"Grain, Textiles, and Demand Elasticity in Late Mamluk Egypt"

A Preliminary Sketch

Stuart Borsch, Assumption College

Embroidered Linen Fragment from Fourteenth Century Mamluk Egypt

Embroidered Silk Fragment from Fifteenth Century Mamluk Egypt

Introduction

The trajectory of the late Mamluk Egyptian economy has been the subject of a number of studies that have explored various facets of the economic malaise that set in during the late medieval

period. This article is a preliminary step in an early stage of research; the intent of is to enhance the analysis of this problem with a hypothetical sketch of the fate of two markets, grains and textiles that will serve as representatives for broader spheres of economic activity. Some basic tools of economic analysis, including the production function and demand elasticities will be employed here in the hopes that they will shed more conceptual light on a relatively complex agrarian-commercial problem.

This article will begin by examining economic changes that were caused by depopulation from fourteenth and fifteenth century plague pandemic, and the impact of the resulting supply shock on the economy of Egypt, with a particular focus on the collapse of Egypt's irrigation system. Demand elasticities will then be used to explore the hypothetical reactions of the grain and textile markets to the fall in aggregate production. The article will also explore the role of some diverse elements in the Egyptian domestic grain market, including crop selection and the growing of durra (sorghum). After an examination of the international market for textiles, the question of Egypt's currency, in particular silver specie, and its impact on the current account will be explored. The interaction of these elements will then be brought together to frame an analysis of Mamluk Egypt's economy in the fifteenth century.

Depopulation and Irrigation System Collapse

Substantial and sustained loss of population was the result of plague pandemic that started with the Black Death in the mid-fourteenth century. Depopulation made itself felt in a number of areas, but its principal target was the agrarian sector. The decline in population had a very

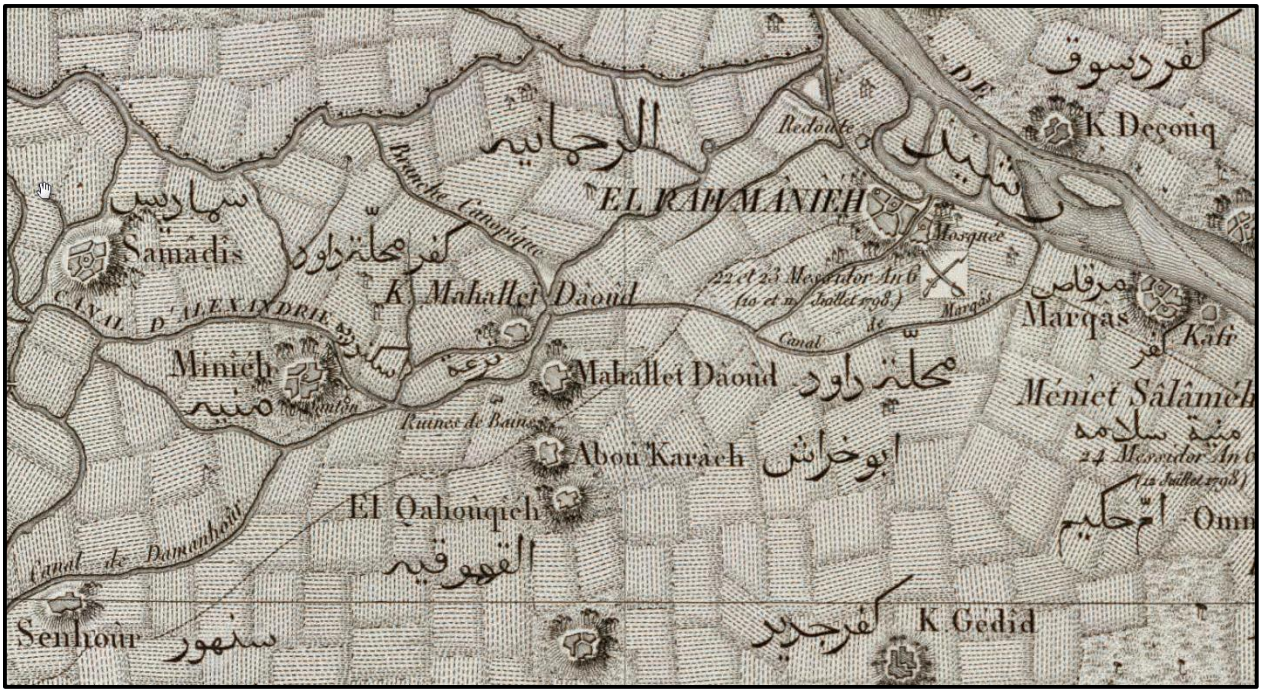
dramatic effect on agriculture, as the loss of rural labor had a direct impact on the functioning of the irrigation system. The two parts of the irrigation system, the baladi (the inner village system: local and simple), and the sultani (the interconnecting superstructure: remote and complex) were affected in different ways, with especially dismal results for the sultani part of the system. There is abundant evidence for the collapse of the sultani system which, via vital interconnections with the local systems, crippled the structure as a whole.[1] Overall system collapse seems to have been out of proportion with the loss of population.

The Basin Irrigation System in Upper Egypt

From Julien Barois, *Irrigation in Egypt*, Planche II

Al-Qalqashandī, writing in the fifteenth century, informs us that, "in our times, the maintenance of the baladi system is being neglected, and the upkeep of the sultani system has been limited to the most trivial repairs that have little impact on production."[2] Ibn Ḥajar al-Asqalānī describes how the system has been badly damaged and how openings in the sultani dikes were allowing Nile floodwater to pour out of the basins before the completion of absorption and the settling of alluvial silts.[3] These cuts in the dikes were also causing serious episodes of excess inundation.

Quite often, too much floodwater was accumulating in low lying spaces, preventing proper drainage, waterlogging the soil, allowing for the infestation of pests, and delaying the sowing of the winter crop.[4]



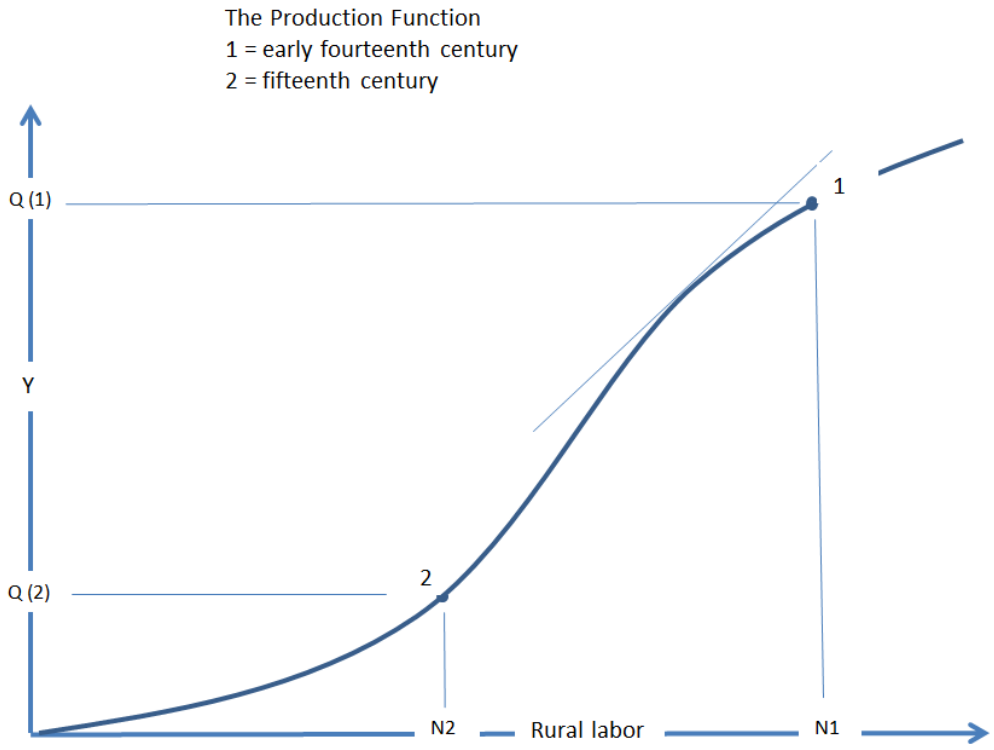
The *Khalīj al-Ashrafiyya* (Alexandria) and Baḥr *Damanhūr* in the province of *Buḥayra* in 1801 *Sultānī* canals from the port town of *al-Raḥmāniyya* (right) on the Rashīd branch of the Nile to the villages of *Samādīs/Samadīsa* and Sanhūr (left)

By Pierre Jacotin, with survey conducted (1801) by M.M. Simonel, Schouani, Lancret, Cabrol et Legentil in *Description de l'Egypte ou recueil des observations et des recherches qui ont ete faites en Egypte pendant l'Expedition de l'Armee francaise*. Seconde edition. Dediee au Roi. Publiee par C.L.F. Panckoucke, Chevalier de la Legion d'Honneur. Atlas geographique. Paris, Imprimerie de C.L.F. Panckoucke. MDCCCXXVI. Flle. 36. Foueh, Damanhour. Leve par M.M. Simonel, Schouani, Lancret, Cabrol et Legentil. Jacotin dirt. [1826]

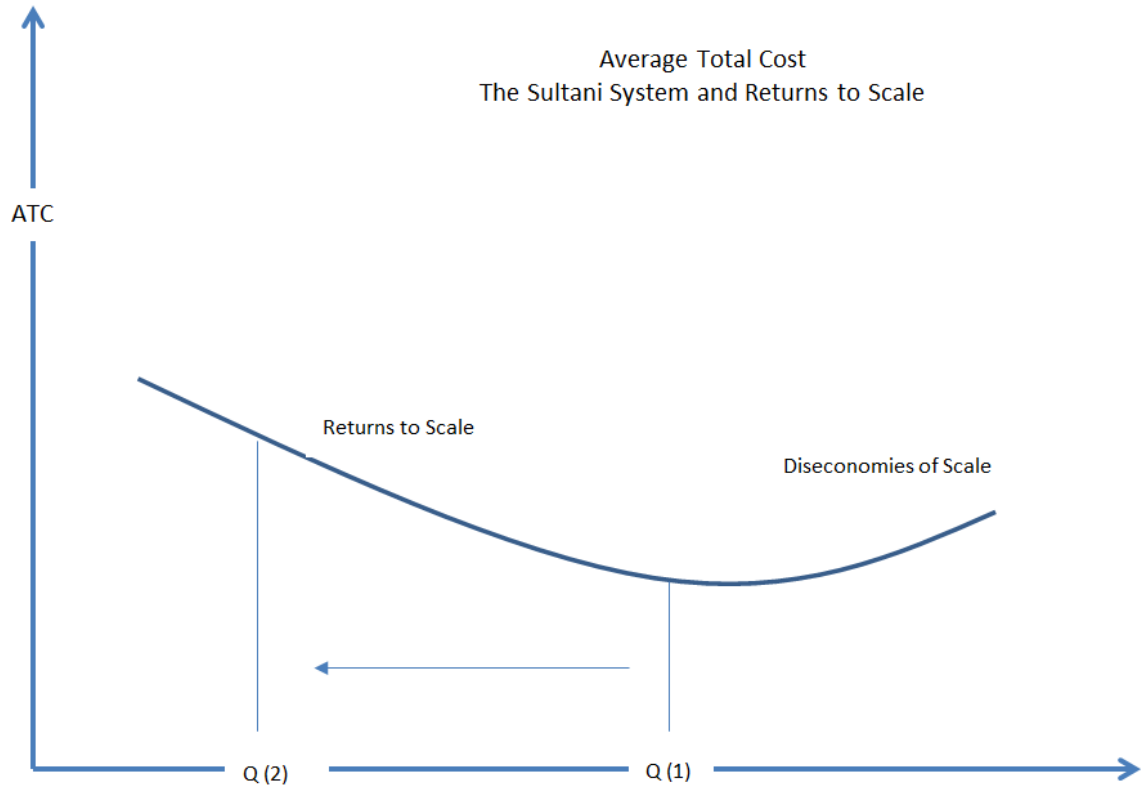
Used with the kind permission of the David Rumsey Map Collection of maps online at: www.davidrumsey.com.

If there was an inherent and underlying cause for the dramatic reaction of the system to depopulation, it lay in the nature of the Mamluk socio-political system. Depopulation led to resource scarcity which potentiated anarchic chaos, intensified factional fighting, and the loss of centralized control of the irrigation system.[5] Decentralization entailed devolution of authority to regional governors (*wulāt*) who were short-tenured and indifferent managers of the sultani system.[6] The weakness of the regional administrative structure led to a massive crisis in maintenance and repair, and hence the collapse of the system as a whole.[7] Thus the overall drop in population led to a change in the polity, and this change in polity led to the ruin of the irrigation system.

The effect of irrigation collapse was the severe and sustained impairment of rural production of grain and commercial factors, particularly flax and sugar that fed urban export industries.[8] The collapse of the irrigation system also led to a decline in rural production that was substantially out of proportion to the drop in population.[9] In the following figure, one can see that the linear drop in population was matched with a disproportionate decline in production. This dramatic fall in agrarian output was due to the loss of large-scale structural efficiencies as regional connections (i.e. the sultani system) failed. The marginal product of labor plummeted as these system interconnections ruptured.



One can also envision this result as a sharp rise in the average total cost of the system. This occurred when the benefits of economies of scale were lost during structural collapse. An efficient complex system became a costly simple system and repair costs spiraled upwards when the network lost coherency. This proposition is illustrated in the following figure.



Thus the overall impact of this structural collapse was a drastically reduced level of agricultural output. The drop in output can be visualized as substantial shrinking of the effective land area available for agrarian production. This land area did not decrease in proportion to population decline; it dramatically surpassed that proportion, dropping by as much as ⅔ over the course of a century.[10] The counter-intuitive proposition here is therefore that land became the scarce factor and labor the abundant factor in the wake of plague depopulation.

Elasticities: how they shaped the economic impact of this supply shock

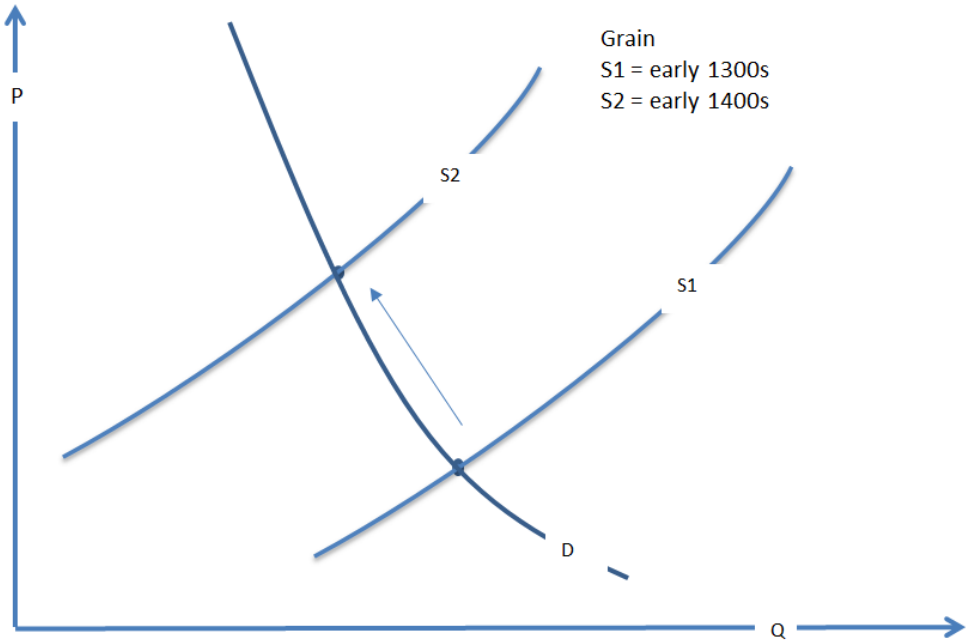
How did the sharp drop in production affect the product and factor markets of Mamluk Egypt? The following model employs two spheres of production, grain and textiles, as representatives of agrarian and "industrial" activity. While market response depended on many factors, the focus here is the impact of the supply shock, and the interaction of this supply shock with the mechanisms of market demand elasticities. Elasticity will serve here as a focusing device for conceptualizing the overall problem.

1st Type: Price Elasticity of Demand and Supply

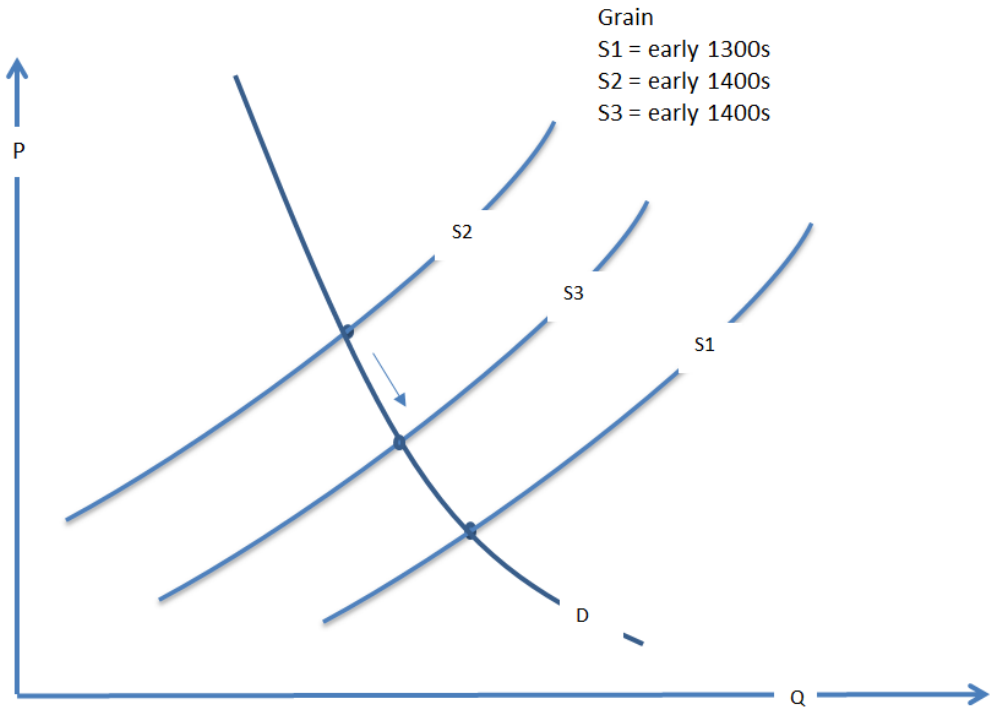
The first of three types of elasticity that follow is the price elasticity of demand: the ratio of a change in demand divided by the change in price.

$$Є = \frac{\%\ change\ in\ quantity\ demanded}{\%\ change\ in\ price}$$

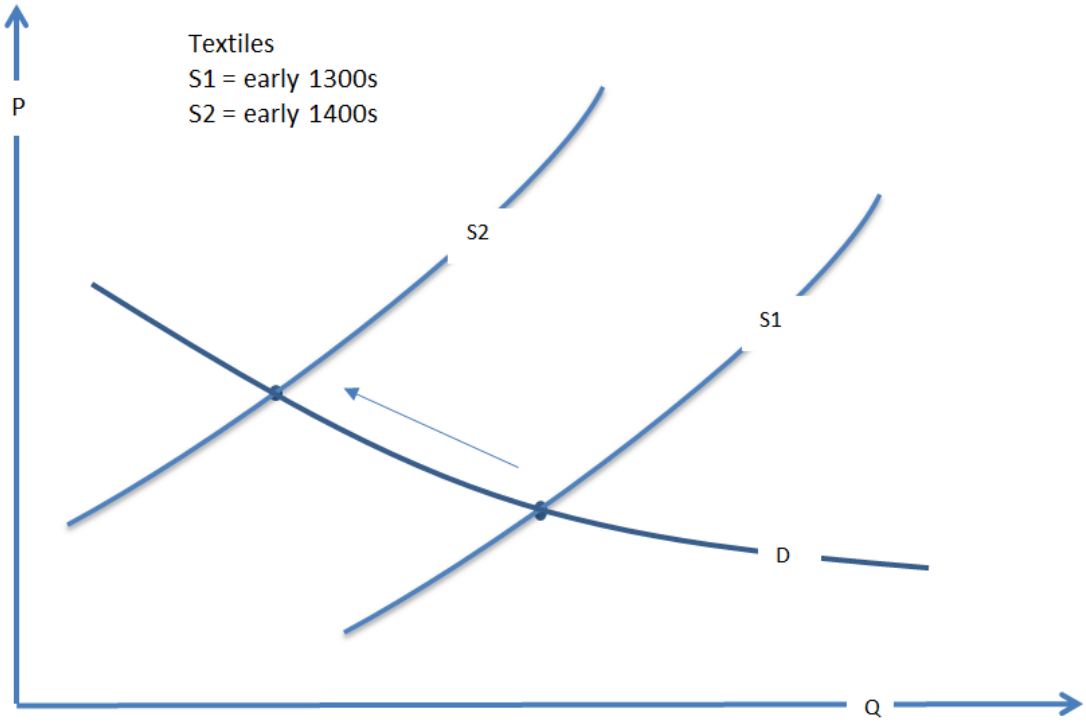
The demand curve for grain is assumed to be very inelastic. This is based upon the simple assumption that consumers are unable to significantly reduce their consumption of grain. They are therefore willing to pay significantly higher prices.[11] The result is shown in the following figure, where the supply of grain has dropped, the quantity demanded has changed very little, and the price has increased dramatically.



The attraction of higher prices then impels producers to favor the cultivation of grain at the expense of other crops (notably the textile factors, flax, cotton, and wool). In the circumstance of severe scarcity, non-foodstuffs are pushed aside and grain takes their place: grain crowds out other goods. The resulting situation is depicted in the following figure, where supply of grain increases and the price of grain goes down. But the end outcome for the economy of Egypt, shown at S3-D, is still one of relative grain scarcity and higher prices.[12]



For textiles, it is observed that the elasticity of demand is relatively large and the quantity demanded drops precipitously, leading to a very small increase in price. This is because consumers are willing to forgo expenditure on textiles, and concentrate on basic survival needs. The result is depicted in the following figure, where supply decreases, the quantity demanded drops substantially, and the price increases by a very moderate amount.



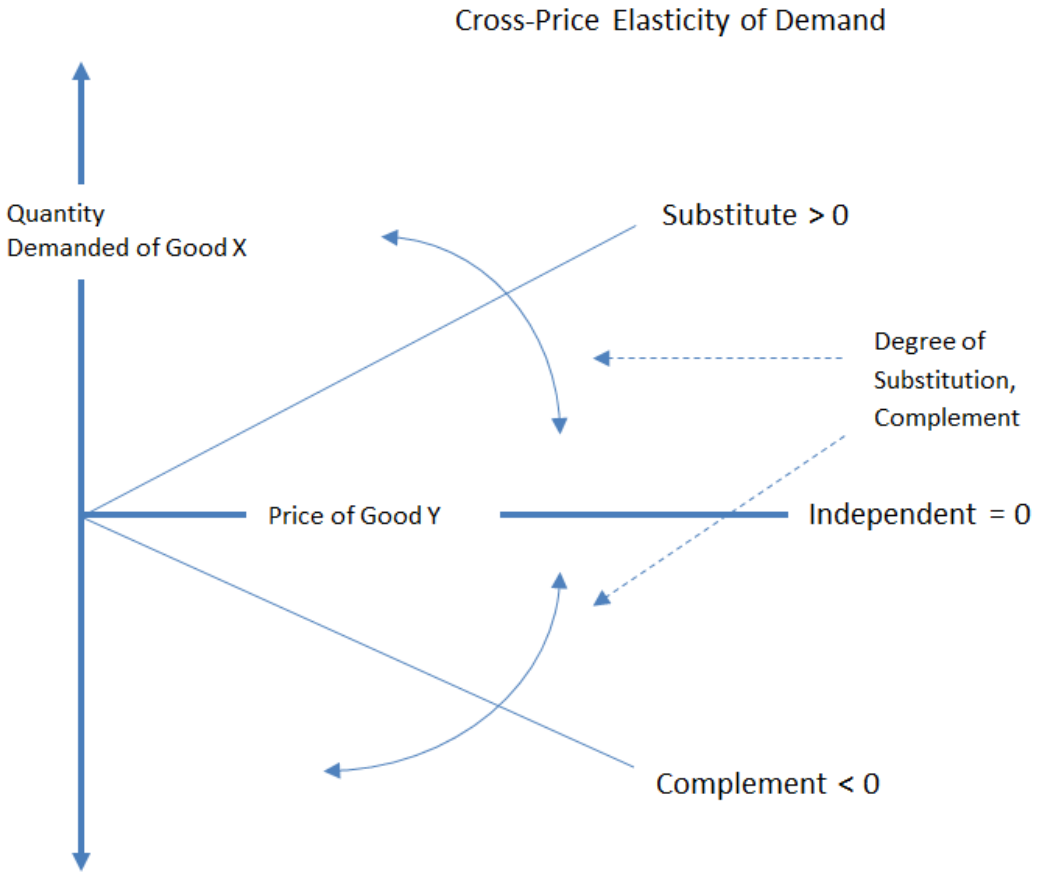
Thus from the viewpoint of this simple analytical tool, textile production is shown to suffer far more than grain production in the reduced circumstances of the fifteenth century.

The 2nd Type: The Cross-Price Elasticity of Demand

The cross price elasticity of demand (Xed) measures how the quantity demanded of one good changes in response to the variation in price of a second good. In its most simple form as an equation, it may be rendered:

$$\text{Xed} = \frac{\%\ change\ in\ quantity\ demanded\ of\ good\ a}{\%\ change\ in\ price\ of\ good\ b}$$

One can visualize this with an example from a modern economy: if the price of hamburgers - good (b) - goes up, the demand for hotdogs - good (a) - goes up with it, and consumers will be tempted to switch from hamburgers to hotdogs as an easy and obvious replacement. In this case, good (a) is a *substitute* for good (b) and Xed is positive. If, on the other hand, one takes the example of computer hardware and computer software, then we are talking about goods that *compliment* each other. If the price of computer hardware goes up, people are going to buy fewer computers, and their corresponding demand for accompanying software will go down. So computer software is a compliment of computer hardware, and demand decreases with the increase in price: Xed is negative. On the following graph, one can see representative curves for substitutes, compliments, and, at a slope of zero, independents (for which there is no cross-price relationship between the two goods).[13]



While the basic scheme of this mechanism is fairly straightforward, the application of this conceptual tool hinges on a historically obscure factor that played a role far out of proportion to its meager showing in the sources. This is durra (sorghum), the subsistence diet of the peasant, the consumption of which waxed and waned with the successes and failures of Nile floods over the Islamic centuries. The story of grain and textiles is bound up with the story of this crop of last resort, and the selection of this crop is bound up with the operation of the cross-price elasticity of demand.

Durra is an old world plant that is an important staple for poor and rural people in many parts of the world. It is grown primarily in Africa, South Asia, and Central America.[14] It is resistant to salinity and can be grown in the most arid conditions – conditions that would impair the cultivation of other grains such as wheat and barley. At the same time, it is tolerant of flooding and it can be grown where there is an excess of water that would overwhelm many other crops.[15] It is thus a very hardy plant that can be cultivated under the most difficult circumstances. It does, however demand high temperature, requiring an average temperature of 80 degrees Fahrenheit, and a minimum nighttime temperature of 55 degrees Fahrenheit.[16] It has a yield of 2,200 liters per feddān (the .6ha Mamluk feddān), which compares very favorably with wheat: the latter at roughly 1000 liters per feddān.[17]

Because durra requires relatively intense heat, it was not grown as a winter crop. In Egypt's agrarian system it was primarily grown as a flood crop in the late summer and early autumn.[18] It was sown at the beginning of the Coptic month of Misrā (August) when the flood was at half its height and it was harvested in Bāba (October), before the sowing of the winter crops.[19] The technique was to either grow it on the banks of canals, or, quite often, to segment off sections of the irrigation basin and water the durra using a syphon canal feeding from one of the upper basins.[20] It required a great deal of water and had to be carefully tended.[21]

Durra was (and, as Indian corn, still is) a major part of the peasant diet.[22] It was used by peasants as an alternative to wheat and barley.[23] With a high caloric content, its high yield allowed for a high carrying capacity for population. Yet durra was not part of the market economy; it was grown only for peasant consumption and was not bought and sold in the marketplace. It did not

appear on the schedule of rent and taxation in the bureaucratic manuals of the sultanate.[24] Ibn Mammātī, in his treatise on bureaucratic procedures, doesn't even mention durra.[25] Al-Qalqashandī, in his enormous chancery manual, at least acknowledges the existence of durra, but doesn't report a rent/taxation (qatīʿa) rate.[26] Durra could be grown on plots classified as sibākh (highly saline), sharaqī (un-irrigated), and mustabḥar (over-inundated). None of these categories were subject to rent and taxation (except in some cases sibākh). Thus durra existed outside of the urban market system and outside of the rent and taxation system, a form of sustenance unseen by the rent and tax collectors of the rural-urban bureaucracy.

Peasants were known to subsist on durra alone, and this was particularly true in times of famine. The shift to durra was symptomatic of Egypt's supply shock. Since durra could be grown in conditions that were either very high in salinity, very dry, or, conversely, over-inundated, it was an ideal survival crop for times when the irrigation system was falling apart. Thus if canals were choked with silt, dikes were ruptured, and dams were broken open, durra could be grown in these marginal conditions – allowing peasants to survive under the worst of circumstances.[27] Durra thus had its own special ecological niche, surviving and even thriving when the growing of wheat, barley, and other crops were severely curtailed by the adverse conditions.

As peasants attempted to grapple with the malfunctioning irrigation system, many of them shifted to this more autarkical mode of survival.[28] Al-Maqrīzī tells us that peasants were living off durra alone during the great crises (*ḥawādith*) of 806-808/1403-1405. He also reports durra consumption as a reflection of disaster in 825/1422.[29] The economic historian Eliyahu Ashtor found that consumers changed their dietary habits in the late fifteenth century, and people began

eating millet and sorghum instead of wheat and barley.[30] Other scholars take note of a more general shift in consumption away from wheat, towards durra and barley.[31] Nineteenth century observers reported that the cultivation of durra increased in proportion to worsening flood conditions.[32]

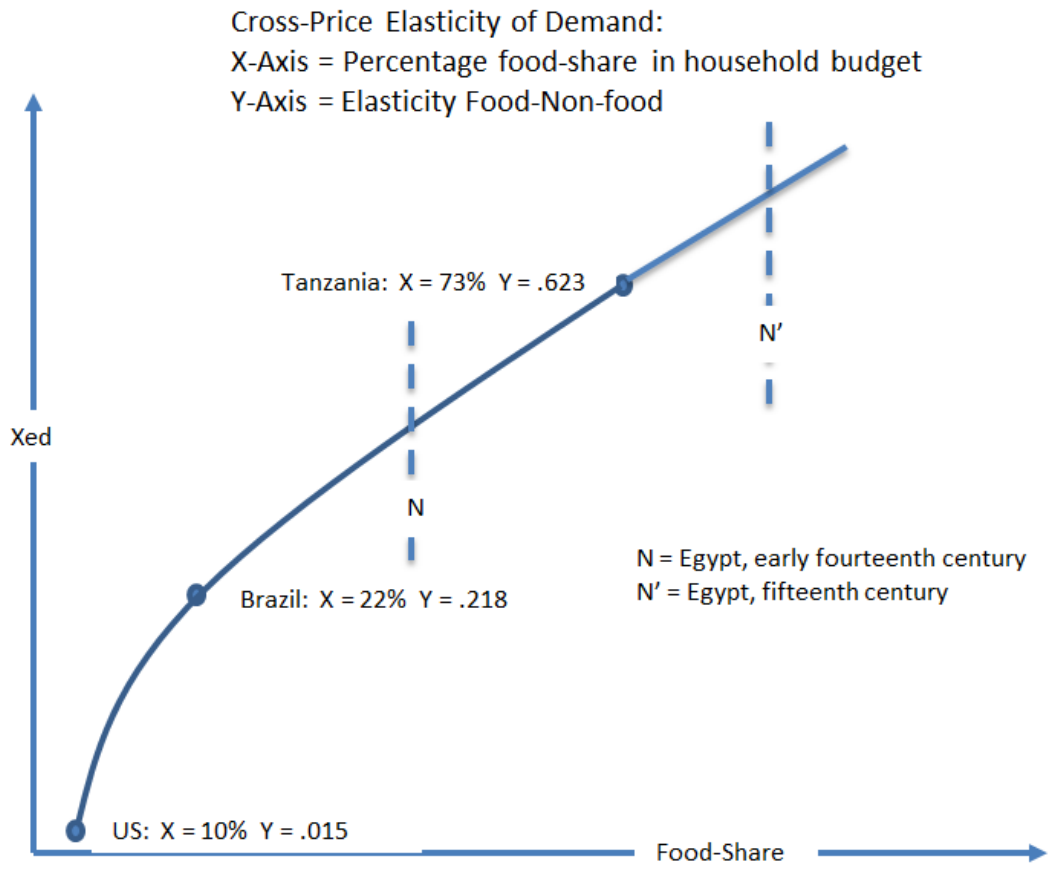
Why was this switch to durra so important? What does the transition to durra have to do with the cross-price elasticity of demand and the grain/textile markets? The transition to durra ultimately had a dramatic impact on the grain and textile markets via the cross-price elasticity of demand. It was significant that the transition to durra was accompanied by falling per-capita income because falling per-capita income magnified the degree of substitution in the cross-price elasticity of demand.

Studies of modern world economies illustrate the stark fact that cross-price elasticities of demand increase in reverse proportion to per-capita income. When one moves from the developed to the underdeveloped world, and as the corresponding food-share in the consumption basket rises, the cross-price elasticity of demand rises as well.[33] When budget constraints are truly desperate, purchasing decisions take on an urgency unseen under more prosaic circumstances.

In the present day world, when one moves from a developed country like the United States, to a middle income country like Brazil, food-share climbs from some 10% of budget for the US, to roughly 22% for Brazil. At the same time, Xed for the basic groups (food/non-food) increases from .015 for the US, a relatively low degree of substitution, to as much as .218 for Brazil. If one looks at a more extreme case like that of Nigeria, where the food-share climbs as high as 73%,

Xed rises even further, to .623, where the relationship of substitution is much stronger.[34] Thus there is a spectrum of elasticity here that varies according to per-capita income and relative food-share.

The unfortunate inhabitants of Egypt in the worst years of the fifteenth century would have experienced extreme degrees of cross-price demand elasticity. Food-share for consumers in the urban setting, for which we have data, rose from some 50% in the early fourteenth century to some 80 to 90%, or higher, in the early fifteenth century. As these needs were expressed as fractions of basic caloric grain requirements, it is hardly surprising that the cross-price elasticity for durra/other grains would have been very high. In the figure below, present-day statistics are juxtaposed with extrapolations for Mamluk Egypt in the early fourteenth century (N) and for the fifteenth century (N').



What then were the wider consequences of this process of substitution? What does the story of durra tell us, in general terms, about the grain and textile markets? It seems quite clear that it was ultimately as severe as the sense of urgency that drove peasants to make the switch. Peasants had been accustomed to bringing their grain to rural markets to exchange for silver specie with which to pay their rents.[35] This activity was easily the most vibrant and substantial component of market transaction in the rural sector of Mamluk Egypt's economy. But durra took the place of the principal monetized grains, wheat and barley, and these staple goods of the rural market economy vanished.[36] The vacuum created by their absence wreaked collateral damage on all the

other sectors of rural commerce.[37] Rental payments shifted from cash to kind, the rural market system was ruined, and the rural sector moved towards a barter economy.[38]

What about textiles themselves? Next to grain, textile factors were the most significant artery of rural commercial activity. Damage to the grain market meant damage to the textile factor market and thus damage to textile production capacity in general – and all indications are that both the factor and product markets were badly impaired by the early 1400s. Ibn Taghrī-Birdī and al-Maqrīzī testify to the very dramatic fall in production capacity over a 50 year period from the late fourteenth century to the early fifteenth century.[39] The economic historian Ashtor focuses on the early fifteenth century as the locus of decay for the textile market, which he chooses to call the "most important sector of industrial production in the Middle Ages." Given the concurrent damage to the production infrastructure, i.e. the irrigation system, it goes without saying that factors such as wool were especially hard hit, as references to the pastoral economy suggest.[40] Overall it seems that durra played an important role in this economic transformation, via the mechanism of cross-price demand elasticity.

3rd Type: The income elasticity of demand

Another elasticity mechanism, the income elasticity of demand, also played a role here – and it did so via durra substitution as well. Income elasticity of demand measures the exact change in quantity demanded of a good with respect to a change in income.

$$\text{Ei} = \frac{\%\ change\ in\ quantity\ demanded}{\%\ change\ in\ income}$$

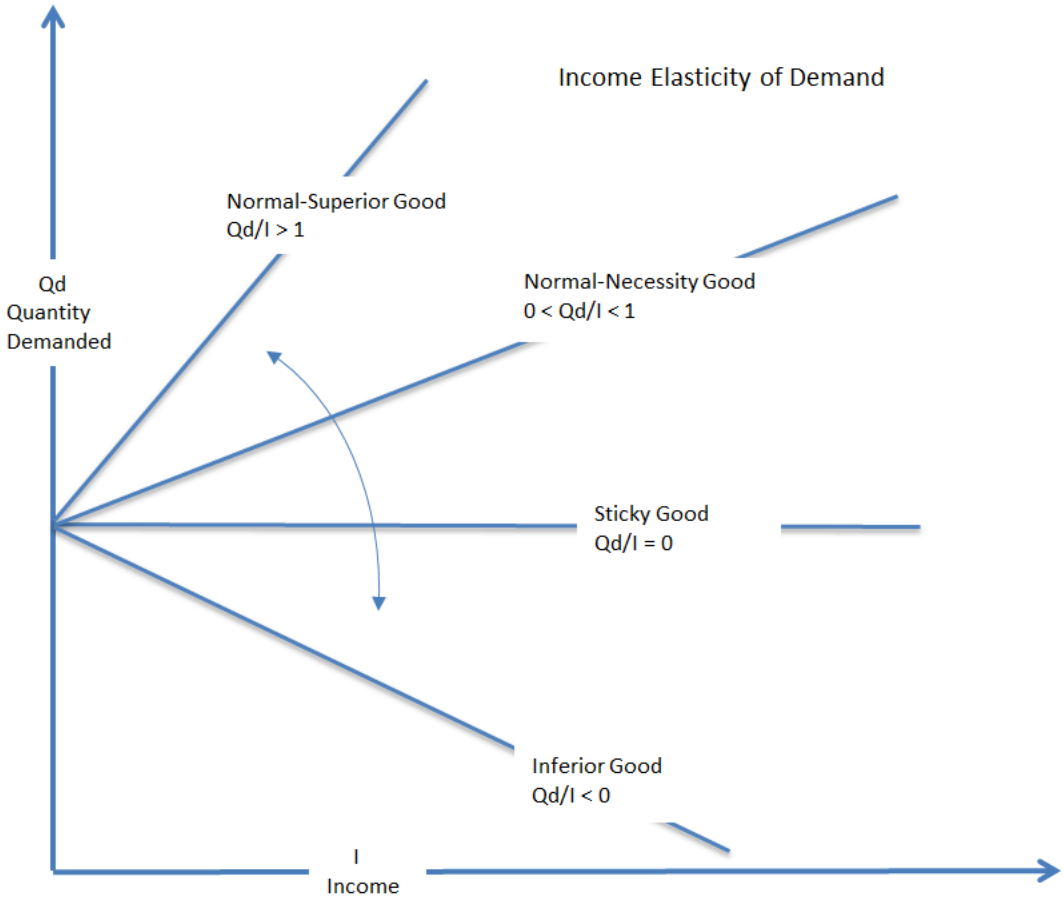
When a consumer's income drops, what goods will he forgo, how will his consumption patterns change? One would logically expect that his demand for most products decreases with falling income, with the reduction of demand being greater or lesser in degree to the urgency of need. This is indeed the case, and it is the subject of "normal" goods that fall into the sub-categories of "superior" and "necessity." But what of the counter-intuitive proposition: that consumer demand would rise as income falls? This is the proposition and attraction of the "inferior" good, for which exceptions are made as economic alternatives are curtailed; the quantity demanded of the inferior good increases as income decreases. (In a modern economy, the increased use of public, over private, transportation is the most common example.)

As was the case with the cross-price elasticity of demand, the switch to an inferior good takes place as economic misery sets in and expenses are curtailed. With incomes plummeting, and food-share spiraling upward in the early fifteenth century, the consumers of Mamluk Egypt, rural and urban, took recourse to inferior goods. This mechanism, as it operated in the early fifteenth century, further explains why Egyptians switched to durra, a classic case of the inferior good. And again, the same train of causation applies here as well, what was good for durra was bad for commerce, with more of the same consequences for the textiles market.

Even more so, much more so, as it turns out, when one looks at the workings of this elasticity on the non-inferior, or "normal" goods. When selections were made, and survival needs put in first place, most textiles did not fare very well. It is clear that the fall in demand for normal goods hinged upon the urgency of its consumption. Wheat, barley, and broad beans, the three pillars of

the mix that the Mamluk authorities used as the price mechanism for the macro-economy, fell into the range of "normal-necessity goods," whose elasticity was positive, but at a ratio of less than one. But textiles were sacrificed in this equation, as "normal-superior" goods whose elasticity was greater than one. We saw above that textileʾs large price-demand elasticity determined a substantially reduced production point when Mamluk Egyptʾs economy was struck with a supply shock. So here too, the pressure of income elasticity operates against textiles.

One can see the range of goods on the following figure, where Ei (the slope Qd/I) varies according to the manner in which urgency and necessity drive consumption patterns, and goods fall into a range that runs from durra (an inferior good) to textiles (a normal-superior good).

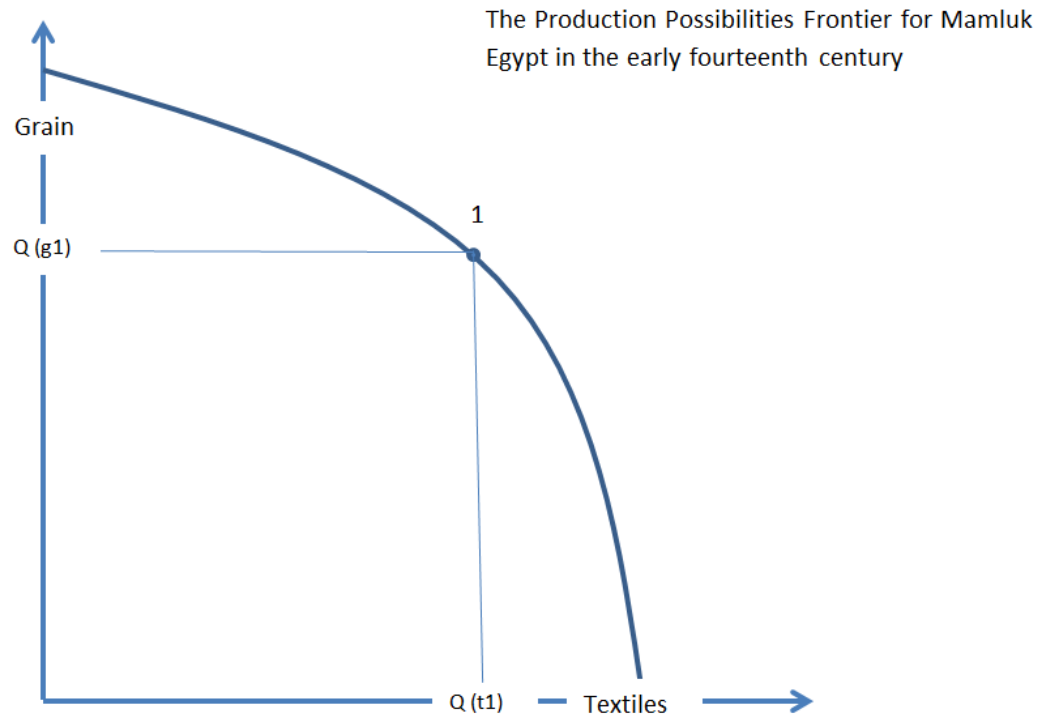


That textiles were sacrificed by both producers and consumers is clear from the historical record. What is remarkable here is the punishing degree of this income extremis. By the early fifteenth century, Egyptian consumer income, in terms of real wages, may have dropped by as much as 80%.[41] Survival was indeed the sole priority for most Egyptians, and even that was beyond their means in these worst of the worst times.[42]

The Production Possibilities Frontier (PPF)

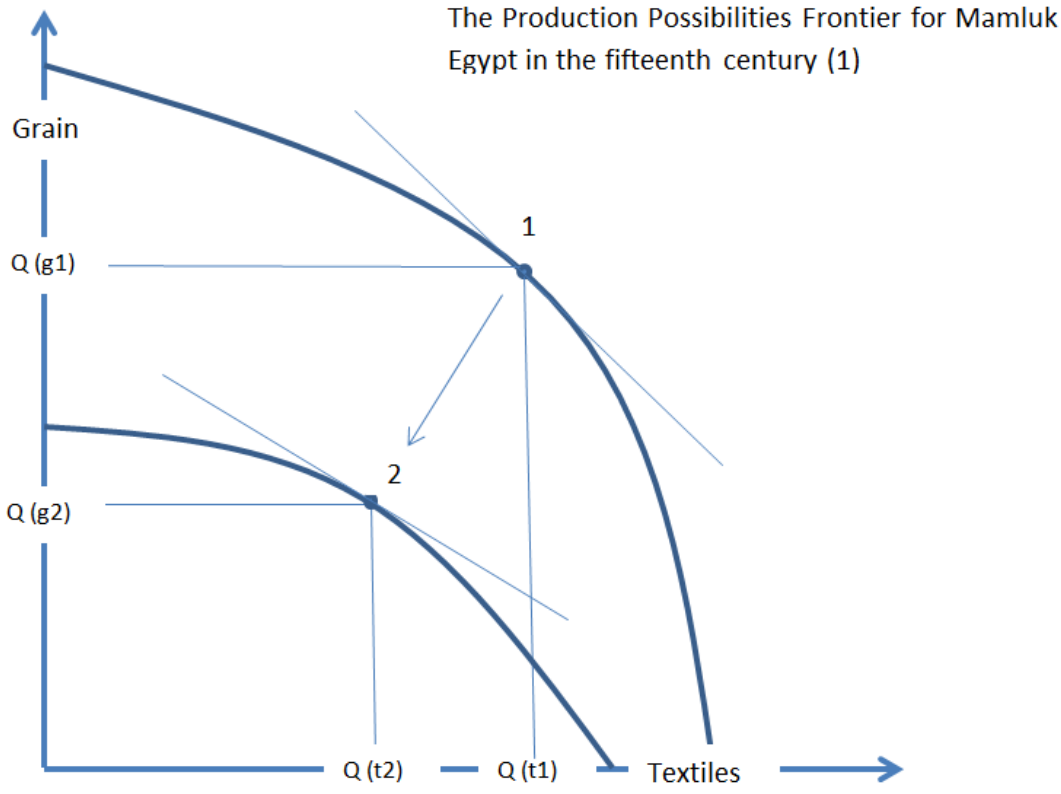
Another useful way to visualize the changes in the grains and textile markets is to graph the production possibilities frontier using the specific factors model.[43] In this representation of Egypt's economy, two goods are produced, grain and textiles. Three factors of production are employed in the output of grain and textiles: land, labor, and capital, where labor is a mobile factor, land is specific to grain, and capital is specific to textiles.

In the figure below are the production alternatives for this highly simplified economy that produces only two goods, grains and textiles. Here the curve represents the range of different possible alternatives for the production of these two goods.



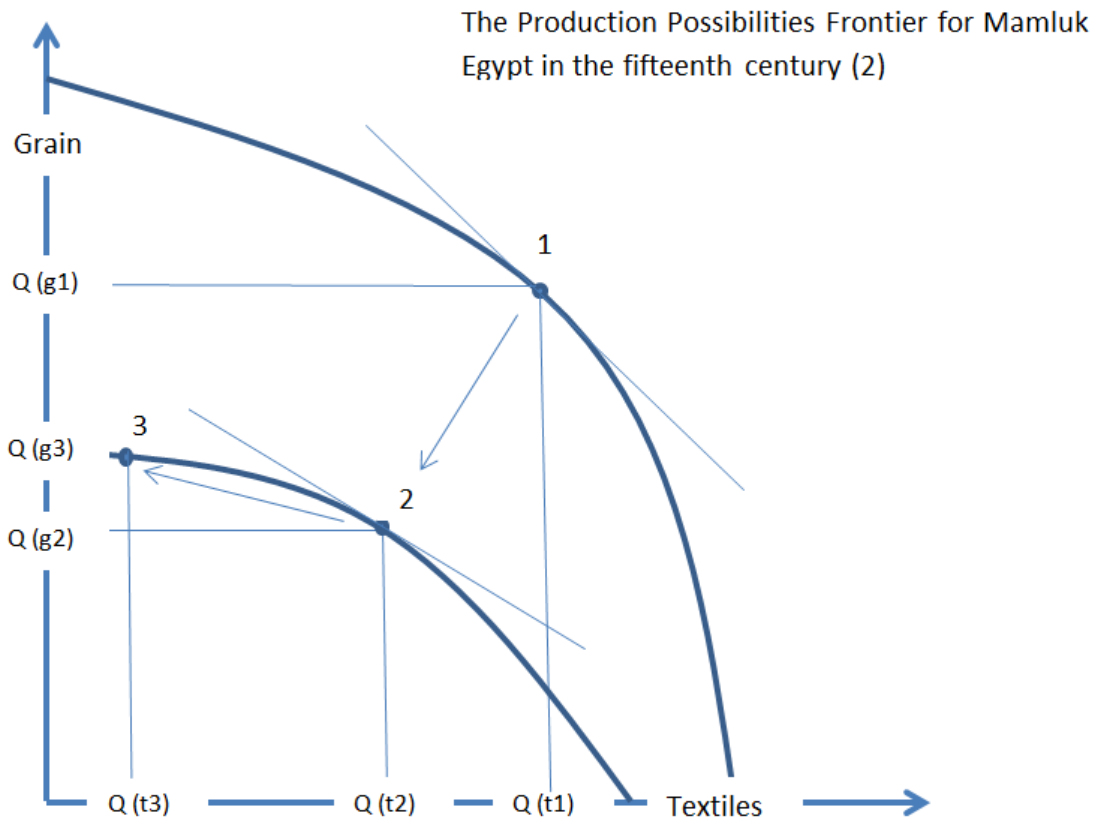
The figure below represents Egypt's reduced economic alternatives in the early fifteenth century. On this new, retracted, curve for the early fifteenth century economy following sustained

depopulation, the production of both goods has been sharply curtailed, and the economy's choice of production alternatives is represented by point (2). The slope of the curve at point (2) is lower than the slope at point (1), reflecting lower opportunity cost of textiles in terms of grain. The curve is thus biased in favor of textiles: here is the counter-intuitive "abundance" of labor, given the severe retraction in the effective cultivable land area.



In the following figure, point (2) depicts the outcome based on supply factors alone, while point (3) demonstrates the shift in production which results from the impact of price demand elasticity upon grain and textiles. At point (3), textile production has been sacrificed for grain production

and the shallower slope of the line at point (3) reflects the new ratio of the price of textiles divided by the price of grain in the mid-fifteenth century, where the price ratio of textiles to grain has decreased.



The Invasion of "Jukh"

Further developments may be addressed with reference to the international textiles market. In the fifteenth century, the slump in Mamluk Egypt's textile production seems to have been

accompanied by the import of large quantities of foreign textiles. One token of this market penetration came in the form of wool products from Europe, some of which were called "*jukh*." *Jukh* is sometimes translated as broadcloth, and traced to the production of English broadcloth in the fifteenth century. The term is used in present day Arabic to refer to both woolens and cotton fabrics that are of particularly dense weave. Historically, *jukh* also seems to have had a wider connotation that indicated all woolen cloth from Europe. An 877/1437 letter from the Sultan Qāytbāy to the Doge of Venice, refers to *jukh* cloth in parallel with *qumāsh*.[44] There are cognate words, chūkhā and choqa, in Persian and Turkish, respectively.[45] Goitein notes that it may have been a kind of cloak or raincoat.[46] *Jukh* of high quality is referred to in a 919/1513 "general order" (*marsūm muṭlaq*) to Mamluk officials regarding trade with Venetians.[47]

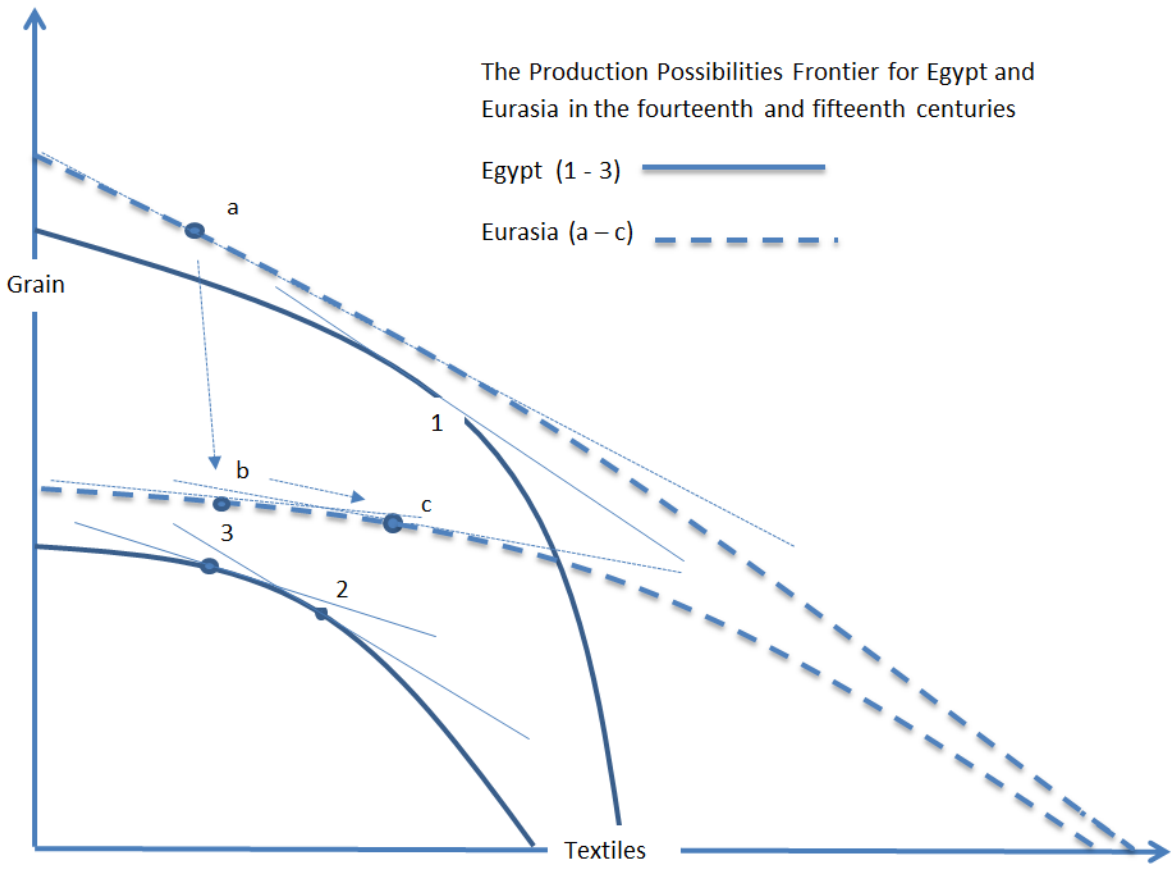
Among Mamluk contemporaries who mention *jukh*, al-Qalqashandi refers to it as a "superior fabric" made in Venice.[48] The subject of *jukh* evoked some bitter commentary on the part of the market inspector al-Maqrīzī. He caustically informs the reader that *jukh*, a fabric from Europe, was only worn during rainy weather. But after the recent disasters (*al-Ḥawādith*), by which al-Maqrīzī and other chroniclers mean the horrific plague, low Nile, and famine from 1403 to 1405, domestic textiles "became expensive and necessity forced people to abandon luxury fabrics. Most people then began to weak *jukh* – a product imported from Europe."[49] Patchy data from al-ʿAynī and al-Maqrīzī suggests that domestic textile prices increased by roughly 75% in this period.[50]

Andre Raymond has summed up the situation: "The decline of the local textile industry is no doubt reflected in the vogue for European woolen fabric (*gukh*). Traditionally worn only by the

poorer classes, *gukh* seems to have come into general favor in the fifteenth century. It was cheaper than Egyptian cloth, which was at one time more highly prized, and also owed its penetration of the Egyptian market to the growing dominance of Western merchants."[51] Archibald Lewis notes that, "it was no accident that in Mediterranean Europe textiles could now be produced so cheaply that the Moslem East's weavers found it impossible to compete against them as exports."[52] And Louise Mackie contends that in Europe, "the textile industry had, by 1400, benefited from technological innovations that enabled the manufacture of finer and cheaper silks and woolens than in the Mamluk Kingdom."[53]

Lopez, Miskimin, and Udovtich went further and described this trend in terms of a wider geographical scope, contending that, "large quantities of European and Eastern textiles were found in the markets of Cairo and Alexandria. Not only did these imports directly aggravate an already serious balance of payments problem, but they also contributed in some measure to a decline of the indigenous Egyptian textile industry."[54] In this wider scheme of things, aggressive trade strategies can be observed in the case of Ming China, which was actively cultivating trading ties, exporting textiles, and seeking markets in the Middle East, as represented by the voyages of Zheng He and the Mamluk efforts to shift trade depots from Aden to Jiddah.[55] The development of stronger long-distance trade networks from India and the emergence of Malacca as a major trading center should also be considered here.[56]

The invasion of *jukh* and other textile goods from Europe, South Asia, and Far East Asia, can be conceptualized in terms of shifts in comparative advantage that arose from changes in factor proportions in Asian and European markets, changes that accompanied world-wide plague pandemic. One can visualize this in terms of hypothetical production possibilities frontiers, where the economic outcomes for two regions, Eurasia and Mamluk Egypt, are set side-by-side. Using here the Heckscher-Ohlin factor proportions model[57], it is suggested here that these economies might have witnessed changes that biased production in the direction of textiles, even when production in all economic spheres declined sharply due to depopulation.[58] Shown in the figure below, Eurasia's production shifts from (a) to (b) and then (c), in a mirror image of the market elasticities in Egypt. It can be seen that the post-plague production possibilities frontier is shallower than Egypt's, reflecting lower opportunity costs for textiles in terms of grain, and a comparative advantage in the production of textiles. The export of *jukh*, it is suggested, was representative of this comparative advantage.



Whatever the magnitude of this shift, it seems plausible that a current account deficit was a considerable problem for Egypt during this time.

E. Ashtor promoted the story of the dramatic trade imbalance and then went further still and posited a center-periphery/developed-underdeveloped relationship between Europe and the Near East in the late medieval period. In his model, raw materials flowed from the Near East and were exchanged with finished products from the European west. As Ashtor argued: "The Middle East supplied Europe with raw materials and bought industrial products from them…what we are dealing with here is a previously industrialized and monetary economy which, having declined,

became dependent upon a swiftly progressing and more modern economy."[59] If one were to accept this dramatic schema, it might be logical to ask if the economies of South and East Asia represented another such developed center vis-à-vis Egypt.

At the same time, one should take note of scholarship that rejects this view in its entirety. As Munro cogently sums up a contrary point of view, "The fact that the Italians had been so successful in marketing not only their own but other European woolens in the Levant is hardly evidence of any Mamlūk 'industrial decline, as Ashtor has so frequently argued." Furthermore, he reasons that, "Trade is not a Mercantilist zero-sum game, in which the victors gain by imposing their goods on the losers. Trade serves to satisfy mutual and differing wants, in order to benefit both sides, indeed in what Classical Economists called the 'gains of trade', from the 'law of comparative advantage."[60] The only significant comparative advantage that Munro sees here was that of English cloth over other woolens due to English export taxes on wool. In fact, Munro's analysis suggests that any comparative advantage Europe had in the Levant was greatly reduced in the later fourteenth and early fifteenth centuries by rising transaction costs stemming mainly from intensification of warfare.[61]

The Current Account and the Capital Account

However one views the role of comparative advantage here, we should examine the monetary aspects of the grains and textiles markets, as they are an important part of this hypothetical analysis. Precious metals shortage was a marked feature of the Egyptian economy in the early

fifteenth century and there seem to have been two possible causes here: supply factors and the potential impact of a trade deficit.

How might supply factors have affected Egypt's monetary situation? The European supply of silver seems to have dried up at this time. The term "silver famine" is no longer in vogue among economic historians of medieval Europe, but this famine was nevertheless very real for the inhabitants of late Mamluk Egypt. Aḥmad ibn ʿAlī al-Qalqashandī is quite specific: Egyptian silver supplies came from Europe, and European supplies had dried up.[62] Al-Maqrīzī reports essentially the same information.[63] Other sources for this period, including Egyptian archival records, clearly indicate that silver had all but vanished from Egypt's markets.[64] Did other suppliers also fail Egypt? Central Asian supplies seem to have been impacted, with Iranians making an abortive attempt to switch to paper currency.[65] Trading partners as far afield as India and China were apparently grappling with a shortage of silver during this period.[66] Malaccans were suffering from such a severe precious metal shortage that they resorted to using tin for currency.[67] Seemingly there was something of a global aspect to this phenomenon.

But what of Egypt's current account? It is possible that Egypt's trade deficit was draining its supply of silver and Egypt was also exchanging silver for European copper.[68] Was a trade deficit across the Indian Ocean also working to rob Egypt of its silver? Ibn Ḥajar al-ʿAsqalānī thought so, indicating that the Mamluk regime was concerned enough to try to take action: "The Mamluk regime forbade the use of silver in the making of silver utensils and tools and took stern measures against those who, by exporting minted silver to the Hejaz, attempted to profit from Indian demand for this metal. Because of this, silver thus became very scarce."[69] The monetary

side of Egypt's current account deficit had an enormous impact on the grains and textiles markets, as we will see.

But an unmistakable "copper famine" also comes into the story here, and this famine plays an important role in the larger economic schema of late Mamluk Egypt.[70] Why was copper scarce as well? As was the case with silver, some scholars have blamed the problem on a shortage of supply from Europe, reasoning that copper loads in mines, so often found with silver, suffered the same fate.[71] Data indicates that copper imports from Europe had dwindled to a small trickle at the dawn of the fifteenth century, shortly before this copper famine began.[72] Could Egypt's trade deficit have played a crucial role here as well? A negative current account with Indian Ocean trading partners may have had a substantial role in the process of draining Egypt's copper supply.[73] And, as with silver, the shortage of copper seems to have had a reach across the Indian Ocean. Ming China closed down much of its copper production in the 1400s, resulting in a shortage of this copper metal that had been, "one of the key media of exchange in maritime Asia since at least the twelfth century."[74] There was an associated shortage of all metal currencies in Southeast Asia.[75]

But the shortage of copper took on its own dynamic in Egypt. As copper grew scarce, the Mamluk sultanate made a series of efforts to profit from the rising price of the metal by recalling old copper coinage (fulūs qadīm) and issuing its own new copper coinage (fulūs judud) at a higher price. The regime also attempted to profit from the situation by debasing copper coinage with other metals, such as lead, zinc, and iron.[76] These clumsy operations set Gresham's law into motion in Mamluk Egypt. We are told that the issuing of new, debased, coinage at a higher price,

created a situation whereby, "merchants and moneychangers were culling out the higher quality coins and exporting them to the Hejaz, Yemen, the Maghrib, and India."[77] ʿImād Abu Ghazi tells us that the raw copper was sold in India at a price higher than the minted fulūs, leading to an overall scarcity of copper coinage.[78]

As was the case with silver, phenomena here seem to have found parallels across the Indian Ocean, whereby copper coinage succumbed to Gresham's law in Ming China.[79] So the regime's attempts to profit from the scarcity of copper had the effect of exacerbating this copper famine, and all means of currency transactions were threatened in the 1420s and 1430s.[80] To make matters worse, a unit of account, the dirham min al-fulūs, was employed to reckon with the adoption of copper currency as the primary medium of exchange in Egypt.[81] Wild inflation set in, inflation that alarmed merchants, money changers, and market inspectors.[82] Transaction costs soared. The dirham min al-fulūs, serving as a representative currency with copper as its base, was an unstable mechanism. As the fifteenth century wore on, this unit of account became uncoupled from the underlying metal.[83] As the official copper price fluctuated, the unit of account effectively became a purely fiat currency, stimulating ripples of panic in the monetary markets of Mamluk Egypt.[84] Devoid of silver, denuded of all but a paucity of copper currency, and that currency heavily debased, Egypt's economy lay prostrate in the first half of the fifteenth century.

What then, was the impact of these alarming developments on the main arteries of commerce, the grain and textile markets? The answer to this question calls for a glance at the happier days of Egypt before the onset of plague pandemic.

The agrarian system and rural market system, in Lower Egypt at least, had been highly monetized. Peasants were expected to sell their crops to obtain specie for rent. Rent was paid in installments over the course of the agricultural year, in intervals of 1/8 to 1/3, paid from Amshīr (February) through Baʾūna (May). Local markets were dense enough in the countryside to allow for peasant exchange. Sale of grain could be easily exchanged for specie. The landholding system had been very efficient and stable, with reliable the silver dirham functioning as an efficient and orderly mechanism for exchange and rent payment. The level of rent, for most crops, was equal to 2.5 to 3 ardabbs per feddan (.6 ha) or some 264 to 316.8 liters.[85] But most transactions took place in specie, with the rent for 1 feddan equal to 30-40 silver dirhams.[86] During the early Mamluk period (1250-1350) rents were stable, and this silver amount served for all transactions. Silver was thus the essential staple of this technically advanced and highly monetized economy. As was the case with urban areas, silver was the essential medium, with gold used for very large transactions, and copper used as petty change for small transactions.

All of this was violently changed by the currency crisis of the early 9th/15th century. Silver disappeared from the rural markets. Peasants no longer had a reliable mechanism for rent and other median-level transactions. Copper took its place, but was a poor substitute for silver. Peasants hated copper and often refused to deal in it. A complex crisis of interchange confusion struck the rural domain at this time, meaning that a very stable transaction system had been replaced by a highly variable and uncertain medium.

Rural land rents in the early fifteenth century were paid in fulūs coins, not silver.[87] "The money that anyone now receives from land tax or any other source consists instead of [copper] fulūs… weighed by the raṭl."[88] Real rents went up in the midst of surging inflation.[89] As copper itself then became extremely scarce, as its price surged by some 600%, as copper coinage was debased with other metals, the rural economy was effectively robbed of all viable currency.[90] Subsequent barter was accompanied by rent extraction in kind, and rural flight became a common phenomenon.[91] The overall monetary shortage acted as a violent supply shock to the economy and, as barter became the common means of highly inefficient and effectively expensive transaction in the rural economy, waves of economic chaos gripped the agrarian system.[92]

The monetary market had a very dramatic impact on proto-industrial inputs such as sugar and flax, robbing the textile industry of its primary factors.[93] The crisis furthermore created webs of feedback. Upwardly spiraling prices for textiles greatly exacerbated Mamluk Egypt's trade deficit, and the expanding trade deficit accelerated the drain of silver and, seemingly, copper currency. The shortage of these metals then further deepened the crisis in factor markets, feeding and fanning the trade deficit.

The ailing condition of the irrigation system moved in tandem with the monetary crisis, worsening overall economic conditions. Demand elasticities acted to further deepen the crisis. All of these elements acted to damage the grains and textile markets, and these factors interacted with each other.

"It's an ill-wind that blows nobody any good," as Lopez, Miskimin, and Udovitch long ago observed of the economies of Europe, the Middle East, and India at this time.[94] Although much of this picture drawn here is composed of hypothetical economic reasoning, Egypt's grain and textile markets might be seen to be markers of aggravated economic distress in the early fifteenth century. As far as is posited here, late Mamluk Egypt never recovered from this crisis, though the copper and silver shortages slowly eased up. It seems likely that the pathetic condition of the irrigation system awaited the Ottoman intervention into the infrastructure of the economy. It is conceivable that only then did conditions begin to improve.

---

[1] Stuart Borsch, *The Black Death in Egypt and England*, Austin: University of Texas Press, 2005, pp. 41-6.
[2] Aḥmad ibn ʿAlī al-Qalqashandī, *Subḥ al-aʿshā fī sināʿat al-inshā*, ed. Muḥammad Ḥusayn Shams al-Dīn, Beirut, Dār al-Kutub al-ʿIlmiyya, 1987, 15 vols., vol. 3, p. 516.
[3] Aḥmad ibn ʿAlī Ibn Ḥajar al-ʿAsqalānī, *Inbāʾ al-ghumr bi abnāʾ al-ʿumr*, Beirut, Dār al-Kutub al-ʿIlmiyya, 1969, 9 vols., vol. 8, p. 257.
[4] Aḥmad ibnʿAlī al-Maqrīzī, *Kitāb al-sulūk li-maʿrifat duwal al-mulūk*, ed. Saʿīd ʿAbd al-Fattāḥ ʿĀshūr, Cairo, 1957, 4 vols., vol. 4, p. 874. The delay in sowing led to the late bloom of the spring harvest which subjected the new crops to the dangerously high temperatures of the early summer.
[5] Borsch, *Black Death*, p. 41; addressing the theme of rising factionalism, see Jo Van Steenbergen, "*Order Out of Chaos: Patronage, Conflict and Mamluk Socio-Political Culture, 1341–1382*, 1997, pp. 169-73; Amalia Levanoni, *A Turning Point in Mamluk History: The Third Reign of al-Nāṣir Muḥammad Ibn Qalāwūn (1310-1341)*, Leiden, Brill, 1995, pp. 197-9; C. F. Petry, "A Paradox of Patronage During the Later Mamluk Period," *The Muslim World* 73 (1983), p. 204; Daisuke Igarashi, "The Evolution of the Sultanic Fisc and al-Dhakhīrah During the Circassian Mamluk Period," *MSR* 14 (2010), pp. 89, 106; Daisuke Igarashi, "The Private Property and Awqaf of the Circassian Mamluk Sultans: The Case of Barquq," *The Society for Near Eastern Studies in Japan (Nippon Oriento Gakkai)* LXIII (2008), p. 170; for a contrary perspective, see Robert Irwin, "Factions in Medieval Egypt," *Journal of the Royal Asiatic Society* (1986), pp. 228-246.
[6] For the transfer of control of the system to the governors, see Khalīl bin Shahīn Al-Ẓāhirī, *Kitāb zubda kashf al-mamālik wa bayān al-ṭuruq wa-l-masālik,* ed. Paul Ravaisse, Paris: Imprimerie Nationale, 1894, p. 129; Aḥmad ibn ʿAlī al-Maqrīzī, *Kitāb al-mawāʿiẓ wa-l-iʿtibār bi-dhikr al-khiṭaṭ wa-l-āthār*, Cairo, 1853-1854, 2 vols., vol. 1, p 101; Tsugitaka Sato, *State and Rural Society in Medieval Islam*, Leiden, Brill 1997, p. 226; ʿĀmr Nagīb Mūsā Nāṣir, *al-Ḥayāt al-iqtiṣādiyya fī Miṣr,* Ramallah: Dār al-Shurūq, 2003, pp. 121, 172, 176-179. For the flaws of

regional control, see Borsch, *Black Death*, p. 42; Al-Qalqashandī, *Subḥ*, 3: 51-53; 4: 61-64; 6: 192-193;.

[7] S. J. Borsch, "Nile Floods and the Irrigation System in Fifteenth-Century Egypt," *MSR* 4 (2000), p. 461; Yūsuf Ibn Taghrī Birdī, *Ḥawādith al-duhūr fī madá al-ayyām wa-l-shuhūr*, 4 vols., ed. William Popper, Berkeley, University of California Publications in Semitic Philology, 1930, 4 vols., vol. 4, p. 673; Muḥammad ibn Muḥammad al-ʿAsādī, *al-Taysīr wa-l-iʿtibār wa-l-taḥrīr wa-l-ikhtibār fīmā yajibu min ḥusn al-tadbīr wa-l-taṣarruf*, ed. ʿAbd al-Qādir Aḥmad Ṭulaymāt. Cairo, Dār al-Fikr al-ʿArabī, 1968, pp. 92-3; Ibn Iyās, *Badāʾiʿ al-zuhūr fi-waqāʾiʿ al-duhūr*. ed. Muṣṭstafá Muhammad, Cairo: al-Ḥayā al-Miṣriyya al-ʿAmma li-l-Kitab, 1982, 5 vols. vol. 5, pp. 114-15; Ibn Iyās, *Nuzhat al-umam fī-l-ʿajāʾib waʾl-ḥikam*, ed. Muḥammad Zaynham Muḥammad ʿAzab. Cairo, Maktaba Madbūlī, 1995, p. 182.

[8] al-Maqrīzī, *al-Khiṭaṭ*, vol. 1, pp. 94-100.

[9] Borsch, *Black Death*, pp. 118-33.

[10] Borsch, *Black Death*, pp. 80-87.

[11] The drop in demand, posited as less than the drop in supply, is not depicted here for simplicity's sake.

[12] Borsch, *Black Death*, pp. 91-6.

[13] Xed is held "uncompensated" by (independent of) the income elasticity of demand.

[14] P. R. Carter et al., "Grain Sorghum (Milo)" in *Alternative Field Crops Manual.* Dept. of Agronomy and Plant Genetics, University of Minnesota, St. Paul, Minnesota, 1989, pp. 90-117.

[15] Ibid.

[16] Ibid.

[17] Thomas Park, "Early Trends toward Class Stratification: Chaos, Common Property, and Flood Recession Agriculture," *American Anthropologist* 94 (1992), p. 92.

[18] It was also grown as a summer crop.

[19] W. Willcocks and J. I. Craig, *Egyptian Irrigation*, 3rd edition, London: E. & F N. Spon Ltd., 1913,2 vols., vol. 1, p. 309.

[20] "Most (of the basins) have reserved for millets large areas which are separated from the rest of the basins by subordinate dykes, and are only filled at the time of the discharge after the millet crop is off the ground. In very many of the larger basins, so late is the full supply in coming, that all the higher-lying parts of the basins are sown with millet in August, reaped in October, before the final filling takes place," Ibid.

[21] Ibid., p. 304.

[22] ʿĀmr Nagīb Mūsā Nāṣir, *al-Ḥayyāt al-Iqtiṣādiyys fī Miṣr*, Ramallah, Dār al-Shurūq, 2003, p. 344; Kenneth Cuno, *The Pasha's Peasants. Land, Society, and Economy in Lower Egypt, 1740- 1858*, Cambridge, Cambridge University Press, 1992, p. 18.

[23] Willcocks, *Egyptian Irrigation*, p. 314.

[24] I list rent in distinction from taxation here because taxation belongs in a separate category in the land revenue system. Taxation was properly added on top of rent.

[25] See Ibn Mammātī's list of crops in Al-Asʿad Ibn Mammātī, *Kitāb al-qawānīn al-dawānīn*. ed. A.S. Atiya, Cairo, al-Jamʿiya al-Zirāʿiya al-Malakiyya , 1943, pp. 358-70.

[26] Al-Qalqashandī mentions it with no details, *Ṣubḥ*, vol. 33, p. 343. Durra was hated by urban consumers. Wheat, barley, and other winter crops were preferred. They would only consume durra during desperate times of drought and famine. See Adam Sabra, *Poverty and charity in medieval Islam*, Cambridge, U.K., Cambridge University Press, 2000, pp. 163,167.

[27] At the same time, with regards to major winter crops, Fekri Hasan has remarked that "the ratio of barley to wheat at Nagada Predynastic sites was 2:1. Although emmer wheat is preferred, barley is more resistant to salinity and fluctuations in ground moisture and was for this reason most probably cultivated more widely than wheat…emmer wheat gained over barley only at the end of the New Kingdom." Fekri Hassan, "The Dynamics of a Riverine Civilization: A Geoarchaeological Perspective on the Nile Valley, Egypt," *World Archaeology* 29 (1997), 55.
[28] Borsch, *Black Death*, p. 50.
[29] Al-Maqrīzī, *Sulūk*, vol. 4, p. 603.
[30] Eliyahu Ashtor, *Levant Trade in the Later Middle Ages*, Princeton, Princeton University Press, 1983, p. 437; idem., Eliyahu Ashtor, *A Social and Economic History of the Near East in the Middle Ages*, Berkeley and Los Angeles, University of California Press, 1976, p. 319.
[31] N. Coureas, "Trade between Cyprus and Mamluk Lands in the Fifteenth Century, with Special Reference to Nicosia and Famagusta." in U.Vermeulen and K. Dʾ Hulster (eds.) *Egypt and Syria in the Fatimid, Ayyubid, and Mamluk Era*, V. Leuven – Paris – Dudley, MA, Uitgeverij Peeters, 2007, pp. 427-9.
[32] Willcocks, *Egyptian Irrigation*, 314: "in years of a defective flood…the flood sorghum irrigation will be extensive."
[33] Anita Regmi and James L. Seale Jr., *Cross-Price Elasticities of Demand Across 114 Countries*, Technical Bulletin Number, 1925, United States Department of Agriculture, 2010, pp. 5, 13-14 - using Slutsky own-price elasticities.
[34] Ibid., pp. 13-14.
[35] Nāṣir, *al-Ḥayāt*, p. 347.
[36] Borsch, *Black Death*, 50-1.
[37] Ibid., 52.
[38] Borsch, *Black Death*, 47; al-Qalqashandī, *Subḥ*, 3: 519-22; Tarhkān, Ibrahim ʿAli. *al-Nizam al-Iqtaʿi fiʾl-Sharq al-Awsat fi-l-ʿUsur al-Wusṭa*, Cairo, Dār al-Kātib al-ʿArabi at-Tabaʿa wa-l-Nashra, 1968, 100.
[39] See also al-Maqrīzī, *Suluk*, IV: 909.
[40] Al-Maqrīzī, al-Suluk, IV: 603, 663.
[41] Borsch, *Black Death*, 111.
[42] See, for example, al-Maqrīzī's discussion of the "*Ḥawādith*," in *al-Sulūk*, 3, 1113-69.
[43] Paul Krugman and Maurice Obstfeld, *International Economics: Theory and Policy*, seventh edition, New York: Pearson, 2005, pp. 84-92; Paul Krugman and Maurice Obstfeld, *International Economics: Theory and Policy*, second edition, New York, Harper Collins, 1991, pp. 40-50.
[44] John Wansbrough, "A Mamluk Letter of 877/1473," *BSOAS* 24, 2 (1961), 206, 208, 212-13; Sultan Qāytbāy complains here that the Venetians are shorting the Italian piece (here "*khirqa*," 55 *dhirāʿ*/cubits or 30 meters) to half of its proper length (at 30 cubits, some 15 meters) and are also "*maqṭūʿ min al-wasaṭ*": cut in the center.
[45] Ibid., p. 212.
[46] S. D. Goitein, *A Mediterranean Society: An Abridgement in One Volume*, Berkeley, University of California Press, 1999, p. 140.
[47] D.S. Richards, "A Late Mamluk Document concerning Frankish Commercial Practice at Tripoli," *BSOAS* 62, 1 (1999), 30.
[48] Al-Qalqashandī, *Ṣubḥ*, 5: 383.
[49] Al-Maqrīzī, *Khiṭaṭ*, 1: 98.

[50] Eliyahu Ashtor, *Histoire des prix et des salaries dans l'Orient medieval,* SEVPEN, vol. 8. Paris: S.E.V.P.E.N., 1969, pp. 340-5. With a linen *thawb* (also meaning a piece of some 55 cubits/30 meters - like *khirqa*) selling for around 23 *dinars Ashrāfī* in the early fifteenth century. Compare with Munro's data that lists woolen broadcloth pieces from Catalonia and Narbonne selling in the Levant for prices ranging from 10.5 to 16.5 Florins (i.e. roughly equivalent to *dinars ashrāfī*). See John Munro, "The Rise, Expansion, and Decline of the Italian Wool-Based Textile Industries, 1100-1730: a study in international competition, transaction costs, and comparative advantage," Working Paper 440, October, 2011.pp. 80-2. Ashtor lists woolens of Southern France selling for 9-11 ducats, Catalan woolens selling for 10-12 ducats, in the 1390s. See Eliyahu Ashtor, *Levant Trade in the Later Middle Ages,* Princeton, Princeton University Press, 1983, pp. 153-5, 341. European linens were selling for prices ranging from 3.3 to 7 ducats.
[51] André Raymond, *Cairo,* Cambridge, Harvard University Press, 2000, 146.
[52] Archibald Lewis, "The Islamic World and the Latin West, 1350-1500," *Speculum* 65 (1990), pp. 839.
[53] Louise Mackie, "Toward an Understanding of Mamluk Silks: National and International Considerations," *Muqarnas* 2 (1984), p. 127.
[54] Abraham Udovitch, Robert Lopez, and Harry Miskimin. 1970. "England to Egypt, 1350-1500: Long Term Trends and Long Distance Trade," in Michael Cook (ed.), *Studies in the Economic History of the Middle East*, London, Oxford University Press, 1970, p. 126.
[55] John Meloy, *Imperial power and maritime trade: Mecca and Cairo in the later Middle Ages*, Chicago, Middle East Documentation Center, 2010, pp. 66-7; Atwell, "Time, Money, and the Weather," 89.
[56] Lewis, "The Islamic World," p. 837.
[57] Krugman, *International Economics*, 2005, pp. 50-61; idem, *International Economics*, 1991, pp. 68-84.
[58] The impact of plague pandemic on China was every bit as severe as it was for the rest of Eurasia. From the thirteenth century to the late fourteenth century, the population of China dropped from some 108 million to barely 67 million, a substantial portion of this damage was due to *Yersinia pestis*. Conrad Shirokauer et al, *A Brief History of Chinese and Japanese Civilizations,* Fourth Edition, Boston, Wadsworth, 2013, p. 228. For a discussion of these factors, see John Dardess, "Shun-ti and the End of Yuan Rule in China." In Herbert Franke and Denis Twitchett (eds.), *The Cambridge History of China*, vol. 6., Cambridge, Cambridge University Press, 1994, pp. 585-6.
[59] Eliyahu Ashtor, *Technology, Industry and Trade: The Levant versus Europe, 1250-1500,* London, Variorum Reprints, 1992, pp. 280-1.
[60] John Munro, "*South German silver, European textiles, and Venetian trade with the Levant and Ottoman Empire, c. 1370 to c. 1720: a non-Mercantilist approach to the balance of payments problem in Simonetta Cavaciocchi (ed.) Relazione economiche tra Europa e mondo islamico, seccoli XIII - XVIII,* published Atti delle "Settimana di Studi" e altri convegni, Istituto Internazionale di Storia Economica "Francesco Datini" (Florence: Le Monnier), Vol. 38, No. 1 (2007), pp. 938-9.
[61] John Munro, "The Rise, Expansion, and Decline of the Italian Wool-Based Textile Industries, 1100-1730: a study in international competition, transaction costs, and comparative advantage," Working Paper 440, October, 2011, p. 14.
[62] Al-Qalqashandī, *Ṣubḥ,* 3, p. 535; For the European silver famine, see John Munro, "Crisis and Change in the Later Medieval English Economy: a Review Article," *Journal of Economic*

History 58 (1998), p. 217. For the European silver famine, Munro refers to the episode as the "unhappily and inaccurately termed late medieval bullion famine," preferring the label, "*relative* monetary scarcities." Ibid., p. 217. Ironically, the seeds of European recovery were to be found in Egypt, where the mechanics of the Saigerhutten process were well understood as early as the thirteenth century. See Ibn Baʿra's instructions to combine lead with the silver-copper alloy and melt it under powerful "upside-down" bellows (*rūbāsh*) and: (فيخرج الرصاص ما في جسم الفضة من النحاس) "the lead pulls the silver out of the silver-copper mix," And when the lead has then been removed, "you are left with pure silver." From Ibn Baʿra's Ayyūbid mint manual in Ehrenkreutz, "Extracts," p. 442.

[63] Al-Maqrīzī*, Shudhūr*, 159; Aḥmad ibn ʿAlī al-Maqrīzī, *Shudhūr al-ʿuqūd fī dhikr al-nuqū*d, ed. Muhammad ʿAbd al-Sittār ʿUthmān, Cairo, Dār al-Maʿārif, 1990, p. 159; al-Maqrīzī, *al-Sulūk*, 3: 1111; 4: 27; Shoshan, Boaz. "Exchange-Rate Policies in Fifteenth-Century Egypt." *JESHO* XXIX (1986), p. 28.

[64] Reference here is to Islamic pious donations (waqf) and their associated deed records from the fifteenth century CE. See *Wizārat al-Awqāf*, waqfiyyāt raqam AW 738, AW 749, AW 809, AW 886.

[65] Shoshan, Boaz, "From Silver to Copper: Monetary Changes in 15th Century Egypt," *Studia Islamica* 56 (1982), pp. 100, 102; Aḥmad ibn ʿAlī al-Maqrīzī, *Ighātha al-ʿumma bi-kashf al-ghumma*, trans. Adel Allouche, *Mamluk Economics: A Study and Translation of Al-Maqrīzī's Ighāthah,* Salt Lake City, University of Utah Press, 1994, p. 18.

[66] Atwell, "Time, Money, and the Weather," 97.

[67] Ibid., 97.

[68] See al-Maqrīzī, *Shudhūr*, pp. 156-9, and the famous incident of Maḥmūd bin ʿAlī wherein, "the Franks began to deal in unworked copper, seeking profit, and they imported silver from Egypt, until it became scarce and nearly depleted." Allouche notes that the trade deficit was a prominent part of this equation where he refers to a "shrinking of the volume of Mamluk exports due to a decline of local industrial production, especially of sugar and textiles." See Allouche, *Mamluk Economics*, 18.

[69] Ibn Ḥajar al-ʿAsqalānī, *Inbāʾ* vol. 8, p. 390.

[70] Jean-Claude Garcin and Mustapha Anouar Taher, "Enquete sur le financement d'un waqf Egyptien du XVe siècle, les comptes de Jawhar al-Lala," *JESHO* 38 (1995), p. 288; Shoshan, Boaz, "From Silver to Copper: Monetary Changes in 15th Century Egypt," *Studia Islamica* 56 (1982), p. 110; John Meloy, "Copper Money in Late Mamluk Cairo: Chaos or Control?" *The Journal of the Economic and Social History of the Orient* 44, no. 3 (2001), p. 298; Jere Bacharach, "Circassian Monetary Policy: Copper," *JESHO* 19 (1976), p. 43; Gilles Hennequin, "Mamlouks et metaux precieux a propos de la balance des paiements de l'Etat syro-egyptienne a la fin du Moyen Age-question de method," *AI* 12 (1974), 37-44.

[71] Shoshan, "From Silver to Copper," 110.

[72] Eliyahu Ashtor, *Les métaux précieux et la balance des payements du Proche-Orient à la basse époque*, Paris: S.E.V.P.E.N., 1971, p. 83. While annual copper imports from Europe average nearly 1 million kilograms in the late fifteenth and early sixteenth century, their annual average is little more than 40,000 in 1399-1400 CE. It seems hard to accept the former figure, but the indicated discrepancy is nonetheless indicative.

[73] Jere Bacharach, "Circassian Monetary Policy: Copper," *JESHO* 19 (1976), p. 43.

[74] Atwell, "Time, Money, and the Weather," p. 97.

[75] Ibid.

[76] al-Maqrīzī, *al-Suluk,* 4: p. 3; Garcin and Taher, "Les comptes," 287.
[77] Al-Maqrīzī, *al-Sulūk*, 4, pp. 642, 794.
[78] Abū Ghāzī, *Tatawwur*, 65; al-Najīdī, *al-Naqd*, 361-2.
[79] Maḥmūd Badr al-Dīn al-ʿAynī, *ʿIqd al-jumān fī taʾrīkh ahl al-zamān*, ed. Muhammad Muhammad Amīn, Cairo, al-Ḥayʾa al-Miṣriyya al-ʿĀmma lil-Kitāb, 4 vols., vol. 4, p. 97.
[80] See Warren Schultzʾs discussion of the sultanateʾs fundamental inability to control monetary events, and some of the reactive strategies that the regime employed: Warren C. Schultz, "ʾIt Has No Root Among Any Community That Believes in Revealed Religion, Nor Legal Foundation for Its Implementation': Placing al-Maqrīzī's Comments on Money in a Wider Context," *MSR* 7, 2 (2003), p. 180; See also Arthur Rolnick and Warren E. Weber, "Gresham's Law or Gresham's Fallacy?" *Journal of Political Economy,* 9a (1986), pp. 185-99.
[81] This *dirham min al-fulūs* seems to have first appeared in the year 1401 CE. See Allouche, *Mamluk Economics*, 16-17.
[82] Al-Maqrīzī, *al-Sulūk*, 4: pp. 27-29.
[83] al-ʿAynī, *ʿIqd*, vol. 4, p 252.
[84] Al-Maqrīzī, *al-Sulūk*, 4: pp. 27-9.
[85] An ardabb was equal to 92.4 liters.
[86] See al-Qalqashandī, *Ṣubḥ* 3: pp. 519-22.
[87] Allouche, *Mamluk Economics,* p. 77.
[88] Ibid., 84.
[89] See, for example, al-Maqrīzī, *al-Sulūk*, 4: p. 28; Borsch, *Black Death*, pp. 47-9.
[90] Borsch, *Black Death*, pp. 47-9.
[91] Ibid.
[92] ʿĀmr Nagīb Mūsā Nāṣir, *al-Ḥayyāt*, p. 343.
[93] See, for example, al-Maqrīzīʾs discussion of the sugar industry, al-Maqrīzī, *Khiṭaṭ*, vol. 1, pp. 99-100.
[94] Abraham Udovitch, Robert Lopez, and Harry Miskimin. 1970. "England to Egypt, 1350-1500: Long Term Trends and Long Distance Trade," in Michael Cook (ed.), *Studies in the Economic History of the Middle East*, London, Oxford University Press, 1970, p. 95.