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Comparative Development**

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Abstract

This study explores the interaction between trade and geography in shaping the Islamic economic doctrine and in turn the comparative development of the Muslim world. We build a model where an unequal distribution of land quality in presence of trade opportunities conferred differential gains from trade across regions, fostering predatory behavior from the poorly endowed ones. We show that in such an environment it was mutually beneficial to institute an economic system of income redistribution featuring direct income transfers in return for safe passage to conduct trade. A commitment problem, however, rendered a merely static redistribution system unsustainable. Islam added a set of dynamic redistributive rules that were self-enforcing under large gains from trade and high proportions of arid land. While such principles fostered the expansion of trade within the Muslim world they limited the accumulation of wealth by the commercial elite, shaping the economic trajectory of Islamic lands in the preindustrial era.

Keywords: Religion, Islam, Geography, Inequality in land quality, Wealth accumulation, Public good investment, Trade, Conflict.

JEL classification Numbers: O10, O13, O16, O17, O18, F10, Z12.

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" For the protection of the Quraysh.

Their protection during their trading caravans in the winter and the summer.

So let them serve the Lord of this House.

Who feeds them against hunger and gives them security against fear. "¹

(Qur'an, 106: 1-4; MH Shakir's translation)²

1 Introduction

In the last years, the empirical growth literature has seen an increased interest in the relationship between religion and politico-economic performance.³ Nevertheless, despite the prominence of religion as a focal research topic across disciplines, its origins within economics are poorly understood. Consequently, identifying the forces behind the formation of religious adherence will greatly enhance our understanding of the phenomenon and its implications for comparative economic development.

This study examines the economic origins of the Islamic doctrine and explores theoretically its implications for the process of comparative development in the Muslim world. Motivated by the empirical findings in our companion study, Michalopoulos, Naghavi, and Prarolo (2012), that inequality in land productivity and trade possibilities are fundamental determinants of contemporary Muslim adherence, we build a model where the interplay between these two forces dictates the redistributive nature of the Islamic economic principles and explore its consequences for inequality and growth in the pre-industrial era.⁴

The link between the structure of production and institutional formation was early identified by Marx (1833 [1970]). According to Marx (1833 [1970]), religion is like any other social institutions in that it is dependent upon the economic realities of a given society, i.e., it is an outcome of its productive forces. Similarly, this study argues that since Islam emerged when land dictated productive decisions, the Islamic institutional arrangement had to be compatible with the conflicting interests of groups living in regions characterized by an unequal distribution of agricultural endowments. Islamic principles were devised as a means of governing the divergent interests of geographically unequal regions in the beginning of 7th century Arabia at the critical juncture when trade routes were diverted over the peninsula. This is a prime

¹Quraysh was the tribe dominating Meccan trade in the eve of Islam. Mohammad himself was member of the Quraysh.

²Tahrike Tarsile Qur'an, Inc., (1983).

³See for example, Barro and McCleary (2003, 2006a, 2006b) , Campante and Yanagizawa-Drott (2013), Chaney (2012), Porta, de Silanes, Shleifer, and Vishny (1997), Pryor (2007), and Martin, Doppelhofer, and Miller (2004).

⁴It is important to note that the proposed theory is an attempt to rationalize the set of economic principles embedded in the Islamic doctrine, remaining agnostic as to its theological underpinnings.

example of how historical accidents, like the latter, may interact with geographical features to lead to the emergence of a particular institutional framework, that of Islam. It is useful to note that we do not argue that Islamic principles are the only rules that may emerge under unequal geographic conditions in presence of trade opportunities. We do show nevertheless, that those rules prescribed in the Islamic economic doctrine provide a solution to the conflicting interests caused by an unequal geography.⁵

In a stage of development when land determines productive capabilities, regional agricultural suitability plays a fundamental role in shaping the potential of a region to produce a surplus and thus engage in and profit from trade. Motivated by this observation, the theory illustrates how an unequal distribution of land quality across regions may induce predation from the less privileged territories instead of productive and mutually advantageous activities (Olson, 2000). In particular, it suggests that inequality in agricultural productivity in presence of trade opportunities conferred differential gains from trade across regions, fostering predatory behavior from the poorly endowed ones. In such an environment agriculturalists faced the constant threat of predation from nomads when engaging in overland trade. The costly nature of predation with roving bandits destroying surplus, created room for intervention and redistribution, leading to concessions towards the dwellers of semiarid regions in exchange of secure passage and access to the trade networks.

We show that a set of rules featuring only *static* income redistribution is not sustainable due to commitment problems that arise in an intragenerational income transfer scheme, undermining the efficiency of such agreements. On the contrary, arrangements incorporating elements of dynamic intergenerational redistribution, where bequests no longer exclusively benefit the heirs of the rich, are more likely to be viable in the long-run. In the context of the proposed theory, the Islamic doctrine distorted the relative returns to the factors of production against wealth accumulation inducing a relatively less unequal diffusion of wealth in the society over time through channels such as investments in public goods by means of religious endowments.

We conjecture that the adoption of Islam over geographically unequal territories gave such regions an early lead by facilitating trade. However, by discouraging the concentration of wealth through redistributive rules, reduced the investment capabilities necessary for keeping pace with the changing trading technologies. The resulting anemic commercial elite may have contributed to the eventual decline of the Muslim lands vis-à-vis Western Europe.⁶ In sum, the

⁵Although a comparison between communism and Islamic economic principles is beyond the scope of the study it is perhaps interesting to note that the common goal of narrowing income inequality was pursued via very different means. Notably, Islam encouraged a market economy tolerating individual property rights while limiting capital accumulation, whereas communism featured the opposite characteristics.

⁶This argument can also explain the inverse relationship between Islam and democracy (Huntington, 1993). On the contrary, in the Western world the transatlantic trade gave rise to a powerful and wealthy commercial class that also turned the political scene in its favor, limiting the ruler's powers and contributing to the rise of

Islamic economic principles that allowed the Muslim lands to escape from a state of constant feuding and flourish in the preindustrial world, limited their potential for growth in the eve of large scale shipping trade and capital-intensive industrialization (Chaudhuri, 1985).

Religion has been viewed as being both a cause and an outcome of economic development with Weber (1905 [1930]) pioneering the independent role of Protestant ethics in fostering economic progress. Such a feedback of religious affiliation to economic outcomes is also present in our study where we show that the very adoption of the Muslim economic principles had both long-run and short-run effects on the economic performance of the Muslim lands. Becker and Woessmann (2009) show in a recent study, however, that the significant association between Protestantism and economic prosperity across counties in late 19th-century Prussia may be attributed to differences in literacy between protestant and non-protestant regions. Along the same lines, Botticini and Eckstein (2005, 2007) document how an exogenous change in the Judaic religious doctrine in the 2nd century transformed the Jewish human capital towards literacy providing them with a comparative advantage in urban, skilled occupations centuries later. Finally, on the role of the economic environment in affecting religious rules, Cervellati, Jansen, and Sunde (2008) provide a theory where differences in the religious norms regarding charity versus self-responsibility, i.e., Catholicism versus Protestantism, depend on the relative importance of luck versus effort when individuals invest in human capital and face non-insurable idiosyncratic income shocks.

The rest of the paper is organized as follows. Section 2 discusses in detail the elements of the Muslim economic doctrine and describes the role of trade and geography in the formation of Islam including historical evidence from the Arabian peninsula. Section 3 presents the theory and the results. Section 4 summarizes the key findings and concludes.

2 Historical Background

The proposed theory rests upon two fundamental building blocks: (i) trade interests, particularly salient in 7th century Arabia, were a major driving force in the formation of Islam and (ii) inequality was a primal feature of the pre-Islamic Arabian economy which the Islamic economic principles had to directly address.⁷

We argue that such conditions led to the emergence of a set of economic rules focusing on (i) static income redistribution and poverty alleviation through arrangements known as *ilaf* prior to- and *zakat* upon the advent- of Islam, and (ii) a dynamic redistribution system. The one

constitution and democracy.

⁷In fact, in Michalopoulos, Naghavi, and Prarolo (2012) we show that the interaction between proximity to trade routes and geographic inequality is not unique to the origins of Islam but is a key determinant of the spatial distribution of contemporary Muslim societies across as well as within countries.

introduced by the Islamic doctrine entailed explicit costs imposed on wealth accumulation via the anti-*riba* laws, as well equitable inheritance laws and investments in public goods provision through donations to religious endowments, the *waqf*.

2.1 The Origins

Arabia has a distinct geography with few places in Yemen, Bahrain, Central Arabia and several scattered oases in the interior producing agricultural goods, such as frankincense, myrrh, vine, dyes and dates in the eve of Islam. The rest of the peninsula features deserts and semi-arid regions where nomadic life-style was the norm (Ibrahim, 1990). Across these infertile swaths of land, tribes were directly involved in the collection of booty by conducting raids, known as *ghazu*, on commercial caravans trading local produce as well as spices, gold, ivory, pearls, precious stones, and textiles - arriving at the local ports from Africa, India, and the Far East (Berkey, 2003). Scholars have argued that this distinctive geography shielded the local populations from any form of urbanization allowing them to maintain their tribal culture, preventing the formation of a unifying social structure (Haber and Menaldo, 2010). At the same time, the infrequent urban commercial economies in a limited number of oases exacerbated social and economic inequities between clans (Berkey, 2003).

In the pre-Islamic era, trade was maintained in the Peninsula as long as peripheral kingdoms along the edges of Arabia, namely Himyarites, Ghassanids and Lakhmids, guarded the routes and policed the Bedouin tribes. These kingdoms all disintegrated in the course of the 6th century. As a result, political and commercial control over the Bedouin communities could no longer be exerted and the Arabian economy got in decline (Lapidus, 2002). In parallel, the Persian and Byzantine empires had been fighting a series of long and exhausting wars since the start of the 6th century.

By the early 7th century the conflicts had disrupted long-distance trade crossing the two empires (Lewis, 1993). Piracy in the Red Sea was also on the rise due to the declining sea power of the Byzantines (Winder, 2008). These events caused long-distance trade diversion through the peninsula giving profound commercial value to overland trade routes in Arabia. The resulting traffic created new potential economic benefits for the scattered oases. First, by selling to the merchants they could take advantage of markets outside Arabia, and second, the increased caravan traffic was equivalent to higher demand for local produce.⁸

In order to materialize these benefits through trade, they needed to maintain safe passage for over a thousand miles of trails in an unsafe desert that crossed numerous tribal territories (Bogle, 1998). As a result, caravans were constantly exposed to raids by the Bedouins, who

⁸Crone (2007) discusses the possibility that Meccans benefited directly from the Persian and Byzantine wars supplying leather and hides to the Roman army.

made up a considerable fraction of the population in the Arabian peninsula at that time (Berkey, 2003). This situation prompted early attempts to mitigate conflict in pre-Islamic Arabia. For example, in search for security the Meccan merchants offered the arrangement of *ilaf* according to which they would carry commodities produced by other tribes to be sold in markets and fairs. In exchange, these tribes would provide security and protection (*khafara*) for Meccan caravans passing through their territories. Also, within Mecca rich merchants were engaging in alms provision to alleviate poverty. Such attempts, coupled with the formation of tribal alliances, partially decreased tensions; nevertheless, these measures were short-lived since many tribes were not bound by the institution of *ilaf* and alliances were constantly switching. These elements produced a conflictual environment featuring the merchants and oasis cultivators, on one side, and the Bedouins, on the other. Ibrahim (1990) succinctly summarizes the economic conditions prevailing in the eve of Islam: "An unequal distribution of wealth and resources already existed in and around Mecca. This unequal distribution had the potential to disrupt its network of alliances and trade routes".

It was in this cross-section of historical events that Muhammad was born. In Muhammad's Arabia there was no government at any level. The Prophet formed his own state, and he gave it a sacred law prescribed by Allah (Muller, 1958). The importance of trade in the formation of Islamic principles can hardly be underestimated.⁹ Muhammad himself was a Meccan merchant, and the majority of those who contributed to the crystallization of the Muslim law over time had a merchant or craftsman background (Cohen, 1970).¹⁰ To reach out to the heterogeneous Arabian tribes, a doctrine with a political base appealing to the divergent interest groups was necessary. The Islamic economic principles were forged to align the clashing interests nurtured by the underlying unequal geography effectively acting as a state-building force. It offered a means by which tribes could be unified through a common identity under one god that transcended clan and class divisions (Stearns, Adas, Schwarz, and Gilbert, 2010). This is in line with Iannaccone (1992) and Aimone, Iannaccone, Makowsky, and Rubin (2013), who view religion as a club good showing how unproductive costs can overcome free-rider problems associated with collective action. Levy and Razin (2012) further argue that religious organizations arise endogenously to foster social cooperation and social behavior by instilling beliefs on the connection between rewards and punishments.

⁹See Bairoch (1988) for a discussion on how trade preceded urbanization in the Middle East.

¹⁰In addition, Hodgson and Burke (1993) stress that the interests of merchants who wanted to gain access to the widest possible network of trade routes coupled with the casteless and egalitarian message of Islam contributed to its massive expansion.

2.2 The Codes

In Islam, acts of charity are divided into voluntary (*sadaqa*) and obligatory (*zakat*). *Zakat* is a religious obligation and is one of the Five Pillars of Islam.¹¹ The Qur'an requires a believer of sufficient economic means to give a fraction of her accumulated income for alms. *Zakat* is allocated among the needy, the poor, those in debt, travelers, the *zakat* collector and for slaves or captives. During the early history of Islam, *zakat* was collected and distributed by the government appointed officials, in a centralized manner and it was effective in alleviating poverty. While *zakat* remained a main pillar of Islam, it lost significance over time giving way to other forms of redistribution. Indeed, its centralized collection was less frequently enforced with time and adherence to it was left to the discretion of local authorities (Kuran, 2008b).¹²

A remarkable feature of the Islamic doctrine is the dynamic nature of redistribution. Indeed, Islam features a host of detailed rules describing the limits imposed on the accumulation of wealth. The role of inheritance laws and anti-usury laws are two characteristic examples. Islamic law by recognizing only natural persons effectively blocked the emergence of more complex organizational forms such as corporations, restricting the mobilization and pooling of resources. Regarding the inheritance laws Qur'an specifies that two-thirds of one's wealth be allocated to various family members, including very distant relatives making it a rather egalitarian distribution system (Kuran, 2008a). Equitable inheritance laws coupled with the fact that more wealthy individuals were allowed to have more wives and consequently children, was an additional force against the concentration of wealth and the increase in inequality. For a thorough discussion on the economic principles of Islam, see Kuran (2004a). Also Kuran (2003) argues that a by-product of such inheritance laws was an increase in the costs of dissolving a business partnership following a partner's death rendering business enterprises small, simple, and generally ephemeral.

Perhaps, the most widely known Muslim economic principle is the prohibition against *riba*, which most Muslim scholars have interpreted as "interest" (*riba*).¹³ *Riba* in the pre-Islamic days was a system whereby the principle kept redoubling every time a borrower could not pay it back. Such arrangement would frequently lead to the imprisonment or enslavement of the borrower. As a result of the *riba*-ordinance of the Qur'an, Islam was formally committed to the

¹¹For a discussion on how the doctrines of salvation and damnation provide different incentives for performing economic activities and charitable deeds in Hinduism, Buddhism, Christianity, and Islam, see McCleary (2007).

¹²Kuran (2001) notes that the third Caliph Uthman turned the obligation to pay *zakat* essentially into a tax on agricultural output. Also, Jalili (2006) recognizes that although the tax systems differ considerably among the Shiite and the four Sunni Schools (Malekite, Shafeite, Hanafite and Hanbalite) they share common key objectives with respect to alleviating poverty and improving income distribution.

¹³There was substantial controversy among early Muslims regarding the scope of this prohibition or even on the definition of "interest", see Rahman (1964) for a detailed discussion. Nevertheless, in the Islamic lands, Christians and Jews who were not subject to this restriction, systematically engaged in money lending.

eradication of interest in loan contracts. Kuran (2004b) argues that in practice, money lending continued, however, uncertainty about the legitimacy of interest, combined with the lack of corporate law, imposed significant transactions costs on both lenders as well as borrowers.

One could use either of the principles described above to formalize the frictions on wealth accumulation under Islam. In the context of the proposed theory we focus on the limitations regarding interest bearing loans as well as on the formation of more efficient organizational forms.¹⁴ Such restrictions distorted the relative returns to the factors of production against capital accumulation and in favor of public goods investments enhancing labor productivity. In fact, the Qur'an declares that the opposite of *riba* is *sadaqa* which is spending to the benefit of people, that is, investing in assets enhancing the welfare of the community (Rahman, 1964). In Islam the institution that emerged to allow for investing on such public functions was the *waqf*, an inalienable endowment created by a person who granted land or other immovable property in perpetuity for the advancement of a charitable or pious purpose, see Kuran (2001) for a comprehensive account of the *waqf* system.

While *zakat* catered to the immediate needs of the poor, *waqfs* were voluntary and enhanced the population's productive capacity through the provision of public goods such as education, health care, and public utilities.¹⁵ Other examples of *waqfs* include mosques, free accommodations for the poor, building and maintenance of water conduits and other public services that would benefit the community. The earliest *waqfs* appear in the first decades of Islam (Habib, 2004). *Waqfs* also contributed to the sedentarization of Arabs, i.e., transforming some of the Bedouins from raiders to city dwellers (Bamyeh, 1999). Moreover, it has been argued that in the newly-created Islamic urban hubs the common use of public facilities like those funded by *waqfs* was the main source of interaction across different tribes leading to the rise of Islamic identity.¹⁶ By the 18th and 19th century aggregate estimates on land *waqfs* reveal their enormous economic standing. In Turkey three quarters of the country's arable land, half of the agricultural land in Algeria, one third in Tunisia and sizeable fractions in many other Muslim countries were under *waqf*. Although similar estimates for assets other than land are not available, it is known that the *waqf* system controlled a vast array of urban assets.¹⁷

¹⁴See Rubin (2009) for a comprehensive overview of interest bans in different religions.

¹⁵Shatzmiller (2001) stresses that "What conferred a unique historical significance on the public *waqf*, was the fact that for hundreds of years it provided the *only* regular financial support for the *medresa*, a provider of higher education". There are two types of *waqfs* the purely public ones and the family *waqf*. The key difference being that unlike the public one, whose services would be purely serving the community, in case of the family *waqf* a fraction of wealth generated by the endowment would be directed to the family members of the donor or the donor himself. Our theory focuses on the former.

¹⁶See Patel (2007) for an extensive discussion on the role of Islamic cities in developing an Islamic supra-identity across tribes and the horizontal transmission of Islamic cultural norms among initially inward-oriented Arab tribes through attendance in entities such as schools and central mosques.

¹⁷According to Kuran (2001), the Islamic *waqf* emerged as a result of volatile property rights, where religious

Thus, unlike pre-Islamic local arrangements like *ilaf* and *khafara*, or even the *zakat* after Islam, which was insufficient by itself to settle ongoing conflicts, Islam added a set of rules that dictated inter-generational income redistribution providing a credible commitment to the conflicting parties. Other scholars have linked the success of Islamic expansion to its platform of state formation, mediation among lineage groups and moral reform (Lapidus, 2002). For example, Crone (1987) highlights that Islam was mainly offering a programme of Arab state formation and conquest. This is a complementary point of view that stresses the role of conquests. We contribute to this line of thinking by showing that, in order to unite conflicting local interests among tribes in pre-Islamic Arabia, an appropriately crafted set of rules was necessary.

It is perhaps interesting to note that Muhammad’s message was first accepted in Medina as a result of Medina’s oasis cultivators facing increased conflict from nomads in the periphery, Aswad (1963), consistent with the proposed argument that Islamic economic principles were forged to align these clashing interests nurtured by an underlying unequal geography. Nevertheless, we show that these principles though economically beneficial in the short run impeded, in the long run, a capital-intensive mode of production hindering development.

3 The Model

The theory illustrates (i) the conditions under which an unequal geography exposed to trade opportunities leads to the adoption of the Islamic economic principles, and (ii) the long-run consequences of the latter on the society’s economic trajectory and growth. The crux of the argument is that the appearance of trade routes exacerbated divergent economic opportunities across fragmented patterns of fertile and arid land. To fix ideas, consider two tribes, one living in a fertile region, and the other in an arid one. The tribe in the fertile region could greatly benefit from trade by selling its output at higher prices, whereas the tribe in the arid region could not. It is the juxtaposition of few fertile pockets of land surrounded by vast arid steppes that causes the predatory behavior of the nomads when trade opportunities arise. To the extent that the size of the arid region is large enough to significantly threaten trade activities, we show that a set of rules resembling the economic principles of Islam may emerge. As in Anderson and Bandiera (2006) the interaction of predators and prey is crucial. A confrontation between the trading caravan and the Bedouins taking place in the desert on the way to trade routes results in a loss of cargo. The more desert to cross, the more vulnerable are traders’ activities, giving geographic inequality a crucial role in determining the emergence of economic institutions.

endowments provided a credible commitment device to give property owners economic security in return for social services and lower taxation. Also, by allowing the *waqf* donor to designate the manager of the *waqf* granted him a way to circumvent the strict inheritance laws.

Consider an overlapping-generations economy in which economic activity extends over infinite discrete time. In every period, each region produces a single homogeneous good using effective labor, capital, and land quality, which we consider as a technological parameter. Regional output grows over time due to the accumulation of capital and effective labor, while land quality is exogenous and fixed. The stock of capital in every period is the output produced in the preceding period net of consumption and investment in public goods that enhance labor productivity.

There are two equally-sized tribes, one living in each region. We assume agents cannot migrate between regions since adapting to different ecologies requires the accumulation of very different types of specific human capital (Chaney, 2012; Michalopoulos, 2012). In the MENA region for example, people living in arid lands were predominantly nomadic, while those living in fertile zones were mainly sedentary (Mikhail, 2012). Denoting T_r as the land quality in region r where $r = \{P, R\}$ (Poor or Rich) and setting $T_R = 1$, we can define the relative land quality as $v = \frac{T_R}{T_P} = \frac{1}{T_P} > 1$. Without loss of generality, the fertile regions (oasis) is surrounded by a mass of desert $0 \leq \lambda \leq 1$. With the vector (v, λ) we may characterize the economy-wide land quality distribution whose geographical inequality is increasing in both arguments.

Agents may decide to sell their regional output at a foreign market if profitable. The domestic price is normalized to 1, whereas the availability of trade routes in the vicinity allows access to the foreign market: $p > 1$. Thus, the appearance of trade routes, as in 7th century Arabia, works as a positive price shock that may induce trade. Trade involves a fixed cost $\mu < 1/2$, needed to set up a caravan to reach the foreign markets.¹⁸ The more desert merchants have to cross to reach trade routes (large λ), the more they may lose from an organized ambush by those who do not find it profitable to trade. Such *roving bandits* can challenge the traders by incurring a cost equal to $\theta < 1/2$, where θ can be expressed as the fraction of the booty lost at the end of a raid. We refer to such confrontation between raiders and traders as conflict hereafter, the outcome of which is determined by the underlying geography of the area.

Within each period, the timing of the events can be summarized as follows: (1) agents inherit effective labor and/or private wealth from the previous generation; (2) production takes place; (3) static or dynamic redistribution is offered by the rich; (4) caravan sets off to trade; (5) the poor decide whether or not to attack the caravan; (6) trade/redistribution/raid outcomes are realized; (7) consumption and bequests of wealth and/or investment in effective labor take place.

¹⁸We assume that it is prohibitively costly to engage in long-distance trade at an individual level. This is consistent with the historical record, where long-distance trade expeditions were organized and implemented at the community/tribal level.

3.1 Production of Final Output

Production in each region displays constant-returns-to-scale with respect to the reproducible factors of production. The output produced at time t in region r , is $y_{r,t}$:

$$y_{r,t} = T_r(1 - \alpha)h_{r,t} + \alpha k_{r,t}; \alpha \in (0, 1), r = \{P, R\}.$$

where T_r is land quality in region r , $h_{r,t}$ and $k_{r,t}$ represent the regional effective labor and the amount of capital employed at period t in region r . Marginal product of effective labor and capital are equal to the wage rate per unit of effective labor w_r and the rate of return to capital R_r respectively. With perfect substitutability, the producers' inverse demand for factors of production is:

$$\begin{aligned} w_r &= (1 - \alpha)T_r \\ R_r &= \alpha T_r, \end{aligned} \tag{1}$$

that is constant over time in each region r . We assume that capital depreciates fully every period and that

$$\alpha > \frac{1}{2}, \tag{C1}$$

implying that capital is relatively more productive than labor.

3.2 Individuals' Wealth and Preferences

A representative agent from each tribe lives two periods. An adult at time t is an individual of generation t . In the first period, agents are economically idle. In the second period, they supply inelastically their effective labor $h_{r,t}$ in region r where they are born, earning the prevailing wage rate w_r . Moreover, they may receive capital bequests, $s_{r,t-1}$, from their parents, generating an income that is the return rate on capital R_r times the amount of bequests. Each agent's gross income is therefore:

$$I_{r,t} = w_r h_{r,t} + R_r s_{r,t-1}, \tag{2}$$

which can be consumed locally or traded abroad. Moreover, the rich can transfer a part of their gross income to the poor in order to avoid the risk of being raided.

An individual's preferences are defined over consumption in the second period of his life, $c_{r,t}$, and potential gross income of his offspring, $I_{r,t+1}$. We assume that people consume up to a satiation level \tilde{c} , after which they maximize utility on the basis of the gross income of their child. Consider a utility function $U(c_t; I_{t+1})$ defined as

$$U(c_t; I_{t+1}) = c_t + \beta I_{t+1}, \tag{3}$$

together with the constraint $c_t \leq \tilde{c}$, where $\beta < 1$. As it will become apparent this utility function is adopted to capture the spirit of Kaldorian-Keynesian savings behavior i.e., bequests

and savings are an increasing function of wealth. Allowing for a more standard utility function, like $U_{r,t} = \beta \ln c_{r,t} + (1 - \beta) \ln I_{r,t+1}$, would deliver qualitatively similar results. However, in this case the adult's income threshold of investing in children's income (either through savings or effective labor enhancing investments) becomes endogenous to the anticipated factor returns, making the analysis more cumbersome without adding further insights. More generally, the qualitative predictions would go through as long as there are non-convexities in either the production side or in the utility function producing an economic environment where inequality increases over time.

3.3 Optimal Consumption and Transfers

Proceeding backward, in this section we look at the optimization problem of rich and poor agents given their net income, $Y_{r,t}$. Gross income $I_{r,t}$ evolves into net income $Y_{r,t}$ through the process of trade and conflict, as described in Section 3.4 below.

3.3.1 Private Capital versus Public Good Bequests

Effective labor may accumulate over time through investments, $e_{r,t}$, in public goods that enhance labor productivity, i.e. *waqfs*. Unlike capital bequests that are individual specific, public goods by nature provide benefits across all regions of the economy. The following law of motion describes how effective labor evolves over time:

$$h_{r,t+1} \equiv h_{t+1} = 1 + \gamma(e_{R,t} + e_{P,t}), \quad (4)$$

Each individual is endowed with one unit of labor in absence of any *waqf* investment and $0 < \gamma < 1$ captures the marginal benefit of *waqf*.

It follows from (3) that an adult allocates her net income towards own consumption up to the level of \tilde{c} , and devotes her remaining income to maximize the potential gross income of her child in (2). In deciding how to best finance a child's gross income, an adult anticipates future wage rates and capital returns and optimally splits bequests between private capital $s_{r,t}$ and a *waqf* investment, $e_{r,t}$. Investment in capital delivers a marginal benefit equal to R_r whereas from (4) the marginal benefit of investing in *waqf* is γw_R for a rich individual and γw_P for a poor one. If net income is $Y_{r,t} \leq \tilde{c}$, it is entirely spent on consumption, while if $Y_{r,t} > \tilde{c}$, utility (3) is maximized subject to budget constraint:

$$s_{r,t} + e_{r,t} \leq Y_{r,t} - \tilde{c}, \quad (5)$$

where $Y_{r,t} - \tilde{c}$ is net income after consumption.

Now that we have defined the main building blocks and individuals' optimization structure, it is useful to define the starting point of the economy:

Definition 1 *The initial condition of the model (at time $t = 0$) is one in which $h_0 = 1$ and $s_{P,-1} = s_{R,-1} = 0$, so that $I_{P,0} = \frac{1-\alpha}{v}$ and $I_{R,0} = 1 - \alpha$.*

In order for trade opportunities to act as a trigger for capital accumulation, we assume that in absence of trade, $p = 1$, no individuals leave bequests:

$$1 - \alpha < \tilde{c}. \quad (\text{C2})$$

It follows that without trade and under (C2) regional incomes remain constant. Moreover, throughout the analysis we assume that the tribe in the agriculturally poor region is initially unable to engage in trade, i.e.

$$I_{P,0} < \mu, \quad (\text{C3})$$

and this is always true for large enough values of v . Condition (C3) implies that if $v \rightarrow 1$ the poor region is indistinguishable from the rich one because their productivities coincide and they would behave similarly in terms of production, trade, and bequests. Moreover, looking at (1), (2) and (4), $v \rightarrow \infty$ gives $I_{P,0} \rightarrow 0$. Hence, we consider small enough values of land productivity, T_P , such that the emergence of trade opportunities creates conflicting interests between regions.

Finally, let us define a minimum price obtained by trading abroad,

$$\underline{p} \equiv \frac{\tilde{c}}{(1 - \alpha - \mu)\theta}, \quad (\text{C4})$$

which is achievable once commercial trade routes emerge in the vicinity. In what follows, we characterize the optimal behavior of agents in the rich region given conditions (C1), (C2), (C3) and (C4). Note that in absence of income transfers agents in the poor region cannot reach satiation point \tilde{c} , and hence do not leave bequests. Thus, in the rest of this section we only refer to the bequeathing behavior of the rich.

3.3.2 Anti-Riba Regulation and Investment in Public *waqf*

Kuran (2008a) argues that anti-*riba* laws for the Muslims were equivalent to increasing transactions costs, which limited the return on wealth accumulation for Muslim adherents. The lower return on private investment implied by the anti-*riba* law induced the agents to switch to public labor-enhancing investments. We model such restrictions as follows. Define the net return on capital investments as $R_R^N = \delta R_R$, where $\delta \in [0, 1]$ is an inverse measure of the distortion in the marginal product of capital induced by the limitations on contracts involving capital investments. The comparison between the two forms of investment boils down to evaluating the returns from private capital bequests versus public good investments, i.e., $\delta R_R \leq w_R \gamma$.

Returns to factors of production are independent of the quantity of factors employed, so individuals from fertile regions prefer public good investments over capital savings as long as:

$$\delta \leq \frac{1-\alpha}{\alpha} \gamma \equiv \delta_R$$

Below we study the bequest behavior of parents as a function of the *riba* regime in which they live, i.e. with or without restrictions on capital investments. When there are no distortions on capital accumulation, $\delta = 1$, rich only bequeath capital when bequests are positive:

$$s_{R,t}^*(Y_{R,t}) = \begin{cases} 0 & \text{if } Y_{R,t} \leq \tilde{c} \\ Y_{R,t} - \tilde{c} & \text{if } Y_{R,t} > \tilde{c} \end{cases} . \quad (6)$$

When restrictions are significant, i.e. *riba* is not allowed, $\delta \leq \delta_R$, the rich invest in public goods. In this case optimal labor enhancing investment becomes:

$$e_{R,t}^*(Y_{R,t}) = \begin{cases} 0 & \text{if } Y_{R,t} \leq \tilde{c} \\ Y_{R,t} - \tilde{c} & \text{if } Y_{R,t} > \tilde{c} \end{cases} . \quad (7)$$

Note that because of (4) the poor benefit from the *waqf* investment made by the rich.¹⁹

3.4 Trade, Conflict, and Redistribution

In absence of bequests, foreign prices p and the level of land quality determine the ability to engage in trade. Generally, a region trades if and only if $I_{r,t} < p(I_{r,t} - \mu) \iff I_{r,t} > \frac{p\mu}{p-1}$ when there is no risk of conflict. In this section, we discuss the initial stage of the economy at $t = 0$ as defined above.

3.4.1 Trade and the Threat of a Raid

When trade becomes a viable option only the tribe in the fertile region may participate. Given condition (C3), the tribe in the poor region cannot overcome the fixed trading cost, μ . Nevertheless, it may raid the caravan of the trading region and obtain part of the goods if profitable. These decisions are considered to be collective actions as tribalism or *asabiyya* (the clan spirit) obliged each tribe to protect its fellow members (Watt, 1961). The outcome of the confrontation depends on the fighting strength of each side, determined by a retention function $f_r(\lambda) \in [0, 1]$ whose argument is the size of the poorly endowed region λ . The function $f_r(\lambda)$ is continuous and differentiable. Without loss of generality we focus on the retention rate of the rich region, i.e., $f_R(\lambda) = 1 - f_P(\lambda)$, where $f_R(1) = 0$, $f_R(0) = 1$, $\frac{\partial f_R(\lambda)}{\partial \lambda} < 0$ and $\frac{\partial f_P(\lambda)}{\partial \lambda} > 0$. Note that introducing a Malthusian environment with endogenous fertility would imply that regions with

¹⁹Given our utility function, there are no free riding incentives. Given $\delta < \delta_R$ once $c = \tilde{c}$ is attained, the only way to increase utility is to leave bequests. Moreover, allowing the *waqf* donors to partially internalize the return on *waqfs* would not change the qualitative predictions.

better land quality are more densely populated (Ashraf and Galor, 2011), weakening the potency of predation by the poor. Properties of $f_r(\lambda)$ emphasize the fact that overland trade is space intensive, so that the higher is the proportion of arid lands, λ , the larger is the predation threat to any caravan on the way to trade routes. In other words, the importance of relative population densities in determining the conflict outcome diminishes when the latter takes place out in the desert.

We model the trade and raid process as a sequence, where the rich evaluate the profitability of trade conditional on the decision of the poor whether or not to raid.²⁰ It follows from (3), (6), and (7) that utility is increasing in net income. At any time t , the rich tribe would trade if its post-conflict net income $Y_{R,t}^c$ exceeds the income under no trade, $I_{R,t}$:

$$I_{R,t} < Y_{R,t}^c \equiv p(I_{R,t} - \mu)f_R(\lambda),$$

which in period 0 can be rewritten as

$$f_R(\lambda) - \frac{1 - \alpha}{p(1 - \alpha - \mu)} > 0. \quad (8)$$

The inequality shows that trade is more likely to occur as the ability of the rich to retain goods during a raid increases (larger $f_R(\lambda)$), and gains from trade are large (a higher gross income $1 - \alpha$, higher prices p , or lower trade costs μ).

Lemma 1 *There exists a unique threshold of poor region's size $\bar{\lambda} \in (0, 1)$ giving $f_R(\bar{\lambda}) = \frac{1 - \alpha}{p(1 - \alpha - \mu)}$, so that trade in the presence of conflict is only profitable for $\lambda < \bar{\lambda}$.*

P proof. Since $f_R(\lambda)$ is continuous, monotonically decreasing in λ , $f_R(0) = 1$ and $f_R(1) = 0$, it follows from the *Intermediate Value Theorem* and (8) that there exists a unique level of poor region's size $\bar{\lambda}$ such that $f_R(\bar{\lambda}) = \frac{1 - \alpha}{p(1 - \alpha - \mu)} \equiv \bar{f}_R$. Hence there exists a $\lambda \equiv \bar{\lambda}$ such that if $\lambda < \bar{\lambda}$ then $f_R(\lambda) > \bar{f}_R$ and the rich trade, whereas if $\lambda \geq \bar{\lambda}$ then $f_R(\lambda) \leq \bar{f}_R$ and they only consume locally. ■

The tribe in the poor region may plunder the goods being traded. In line with the historical evidence, we assume a raid may occur when a caravan is on its way to the trade routes.²¹ There is a cost of conflict for the poor that represents resources lost during an ambush. In particular, they sustain a loss equivalent to a fraction θ of any booty they seize

²⁰We abstract from partial coalition formation, i.e., the rich bribing some of the poor into power-sharing, thus limiting the strength of the remaining poor to a sufficiently low level. Such practise did take place between the fall of the Roman Empire and the rise of Islam, between merchant clans and bedouin tribes. However, most of them were short-lived and coalitions were constantly switching precipitating the emergence of Islam, see Ibrahim (1990).

²¹Note that as the poor cannot overcome the costs of setting up a caravan, we assume away the possibility of trading goods collected during a raid.

at the end of the conflict. Thus, raiding is only a credible threat if what the poor can obtain exceeds the income of remaining passive and consuming own production, i.e.,:

$$I_{P,t} < I_{P,t} + (I_{R,t} - \mu)[f_P(\lambda) - \theta], \quad (9)$$

which can be rewritten as

$$f_P(\lambda) - \theta > 0. \quad (10)$$

The inequality shows that the poor would only raid if the share of goods they obtain is large enough to overcome the costs of conflict θ .

Lemma 2 *There exists a unique threshold of poor region's size $\underline{\lambda} \in (0, \bar{\lambda})$ giving $f_P(\underline{\lambda}) = \theta$, so that a raid is only a credible threat for $\bar{\lambda} > \lambda > \underline{\lambda}$.*

P proof. Note that $f_P(\lambda)$ is continuous and monotonically increasing in λ , $f_P(0) = 0$ and $f_P(\bar{\lambda}) = 1 - \frac{1-\alpha}{p(1-\alpha-\mu)}$. As long as $p > \frac{1-\alpha}{(1-\alpha-\mu)(1-\theta)} \implies f_P(\bar{\lambda}) > \theta$, which holds from (C2), (C4) and $\theta < 1/2$, it follows from the *Intermediate Value Theorem* that there exists a unique level of poor region's size $\underline{\lambda} \in (0, \bar{\lambda})$ such that $f_P(\underline{\lambda}) = \theta \equiv \underline{f}_P$. Hence, there exists a $\lambda \equiv \underline{\lambda}$ such that if $\lambda > \underline{\lambda}$ then $f_P(\lambda) > \underline{f}_P$ and the poor raid, whereas if $\lambda \leq \underline{\lambda}$ then $f_P(\lambda) \leq \underline{f}_P$ and there is no conflict. ■

3.4.2 The Static Redistribution System

We now introduce the possibility of static, that is same period, income redistribution, *zakat*, and investigate the necessary conditions under which a *zakat* contract is mutually beneficial and whether can be an equilibrium outcome. The *zakat* contract takes the form of a fraction z of rich's income that is transferred to the poor. We assume that *zakat* once agreed upon is paid prior to trade. The poor would prefer a *zakat* payment as a form of compensation to refrain from conflict if the transfer is larger than what they would gain from a raid:

$$I_{P,t} + z(I_{R,t} - \mu) \geq I_{P,t} + [(f_P(\lambda) - \theta)(I_{R,t} - \mu)].$$

This gives a minimum acceptable *zakat* rate, \underline{z} , of

$$\underline{z} \equiv \underline{z}(\lambda) = \max\{0, f_P(\lambda) - \theta\}, \quad (11)$$

which is weakly increasing in $f_P(\lambda)$, thus weakly increasing in λ and weakly decreasing in θ . Note that \underline{z} only becomes positive at \underline{f}_P , which looking at (10) occurs at the exact level of poor region's size $\underline{\lambda}$, that is when the poor find it optimal to raid.

The maximum *zakat* rate the rich would be willing to pay can be found by comparing their post-trade income under conflict with that under a *zakat* regime:

$$p(1 - z)(I_{R,t} - \mu) \geq f_R(\lambda)p(I_{R,t} - \mu),$$

which gives

$$\bar{z} \equiv \bar{z}(\lambda) = f_P(\lambda) \leq 1. \quad (12)$$

and is increasing in λ . Note that conflict occurs only when $f_P(\lambda) > \underline{f}_P$. Below this threshold there is no conflict so the maximum *zakat* rate of the rich is 0. It is easy to see from (11) and (12) that $\underline{z} < \bar{z}$ always holds, thus there exists a positive *zakat* rate that delivers a Pareto preferred outcome as long as $\lambda > \underline{\lambda}$.

Given the structure of trade and redistribution, we can now define the net income of the rich as:

$$Y_{R,t} = \begin{array}{ll} p(I_{R,t} - \mu) & \text{no conflict} \\ f_R(\lambda)p(I_{R,t} - \mu) & \text{conflict} \\ (1 - \underline{z})p(I_{R,t} - \mu) & \text{zakat} \\ (1 - \underline{z})f_R(\lambda)p(I_{R,t} - \mu) & \text{zakat and conflict.} \end{array} \quad (13)$$

The net income of the poor is equal to their gross income, plus *zakat* earnings, with the latter being equivalent to their potential gains from conflict:

$$Y_{P,t} = I_{P,t} + \underline{z}(I_{R,t} - \mu). \quad (14)$$

If the poor deviate by raiding after receiving the transfer payment, they can achieve a net income of

$$Y_{P,t} = I_{P,t} + [\underline{z} + (1 - \underline{z})(f_P(\lambda) - \theta)](I_{R,t} - \mu). \quad (15)$$

Although adopting a static redistribution system is Pareto efficient, it is not guaranteed that it is a Nash equilibrium because the poor may deviate and attack the caravan after having received the transfer. In fact, the pre-Islamic redistribution attempts between tribes in Arabian peninsula (*ilaf*) could be thought of as an unstable equivalent to the Islamic institution. This is straightforward to see in Figure 1 that illustrates the outcome of the game between the rich and the poor in terms of their net income. The dominant strategy for the rich is to not redistribute their wealth and for the poor to raid, giving rise to a Prisoner's Dilemma problem. A static redistribution system hence fails to deliver a sustainable solution that safeguards trade as the nomadic clan always finds it optimal to raid the caravan after receiving the redistribution.

	<i>rich</i>	
<i>poor</i>	<i>no zakat</i>	<i>zakat</i>
<i>raid</i>	$\begin{aligned} \text{poor: } & \frac{1-\alpha}{\nu} + [f_p(\lambda) - \theta]\Delta \\ \text{rich: } & 1-\alpha + \alpha[pf_R(\lambda)\Delta - \tilde{c}] \end{aligned}$	$\begin{aligned} \text{poor: } & \frac{1-\alpha}{\nu} + \{z + (1-z)[f_p(\lambda) - \theta]\Delta \\ \text{rich: } & 1-\alpha + \alpha[pf_R(\lambda)(1-z)\Delta - \tilde{c}] \end{aligned}$
<i>no raid</i>	$\begin{aligned} \text{poor: } & \frac{1-\alpha}{\nu} \\ \text{rich: } & 1-\alpha + \alpha(p\Delta - \tilde{c}) \end{aligned}$	$\begin{aligned} \text{poor: } & \frac{1-\alpha}{\nu} + z\Delta \\ \text{rich: } & 1-\alpha + \alpha[p(1-z)\Delta - \tilde{c}] \end{aligned}$

where $\Delta = I_{R,t}^c - \mu$

Figure 1: The Failure of a Static Redistribution System

Lemma 3 *Using (11) and (12), a zero zakat rate obtains for $\lambda \leq \underline{\lambda}$, while for $\lambda > \underline{\lambda}$ there exists a positive zakat rate of z increasing in λ , which is beneficial for both sides. Commitment problems, however, impede the Pareto efficient solution rendering a static redistribution system as such ineffective.*

P proof. Follows by directly comparing (11) to (12), the properties of $f_P(\lambda)$, and the properties of the Nash equilibrium in Figure 1. ■

3.5 Geography and the Emergence of Islamic Economic Principles

We now turn to conditions that give rise to the emergence of Islam as an endogenous institution. We refer to Islam as a contract that besides the static transfer (which was shown to be unsustainable), adds a dynamic layer of redistribution. This can be modelled as any force that spreads wealth and avoids its concentration such as a partible inheritance system, or a combination of regulations that limit wealth accumulation and induce public good investments by the rich, i.e., *waqf*. In the latter case, benefits to the next generation in terms of higher labor productivity are also enjoyed by the poorer clan.

Starting with the initial condition at $t = 0$, an Islamic pact is offered and must be accepted by both sides to go through. Figure 2 displays a redistribution scheme that exhibits

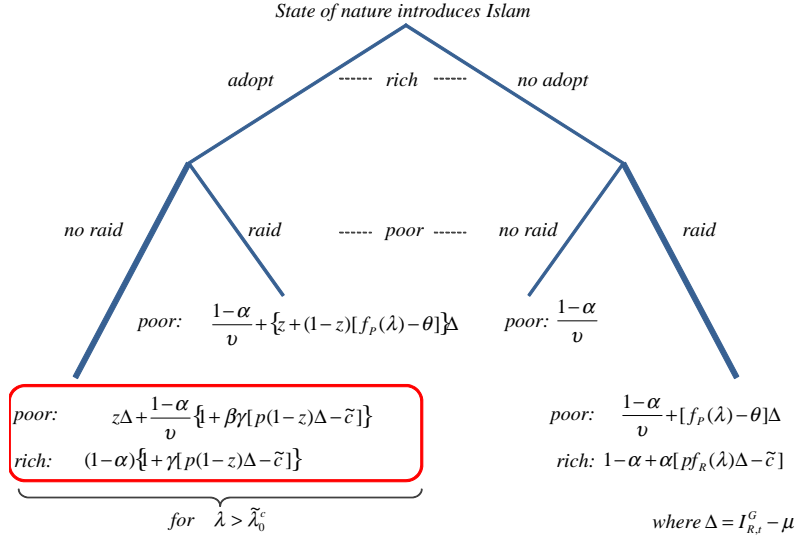


Figure 2: Islam as a System of Dynamic Redistribution

both static and dynamic aspects. The introduction of the latter acts as a coordination device by eliminating the commitment problem present in a system of static redistribution only. This line of reasoning can be illustrated by a game, where the rich adopt Islam if profitable, and the poor follow and decide whether to abide by the doctrine or resort to predation.

The nomadic clan uses the threat of conflict to establish Islam with its bargaining power increasing in λ . To see whether or not an Islamic-like set of rules goes through one may compare the utility of the rich clan with and without Islam. The latter calculate their utility under Islam U_R^ξ with both *zakat* and anti-*riba* in place and compare it to their outside option U_R^c , which is conflict for all $\lambda > \underline{\lambda}$. At time $t = 0$, the level of net income under conflict Y_R^c that gives $Y_R^c = \tilde{c}$, above which the rich leave capital bequests, solves

$$f_R(\lambda) - \frac{\tilde{c}}{p(1-\alpha-\mu)} > 0. \quad (16)$$

With equality, (16) gives $\lambda \equiv \tilde{\lambda}_0^c$ so that capital bequests are positive if $\lambda < \tilde{\lambda}_0^c$ and zero otherwise. In addition, looking at (8) and (16) along with (C2) and (C4) assures that $\underline{\lambda} < \tilde{\lambda}_0^c < \bar{\lambda}$. Bequests are more likely to be positive when $f_R(\lambda)$, $1 - \alpha$, and p are larger, and for lower trade costs μ .

Lemma 4 *Under conflict there exists a unique threshold of poor region's size $\tilde{\lambda}_0^c \in (\underline{\lambda}, \bar{\lambda})$ giving $f_R(\tilde{\lambda}_0^c) = \frac{\tilde{c}}{p(1-\alpha-\mu)}$ so that capital bequests are positive only for $\lambda < \tilde{\lambda}_0^c$.*

P roof. Note that $f_R(\lambda)$ is continuous, $f_R(\underline{\lambda}) = 1 - \theta$ and $f_R(\bar{\lambda}) = \frac{1-\alpha}{p(1-\alpha-\mu)}$. Given (C2), (6), (8), (13) and (16), as long as $p > \frac{\tilde{c}}{(1-\alpha-\mu)(1-\theta)} \implies f_R(\tilde{\lambda}_0^c) > 1 - \theta$, which holds from (C4) and $\theta < 1/2$, it follows from the *Intermediate Value Theorem* that there exists a share of poor regions $\tilde{\lambda}_0^c \in (\underline{\lambda}, \bar{\lambda})$ such that $f_R(\tilde{\lambda}_0^c) = \frac{\tilde{c}}{p(1-\alpha-\mu)} \equiv \tilde{f}_{R,0}^c$. Also, since $f_R(\lambda)$ is monotonically decreasing in λ , this $\tilde{\lambda}_0^c$ is unique. So, if $\lambda < \tilde{\lambda}_0^c$ then $f_R(\lambda) > \tilde{f}_{R,0}^c$ and capital savings by the rich are positive, whereas if $\lambda \geq \tilde{\lambda}_0^c$ then $f_R(\lambda) \leq \tilde{f}_{R,0}^c$ and savings are zero. ■

Similarly, one may derive the threshold λ below which investments are positive under an Islamic contract, by solving for the net income under Islam, Y_R^ξ , that guarantees consumption equal to \tilde{c} . The only difference from the previous case is the additional gain from avoiding conflict. The following inequality solves for $\tilde{\lambda}_0^\xi$ below which bequests under Islam are positive:

$$f_R(\lambda) - \frac{\tilde{c}}{p(1-\alpha-\mu)} + \theta > 0. \quad (17)$$

Substituting for \underline{p} from (C4), one can show that (17) always holds, hence *waqf* bequests by the rich are always positive under Islam. Note that while $Y_R^c > \tilde{c}$ no longer holds for $\lambda \geq \tilde{\lambda}_0^c$, $Y_R^\xi > \tilde{c}$ still obtains due to the extra term θ .

The poor under no Islam always find it optimal to raid as in the static redistribution case. In contrast, under Islam, which includes *zakat* and a *waqf*-inducing anti-*riba* regime, they are strictly better off to comply when gains from trade are large. Given the sufficient condition for the rich to adopt Islam, $\lambda \geq \tilde{\lambda}_0^c$, from Lemma 4, should the poor choose to raid after the Islamic contract is offered neither side can enjoy the benefits of *waqf* as no wealth remains to be bequeathed. Indeed, since the rich get raided *and* pay *zakat* in this case, the zero bequest threshold is reached at a lower level of λ than $\tilde{\lambda}_0^c$. Raiding is therefore no longer incentive compatible for the poor under the structure offered by Islam. This leaves a choice between the static benefits of a raid versus the dynamic gains from Islam:

Lemma 5 *When gain from trades are large ($p > \check{p} \geq \underline{p}$), the utility of the poor under Islam is greater than the one-time benefits from a raid obtained upon deviation from the principles, i.e. $U_P^\xi > U_P^c$.*

P roof. The utility of the poor in case they accept Islam offered by the rich or forego the benefits and raid are depicted on the left branch of the tree in Figure 2. Islam is strictly preferred by the poor if and only if the dynamic gains outweigh a one-time raid such that $U_P^\xi > U_P^c \implies \frac{1-\alpha}{v}\beta\gamma(p(1-\underline{z})(1-\alpha-\mu) - \tilde{c}) > (1-\underline{z})(f_P(\lambda) - \theta)(1-\alpha-\mu)$ at time $t = 0$, where *zakat* earnings appear on both sides and therefore cancel out. This condition reduces to $p > \frac{\tilde{c}}{\theta(1-\alpha-\mu)} + \frac{f_P(\lambda) - \theta}{\frac{1-\alpha}{v}\beta\gamma} = \underline{p} + \frac{f_P(\lambda) - \theta}{\frac{1-\alpha}{v}\beta\gamma} \equiv \check{p}$, where we have used $1 - \underline{z} = f_R(\lambda) + \theta$ in the denominator of the first term on the RHS and replaced $f_R(\lambda) = 0$ to depict the minimum value it can take. ■

Lemma 5 shows that under large gains from trade the poor respond positively to the adoption of Islam by the rich, i.e., they unify to join the Islamic community. Focusing on $t = 0$, it is straightforward to show that Islam is accepted by both sides for all $\lambda \geq \tilde{\lambda}_0^c$ where the alternative is no bequests. In this range, the only option for the rich to leave benefits to the next generation is to switch to Islam and public goods investments as opposed to capital bequests. Islam also brings static gains by preventing conflict. The difference between what a rich is willing to pay to avoid conflict and what he actually pays, i.e. the difference between \underline{z} and \bar{z} in (11) and (12), is the economic value added by Islam and amounts to θ . On the dynamic side, the poor also gain by assuring bequests to their offsprings, which outweigh static gains from a raid under large gains from trade.

One may therefore state:

Proposition 1 *When the mass of the arid lands and gains from trade are substantial such that $\lambda \geq \tilde{\lambda}_0^c$ and $p > \check{p}$, an Islamic contract is agreed upon by the rich clan and respected by the nomadic one at $t = 0$.*

P roof. Follows directly from Lemmas 4 and 5. For large enough values of p that make dynamic gains from Islam more attractive than a one-time raid for the poor, $\lambda \geq \tilde{\lambda}_0^c$ is a sufficient condition for Islam to be accepted as an institution because (i) the rich will have a static gain by avoiding a raid, (ii) the rich will have dynamic benefits as opposed to no capital bequests, (iii) the poor obtain higher dynamic gains from *waqf* than raiding and the latter leaves no wealth by the rich to be invested in *waqf*. ■

Looking back at Figure 2, Islam is proposed for all $\lambda > \tilde{\lambda}_0^c$, where the rich prefer *waqf* to individual accumulation of wealth under conflict and the poor consequently respect the system and refrain from raids to receive the long-run benefits of Islam as opposed to the one time gain from a raid.

In summary, when there are few arid regions to cross, i.e., for $\lambda < \underline{\lambda}$, there is no material threat of a raid and no redistributive institutions emerge. However, when they account for a moderate part of the geography, i.e., $\underline{\lambda} < \lambda < \tilde{\lambda}_0^c$, the rich may prefer to accumulate and the poor therefore continue to raid. This is an economy where static redistribution collapses due to commitment problems. Finally, as long as the mass of arid lands is large enough, the rich accept Islam because the threat of conflict is effective and potential losses are high. Islam is accepted for $\lambda \geq \tilde{\lambda}_0^c$ because the rich will otherwise not be able to leave any bequests under conflict, or even trade for $\lambda \geq \bar{\lambda}$. As a consequence, once trade becomes feasible in period $t = 0$, Islam is founded for $\lambda \geq \tilde{\lambda}_0^c$, the rich pay *zakat*, and leave bequests in the form of public *waqfs*.

In what follows we explore the dynamics to establish the conditions under which the Islamic economic principles, once adopted, also persist in the long run. In other words, we examine whether there exists a steady state threshold value of poor regions' size $\tilde{\lambda}_S^c < 1$, above which the Islamic equilibrium obtains. Moreover, we present some results related to the dynamic behavior of economies characterized by different regimes and analyze the steady state levels of income and inequality under different initial conditions.

3.6 Persistence of the Islamic Doctrine and the Long-term Evolution of Income

In presence of regional gains from trade and large inequality in land productivity, the presence of vast arid lands is a fundamental determinant of the emergence of the Islamic institution. We now conduct a dynamic analysis to study the persistence of Islam and the long-run evolution of the economy. In doing so, we derive the steady state income of the rich and the poor region in each case and observe ex-post the conditions under which Islam persists. The analysis also allows to track the dynamics of inequality in the presence and in absence of Islam.

A full Islamic contract comprises an anti-*riba* law together with a *zakat* transfer from the rich to the poor. We know from Proposition 1 that an Islamic institution is initially founded if $\lambda \geq \tilde{\lambda}_0^c$. The anti-*riba* law sways the rich to divert bequests from private capital to public good investments that enhance labor productivity of all agents. Note that due to the public nature of *waqf*, inequality under Islam does not change along the process of development. However, the bequest and the Islam thresholds, referred to as $\tilde{\lambda}_t^c \equiv \tilde{\lambda}_t^c(I_{R,t})$ henceforth, may change due to $I_{R,t}$ increasing over time.

Corollary 1 *At any period t , the expression $f_R(\tilde{\lambda}_0^c)$ derived in Lemma 4 is generalized to $f_R(\tilde{\lambda}_t^c) = \frac{\tilde{c}}{p(I_{R,t}-\mu)}$. Since $\frac{\partial f_R(\tilde{\lambda}_t^c)}{\partial I_{R,t}} < 0$, it follows that the threshold value $\tilde{\lambda}_t^c$ rises over time as $I_{R,t}$ increases. Intuitively, a larger gross income eases the constraint to leave bequests for the rich in presence of conflict and discourages the persistence of Islam.*

P proof. Substituting the gross income in period 0, $(1 - \alpha)$, with the gross income in period t , $I_{R,t}$, in the RHS of $f_R(\tilde{\lambda}_0^c)$ in Lemma 4, the expression becomes $f_R(\tilde{\lambda}_t^c) = \frac{\tilde{c}}{p(I_{R,t}-\mu)}$. Further, $\frac{\partial \tilde{\lambda}_t^c}{\partial I_{R,t}} > 0$ follows by directly inspecting the expression in the Corollary and using the properties of $f_R(\lambda)$. ■

Given Corollary 1, as long as (i) $\lambda \geq \tilde{\lambda}_t^c$, (ii) $\frac{I_{R,t}}{v} < \mu$ and (iii) $Y_{P,t} < \tilde{c}$ so that the poor cannot engage in trade or leave bequests at all t , Islamic rules are accepted in every period. Note that (i) follows from Proposition 1 and (ii) and (iii) generalize conditions (C2) and (C3). If conditions (ii) or (iii) fail at any time t , the poor get enough income to trade or leave bequests,

respectively. In this case, the need to adhere to the Islamic principles diminishes even if initially adopted.

The economy evolves according to the dynamic equations

$$\begin{cases} I_{R,t+1} = (1 - \alpha)(1 + \gamma[(1 - \underline{z})p(I_{R,t} - \mu) - \tilde{c}]) \\ I_{P,t+1} = \frac{I_{R,t+1}}{v} \end{cases} \quad (18)$$

where we have used equations (7), (11), (13) and (14). Note that income inequality is *constant* and equal to v along the process of development. Gross income of the rich increases in every period and eventually monotonically reaches the steady state level:

$$I_{R,S} = (1 - \alpha) \left(1 + \gamma \frac{p(1 - \alpha - \mu)(1 - \underline{z}) - \tilde{c}}{1 - p(1 - \alpha)\gamma(1 - \underline{z})} \right) \quad (19)$$

if $p < 1/[(1 - \alpha)\gamma(1 - \underline{z})]$. It is easy to see that this sufficient condition ensures that both the denominator in the parenthesis in (19) is positive guaranteeing a positive steady state income level, and the slope of the linear function $I_{R,t+1}$ is between 0 and 1. A first-order linear dynamic equation with such features delivers a stable steady state with monotonic convergence. The steady state gross income is the wage rate times the steady state level of investment in public goods. It is positive and larger than initial gross income $(1 - \alpha)$ from (C4). The gross income of the poor also increases under Islam because of the enhanced labor productivity arising through *waqf* investments. Poor's income is at its maximum level in the steady state with $I_{P,S} = \frac{I_{R,S}}{v}$. If the price condition above is not satisfied, growth of income of both the rich and the poor is unbounded, (ii) or (iii) will eventually fail to hold, and the importance of implementing the Islamic economic principles declines in the long-run.

Corollary 1 shows that the Islamic contract may be abandoned as the gross income of the rich increases. However, using (19) one may show that there exists a threshold mass of the poor lands, $\tilde{\lambda}_S^c$, above which the rich remain loyal to Islam in the long run.

Proposition 2 *There exists a unique threshold $\tilde{\lambda}_S^c \in (\tilde{\lambda}_0^c, 1)$, where Islam is adopted both in the short and in the long-run for $\forall \lambda \geq \tilde{\lambda}_S^c$.*

P proof. To check for the existence and uniqueness of $\tilde{\lambda}_S^c < 1$, first substitute $\lambda = 1$ into expression $f_R(\tilde{\lambda}_t^c)$ in Lemma 4, yielding $\frac{\tilde{c}}{p(1 - \alpha - \mu)}$. From (C2) and (8) we know that $f_R(1) < \frac{\tilde{c}}{p(1 - \alpha - \mu)}$, so that in the limit case of $\lambda \rightarrow 1$ the rich would prefer the Islamic contract. Next, Corollary 1 shows that $\tilde{\lambda}_t^c$ is increasing with time. It follows from the *Intermediate Value Theorem* that there exist a unique $\tilde{\lambda}_S^c > \tilde{\lambda}_0^c$ such that if $\lambda > \tilde{\lambda}_S^c$ then Islam persists in the long run, whereas if $\lambda < \tilde{\lambda}_S^c$ then Islam may get abandoned after being adopted in $t = 0$. ■

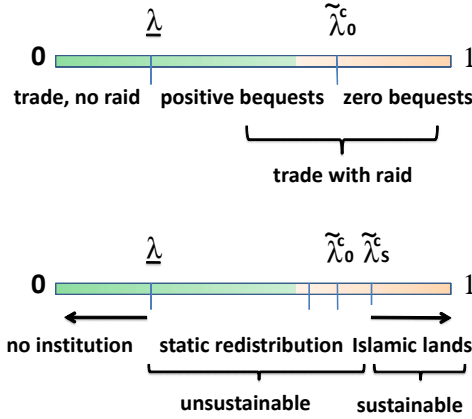


Figure 3: Land Quality and Islamic Institutions

Proposition 2 establishes the existence of an interval, in which Islam is sustainable in the long run. We can conclude that Islam is initially founded and may be abandoned in the long run for $\tilde{\lambda}_0^c \leq \lambda < \tilde{\lambda}_S^c$, while it is founded and persists for $\tilde{\lambda}_S^c \leq \lambda < 1$. If the contract is abandoned, the economy ultimately evolves back into a no institution case. Figure 3 presents the main results of the two propositions on the critical values of λ that determine the adoption and persistence of the Islamic institutions parallel to those that decide the behavior of the society regarding trade, raids and bequests.

In economies where the share of the poorly endowed territories is such that $\lambda < \tilde{\lambda}_S^c$, institutions either do not emerge or may not persist and regions evolve along different economic trajectories. Assuming for simplicity that only the rich can engage in trade, the gross income of rich and poor follow the dynamics described by:

$$\begin{cases} I_{R,t+1} = (1 - \alpha) + \alpha[f_R(\lambda)p(I_{R,t} - \mu) - \tilde{c}] \\ I_{P,t+1} = I_{P,0} = \frac{(1-\alpha)}{v} \end{cases} \quad (20)$$

where we have used condition (C3) and equations (5), (6), (13) and (14). Gross income of the poor remains constant whereas that of the rich increases every period due to condition (C4) and in the long run either explodes along with inequality or reaches the steady state level

$$I_{R,S} = (1 - \alpha) + \alpha \left(\frac{f_R(\lambda)p(1 - \alpha - \mu) - \tilde{c}}{1 - \alpha f_R(\lambda)p} \right), \quad (21)$$

for $p < \frac{1}{\alpha f_R(\lambda)}$, where $f_R(\lambda) = 1$ for $\lambda \leq \underline{\lambda}$. This may be decomposed into the labor income (first term) plus the returns on capital times the steady state level of capital bequests. Comparing (19) to (21) reveals that the income of the rich region, even under the steady state, is always lower under Islam because of (i) lower return from public good investments and the dilution

of *waqf* benefits and (ii) the fraction of gross income transferred to the poor due to a positive *zakat* rate z .

Proposition 3 *While the Islamic doctrine was suitable to mitigate income inequality in the society, it hampered economic development by limiting private investments and wealth accumulation, thereby constraining long-run growth of income.*

P roof. Follows directly from equations (18)-(21). ■

To summarize, in absence of Islamic rules territories characterized by a large share of poorly endowed areas would be trapped in a state of eternal feuding. So, while the emergence of Islam allowed these economies to escape a conflict trap and flourish in the preindustrial world, these very institutions resulted in negligible capital accumulation shaping the economic trajectory of the Islamic lands. These findings complement Galor and Tsiddon (1997), who show that polarization of income in early stages of development serves as a necessary ingredient to future economic growth and that prematurely implementing policies designed to reduce inequality leads to stagnation in the long-run. Similarly, Galor and Moav (2004) argue that income inequality in the early stages of development is growth promoting since it leads to wealth being channeled towards those with higher propensity to save, fueling the accumulation of capital. In the context of the proposed theory, Islamic economic doctrine in pursuit of keeping an already unequal income distribution within bounds, engineered principles that channeled preindustrial wealth towards public good investments in the form of religious endowments.

4 Conclusion

This research sheds new light on the economic origins and consequences of the Muslim economic doctrine. The theory provided links the emergence of trade opportunities across geographically unequal territories to the formation of the Islamic principles and investigates how the adoption of the latter shaped the economic performance of the Muslim world in the preindustrial era.

We have sketched a simple model that shows how geographic inequality when exposed to trade opportunities leads to the emergence of dynamic redistributive institutions similar to those prescribed by the Islamic doctrine. In the context of the model the following elements are crucial. First, substantive gains from trade. Second, the size of the region that cannot benefit from trade is important in determining the institutional setup. If poorly-endowed territories constitute a small fraction of the landscape no redistributive institutions arise, while for intermediate values, only static redistribution is feasible but unsustainable due to commitment problems. However, once their size crosses a certain threshold, the threat for the rich to be raided increases to the point that they are willing to adopt the Islamic contract. The results

are consistent with our companion paper, Michalopoulos, Naghavi, and Prarolo (2012), where we find that the interaction between distance to pre-industrial trade routes and geographic inequality is a key predictor of the distribution of Muslim communities in the Old world.

We argue that geography and trade opportunities forged the Islamic economic doctrine influencing the process of historical development of the Islamic lands. In particular, the unequal distribution of land endowments conferred differential gains from trade across regions, fostering predatory behavior from the poorly endowed ones. In such an environment, it was mutually beneficial to institute an economic system dictating income redistribution. A static transfer of income only, however, was unsustainable due to commitment problems undermining the viability of trade. Islam offered principles that provided a dynamic redistribution system tailored to limit the accumulation of wealth across highly unequal regions. Examples of dynamic redistribution that kept wealth inequality within limits include the partible inheritance rules, the frictions on borrowing and lending and the concomitant emphasis on public goods provision via religious endowments. As a result of these principles the Muslim lands managed to escape a state of constant feuding and flourish in the preindustrial world limiting, however, the wealth accumulation for the commercial elite and hence the potential for growth in the era of large-scale shipping trade and industrialization.

Finally, it is worth noting that Christianity also emerged in current day Israel and Palestine which feature a prominently unequal distribution of land endowments. Despite these common geographical origins, which may explain the similarities in the economic doctrine between Christianity and Islam, the former eventually spread in Europe modifying over time its doctrine. For example, although Christianity did enforce rigorously the prohibition on interest in the beginning, gradually and particularly with the Protestant Reformation enforcement of laws against usury were relaxed (Rubin, 2011).²² The different path of development experienced by the Christian world can also be associated with inheritance laws, which in several instances preserved economic inequality and encouraged the accumulation of capital (Bertocchi, 2006)

²²In fact, by the beginning of the 17th century usury was downgraded from an offence against public morality to a private conscience issue, Visser and Macintosh (1998). Also, during the Amoraic period in Babylonia (200AD to 500AD) interest rate started being accepted by the Jewish community.

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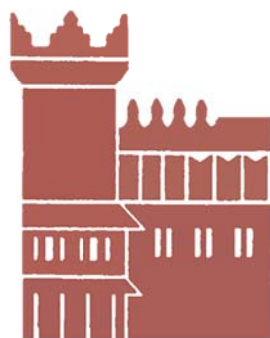
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