

At the Origins of Middle Eastern Trade, 700-1000 AD: An application of the Gravity Theory of Trade

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I. INTRODUCTION

This paper proposes to apply the model of the Gravity Theory of Trade to empirical evidence from the Middle East, in the hope of gaining new insights into the beginning of and the development of trade under Islamic rule. Gravity Theory of Trade predicts trade volume and flow between nations by relating the size of their respective economies to proximity, namely the distance separating them. ¹ The model of the Gravity Theory of Trade combines the study of the basic determinants of trade, the capacity of an entire economy to produce surplus for trade, and relates it to the ways it could be moved efficiently, including the cost of long-distance transport. It provides a breakdown of the various inputs, or determinants of trade and the energy and vitality through which they were moved. Historians also added another dimension to the discussion by economists, by speaking about impediments to trade flows other than tariffs, which is 'border effects'. By border effects they mean obstacles to trade flows triggered by differences in economic culture, language, religion, and legal system, measures and weights as well as coinage and monetary systems. All factors impede the pull of 'gravity', weaken it and put restrictions on trade. Although the use of Gravity Theory of Trade is mostly found in work on trade flows between present-day nation states, it has historical roots: its origins were traced back to Adam Smith in eighteenth century Scotland, ² and it was applied with great benefit to the analysis of trade flows within medieval European regions.³ Today, the principles of the Gravity

¹ Tinbergen (1962); For trade theories with focus on size of the economy and geography, http://www.economicsonline.co.uk/Global_economics/Gravity_theory_of_trade.html; Ethier, Helpman and Neary (1993).

² Elmslie (2018).

³ Persson and Sharp (2010: 14-19).

Theory of Trade are implicit in the free trade agreement among the EU member nations and explain the exclusion of Russia, with its underdeveloped economy, geographical distance, and assortment of border effects.⁴

Nonetheless, empirical evidence from premodern societies has been used to investigate determinants of trade using Gravity Theory of Trade. For instance, economic change and integration in the medieval European economy was studied by linking trade to economic growth, embedding its determinants.⁵ It produced a new interpretation of early European trade which sees the delay in trade activities across Europe, 600-1000AD, as an outcome of the small size of the economy, its low productivity, insurmountable high transportation costs, and resilient border effects. When the European economy began to grow in the eleventh century, through gains from division of labour and rise in labour productivity, the environment of trade improved. Cost of overland transportation declined, border effects diminished by amplified conversion to Christianity, standardization of weights and measures took place and new institutions enforcing contracts appeared.⁶ The determinants of the Gravity Theory, -the size of the economy, proximity and border effects, offered a new approach to trade as being both the outcome and the agent of integration.⁷ By applying Gravity Theory of Trade to evidence from the Middle East I hope to shed new light on the origins of trade after the Islamic conquest, its rise and development. I hope to get a better understanding of the factors and conditions which defined and determined the volume and the flows of trade between the regions in the Middle East and between the Middle East, Europe and Asia.

Recent work provided new evidence on the economy of the early Islamic Middle East making it is possible to advance statistical estimates of the ‘the size of the national economy’, the first determinant of the Gravity Theory.⁸ There is also new evidence on border effects, the second determinant in the Gravity Theory of Trade. A series of ‘standardizations’ took place between the eighth and the tenth centuries in the Middle East, which reduced border effects and

⁴ ‘Europe trades, therefore it is!’ Persson and Sharp (2010: 14-19).

⁵ Persson and Sharp (2010).

⁶ Persson and Sharp (2010: 4-5, 14-23, 25-46).

⁷ Pirenne (1937); Lopez (1971). The discussion leaves out entirely the effect of long-distance trade on Europe’s economic growth as claimed by Avner Greif. Clark (2007).

⁸ Pamuk and Shatzmiller (2014).

lowered trade related costs. The first was standardization of the money, the second, of weights and measures. A third was language standardization, and the fourth, standardization of commercial law. Standardizations also improved the quality of transaction technology by shifting knowledge transmission from oral to written means. The adoption of paper as writing material, a technological innovation that ended the limitation imposed by the use of papyri, increased the supply of writing material, cut costs of transaction technology and increased its efficiency.⁹ The new developments positively affected flows and volume of trade.

Proximity, or cost of transportation, the third determinant of the Gravity Theory of Trade, needed to be excluded from the present discussion for lack of evidence. Avraham Udovitch said in his study of Islamic trade that “In the absence of documentary evidence the quantitative aspects of trade is all but eliminated”.¹⁰ Indeed, variables such as the terrain, the cost of animal and human transport, river boats and overland transport, the number of trade related trips and the weight of the commodities, which crucial to the question of costs remain elusive. Nonetheless, the influx of documents from the *Geniza* records provides data on transport costs in regional and long-distance trade, and offers evidence on the third important determinant of the Gravity Theory of Trade, language standardization.¹¹ The eleventh century *Geniza* documents also provide a convenient ending point to the chronological discussion of the formative period. It will be argued here that even on the strength of the evidence regarding the first two determinants, economic growth and early dismantlement of border effects, a reasonably estimate of the volume and the size of trade in the early Middle East is possible.

Will it work for the Middle East? In making the case for the Gravity Theory use in another part of the medieval world it needs to be pointed out that the similarities between the medieval Middle East and medieval Europe, were many. By 800AD the newly Islamic territories stretched from North Africa and Spain, to the Middle East and Central Asia, and were politically unified. Nonetheless, they represented a geo-political diversity like the European one, an assortment of regions, religions, languages, ethnicities. Muslim writers, when referring to the

⁹ Shatzmiller (2018).

¹⁰ Udovitch (1970: 3). Shatzmiller (1995). Shatzmiller (2011).

¹¹ The pioneering on this collection of medieval documents began by Goitein. For trade in the *Geniza* period see Goitein (1967); Goitein and Friedman (2008).

new Islamic empire were acutely aware of the disparities among the regions. The geographer al-Muqaddasī for instance, classified the components of the Islamic world according to regions, the distance between them, the goods they traded, the weights and measures they used, the languages spoken, the beliefs and habits practiced by their inhabitants and the political institutions governing them.¹² Like in Europe, it may be assumed that initially border effects, religion, language, law, impeded trade. Empirical evidence also suggests that in both cases, trade played a role in integration after the collapse of the empire. In Europe, trade was instrumental in keeping regions together after the collapse of the Roman and Carolingian Empires,¹³ as it did in the Middle East after the fall of the Umayyad Empire and the disintegration of the Abbasid Empire in the tenth century. In terms of geographical endowments, the two differed, but they resembled in terms of surface, population and human capital. However, the Middle East, driven by the economies of Iraq and Egypt, diverged from Europe, and staged an instance of early economic growth at an earlier stage with a larger economy on one hand and an early erosion of border effects, on the other.

The structure of the paper is as follows: the first section is devoted to the size of the Middle East economy between 700 and 1000AD. It will present the evidence and explain how it is interpreted. Next, it will be applied to the model of the Gravity Theory of Trade. In this formula, the equation will be as follows: $\text{Volume of trade} = \frac{\text{GDP of first trading state} * \text{GDP of second trading state} * \text{border effects}}{\text{distance}}$.¹⁴ The second section will deal with the border effects. Various standardizations will be briefly presented and their impact on the conduct of trade will be evaluated, in particular the quality and efficiency of trade transactions. The third and conclusive section, will define the benefits of applying the Gravity Theory of Trade to the Middle East, showing how it sheds new light on old parameters of trade between the Middle East and Europe.

II. ECONOMIC CHANGE AND THE SIZE OF THE ECONOMY

The first determinant in the Gravity Theory of Trade model is the size of the national economy, for which we selected the combined economies of Iraq and Egypt, the economic core

¹² Al-Muqaddasī (1994).

¹³ Persson and Sharp (2010: 10-14).

¹⁴ Tinbergen (1962: 262-69) for a mathematical formula.

provinces of the Empire. The intent of this section is twofold, first to provide as much numerical evidence as possible in the discussion of this determinant, especially since the rest of the evidence is qualitative. Second, to discuss additional indicators of complexity and productivity such as division of labour, a factor in determining the volume and flow of trade.¹⁵

The size of an economy is measured by its GDP, the sum of all goods and services produced by the economy in each period. A study of wages and prices has shown that wages rose dramatically in the Middle East after the Islamic conquest, in response to manpower shortages in the aftermath of the Justinian Plague.¹⁶ Prices of essential goods such as wheat, declined accordingly, so that the economy of Iraq and Egypt, provided wage earners with much more above subsistence existent between 700-1000. Expressed in 1990 U.S. dollars (used to calculate pre-industrial GDP), levels of purchasing power reached well beyond subsistence level.¹⁷

Purchasing power of subsistence level commodities, defined as the BBB, or the bare basket items, such as bread or wheat, some meat, oil, rent, minimum income needed to survive, was calculated as being \$325 per annum (in 1990 prices), while average wage rates ranged between \$890 and \$990 in Iraq and Egypt, accounting for a purchasing power of 2 or 3 times subsistence level. Using the income side approach to GDP it was possible to estimate GDP per capita. Average incomes, usually 1.5 to 2 times the wages of the unskilled or landless individuals, were added to income from wages of skilled workers, usually higher than the wage rates of the unskilled, and to income from land and capital investment, and income from women's employment.¹⁸ The peak for GDP per capita in the Middle East was reached during the second half of the eighth century and early ninth century in Iraq, at 890 and 990 in purchasing power parity (PPP) in 1990 U.S. dollars. Egypt's GDP per capita estimated at \$800 - \$910 during the eighth century was second. The combined GDP per capita numbers achieved by this method were compared and were shown to be higher than the averages for the Roman Empire and Byzantine Empire at their peak, but not as high as southern and northwestern Europe in the late

¹⁵ Persson and Sharp (2010: 25-31). On division of labour Shatzmiller (1994)

¹⁶ Pamuk and Shatzmiller (2014).

¹⁷ Pamuk and Shatzmiller (2014: 198- 208).

¹⁸ Pamuk and Shatzmiller (2014: 218-221). For the share of females' wage and income, Shatzmiller, (2007: 149-176).

medieval era.¹⁹ Recurrences of the plague lasted until the eighth century, but the effect of the early economic growth, high wages, purchasing power and standards of living, was maintained in the long-run, with minor fluctuations until the 16th century.²⁰

The validity of our methodology and the conclusions derived, are based on the data provided and is warranted given what we know about the complexity of the economy. Measuring labour productivity in medieval economies is notoriously difficult,²¹ but we know that labour productivity was raised in the agricultural sector.²² Watson has drawn attention to the change in the cultivation of new crops, but change in demand led to transforming the agricultural sector from one focused on food staples to that of industrial plants. A rise in incomes, the high wages garnered by skilled and unskilled labour, created demand for income elastic goods, such as foods and luxuries, fine textiles, imported spices and fancy dishes. A recent study demonstrated that the Middle East benefitted from high urbanizations rates between 800 and 1000 AD under Islamic rule.²³ Together they suggest the conditions for division of labour, aggregate demand or the extent of the market, named by Adam Smith in the *Wealth of Nations*, were there.²⁴ Statistical evidence on the rise of specialization and division of labour in manufactured goods are particularly significant.²⁵ The additional evidence on urbanization rates suggests rising labour productivity in the Middle Eastern cities as well. It shows an economy which responded to changes in demand. Development of educational institutions, intensified human capital formation. The increased commercialization at the core, pulled the regional industries into its orbit, by supplying raw material, finishing to manufactured products, and developing industries of their own with the technologies they acquired through trade.

In conclusion, based on the Middle East evidence of high GDP numbers, extensive division of labour and rising labour productivity, the indicators of first determinant of the Gravity Theory of Trade, the size of the economy, were shown to be present. We may

¹⁹ Bolt and Van Zanden (2014). Pamuk and Shatzmiller (2014) for references.

²⁰ Bolt and Van Zanden (2014).

²¹ Persson (1988: 104-123). Chapter appropriately titled, “Measuring the immeasurable: Labour productivity in the European economy”.

²² Watson (1983). Shatzmiller (1994). Shatzmiller (2007). Shatzmiller (forthcoming B)

²³ Bosker, Buringh and van Zanden (2013).

²⁴ Shatzmiller (1994) with detailed statistics on division of labour, pp. 170 et sq.

²⁵ Shatzmiller (1994). See Table 5.1, 5.3, 5.4.

hypothesize that the volume and flow of trade between the two core provinces, Iraq and Egypt, and between them and the provinces in the periphery, were substantial. Evidence on the dismantling of border effects reinforces the hypothesis.

III. BORDER EFFECTS DISMANTLING: THE ‘STANDARDIZATIONS’

Islamic geographers devoted entire books to describing the curiosities of the peoples with whom they came into contact. Al-Muqaddasī (d. 991) for instance, in his book, *The Best Divisions for knowledge of the Regions*, divided the regions making up the Islamic world according to the distance between them, the goods they traded in, the weights and measures they used, the languages spoken, the beliefs and habits practiced by their inhabitants, the political institutions governing them and the additional costs associated with border crossing such as customs and duties.²⁶ Indeed, a perfect description of border effects which could have impeded trade, as was the case in Europe.²⁷ The recorded observations by the geographers on border effects is a testimony to their awareness of obstacles to trade, but also to the pragmatism manifested in persistent trade relations despite them. For instance, the evidence from 1648 hoards containing millions of Islamic dirhams and dating from the ninth to the eleventh centuries found along the Russian rivers, attest to extensive and intensive inter – regional trade. The customs and beliefs, languages and behaviour of Vikings and Bulgars did not prevent trade between them and the Islamic regions from taking place. Muslim traders limited the effect of long-distance cost and border effects by meeting the Vikings on the border between the Samanid territories and North-eastern Europe. They cut down costs further by arranging to get the coins needed at the mine itself, where the Samanid government arranged to have a provisory mint minting the official dirhams. These arrangements remained in place if demand for manpower and furs remained in place, but ceased afterwards. In contrast, the few Islamic coins found in Western Europe between the seventh and the eleventh centuries: 447 dinars, 104 dirhams and 25 coppers, demonstrate that the European economies had little to offer.²⁸

²⁶ Al-Muqaddasī (1994).

²⁷ Persson and Sharp (2010: 4-50, 14-23, 25-46). More references below.

²⁸ McCormick (2001: 344); Shatzmiller (2013); Persson and Sharp (2010: 15-16).

Instead, standardizations of the economic tools occurring in rapid succession, affecting money, weights and measures, the Arabic language, and commercial law, changed the patterns of trade. Borders between regions were not abolished after the Empire was dismantled and dues and customs continued to be collected, yet, conduct of trade became more efficient.

MONEY

We begin with the standardization of the coinage. An early intervention in the mints under the Umayyads, followed by a less known Abbasid coins' reform in the early ninth century, resulted in the standardization of the Islamic money, providing stability to the monetary system for years to come. At first came an intervention in the existing mints, re-invigoration minting operations. With hardly any intervals between conquest and minting, new coins appeared. These were Muslim-Byzantine gold and copper coins, Muslim-Sasanian silver coins, Muslim- Sogdian silver and Muslim – Iberian gold. These early coins, named by numismatists 'pre-reform', namely preceding ʿAbd al-Malik's reform of 697, were hybrid coins, issued in copper, silver and gold, with minimal changes to shape and weight and carrying symbols of previous rulers. In the second phase, still under the Umayyads, came a more advanced reform, unifying the system by issuing three coin types, gold *dinars*, silver *dirhams*, copper *fulus*. In phasing out the particularities of the two monetary systems, one gold based, the other silver based, inherited from the Byzantines and Sassanids, a major border effect was eliminated. The Umayyads also adopted a policy of flexibility and non-interference using pre-Islamic dies and leaving pre-Islamic coins in circulation. Umayyad coins continued to circulate under the Abbasids, and Abbasid coins remained in circulation after the provinces broke away and the successor states minted their own coinage. The swift re-organization of the mints was followed by an increase in coin production. Growing demand for precious metals resulted in increased mining activities in various regions susceptible to hold a steady supply of precious metals.²⁹ It was instrumental in the monetization of the economy, and facilitated the pricing of commodities in monetary units in market transactions as well as facilitating tax collection.³⁰ An increased money supply quickened the pace of monetization in the rural areas, where taxes could now be collected in cash. By providing liquidity in the urban and rural areas, the central administration revived the

²⁹ Powers (2012); Morony (2019).

³⁰ Shatzmiller (2017).

monetary system and revamped the tax collection system. Wages were denominated in monetary units and paid in coinage. The increase in the amounts of taxes collected allowed capital accumulation in areas where agricultural surplus was high, such as in Egypt and Iraq, which could now be invested in various industrial projects.³¹

The best indication of the success of the money standardization is its endurance. The exact same system remained in place after the empire disintegrated and the regions became autonomous. Each of the new states minted its own coinage in the three metals with minor changes made to the inscription or the value of the coins. Islamic coinage retained its form when minted in various regions of the medieval Islamic world from the seventh century to the sixteenth, regardless if minted by imperial state or by regional rulers.³²

The long-term impact of the money standardization is visible in various areas. The Islamic coinage was easily recognizable as it was floated in international markets and shipped to Europe by traders, and where its standard weight and a uniform design are consistent over the long-run. Despite periodical shifts in metal fineness, - the precious metal content of the coins, - which due to changes in the availability of precious metals and the exchange rate between gold and silver that varied between one economy to the other, the system remained intact.

Trade was the great beneficiary of the standardization of the coinage. Markets and trade required more liquidity in the economy and it is likely that the government action came in response to the growing demand for coins in the markets. Merchants most likely pushed for increased money supply. The dynamics of the standardization of the money provides another example of responsiveness to demand, which included more demand for labour, as population levels declined in the aftermath of the Plague. Archeological sites in southern Egypt and the Najd together with literary evidence show that the increased prospecting for precious metals and mining in the eighth and ninth centuries, was achieved with slave labour.³³ Slave purchasing also required liquidity in the markets. Finally, the successful standardization of Islamic money stands in contradiction to the many failed attempts and false initiatives to launch unified currency in the

³¹ See list of taxes in Ibn Khaldūn (1958: I: 361-365).

³² http://www.medievalislamicconomy.uwo.ca/money_coinage/coinage/index.html.

³³ Powers (2012); Morony (2019).

pre- and post-Carolingian Empire period in Europe.³⁴ There was no standardization of any type, whether in weight, precious metal content, or shape. In many parts of medieval Europe, in regions such as the Iberian Peninsula, national coinage appeared late and took longer to take hold.³⁵

WEIGHTS AND MEASURES

Standardization of weights and measures was more problematic as the regional variations of designations, weights and destinations was stronger. Weights and measurements always have strong local and long-term properties than coinage, and unlike the supply of coinage supply, could not be directly controlled by the imperial administration. When weights and measures were standardized it was probably prompted by the needs and processes of the inter-regional trade. A database containing all weights and measures used across the medieval regions of the Middle East was compiled by me from the Arabic sources, converted to the metric system, and rendered online in meters, liters and grams for units of length, capacity, weight and mass.³⁶ The database plays a primary role in providing a view of the standardization of weights and measures. It is possible to observe, for instance, first, that all weights and measures were either Arabicized or acquired an Arabized version when derived from the pre-Islamic period. For instance, *waybah*, *mudd*, *qāfīz*, *makkuk*, *jarib*, for dry measures, *dhira'* for length, were originally in Arabic, while the Egyptian *irdabb* measure of wheat,³⁷ *qirāt*, *uqiya*, *qintār*, were pre-Islamic measures which retained and Arabized.³⁸ The 'camel load, *himl*, used for the transport of dry commodities, is the most significant addition to the regional variations. Calculated as an average of 120-150 kg, it was used throughout.³⁹ As a result, the value of weights and measurements of the same name, differ from one region to the other. Standardization in this case was not comprehensive nor could it be successfully imposed, but knowledge of various weights and measures was wide spread, especially among traders.

THE ARABIC LANGUAGE BECOMING A LINGUA FRANCA

³⁴ Persson and Sharp (2010: 33-35)

³⁵ Crussafont, Balaguer and Grierson (2013: 1-19).

³⁶ <http://www.medievalislamicconomy.uwo.ca/measures/index.html>.

³⁷ See the list of Egyptian weights and measures on the site.

³⁸ See lists for all regions on the site.

³⁹ Austen (1987: 273, Table A1)

At the origin of the success of all standardizations was that of the language, which played a major role in effacing border effects. Blum and Dudley credited the standardization of the Latin language in early medieval Europe with facilitating economic growth there, and it was certainly a contributing factor to growth in the Middle East.⁴⁰ Standardization of the Arabic language was cultural levelling process which ran parallel to Islamization.⁴¹ The evidence suggests that the Arabic of the first hundred years in the Middle East was a dysfunctional written language. Displayed in pre-Islamic and early Islamic graffiti and early mosques' inscriptions, in the administrative letters on papyri, in copies of early Qur'ans on papyri and parchment, it shows all the signs of an embryonic stage. The Qur'ans of the eighth and ninth centuries were written in multiple dialects in *Hijāzi* and *Kufic* defective scripts, inscribed in block angular letters and looked like personal anthologies of verses meant for oral recitation, rather than a cohesive written text.⁴² Letters, which could not be connected by ligature, appear as spaces of the same length as spaces between words, making reading extremely difficult. But by the second half of the ninth century, literary Arabic shows signs of standardization of its grammar, syntax, vocabulary, with its literary usages academically defined.⁴³ By the tenth century, utilitarian cursive scripts were adopted for use in documents and in books written on paper.⁴⁴ The adoption of cursive script instead of block letters, improved legibility, thereby leading professional calligraphers to develop an elegant script, only suitable for the Qur'ans. The standardization of the language facilitated a transition from an oral phase to that of a 'writerly' one.⁴⁵ Written texts, which were short before, gained length, while oral communication, too costly before and unreliable in transmission, storage and retrieving information, disappeared. The Qur'anic text for example, was no longer recited from memory but was written down in the new standardized language, with rules of reading, pronunciation, punctuation and intonation specified in written Qur'an reading manuals.⁴⁶ Arabic was now a *lingua franca*, widely used throughout the Middle East in all written communications.

⁴⁰ Blum and Dudley (2003).

⁴¹ 'Arabiyya' (EI2) multiple entries. Papaconstantinou (2010) multiple articles.

⁴² Déroche (2014).

⁴³ Bloom (2001: 100-108). Drory (1988) for parallel standardization in Hebrew.

⁴⁴ Bloom (2001: 106-108).

⁴⁵ Toorawa (2005); Macdonald (2010); Bloom (2001: 101–105).

⁴⁶ Bloom (2001:103).

ISLAMIZATION AND COMMERCIAL LAW

Conversion to Christianity throughout Europe was a standardization process which was instrumental in integrating the various regions and levelling border effects.⁴⁷ Islamization in the Middle East had a similar effect. Likely completed by the tenth century, Islamization was crucial in the normalization and standardization of religious practices and norms of social behaviour, as well.⁴⁸ Islamization also coincided with the codification and standardization of Islamic commercial law, which despite arguments to the contrary, was at the core of trading institutions.⁴⁹ The most important investigation of the standardization of commercial law is that by Abraham Udovitch, *Partnership and Profit in Medieval Islam*.⁵⁰ In surveying partnership, *sharīka*, and *commenda*, *mudāraba*, as defined by the main three legal schools of Islamic law, Udovitch has drawn on an exhaustive set of legal sources, which demonstrate a great deal of unity. Udovitch felt that he was dealing only with theory and lamented the lack of empirical proof: ‘While trade is known to have been active and important, no quantitative evidence, statistical or contractual, is likely to be found to substantiate the findings which are based solely on legal texts’.⁵¹ Instead, he suggested to draw on empirical evidence from the *Geniza* material. It came as no surprise to him that the practice of Jewish merchants depicted the principles enunciated in the Hanafi, Maliki and Shafi‘i legal partnership and *commenda*.⁵²

WRITING AND THE ADOPTION OF PAPER

An important contributing factor to effacing border effects was the increased use of paper which overhauled the trade transaction technology. The adoption of linen rags in the making of paper was a technological innovation, that resulted in greater availability of affordable writing material and was responsible for the change in human capital and in literacy levels.⁵³ The

⁴⁷ Persson and Sharp (2010: 16).

⁴⁸ Bulliet (1979).

⁴⁹ Hallaq (1997); Hallaq (2004).

⁵⁰ Udovitch (1970).

⁵¹ Udovitch (1970:3, 249-261).

⁵² Cohen (2017)

⁵³ The standard work on technological innovation and economic growth in pre-modern Europe is Mokyr (1990).

replacement of papyri by paper in the Middle East was completed by the tenth century and thus coincided with the general shift into standardization. The replacement of Chinese paper mix with linen rags became possible thanks to a shift in agrarian cultivation patterns, referred to above.⁵⁴ An increase in rural settlement in Iraq/Iran, helped the spread of cotton production and flax in Egypt.⁵⁵ Increased flax cultivation in Egypt, facilitated the expansion of the linen industry, increased its productive capacity, which in turn made it feasible to increase the amount and availability of paper's new raw material. The appearance of the new writing material coincided with demand for educational institutions, for literacy skills, and for literacy tools such as writing material and books. Skill premiums in the wages of the likes of secretaries, clerks, teachers etc. also played a role. Papyri, on the other hand, was a plant restricted to Egypt with a limited potential to grow production of the writing material made of its stem. With the commercialization of textile production, paper could be produced anywhere where water and linen rags were available. The efficiency of paper making increased with paper mills located near rivers using cheap energy, water, and through an increase in the number of producers. The consequences of the change in paper production improved the use of written transactions and the use of documents in court procedures.

EFFICIENT TRANSACTION TECHNOLOGY

The shift to written transaction improved efficiency in trade because it managed better the flow of information, reduced the cost of storing it, facilitated diffusion of complex information, increased information dissemination, in addition to facilitating contract enforcement. When commercial data is related orally it risks losing the relevant details and early Middle Eastern trade transactions were inefficient, particularly in the long-distance trade, and in international and intra-regional trade. With standardized Arabic and sufficient writing material, instructions were transmitted in greater details and with certitude that they will be read and followed. The ability to send and receive relevant data in a written form improved the amount of details delivered and the precision by which it was delivered. Instructions for buying and selling goods, prices and availability of commodities, could be transmitted more efficiently. By storing information cheaply, lowering the cost of transmission, and facilitating acquisition and creating

⁵⁴ For details and analysis, Shatzmiller (2018).

⁵⁵ Bulliet (2009)

of new knowledge, the use of written documents led to a fall in the cost of ‘doing business’. The rise in the quality of human capital, especially the rise in literacy and numeracy, improved performance in trade. The *Geniza* documents revealed beyond doubt that traders were literate, a fact of great significance when it comes to the conduct of long-distance trade. Numeracy played a role in the development of new financial instruments and accounting techniques, such as double-entry bookkeeping.⁵⁶ Most importantly it was instrumental in effacing border effects.

Although ‘Efficient transaction technology’ is a term borrowed from IT (information technology) vocabulary it can be effectively used in discussing medieval societies as it is done here.⁵⁷ It refers to the transfer of information in a sequence which will lead to optimal execution and best results possible. The early standardizations in the Middle East not only were instrumental in the erosion of border effects but also in supplying the tools for an efficient transaction technology. Standardization of commercial law provided the legal framework for contract enforcement as executed by the courts, while standardization of the Arabic provided the vehicle to communicate information in standardized form.

DOCUMENTS AND CONTRACT ENFORCEMENT

A final contribution of the new transaction technology combined the effects of language standardization, and synchronization of availability of writing material and literacy skills. The dominant feature of an efficient transaction technology resides in the support it provides for contract enforcement in a timely and cost effective manner by the courts, in enhanced predictability in commercial relationships and reduced uncertainty.

Contract enforcement is fundamental if we expect markets to function properly, collect on debts, or obtain control of property pledged as collateral to secure loans. The combined effect of standardizations of language and commercial law as well as the adoption of paper was necessary for the process. The new commercial law, practical as well as theoretical, could be now stored in law books, notarial manuals, *fatwas* and court decisions. All were utilized with greater facility by lawyers, muftis and notaries, and enhanced efficiency in court procedures.⁵⁸ For the notaries, it was particularly efficient as they could easily select the documents they

⁵⁶ Goitein (1966).

⁵⁷ Blum and Dudley (2003).

⁵⁸ Shatzmiller (2007).

needed and provide a ready to use contract formula. It made the process of registering transactions more efficient and saved on costs. The notaries with their writing skills were an extension of the court, physically and culturally. Written transactions were standardized and secure. Claims could be substantiated with written evidence. Institutions are credited with enforcement of trade contracts, creating trust, reducing transaction costs and increase efficiency but the evidence provided show how it was done in the Middle East.⁵⁹ The rise in the use of documents, of a notarial culture and of court procedure made contract enforcement and conflict resolution more efficient when commercial deals went bad. Court decisions were issued in writing, as the *Geniza* documents demonstrate, enhancing their institutional power.⁶⁰ Trade transactions and related contracts had a better chance of quick ratification and resolution in the case of disputes. The new transaction technology was an important tool in effacing border effects by offering efficiency in the conduct of trade.

IV. CONCLUSION

The Gravity Theory of Trade provides diagnostic tools to predict trade volume and flow. This paper endeavoured to use them to derive better understanding of the economic environment of trade in the first three hundred years of Islamic rule in the Middle East. Quantitative and qualitative measurements were used here to establish the empirical evidence of two of the three determinants of the model, the size of the economy and border effects. The data has shown a complex, large national economy with high degree of division of labour and early erosion of border effects. Based on both determinants it was suggested here that vigorous flows of trade with considerable volume took place in the Middle East between the core provinces, Iraq and Egypt and between them and the provinces in the periphery. As has been suggested, dynamic trade despite border effects, as in the case of the ‘Viking dirhams’, took place, indicating pragmatism on the part of traders, Muslim and Vikings.

The questions surrounding the Middle East trade with medieval Europe also benefit from the application of Gravity Theory of Trade. Trade between the Middle East and Europe declined

⁵⁹ Persson and Sharp (2010: 14-15); Greif (1989).

⁶⁰ Ackerman-Liberman (2007).

in the post Roman period and was behind the Pirenne Thesis.⁶¹ It is ironic that the Islamic conquest had been blamed for generating ‘border effects’ between Europe and the Middle East, and blaming Muslims for trade restrictions and economic decline when the Gravity Theory of Trade just explained why the case was just the reverse.⁶² Trade declined not because Middle East GDP declined, since we know it increased, but rather because European GDP declined and border effects mounted. The increase in Middle Eastern GDP and diminishing border effects benefitted trade with regions within the Middle East and between the Middle East and Central Asia, but not with Europe. The economies of Europe were small, and trade was smothered by high of border effects. Nonetheless, the diagnostic tools of Gravity Theory of Trade may suggest reasons as to why the Middle East was prosperous while Europe fell behind. The query is valid given the great deal of similarity between the two regions. In 650AD Merovingian, Carolingians and Muslims ruled over a similar geo-political diversity: an assortment of regions, religions, languages and ethnicities, small economies, prohibitive transportation costs, and low productivity.⁶³ Why did economic resurgence occur in the Middle East following the Arab conquest, but not in Europe following the German invasions? Why did their path diverge? Why did border effects last for so long in Europe but not in the Middle East?

All these are valuable questions. Intuitively, the reason may be the difference in endowments in favour of the Middle East. Not only the changes in factor ratios which helped the Middle East economy to recover faster after the Justinian plague but also the quality of the land, the climate, the inclusion of two river-irrigated agrarian economies, which served as economic drivers. Alternatively, it may be the role played by new political elites, unencumbered by previous constraints, which provided pragmatism in economic decisions. Yet, the difference may also reside in the way society in the Middle East responded to change. Innovation is rooted in the quality of human capital and the Middle East had arsenals of knowledge, technological and other, stored in writing and oral transmission. The Arab invasion not only did not destroy knowledge but encouraged its usage and renewal. Therefore, border effects in the Middle East

⁶¹ For the *Pirenne Thesis*, Pirenne (1937); Lopez (1971). The discussion leaves out entirely the effect of long-distance trade on Europe’s economic growth as claimed by Avner Greif. Clark (2007).

⁶² Shatzmiller, (2017).

⁶³ Persson and Sharp (2010: 4-5, 14-23, 25-46).

were eroded earlier and more effectively than in Europe and standardizations occurred in the most important indicators and were successful. When Europeans come with the first technological breakthrough, in the form of the heavy plough it was the year 1000AD.⁶⁴ With increased productivity in agriculture, population growth and urbanization, the flow of trade resumed one hundred years later. By that point, GDP was high in the Islamic Middle East, the economy achieved high rate of complexity and border effects were rescinded. Trade proceeded accordingly.

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⁶⁴ Andersen, Jensen and Skovsgaard (2016). Persson and Sharp (2010:57)

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