markets over this period, connecting changes in the nature of spatial market integration to major economic and political developments.

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 socioeconomic 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

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1 I am grateful to the participants of the International workshop on “Economic History of Globalization”, 20-21 October 2011, University of Leuven, Belgium as well as to the participants of the APEBH conference, 16-18 February 2012 ANU, Canberra for their comments. In particular I wish to thank Jeffrey Williamson, David Prentice and Peter Solar for their helpful feedback and encouragement. I also thank Şevket Pamuk and Sisira Jayasuriya for offering their valuable advices and guidance.
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 dramatic surge in trade volumes and values and in the rising ratio of exports to output experienced by the Empire. 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.

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

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2 Major contributions to analysing the process of economic integration of the Ottoman Empire can be found in Inalcik and Quataert, Economic and Social History; Kasaba, Ottoman Empire; Owen, Middle East; Pamuk, Ottoman Empire, and “Prices”; Issawi, Middle East; Inan, Ottoman Empire.

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, “Emancipation”, 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.
separate entity with its own government and head of state.\textsuperscript{4} 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.\textsuperscript{5} 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 the Capitulations.\textsuperscript{6} 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.

\textsuperscript{4} Richards, “Primitive accumulation” 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.

\textsuperscript{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. Even after the British occupation in 1882, Egypt always recognised Ottoman suzerainty.

\textsuperscript{6} The Ottoman concept of capitulation was based on the Turkish \textit{ahd name}, meaning treaty, and from the Arabic \textit{امتياز أجنبي} meaning privileges for foreigners; the Capitulation referred 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 to foreign subjects, while affirming the political sovereignty of the Ottoman state. They were further extended to non-Muslim Ottoman citizens.
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 Nineteenth Century, while others remained comparatively untouched until the Twentieth Century. 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 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 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. But the statistical analysis is quite elementary and the author himself suggests the need for further

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7 See, for example, Quataert, “Provisional report”.
8 See, for example, the study of Marks, “Unity” on rice price convergence in Indonesia and of Goodwin and Grennes, “Tsarist Russia” on wheat price integration in Tsarist Russia.
9 Pamuk, “Prices”. In another paper Özmucur and Pamuk, “Real Wages” 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.
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, we illustrate 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 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.

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.\(^{10}\)

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 slave plantations in the US.

\(^{10}\) 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.
The relevance of Western Anatolia 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.\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.} The crisis, which came to be known as the “cotton famine”, raised concerns about the US 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 Figure 1): Western Anatolian cotton followed a declining trend until the end of the century, while Egyptian cotton exports continued rising. 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.

\[\text{[Figure1]}\]

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 Takahashi Takayama and George Judge model, 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.\(^{12}\)

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

\[
P^{ALEX} = \beta_1 P^{LIVERPOOL} + \gamma_1 P^{IZMIR} + \varepsilon \tag{1}
\]

\[
P^{IZMIR} = \beta_2 P^{LIVERPOOL} + \gamma_2 P^{ALEX} + \varepsilon \tag{2}
\]

where \(P^{ALEX}, \ P^{LIVERPOOL}, \ P^{IZMIR}\) represent prices of cotton in Alexandria, Liverpool (world 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 Figure 2. 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

\(^{12}\) Takayama and Judge, Price allocation models.
absorption capability of the textile industry.\textsuperscript{13} After the huge jump in the early 1860s, 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.\textsuperscript{14} On the other hand, Western Anatolian native cotton, known as “yerli” (a variety of Indian \textit{Gossypium herbaceum}), was rough and short stapled. Owing to its lower quality, it was

\textsuperscript{13}The faster expansion of cotton supply compared with its demand (the harvest of 1859 had been the largest in the history of the US, reducing the price of cotton to its lowest level) led to a large accumulation of stocks in European ports and mills driving 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, Lancashire; Brady, “Reconsideration”; and Farnie, Cotton Industry.

\textsuperscript{14}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.
cheaper than both Egyptian and American cotton and was utilised to produce a coarser cloth.\footnote{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.}

**Figure 2**

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: the change in trade policy, in other words the lowering of export tariffs in 1861/2; the reduction in transport costs; the improved exchange rate stability consequent to the adherence to the gold standard; the market structure of the domestic cotton industry; 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.

*Export taxes*

Until 1861 the Ottoman government imposed a 12 per cent duty on all exports, as established by the 1838 Anglo-Turkish convention and the *Hatt i-Serif* (Imperial Script) of the following year. The major change within the Ottoman trade policy which has affected the cotton trade coincides with the reduction of export duties in 1862 from 12 per cent to 1 per
cent. We can expect that such development in Ottoman trade policy, representing a reduction in trade costs, has had a beneficial effect on market integration.\textsuperscript{16}

\textit{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.

\textit{Exchange rate in the Ottoman Empire}

\textsuperscript{16} 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.
In the 1880s the Ottoman Empire abandoned bimetallism and adhered to the gold standard. The latter has often been regarded by the literature as a crucial factor in facilitating trade expansion and market integration owing to the engendered reduction of exchange rate risk volatility. 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.

*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.

[Figure 3]

As depicted in Figure 3, 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.

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17 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.
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.

*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 Figure 4, between 1850 and 1914 global cotton production was dominated by the US; 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.

[Figure 4]

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.
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 Clemente, Montañés and Reyes unit root test (1998). This is a univariate structural break test which allows for the presence of two regime shifts 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) and CUSUM 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; in piastres per okke or per cwt in Western Anatolia), they have been converted to metric tons per British pound, using exchange rates given by Pamuk for Turkey and by Owen for Egypt.

Prices of American cotton sold in Liverpool, obtained from David Jacks, Kevin H. O’Rourke, Jeffrey G. Williamson, have been held as world prices: Liverpool was the principal global harbour for the import of raw cotton during the Nineteenth Century, and the

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18 Izmir prices for the years 1856 and 1883/4 could not be found; hence the missing data have been filled through interpolation.

19 One qantar is the equivalent of 98/9 lb.; one Egyptian pound corresponds to one British pound.

20 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.

21 Pamuk, Monetary History. Owen, Cotton.
US 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](image)

**APPLICATION**

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 allowing for structural breaks.

The Clemente, Montañés and Reyes test is, therefore, performed to determine the stationarity of the series allowing for two regime shifts: Table 2 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. 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

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22 Jack, O’Rourke and Williamson, Commodity Price Volatility.

23 The cotton price data for all cities have been transformed into their log values.

24 Unit root tests may have low power if a structural break is present in the series as outlined, amongst others, by Leybourne and Newbold, “Spurious rejections”. Moreover, if structural breaks are not taken into account, co-integration techniques may show misleading results.
on the AO and IO models introduce uncertainty as to the true order of integration of the Izmir
cotton price variable.

[Table 2]

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, the Clemente,
Montañés and Reyes unit root test suggested that all 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.25

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:

\[
\Delta \ln P^{ALEX} = \alpha_0 + \sum_{j=1}^{n} b_j \Delta \ln P^{ALEX}_{t-j} + \sum_{j=0}^{n} c_j \Delta \ln P^{LIV}_{t-j} + \sum_{j=0}^{n} d_j \Delta \ln P^{IZMIR}_{t-j} + \delta_1 \ln P^{ALEX}_{t-1} + \\
\delta_2 \Delta \ln P^{LIV}_{t-1} + \delta_3 \Delta \ln P^{IZMIR}_{t-1} + \lambda_1 \text{war} + \lambda_2 \text{gold} + \varepsilon_{1t}
\]

(3)

\[
\Delta \ln P^{IZMIR} = \alpha_0 + \sum_{j=1}^{n} b_j \Delta \ln P^{IZMIR}_{t-j} + \sum_{j=0}^{n} c_j \Delta \ln P^{LIV}_{t-j} + \sum_{j=0}^{n} d_j \Delta \ln P^{ALEX}_{t-j} + \delta_1 \ln P^{IZMIR}_{t-1} + \\
\delta_2 \Delta \ln P^{LIV}_{t-1} + \delta_3 \Delta \ln P^{ALEX}_{t-1} + \lambda_2 \text{war} + \lambda_2 \text{gold} + \varepsilon_{2t}
\]

(4)

where

25 This methodology has also been chosen as it allows the determination of different lag lengths for each
variable, unlike vector error correction (VEC) and VAR models. Moreover, the ARDL bound testing is
preferable when the sample size is small.
\( P^{ALEX} \) = cotton price in Alexandria
\( P^{LIV} \) = cotton price in Liverpool
\( P^{IZMIR} \) = cotton price in Izmir
\( \delta_1, \delta_2, \delta_3 \) = long-run multipliers
\( b_j, c_j, d_j \) = short-run effects

\( war \) = American Civil War (1860-65)

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

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, in other words 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 \( F \) statistics obtained from the regression with the \( F \)-test critical values computed by Kumar Narayan.\(^{26}\) 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 Hashem Pesaran, Yongchoel Shin and Richard Smith: the two computed sets of critical values provide a band that covers all possible classifications of the variables into I(0) and I(1).\(^{27}\) If the computed \( F \)-statistics is higher than

\(^{26}\) Narayan, “Saving”.

\(^{27}\) Pesaran, Shin and Smith, “Bound Testing”.

16
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 3, 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).\(^\text{28}\)

[Table 3]

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, Shin and Smith, which is closely related to the bound testing approach.\(^\text{29}\)

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

\[
\begin{align*}
\ln P_{\text{ALEX}} &= \alpha_0 + \sum_{j=1}^n \alpha_j \ln P_{\text{ALEX}} + \sum_{j=0}^{n} \alpha_2 \ln P_{LIV} + \sum_{j=0}^{n} \alpha_3 \ln P_{IZMIR} + \lambda_j \text{war} \\
&\quad + \beta_1 \text{gold} + \varepsilon_{1t} \\
\ln P_{\text{IZMIR}} &= \gamma_0 + \sum_{j=1}^n \gamma_j \ln P_{IZMIR} + \sum_{j=0}^{n} \gamma_2 \ln P_{LIV} + \sum_{j=0}^{n} \gamma_3 \ln P_{ALEX} + \lambda_2 \text{war} \\
&\quad + \beta_2 \text{gold} + \varepsilon_{2t} 
\end{align*}
\]

Where

\(\alpha_j, \alpha_2, \alpha_3, \gamma_1, \gamma_2, \gamma_3\) embody the long-run coefficients describing the co-integrated relationship.

Following the Schwarz Bayesian Information Criteria, one lag was added to each variable. 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:

\(^\text{28}\) Narayan, “Saving”.

\(^\text{29}\) Pesaran, Shin and Smith, “Bound Testing”.

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\[
\Delta \ln P^{ALEX} = \alpha_0 + \sum_{j=1}^{n} b_1 \Delta \ln P^{ALEX}_{t-j} + \sum_{j=0}^{n} c_1 \Delta \ln P^{LIV}_{t-j} + \sum_{j=0}^{n} d_1 \Delta \ln P^{IZMIR}_{t-j} + \lambda_1 \text{war} \\
+ \beta_1 \text{gold} + \theta_1 \text{ECT}^1_{t-1} + \varepsilon_1 \\
\]

(7)

\[
\Delta \ln P^{IZMIR} = \alpha_0 + \sum_{j=1}^{n} b_2 \Delta \ln P^{IZMIR}_{t-j} + \sum_{j=0}^{n} c_2 \Delta \ln P^{LIV}_{t-j} + \sum_{j=0}^{n} d_2 \Delta \ln P^{ALEX}_{t-j} + \lambda_2 \text{war} \\
+ \beta_2 \text{gold} + \theta_2 \text{ECT}^2_{t-1} + \varepsilon_1 \\
\]

(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:

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

\[
\text{ECT}^2_t = \ln P^{IZMIR}_t - \alpha_0 - \sum_{j=1}^{n} b_2 \ln P^{IZMIR}_{t-j} - \sum_{j=0}^{n} c_2 \ln P^{LIV}_{t-j} - \sum_{j=0}^{n} d_2 \ln P^{ALEX}_{t-j} - \lambda_2 \text{war} \\
- \beta_2 \text{gold} \\
\]
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 and Kumar Narayan and Russell Smyth. 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, they propose 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 per cent critical bounds. In this case, the null hypothesis that all coefficients are stable cannot be rejected.

In Figures 5 and 6 we will report the CUSUM and CUSUMSQ tests’ results for the Ottoman cotton market. In the case of Alexandria (Figure 5), the plot lies outside the 5 per cent critical value bounds in the CUSUMSQ test in 1898, indicating the absence of structural stability in the model during that year. In Izmir (Figure 6) the CUSUMSQ plot lies outside of the bounds between 1862 and 1896. These outcomes, which reflect the existence of a major

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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, marking 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. 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. But the main factor which contributed to these positive developments was 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", which made the cotton fibre finer and of higher lustre so that it resembled silk. 31 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

31 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.
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.

[Figure 5]

In the case of Izmir, three phases have been identified within the process of market integration: the first phase ended 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 such as the default of the Empire (1875/6) and the subsequent establishment of the Public Debt Administration, marking 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 marked the loss of important territories in the Balkans. The period after 1896 (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 gave new impetus to the Anatolian cotton market.

[Figure 6]

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 4 and 5 it can be seen that the process of price convergence between the Egyptian and the global cotton market, continued over time, as shown by the significant coefficients of the error correction terms, before and after 1898. This can be associated with a set of factors: the consolidation of trade linkages between Egypt and Europe, the lowering of transport costs, 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 transmission 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.

[Tables 4 and 5]

*Izmir*

Within the three phases identified earlier for the Izmir cotton market the process of market integration varied remarkably over time (see Tables 6 and 7).

In the first phase the error correction term had a large negative coefficient, thus indicating that prices were not converging. 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. Until mid-

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32 When the ECT parameter has a value smaller than -2 (or when it has a positive value), it implies that the dependent variable (Izmir) diverges from the long-run equilibrium. See Arshad and Hameed, “Long-run Relationship”; Alam and Quazi, “Determinants”.

33 Issawi, Turkey.
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.\textsuperscript{34} These market conditions help us explain the reasons why the raw cotton market responded more to domestic changes, rather than to global ones.\textsuperscript{35} 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: this 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.\textsuperscript{36} This outcome can be related to the revived demand for cotton in the domestic

\textsuperscript{34} Pamuk, Ottoman Empire, claims that the extent to which hand-spinning and weaving of simple peasant cloth was organised under the putting-out system remains unclear.

\textsuperscript{35} 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 1870s indicates total production at 60,000 bales, of which more than 51,000 were exported.

\textsuperscript{36} 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.
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{37} By 1909-11 these factories produced almost a quarter of total yarn consumed in the Empire.\textsuperscript{38} A portion of cotton cultivation thus started being shifted from the international to the domestic market.\textsuperscript{39} 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.

[Tables 6 and 7]

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.

\textsuperscript{37} Issawi, Turkey, p. 310.

\textsuperscript{38} Pamuk, Ottoman Empire, p. 127.

\textsuperscript{39} In 1905, when total output was 42,000 bales, around 24,000 bales were exported.
The results show that while in Egypt cotton market integration strengthened over time, in Western Anatolia, the process of price transmission started at a later stage, at the time of the so called “cotton famine”, caused by the outbreak of the American Civil War. But, unlike the Egyptian experience, market integration did not continue intensifying. 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, such as India and Japan. On the other hand, in Egypt attempts to start a domestic mechanised industry were not successful.

The different paths of industrialisation 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.

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 Şevket Pamuk and Jeffrey Williamson and is related to terms

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40 These outcomes are in line with the analysis of other economic historians. For Egypt see, for example: Owen, Cotton; Issawi, Middle East; Pamuk, “Anatolia and Egypt”. For Western Anatolia, see, among others, Kurmuş “Cotton famine” and Kasaba, Ottoman Empire.

41 See, among others, Pomeranz, Great Divergence; Sugihara, “Labour-intensive Industrialisation”; Quataert, “Proto-industrialisation”.

25
of trade movements during the 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. Undoubtedly, a more thorough investigation of the de-industrialisation patterns experienced by Egypt and Western Anatolia would be helpful in gaining a deeper understanding of the process of commodity market integration in the Ottoman Empire.

REFERENCES

Unpublished documents:
Consular Reports of the British Foreign Office: FO 78/62; 701; 750; 795; 832; 868; 905; 954; 1020; 1108; 1209; 1307; 1447; 1687, National Archives, London.

Secondary Sources:


### TABLES

**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.
Sources: Egyptian: index derived from Owen, Cotton; American and Western Anatolian: Quataert, Ottoman Reform.

**Table 2**: Clemente, Montañés and Reyes test.

<table>
<thead>
<tr>
<th>City</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.

**Table 3**: 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>2. Izmir ($k=4$)*</td>
<td>7.94</td>
<td>4.098-5.694</td>
</tr>
</tbody>
</table>

Note: $k$ indicates the number of regressors.

**Table 4**: ARDL long-run coefficients for the Alexandria market 1845-97 and 1898-1914.

<table>
<thead>
<tr>
<th>Model 1: ARDL (1, 1, 1).</th>
<th>Model 2: ARDL (1, 1, 1).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variable: $lnP_{ALEX}^{1845-97}$</td>
<td>Dependent variable: $lnP_{ALEX}^{1898-1914}$</td>
</tr>
<tr>
<td>Explanatory variable</td>
<td>coefficient</td>
</tr>
<tr>
<td>constant</td>
<td>-0.233</td>
</tr>
<tr>
<td>$lnP_{LIV}$</td>
<td>0.843</td>
</tr>
<tr>
<td>$lnP_{IZMIR}$</td>
<td>0.222</td>
</tr>
<tr>
<td>gold</td>
<td>0.056</td>
</tr>
<tr>
<td>war</td>
<td>-0.193</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.93</td>
</tr>
<tr>
<td>LM test for autocorrelation</td>
<td>0.49</td>
</tr>
</tbody>
</table>

---

43 $H_0$: no serial correlation.
Table 5: short-run dynamics in Alexandria 1845-1897 and 1898-1914.

<table>
<thead>
<tr>
<th>Model 3: ARDL (1, 0, 0). Dependent variable: $\Delta \ln P_{ALEX}^{ALEX}$ (1845-1897)</th>
<th>Model 4: ARDL (1, 0, 0). Dependent variable: $\Delta \ln P_{ALEX}^{ALEX}$ (1898-1914)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explanatory variable</td>
<td>coefficient</td>
</tr>
<tr>
<td>constant</td>
<td>-0.005</td>
</tr>
<tr>
<td>$\Delta \ln P_{LIV}^{IV}$</td>
<td>0.915</td>
</tr>
<tr>
<td>$\Delta \ln P_{IZMIR}^{IZMIR}$</td>
<td>-0.109</td>
</tr>
<tr>
<td>$ECT_{t-1}$</td>
<td>-0.639</td>
</tr>
<tr>
<td>war</td>
<td>0.056</td>
</tr>
<tr>
<td>gold</td>
<td>-0.005</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.67</td>
</tr>
<tr>
<td>Autocorrelation</td>
<td>0.77</td>
</tr>
</tbody>
</table>

Table 6: ARDL long-run coefficients for Izmir market 1845-61, 1862-1895 and 1896-1914.

<table>
<thead>
<tr>
<th>Model 5: ARDL (1, 1, 1) Dependent variable: $\ln P_{IZMIR}^{IZMIR}$ (1845-61)</th>
<th>Model 6*: ARDL (1, 0) Dependent variable: $\ln P_{IZMIR}^{IZMIR}$ (1862-1895)</th>
<th>Model 7: ARDL (1, 1, 1) Dependent variable: $\ln P_{IZMIR}^{IZMIR}$ (1896-1914)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explanatory variable</td>
<td>coefficient</td>
<td>t-ratio</td>
</tr>
<tr>
<td>constant</td>
<td>4.511</td>
<td>1.14</td>
</tr>
<tr>
<td>$\ln P_{LIV}^{IV}$</td>
<td>5.690</td>
<td>2.11</td>
</tr>
<tr>
<td>$\ln P_{IZMIR}^{IZMIR}$</td>
<td>-6.130</td>
<td>1.78</td>
</tr>
<tr>
<td>war</td>
<td>-0.811</td>
<td>-1.33</td>
</tr>
<tr>
<td>gold</td>
<td>-0.003</td>
<td>0.06</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.67</td>
<td>0.92</td>
</tr>
<tr>
<td>Autocorrelation</td>
<td>0.66</td>
<td>0.27</td>
</tr>
</tbody>
</table>

Note: * The variable $\ln P_{IZMIR}^{IZMIR}$ has not been included to avoid multicollinearity.

Table 7: ARDL short-run coefficients for Izmir market 1845-61, 1862-1895 and 1896-1914.

<table>
<thead>
<tr>
<th>Model 8: ARDL (1, 1, 1) Dependent variable: $\Delta \ln P_{IZMIR}^{IZMIR}$ (1845-61)</th>
<th>Model 9*: ARDL (1, 0) Dependent variable: $\Delta \ln P_{IZMIR}^{IZMIR}$ (1862-1895)</th>
<th>Model 10: ARDL (1, 0, 1) Dependent variable: $\Delta \ln P_{IZMIR}^{IZMIR}$ (1896-1914)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explanatory variable</td>
<td>coefficient</td>
<td>t-ratio</td>
</tr>
<tr>
<td>constant</td>
<td>0.043</td>
<td>0.22</td>
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<tr>
<td>$\Delta \ln P_{LIV}^{IV}$</td>
<td>3.084</td>
<td>1.73</td>
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<td>$\Delta \ln P_{IZMIR}^{IZMIR}$</td>
<td>0.830</td>
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<td>$ECT_{t-1}$</td>
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<tr>
<td>war</td>
<td>0.063</td>
<td>0.09</td>
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<tr>
<td>gold</td>
<td>-</td>
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<tr>
<td>Adjusted $R^2$</td>
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<td>0.86</td>
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<tr>
<td>Autocorrelation</td>
<td>0.76</td>
<td>0.57</td>
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</tbody>
</table>

Note: * The variable $\Delta \ln P_{IZMIR}^{IZMIR}$ has not been included to avoid multicollinearity.
FIGURES

Figure 1: Western Anatolian cotton exports from Izmir, 1862-1910 (values in British £) and Egyptian cotton exports, 1822-1913 (average volume in qantars =98-9 lb).

Sources: For Western Anatolia, Quataert, Ottoman Reform; Kurmuş, “Cotton Famine”; Mihci and Mihci, “Reflections”. For Egypt, Owen, Cotton.

Figure 2: Cotton price movements in Liverpool, Alexandria and Izmir, 1845-1914, in British pound per metric ton.

Sources: For Izmir: Consular Reports of the British Foreign Office; Kasaba, Ottoman Empire; Owen, Middle East; Quataert, Ottoman Reform; Ottoman Agricultural Statistics. For Alexandria: Owen, Cotton; Richards, Primitive Accumulation; Johnson, Cotton. For Liverpool: Jacks, O’Rourke and Williamson, “Commodity Price Volatility”.

Figure 3: Ottoman cotton supply chain.

Figure 4: Average annual share in world cotton exports, 1850-1914.

Sources: Hanson, Trade; Mitchell, Americas; Mitchell, Africa; Todd, World’s Cotton. Mihci and Mihci, “Reflections”.
Figure 5: Plots of CUSUM and CUSUMSQ for Alexandria.

Figure 6: plots of CUSUM and CUSUMSQ for Izmir.