Market segmentation and non-uniform Shariah standards in Islamic finance

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Abstract

This paper proposes a new answer to a controversial paradox in Islamic finance described by El-Gamal (2002): “despite the long development of uniform standards for Islamic finance, the market remains largely segmented.” We explain market segmentation as a separating equilibrium in which finance premiums serve as a socially beneficial (although costly) signaling mechanism. Market segmentation under a uniform standard of Shariah-compliance occurs when the Shariah Boards of two Islamic Finance Institutions (IFIs) use different degrees of stringency even though they agree on a common set of minimum requirements to comply with Shariah Law. Heterogeneous degrees of stringency chosen by different IFI Shariah Boards translate into different premiums paid by different customers. One IFI targets the moderately pious consumer segment while the other targets the highly pious segment. The IFI that targets highly pious consumers voluntarily offers a more limited set of investments and financing products. By allowing for multiple Muslim communities with distinct group identities and correspondingly variable willingness-to-pay to signal piety types, the model provides an explanation for market segmentation.

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1. Introduction

El-Gamal (2002) describes four related paradoxes in Islamic finance (IF). The first is the substantial gap between economic theory and the observed IF product offerings or consumer behavior. Second, the IF market remains largely segmented. Despite longstanding attempts to develop uniform standards, the Shariah-compliance policies observed across the industry are markedly heterogeneous, implying that there is no accepted uniform standard in practice.

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Third, the number of active jurists is relatively small, so that the same jurists frequently serve on multiple Shariah Boards. From this substantial overlap of the religious scholars who sit on different Boards, substantial overlap might be expected among those Boards’ juridical interpretations. Fourth, he notes various debates and open questions regarding the number of widely used financial contracts approved by Islamic jurists which have come under sharp criticism for being overused.

Our paper focuses primarily on the second paradox where El-Gamal (2002) provides an answer for the paradox of market segmentation. He suggests that different speeds of innovation between incumbents and new entrants could explain why segmented product offerings are observed—based on different judgments by Shariah Boards at different Islamic Financial Institutions (IFIs) even though there is general agreement on the legal standard that should be applied.

We propose an alternative complementary explanation by showing that market segmentation can also arise as a natural consequence of screening by IFIs. This paper describes a game situation in which IFIs set different Shariah-compliance policies which determine the premiums above the cost of using non-IF products. In this game, a continuum of customers seeking financial services makes decisions about which bank or financial institution to patronize. The decision is to: (i) forgo paying any IFI’s premium and instead deal with a conventional financial institution; (ii) bear the moderate cost of a relatively permissive IIFI; or (iii) bear the high cost of the strictest IIFI. This decision over financial institutions depends on each agent’s piety type (low, moderate, or high), which is known to oneself but not observable to others.

Given one of these three piety types, the consumer’s decision depends on the heterogeneous mix of other consumers’ financial profiles that determine each individual’s cost of conventional finance. The heterogeneity of different agents’ non-IFI options generates a continuum of reference points against which the competing Shariah-compliance policies generate a continuum of IF premiums. Agents weigh the benefits of signaling their own piety type to other agents (by choosing to pay an IF premium) against its cost. Although the model includes only two distinct Shariah-compliance policies set individually by each IIFI, each of these two policies respectively generates a continuum of opportunity costs (and, consequently, variable utility gains from agents’ decisions about how to signal their piety type). Therefore, the decision to become an IFI client transmits different information depending on an individual’s non-IFI option, capturing an important real-world driver of heterogeneous consumer behavior and heterogeneous strategic marketing decisions by IFIs.

Berg and Kim (2014) demonstrate that IF premiums can provide a beneficial signaling technology even in the absence of any direct benefits (intrinsic or otherwise) received by agents who choose to become IFI clients. What is new in this paper is its focus on two competing IFIs that strategically decide on the stringency of their Shariah-compliance policies. In line with El-Gamal’s (2002) description of “market segmentation,” the choice variables of the competing IFIs in our model are scalar-valued degrees of stringency corresponding to each IIFI’s Shariah-compliance policy, which emerges as a strategic marketing tool that presupposes no essential disagreement among Shariah Boards.

The set of Shariah-compliant points in the universe of existing financial securities is a strict subset of the unrestricted universe of feasible risk-return combinations provided by conventional finance. Therefore, the IF premium can be interpreted in units of forgone expected return (which includes premiums paid for debt financing, or as any short position obligating an IF customer to make future payments) while holding volatility constant. All else equal, a more stringent Shariah-compliance policy implies greater forgone expected return at every fixed level of volatility. This risk-invariant decrease in expected returns that any IF client faces (e.g., on a home purchase, a retirement portfolio, an insurance policy, or a small business investment) is equivalent to paying higher prices for financial services, referred to here as the IF premium. This modeling technique deliberately abstracts from any intrinsic benefits derived from adhering to Shariah-compliant financial contracts. Such intrinsic motivation complements the mechanism demonstrated in this paper that rationalizes segmentation into differentiated products offered by IFIs. Our model assumes away these intrinsic benefits to isolate the signaling and reputational effects. El-Gamal (2002) and others have pointed out these may be substantial. Alternatively, some critics suggest interpreting exposure to IFIs as a net social cost (e.g., Khan, 2010). Our abstraction from intrinsic benefits or costs provides a thought experiment focused on signaling and its role in explaining the emergence of market segmentation.

Section 2 discusses market segmentation in the Islamic finance industry that motivates the theoretical model. The model is described in Section 3. The equilibrium analysis appears in Section 4 followed by a conclusion in Section 5.

2. Market segmentation and positioning of IFIs

2.1. Economics of piety

Azzi and Ehrenberg (1975) decompose religiosity into three main components: a salvation motive that captures the idea of afterlife utility; a consumption-of-religious-experience motive, which refers to utility gained directly from going to church and indirectly by participating in religious and non-religious activities with other church members; and a social-pressure

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3 We follow El-Gamal (2002) in assuming that there are exogenously given piety types. Our explanation does not require a face-value interpretation of piety types. The piety types referred to here (e.g., high, moderate and low) can be interpreted simply as distinct Muslim communities with different views about what it means to be pious.

4 Along every constant-volatility vertical segment that passes through the larger non-IFI bullet (encompassing the unrestricted universe of feasible risk-return pairs using conventional finance) and the smaller bullet offered by the IFI measures a vertical distance between these two bullets in units of forgone expected return. Illustrations of different-shaped risk-return bullets corresponding to IFI and non-IFI sectors can be found in Berg and Kim (2014).

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motive that refers to utility from belonging to a club. We are particularly interested in the spirituality component of religion in this paper. Azzi and Ehrenberg devise (and test for) a multi-period utility-maximization model to explain allocation of time to the salvation motive (which is referred to as piety in more recent literature). The main innovation of their paper is that it modeled the opportunity cost of piety in terms of time and money. People economize on spirituality by substituting money for time. Hence, a high-wage person donates more generously and attends church less frequently than a low-wage person. Identifying the opportunity cost of piety is more straightforward in our context of financial institutions, as it is only measured as higher financing costs or, equivalently, lower rates of return. Azzi and Ehrenberg’s (1975) seminal work on the economics of piety led to subsequent studies (e.g., Ehrenberg, 1977; Iannaccone, 1990, 1995; Durkin and Greeley, 1991) focused on explaining the demand side for piety. Our focus in this paper is the supply side of piety and explanations for the existence of IFIs, their Shariah standard(s), and the pricing of goods and services marketed in ways that reflect varying degrees of piety. Piety is complex. Representing its multi-dimensionality in any mathematical model as a vector–rather than scalar–valued attribute (vector-valued profiles of religiosity) invites no simple way of ranking one person’s profile as more religious, or more pious, than another’s. As a technical convenience, the scalar-valued parameter referred to in our model as piety represents an agent’s belief about religious teachings and stringency applied in the interpretation of religious edicts. We acknowledge that the device compresses multi-dimensional beliefs into an overly simplified scalar-valued parameter.

Previous literature on the supply side of piety uses a similarly interpreted scalar-valued approach to describing religiosity in economic models. Barros and Garoupa (2002), for example, use a scalar-valued variable representing the strictness of churches. Based on this description of church preferences for strictness, their model adopts a modified Hotelling model, similar to our approach, to describe how churches position themselves in that ‘strictness space,’ given the heterogeneous preferences in the population of potential churchgoers and the positioning of rival churches.

2.2. Market segmentation

Market segmentation enables firms to focus their services on targeted homogeneous groups of potential consumers. This helps the firm to allocate its limited resources efficiently by strategically selecting the consumer groups whose preferences match the range of contracts it offers. The ability to segment the market relies on information relevant to both the firm and the targeted consumer group (Van Raaij and Verhallen, 1994). Not only does the firm need to distinguish its products (and sometimes itself) using such identifying variables, it also needs to signal its position to the targeted consumer groups. A Priori segmentation uses identifying characteristics, such as demographics, social class, age, or stage in the family life cycle. Post hoc segmentation is often achieved using survey data (Harrison, 1994).

The IF industry is primarily based on religious preferences or piety. It specializes in financial services that meet certain religious beliefs about economic transactions. Customers of IFIs do not, however, hold the same degree, or type, of piety. Hence, market segmentation of IF services can be viewed as necessary for IFIs (to be competitive in attracting customers) and for consumers (to achieve preference satisfaction). Using in-depth interview data collected from financial managers in Singapore and London, Muhamad et al. (2012) describe the Islamic banking market as three main groups. One group is motivated primarily by economic incentives. A second group includes those who are cautious about moral values but not particularly observant of religion. The third group is primarily motivated by religious principles.

In light of the discussion above and our objective to model strategic behavior among multiple IFIs, a minimally fine taxonomy of market segmentation consists of three groups or subpopulations, ordered as low-, moderate- and high-piety types. We do not assume that highly pious customers of financial services are necessarily willing to pay more to make their more stringent lifestyles publically observable. This conclusion is, however, derived from our model as a result.

For a substantial number of IF customers, their financial preferences (in terms of quality of service, profitability and convenience, which serve as criteria for choosing a financial institution) are different from those of consumers who choose conventional finance. See Rosenblatt et al. (1988) on corporate customers; Erol and El-Bdour (1989), Erol et al. (1990), Hegazy (1995) using data from Egypt; Karim and Affif (2005) and Rohmah (2006) on Indonesia; Dusuki and Abdullah (2007) on Malaysia; and Naser et al. (1999) on Jordan. Indeed, a substantial number of consumers have active accounts with both IFIs and non-IFIs.

Other studies of consumer preferences among IFI customers support religiosity as an important motive, but the empirical results vary in terms of the degree to which they prioritize religiosity. For example, studies suggesting that religiosity is the primary motive for choosing an IF include Metawa and Almossawi (1998) and Omer (1992) using data from the U.K.; Othman and Owen (2001) on Kuwait; and Wakhid and Efrita (2007) and Abdub and Omar (2012) on Malaysia. Other studies (Awan and Bukhari, 2011 using data from Pakistan; and Haron et al., 1994; and Haron and Azmi, 2008 on Malaysia) report that although customers’ religiosity plays a role when choosing IFIs, it is not the primary motive.

2.3. Divergence of opinions among IF Shariah Boards

Heterogeneity in the stringency of Shariah Boards’ decisions is not restricted to comparisons between jurisdictions, regions and countries. Heterogeneous decisions by Shariah Boards can be found among IFIs within the same region or city. One account from a senior manager at a Dubai-based asset management firm, for example, describes how his firm’s Shariah Board approved certain products for his own firm but then faced delays in completing sales because the Shariah Boards of other IFIs in Dubai did not permit those same financial products (Torchia, 2012).
Multiple factors contribute to the heterogeneity of Shariah-compliance policies among IFIs. These may or may not reflect conflicting religious opinions among jurists who serve on Shariah Boards. One factor is the nature of Islam itself, which does not have a central authority and therefore allows for (and even embraces) diverse interpretations and understandings of religious texts. Insofar as diversity is viewed as an essential religious tenet of Islam, flexibility and freedom among diverse cultural, geographic and social groups are to be expected. Another factor is the lack of standardization among IFIs. Some countries have specific laws to regulate IFIs. Others have a central authority (not necessarily affiliated with, or appointed by, government) that regulates, or informally manages, IFIs domiciled in a particular country; and in some countries, there is no authority to regulate IFIs apart from individual Shariah Boards (El-Hawary et al., 2007).

Malaysia provides an interesting example in which distinct Shariah-compliance policies are readily observed. Some Malaysian IFIs permit contracts such as Bay‘-al-‘inah, which would not pass the Shariah-compliance policies adopted by IFIs in the Gulf countries. The consequences of permitting a medieval contract such as Bay‘-al-‘inah are crucial both for researchers and active practitioners. A line of Islamic financial products (e.g., Islamic Credit Cards and Negotiable Islamic Debt Certificates (NIDC)) may not be approved in jurisdictions where Shariah standards do not allow the underlying Bay‘-al-‘inah contract (Shaharuddin, 2012). Bay‘ al-dayn (sale of debt) is another contract that is permissible in Malaysia (used in the design of Malaysian Islamic Bonds; see Rosly and Sanusi, 1999) but not in the Middle-East. Our model presented in the next section is motivated by the hypothesis that greater heterogeneity of Shariah-compliance policies is a predictable outcome of the population’s religious and ethnic heterogeneity (e.g., Malaysia’s large non-Muslim minority subpopulations living alongside the Muslim majority).

2.4. Shariah scholars’ reputations

How should we interpret observed heterogeneity in stringency among Shariah Boards? One problem of interpretation is that some IF customers (many perhaps?) may not know very much about Shariah-compliant financial services. Regardless of the extent to which consumers place weight on religious motives, the empirical evidence is that many IF customers have little understanding of Shariah-compliance (even for the IF products they choose). For example, Al-Ajmi et al. (2009) report data showing weak familiarity with Shariah-compliance in Bahrain. They find very low familiarity with most IF products except for murabaha, which is the dominant contract used in Islamic banking. Rammal and Zurbruegg (2007) report similar results among Muslims in Australia.

Where consumers have limited familiarity with Shariah-compliance, how might they infer the degree stringency among different IFIs and IF products? One source of information that is used to make such inferences is the composition of an IFI’s Shariah Scholars Board (SSB) that approves the operations and products of the IFI. Shariah scholars who serve on SSBs are very few, with twenty well-known scholars holding 621 different SSB positions at multiple IFIs (Umal, 2011; Farook and Farooq, 2011). Alman (2012) reports evidence associating multiple memberships among the top-20 Shariah scholars (ranked by the number of SSB positions that a single scholar holds) with higher levels of risk in the loan portfolios of Islamic Banks. A very small number of elite scholars guide the Shariah-compliance decisions of IFIs. The reputations of top-ranked Shariah scholars (who are household names, widely known to consumers in the highly pious segment of the market) appear to also play a significant role in attracting highly pious customers.

Shariah scholars are paid by IFIs to provide fatwas (i.e., religious decisions) on specific financial products. Conflicts of interest are a serious problem according to many practitioners and academics. Responding to this criticism, Shariah scholars defend these potentially conflicting religious and financial motives built into their remunerated relationships with IFIs on the ground that they are accountable before God and, in addition, have a reputation to protect. The reputational component of this argument is observable and, we argue, plays an important role in IFIs’ marketing strategies in regard to different choices over stringency of the Shariah Board.

It is interesting to consider what economic theory might tell us to expect under the usual economic assumptions of rational choice theory. What if IFIs were modeled as own-payoff maximizers subject to the constraint imposed by a uniform minimum standard of Shariah-compliance? Does it follow from rational choice theory that the Shariah-compliance policies of IFIs across the world would tend to converge to this hypothetical uniform minimum standard? We argue that the answer to this question is “No.” Our model shows that Shariah Boards could still have a strong incentive to choose heterogeneous Shariah-compliance standards, helping to achieve informational efficiency and, with it, improve social welfare. Considering the stringency of Shariah-compliance standards as a choice variable reveals how it can be used as a screening device, enabling IFIs to differentiate their brands and product lines to better match different segments of the consumer side of the market.

Two interlinked problems arise. The IF industry’s raison d’être is to provide financial services to these pious segments of the consumer market (i.e., those with a strictly positive willingness-to-pay for Shariah-compliance). If IFIs were to offer excessively lenient products, then they could lose their primary market. Therefore, it likely serves the interest of IFIs to differentiate themselves from conventional finance by offering more stringent products (as in El-Gamal’s, 2002, model). Shariah Boards need to offer sufficiently stringent fatwas to establish and maintain the IFI’s reputation for stringency. The

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5 Bay‘-al-‘inah is a contract that involves sale and buyback of an asset at a markup over the original price. This contract is permissible under the Shafi’i Islamic (madhab) school of thought but prohibited by others. We note that conventional banks actively trade repurchase agreements (REPOS) with central banks, quoting prices as conventional interest rates (i.e., REPO rates).

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latter is the key mechanism that provides consumers with signaling technology. Analysis in later sections shows whether these reputational and signaling incentives lead to: (i) escalation of stringency (i.e., an arms race of ever-increasing stringency among IFIs) as IFIs compete for the highly pious segment; (ii) spiraling toward permissiveness, as IFIs compete for the moderately pious segment; or (iii) a stable outcome with heterogeneous Shariah-compliance decisions among different IFIs that serve different segments of the market.

2.5. Questions

The model in the next section addresses two main questions: (i) under what conditions will there exist a separating equilibrium in which the heterogeneous choices of stringency in Shariah-compliance can be rationalized?; and (ii) can our theoretical mechanism based on signaling explain heterogeneous stringencies of Shariah-compliance decisions by IFIs Shariah Boards as a marketing strategy (while neutralizing the variation in fatwas that stems from genuine disagreements in the interpretation of Shariah Law)? Thus, we set out to make progress toward better explaining market segmentation and observed tensions between the heterogeneity of Shariah Boards’ decisions. We undertake to develop testable implications from theory regarding the role that signaling plays in rationalizing the premiums paid by IFI consumers (i.e., consumers who voluntarily restrict the risk-return choice set of their portfolios and wealth management services). To analyze segmentation on the basis of heterogeneous decisions by Shariah Boards, we assume there are three types of consumers (two of which have strictly positive willingness-to-pay for signaling services by choosing an IFI over conventional finance) and two IFIs.

3. Model

The model adapts Hotelling’s linear city model, where physical distance is interpreted as proportional to the additional financing costs of becoming an IFI consumer rather than using the cheaper non-Islamic financial institution available at each agent’s location on the continuum (i.e., at an exogenously given cost normalized to zero). Agents’ locations are assumed to be distributed uniformly on the unit interval to represent heterogeneity in the publically observable costs borne by an individual when he or she chooses to restrict choice over financial products or, equivalently, pay a premium for Shariah-compliance. Physical movement in Hotelling’s linear city model is interpreted as the decision to move away from conventional finance and become an IF consumer. The model assumes that there are two IFIs, A and B. Each potential IFI consumer faces a cost of becoming an IFI client that is proportional to the distance traveled from his or her initial position to the “location” of the IFI. If an IFI is located at \( z_i \in [0, \infty) \), then the cost borne by an agent at location \( x \) when he or she becomes a client of that IFI is \( t(x - z_i) \), where \( t > 0 \) is the unit transportation cost and the distance norm is given by absolute value of the difference between the two locations. This cost is an agent’s intrinsic disutility. The assumption that \( z_i \) can take any value in the non-negative real line while agents’ initial locations are restricted to the unit interval implies that the IFIs may be located either inside or outside the continuum where agents and their non-Islamic financing options are located.

The model assumes that agents of all piety types receive the same direct utility from IFIs as from the non-Islamic option which is normalized to zero.\(^6\) By abstracting from the multiplicity of motives among pious IFL clients, the assumption that zero intrinsic utility is derived from IFL-client status focuses attention on the signaling mechanism; it shows the economically interesting case of the voluntary payment of two different IFL premiums by agent type. Different IFIs may charge different premiums on the non-IFI option or, equivalently, choose different restrictions on the menu of financial services offered. The model assumes that IFIs can voluntarily set their own premiums even though the scholars who serve on their Shariah Boards agree on the minimum requirements of Shariah Law. Agents whose initial positions are farther away from an IFL are endowed with the possibility (or curse) of publicically incurring a greater cost, which reveals and makes public their otherwise private piety types.

An agent’s true but unobservable piety type \( \omega \) is assumed to take on one of three types: low (L), medium (M), or high (H), \( L < M < H \). We denote \( \Delta M = M - L \) and \( \Delta H = H - M \) to represent exogenously given parameters that determine different willingness to pay to signal piety. An agent’s piety type is private information that other agents, including IFIs and their Shariah Boards, do not know and can never observe directly. Let \( \mu_L, \mu_M, \mu_H \in (0, 1) \) be the proportions of each type within the whole population, where \( \mu_L + \mu_M + \mu_H = 1 \). For notational convenience, the symbol \( \mu \equiv \mu_M + \mu_H \) is introduced to represent the proportion of the population that is to some extent pious (either M- or H-type). It is also assumed that each agent’s initial location \( x \) is known to all agents in the model. Possible interpretations of \( x \) would include the agent’s credit score or neighborhood income, which influences the costs of financial services available to different consumers.

Agents are assumed to make inferences that generate beliefs about the piety of others by observing whether that person is a non-IFI client, a client of A, or a client of B. The observability of piety is a key component of the signaling mechanism analyzed in this paper and has two main components. The two publically observable variables are an agent’s initial location \( x \) and that agent’s observed movement away from the initial location, coded as the choice variable \( m: m = 0 \) codes the decision to be a non-IFI client; \( m = A \) codes the agent’s choice of IFL A; and \( m = B \) codes the agent’s choice of IFL B. Observing both \( x \)

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\(^6\) The assumption that different financial institutions (IFIs and non-IFIs alike) provide equal flows of direct utility does not mean that the products that IFIs and non-IFIs sell are homogeneous. Differentiated characteristics of the products they offer are captured in different distances of financial institutions from their clients.
and \( m \) is required to fully reveal piety types in the separating equilibrium that follows. Agents are assumed to update their beliefs about others' piety types according to Bayes Rule. Based on another agent's initial location and observed IFI status, other agents form posterior beliefs about that agent's piety type, which (in the context of the stylized model) completely characterizes each agent's reputation.

The next step is to specify the social production function that maps an agent's true piety type \( \omega \) and perceived type \( \hat{\omega} \) into a utility flow. The assumption motivating the specification of the utility function that follows is that agents receive extrinsic utility from their reputations as a function of their true piety type. Together, the exogenous data that generate unobservable piety types combine with endogenous beliefs, based on observable initial locations and IFI client-status decisions, to produce social interactions and financial outcomes. These combined social and financial outcomes are then valued differently as a function of each agent's true piety type.

We assume that the benefit an individual gets from interacting with others depends on that individual's true piety type in addition to his or her perceived piety type.\(^7\) We denote this benefit of social interaction as \( V(\omega, \hat{\omega}) \), where \( \partial V/\partial \omega > 0 \) and \( \partial V/\partial \hat{\omega} > 0 \).

For simplicity, we assume that \( V(\omega, \hat{\omega}) = \omega \hat{\omega} \). This functional form implies that the marginal utility of one's reputation in the eyes of other agents depends on one's own piety. This does not necessarily imply that a more pious agent cares more about his or her own reputation for piety.\(^8\) The functional form rather reflects the idea that there is some extrinsic gain from having a reputation for piety and the reputational gain is larger for more pious agents.\(^9\)

Given the definitions above, the model is a three-stage game described as follows. Given any unified standard that may have developed among Islamic jurists (i.e., minimum requirements) for IFIs to comply with Shariah, the two IFIs' Shariah Boards choose their location \( z_i \in [0, \infty) \), interpreted as a choice of stringency or restrictiveness of the financial services offered by the IFI (i.e., the IFI's Shariah-compliance policy). Together with the client's financing option as determined by his or her location, the choices that Shariah Boards \( A \) and \( B \) choose determine the IFI premium that the IFI client faces. Second, individual agents choose one of the three elements in their choice set: non-IFI client, client of IFI \( A \), or client of IFI \( B \).\(^10\) And finally in the third stage of the game, all agents make inferences about the piety types of other agents based on their chosen locations and their decisions about becoming an IFI clients. The decision of one of the following—non-IFI client (choosing conventional financing), client of \( A \), or client of \( B \)—is represented by the choice variable \( m, m \in \{0, A, B\} \).

When considering the three available actions represented by \( m \), the agent of type \( \omega \) with initial location \( x \) (i.e., facing the distances from IFI \( i \), which represent the IFI premium) sees the following payoff function:

\[
u(m, x; \omega) = \begin{cases} V(\omega, \hat{\omega}(x, 0)) & \text{if } m = 0, \\ -t|x - z_A| + V(\omega, \hat{\omega}(x, A)) & \text{if } m = A, \\ -t|x - z_B| + V(\omega, \hat{\omega}(x, B)) & \text{if } m = B. \end{cases}
\]

The payoff of an IFI is determined by two variables: the number of its customers (i.e., the mass or measure of customers, because there is a continuum of agents in the model) and their average piety, denoted by \( \pi_i(P, N) \), where \( P_i \) is the average piety and \( N_i \) is the number of customers. We assume that \( \partial \pi_i / \partial P_i \) and \( \partial \pi_i / \partial N_i > 0 \). We also assume that the primary concern of IFI \( A \) is the measure of its customers, \( N_A \), and that the primary concern of IFI \( B \) is the mean piety of its customers, \( P_B \).

For simplicity, this difference in the marketing objectives can be formulated as lexicographic preferences. Let the preference relation of IFI \( i \) be denoted \( \succ_i \). Then, the IFI's preferences are described by the following orderings:

\[
(P_A^1, N_A^1) \succ_A (P_A^2, N_A^2) \iff N_A^1 > N_A^2 \quad \text{or} \quad P_A^1 > P_A^2 \quad \text{if} \quad N_A^1 = N_A^2,
\]

\[
(P_B^1, N_B^1) \succ_B (P_B^2, N_B^2) \iff P_B^1 > P_B^2 \quad \text{or} \quad N_B^1 > N_B^2 \quad \text{if} \quad P_B^1 = P_B^2.
\]

4. Analysis

As the main solution concept, we employ weak Perfect Bayesian equilibrium (wPBE).\(^11\) Because this is a three-stage sequential game under incomplete information, wPBE rather than Bayesian Nash Equilibrium is a natural solution concept.

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\( ^7 \) This setup is similar to Bernheim (1994) in that an agent's utility depends on his or her type and reputation; our setup is slightly different, however, in that the agent's piety type only affects extrinsic utility in our model, whereas type affects intrinsic utility in Bernheim's model.

\( ^8 \) We are grateful to an anonymous referee for making this point, namely, that a truly pious agent would not care intrinsically about reputation.

\( ^9 \) In Muslim societies (and communities within countries that are not predominantly Muslim), many institutions and important decisions are headed by individual leaders whose reputation for piety is a necessary qualification. For example, it may be necessary that political leaders such as the President or the Prime Minister are sufficiently pious. In decentralized social hierarchies such as those that govern Friday prayers at Mosques, the Imam who leads the prayers should have a reputation of sufficiently high piety.

\( ^10 \) Many banks sell both IF and non-IF products. Thus, an individual's choice can alternatively be interpreted as whether he or she buys an IF product or a non-IF product from a single financial institution offering both.

\( ^11 \) The wPBE concept is defined as a profile of strategies and beliefs such that (i) each type of agent makes a payoff-maximizing choice based on beliefs at each information set and (ii) the posterior beliefs must be updated according to Bayes' Rule whenever possible. Further details on the definition of wPBE are found in Mas-Colell et al. (1995).
The essential step in this solution concept is to compute the posterior belief about an agent’s type (i.e., reputation), conditional on his or her choice as observed by others, according to Bayes’ Rule, which in turn, affects the agents’ (extrinsic) utility.

Let the equilibrium location of IFI \( i \) be \( z^*_i \). Then, the next lemma will turn out to be conveniently used for our analysis.

**Lemma 1.** \( z^*_A, z^*_B > 1 \).

**Proof.** This follows directly from Theorem 1 of Berg and Kim (2014). \( \square \)

The intuition is as follows. If \( z_t \in [0, 1] \) for some \( t=A, B \), then there exists an agent at \( x \in [0, 1] \) who is very near the IFI and consequently faces an arbitrarily small IF premium (i.e., \( |z_t - x| \) is very small). Because the social benefit is strictly positive and there exists an agent for whom the cost is arbitrarily small, such an agent will choose to become a client of IFI \( i \) regardless of piety type. If the IFI sets its premium too low, then it is impossible to exclude the impious type \((L)\).

Lemma 1 implies, in any equilibrium, the locations chosen by the two IFIs are strictly to the right of the unit interval: \( z^*_A, z^*_B > 1 \). This means that the IFIs must impose a strictly positive premium on all clients in equilibrium. Since our goal is to explain market segmentation as an equilibrium outcome, we focus on the case of \( z^*_B > z^*_A > 1 \). Later, we will also consider the possibility of a pooling equilibrium in which \( z^*_A = z^*_B > 1 \).

The first issue is whether a fully separating equilibrium exists. If it does exist, then we will show that the separating equilibrium is described as follows: (i) the IFIs choose \( z^*_A = 1 + (L(M - L))/t, z^*_B = 1 + (L(H - L))/t \); (ii) for any \( x \in [0, 1] \), a type-L agent chooses non-IFI client status, a type-M agent chooses \( A \), and a type-H agent chooses \( B \); and (iii) true piety types are perfectly revealed by the publically observable choices of IFI client status, according to which \( \hat{\omega}(x, 0) = L, \hat{\omega}(x, A) = M, \tilde{\omega}(x, B) = H \), for any \( x \in [0, 1] \). If this could be an equilibrium, then IFI-client status would be shown to provide a signaling service that fully reveals otherwise unobservable piety status: the impious choose non-IFI client status and save themselves the cost of IFI premiums; the moderately pious choose the IFI with modest IFI premiums (or restrictiveness as decided by the IFI’s Shariah Board), \( A \); and the highly pious choose to incur the highest degree of restrictiveness, selecting \( B \).

The uniformity of the minimum Shariah-compliance criterion becomes important at this point. Both \( A \) and \( B \) want to maximize the number of clients who satisfy this uniform standard (i.e., both IFIs want to avoid low-piety types and are happy to have as many medium- and high-piety clients as they can attract). We interpret this uniform standard to be a widely shared understanding of authoritative Islamic jurists. Given this presumed uniformity, the goal is to investigate how segmentation into different degrees of stringency could emerge as strategic choices by different Shariah Boards working to serve the objectives of their associated IFIs. Both IFIs are constrained by the uniform minimum standard to avoid transacting with non-pious \( L \) types. Both IFIs would also like to maximize the number (quantity or mass) of clients, subject to the condition that clients meet the endogenously determined uniform minimum standard. Therefore, the IFIs’ choices of stringency that just meet this condition of excluding \( L \) types is:

\[
\begin{align*}
z^*_A &= 1 + \frac{L(M - L)}{t}, & z^*_B &= 1 + \frac{L(H - L)}{t}.
\end{align*}
\]

At the locations given by the equations above, each IFI satisfies the incentive compatibility constraint which requires that no \( L \) type chooses to be their client, while achieving perfect revelation of all three piety types. Were such an equilibrium to exist, it would be welfare improving in the sense of achieving perfect informational efficiency (i.e., the signaling technology would perfectly reveal all three customers’ piety types) and payoff-enhancing for both IFIs and their customers as well. The property of informational efficiency would explain why the more stringent \( B \) has an incentive to persist in applying more stringent Shariah criteria than \( A \) instead of becoming more permissive (moving toward \( A \)). We will show that this action profile describing an IF market that is perfectly segmented by varying degrees of stringency cannot be an equilibrium. But we proceed to show that a nearly perfect separating equilibrium does exist, which can be chosen arbitrarily close to the perfectly segmented market profile.

Beliefs about individual agents’ types are generated (as posterior Bayesian beliefs) in the separating equilibrium proposed above according to the belief function:

\[
\hat{\omega}(x, m) = \begin{cases} 
L & \text{if } x \text{ chooses } m = 0, \\
M & \text{if } x \text{ chooses } m = A, \\
H & \text{if } x \text{ chooses } m = B. 
\end{cases}
\]

Next, we consider each type of agent’s decision. Given \( z^*_A \) and \( z^*_B \), an individual of type \( L \) located at \( x \in [0, 1] \) faces payoffs:

\[
u(m, x; L) = \begin{cases} 
V(L, \hat{\omega}(x, 0)) = L^2 & \text{if } x \text{ chooses } m = 0, \\
-L(t(z_A - x) + V(L, \hat{\omega}(x, A))) = -t(z_A - x) + L M & \text{if } x \text{ chooses } m = A, \\
-L(t(z_B - x) + V(L, \hat{\omega}(x, B))) = -t(z_B - x) + L H & \text{if } x \text{ chooses } m = B.
\end{cases}
\]

Because both IF premiums are larger, the more distant is an agent’s location \( x \), it follows that all \( L \) types will prefer \( m = 0 \) if the \( L \) type located at \( x = 1 \) does. All agents face at least as large an IF premium as the agent at \( x = 1 \), since the IFIs are to the right of 1. An \( L \) type located at \( x = 1 \) will choose \( m = 0 \) if \( L^2 \geq \max[-t(z_A^* - 1) + LM, -t(z_B^* - 1) + LH] \). Since
max\{-t(z_A^* - x) + M, -t(z_B^* - x) + LH\} = 0 at $z_A^* = 1 + (L(M - L))/t$ and $z_B^* = 1 + (L(H - L))/t$, the condition guaranteeing that all L types prefer $m = 0$ is trivially satisfied.

Similarly, the payoff of an M type located at $x \in [0, 1]$ is:

$$u(m, x; M) = \begin{cases} 
  ML & \text{if } x \text{ chooses } m = 0, \\
  -t(z_A - x) + M^2 & \text{if } x \text{ chooses } m = A, \\
  -t(z_B - x) + MH & \text{if } x \text{ chooses } m = B. 
\end{cases}$$

(7)

The M type at $x = 1$ will prefer A over B if $-t(z_A - x) + M^2 \geq -t(z_B - x) + MH$, which is equivalent to the condition:

$$z_B - z_A \geq \frac{M(H - M)}{t}.$$ 

(8)

Because $z_B^* - z_A^* = (L(H - M))/t < (M(H - M))/t$, this condition is not satisfied, implying that there exists a set of M types near $x = 1$ who prefer B over A. The existence of M types who want to defect from the fully separating outcome described above means that it cannot be supported as an equilibrium.

The intuition for this negative result is that B’s Shariah-compliance policy (in the perfectly segmented action profile) $z_B^*$ is set to barely prevent L types from mimicking H types and therefore is not stringent enough to prevent some M types from mimicking H types. Thus, it is a natural to conjecture that a fully separating equilibrium may be possible if $z_B^*$ were chosen farther away from $z_A^*$ (i.e., B chooses a more stringent Shariah-compliance policy) to make it just costly enough for M types to mimic H types that no M type will choose B. Below, we show that this turns out to be the case. The following proposition is our main result addressing the first of the two questions posed in Section 2.4.

**Proposition 1.** There exists a separating equilibrium if $t \leq (L M)^2$. In the separating equilibrium, (i) $z_A^* = 1 + (L M)/t, z_B^* = 1 + (L M + M H)/t$; (ii) for any $x \in [0, 1]$, all L types choose $m = 0$ (i.e., non-IF client status), all M types choose $m = A$, and all H types choose $m = B$; and (iii) $\tilde{\omega}(x, A) = M, \tilde{\omega}(x, B) = H, \tilde{\omega}(x, 0) = L$ for any $x \in [0, 1]$.12

**Proof.** See Appendix. □

If B deviates from $z_B^* = z_B^* - \epsilon, \epsilon > 0$, (moving slightly toward A), then some M type at $x \in (1 - \epsilon, 1)$ could mimic H types by choosing B. Then B could attract slightly more clients at a slight sacrifice of its clients’ mean piety. Because the primary concern of B’s Shariah Board is the average piety of its clients, it will not choose to deviate.13 It is clear that B will not choose to deviate by moving to A’s location. It is also clear that A will not choose to deviate. If A were to choose $z_A^* - \epsilon$, then A would attract some unwanted L-type clients. If A were to choose $z_A^* + \epsilon$, then it would lose some of its M-type clients, which contradicts the goal described by its preferences.

Why are pious people willing to pay high premiums for IFI products? One reason that is not included as a motive in our model is that agents may have a firm belief that using IFI products provides a direct flow of extrinsic utility. We do not deny that possibility. Our model, however, focuses on the indirect benefit of being an IFI-client. Thus, the essence of the proposition above is that pious people are willing to sacrifice secular (i.e., intrinsic) benefits associated with worldly consumption insofar as that sacrifice enhances utility. Having a reputation for piety can enable pious individuals to become more influential in their religious communities and other social interactions. It is precisely this indirect mechanism in our model that explains why high-piety types are willing to pay IFI premiums.14

The next possibility we consider is a partially separating equilibrium. In the separating equilibrium characterized in Proposition 1, each agent of a particular type has a uniform best response (within its subpopulation of agents of the same type), regardless of location. All H types choose B; all M types choose A; and all L types choose non-IF client status. This action profile holds uniformly even when $x_M < x_M < 0$, i.e., $t \leq (L M)^2$. One may wonder if there exists an interior solution $x_M > 0$ when the transportation cost is very low. In other words, might there be a partially separating equilibrium in which M types located at $x \in (x_H, x_M)$ choose $m = 0$ over $m = A$? This would imply that the choice of $m = 0$ by an agent at $x \in [x_H, x_M]$ does not fully separate types, because others might believe that the agent is an L or M type. The next proposition shows that this is not possible.

---

12 To complete the off-the-equilibrium path strategy specification, we can interpret the strategy $m = A$ as going to a closer and therefore less stringent IFI if and only if $z_A^* < z_B^*$, and we can interpret the strategy $m = B$ as going to a farther-away and therefore more stringent IFI if and only if $z_A^* < z_B^*$. Then, the beliefs about types can be pinned down off the equilibrium path (i.e., when $z_A^* + z_B^*$). If $z_A^* = z_B^*$, both M and H randomly choose between $m = A$ and $m = B$, and the perceived type is the weighted average $\frac{z_A^* + z_B^*}{2} M + \frac{z_A^* + z_B^*}{2} H$.

13 Some may suspect that this result relies critically on asymmetric preferences of two IFIs. But this is not the case. Because $z_A^* < z_B^*$ is off the equilibrium path, other agents may assign arbitrary beliefs to such action profiles. For example, if the most pessimistic belief, $\tilde{\omega} = L$, is assigned to off-equilibrium action profiles, then this belief mechanism, which is outside the IFI’s control, could support the choices by IFIs given in Proposition 1 as an equilibrium, without requiring asymmetric preferences among IFIs. IFI B would not have an incentive to choose $z_B^* < z_A^*$ because the IFI’s Shariah Board (and possibly its clients) would believe that all agents choosing to be clients of B are L types, which results in a substantial loss according to its objective function.

14 Analogously, Mother Teresa can be interpreted as having devoted herself to helping patients suffering with Hansen’s disease—despite the risk of being infected—not simply because she experienced direct altruistic pleasure from helping them, but also because she believed that her actions could influence and move others to follow her example.

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Proposition 2. There does not exist a partially separating equilibrium in which (i) \( z_A^m < z_B^m \); (ii) \( H \) types choose \( m = B \) if \( x \geq x_H \) (possibly 0), and otherwise \( m = 0 \); \( M \) types choose \( m = A \) if \( x \geq x_M \), and otherwise \( m = 0 \); and type-L agents choose \( m = 0 \) for any \( x \in [0, 1] \); (iii) with the belief profile given by:

\[
\hat{\varphi}(x, m) = \begin{cases} 
L & \text{if } m = 0, \\
M & \text{if } m = A \text{ for } x \geq x_M, \\
H & \text{if } m = B.
\end{cases}
\]

\[
\hat{\varphi}(x, m) = \begin{cases} 
\frac{\mu_M}{\mu} M + \frac{\mu_L}{\mu} L & \text{if } m = 0, \\
\text{any belief} & \text{if } m = A \text{ for } x \in [x_H, x_M), \\
H & \text{if } m = B.
\end{cases}
\]

\[
\hat{\varphi}(x, m) = \begin{cases} 
\mu_L L + \mu_M M + \mu_H H & \text{if } m = 0, \\
\text{any belief} & \text{if } m = A \text{ for } x \in [0, x_H), \\
\text{any belief} & \text{if } m = B.
\end{cases}
\]

In other words, there exists no cut-off value \( x_M \in (0, 1) \) that supports a partially separating outcome as an equilibrium.

Proof. See Appendix. \( \square \)

One important feature that distinguishes the partially separating equilibrium from the fully separating equilibrium is that an \( M \)-type agent located at \( x = x_M - \epsilon \) chooses non-IF-client status in the partially separating equilibrium. In this case, when an agent at any location in the half \( \epsilon \)-ball to the left of \( x_M \) is observed to choose conventional finance, this choice does not wrongly reveal the \( M \) type as an \( L \) type. Rather, the observed choice of non-IF conventional finance sends a noisy signal: other agents perceive that an \( M \) type choosing conventional finance is either type \( L \) or type \( M \). The fact that the reputational loss is not a total loss (as a consequence of choosing \( m = 0 \)) makes this choice more attractive relative to choosing \( m = B \). Conditional on \( m = 0 \), the agent’s reputation does not fall all the way to \( L \) but rather to an intermediate reputation somewhere between \( L \) and \( M \). Staying at one’s initial location and choosing the non-IF status is always cheaper than being an IF client and, in the partially separating action profile described in Proposition 2, incurs less of a reputational loss than in the fully separating equilibrium. The fact that reputational losses among higher-piety agents choosing conventional finance falls when the most stringent IFI becomes more stringent, because posterior beliefs about agents’ types conditional on \( m = 0 \) become more dilute (i.e., less informative), also shows why a smaller equilibrium value of \( z_B^m \) is expected. In that case, however, an \( L \) type located at \( x = 1 \) would deviate to \( m = B \), because the cost of pretending to be a high-piety type declines to zero as \( z_B^m \) approaches 1 from above.

5. Conclusion

This paper has extended the model of Berg and Kim (2014) to include three types of consumers (high-, medium-, and low-piety types) and two IFIs whose Shariah Boards choose intensities of stringency for Shariah-compliance. The model provides an explanation for market segmentation in the IF industry, a puzzle first raised by El-Gamal (2002), based on a screening mechanism. We characterized a separating equilibrium in which one IFI targets more highly pious customers than the other, choosing to voluntarily increase the stringency of its Shariah-compliance policy more than is minimally required according to jurists’ unified understanding of the legal minimum standard.

It is reasonable to ask whether one might explain market segmentation among IFIs using a simpler model. For example, Salop (1979) considers the problem of free entry into a circle (or a line) with perimeter equal to one. If we were to adapt Salop’s model to the context of IFIs, then a particular location on the unit interval could be interpreted as an agent’s piety. If, as in Salop (1979), the (symmetric) entrants incur fixed entry costs, say \( K \), and they are supposed to enter equidistantly as long as their net profit is non-negative, then the number of firms is completely determined by \( K \). As such, each firm can only serve consumers in a locally separated market.

Although the mechanism just described is simpler, it has a fatal drawback for our purposes of analyzing market segmentation. In Salop’s model, firms cannot choose their own location (i.e., their own differentiated financial products). Rather, a firm’s location is determined by the number of firms; each firm is therefore forced to passively produce products with characteristics determined by their market. In this sense, we believe that Salop’s model can, at most, provide only limited insight into market segmentation because product differentiation is not a decision variable in the Salop-inspired setup.

Another modeling issue is that the location of an agent should not be interpreted as piety because, to be consistent with the interpretation of spatial variation in Salop’s (1979) model, location should be interpreted by the characteristics of the financial products it offers. Piety of an agent should be measured in a different dimension from the preferences that his or her location reflects. Therefore, we argue that it is more natural that two firms compete for consumers in a two-dimensional space (as in our model) where agents are heterogeneous both in terms of piety as well as costs they face in expressing piety.

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Interpreting the locations of both consumers and firms as piety leads only to a trivial and straightforward re-interpretation of D’Aspremont et al. (1979). The literal interpretation of D’Aspremont’s model in our context would be nearly tautological: that one IFI sells financial products requiring high piety to target more pious consumers, while the other sells products requiring medium piety to target moderately pious consumers. Therefore, we specify our model as a two-dimensional extension of product differentiation models (represented by D’Aspremont et al., 1979, and Gabszewicz and Thissen, 1986) by adding the new ingredient of a second parameter (i.e., piety) and incomplete information about piety types. Why three types? Partitioning the population into three piety types rather than allowing for a continuum of piety types is a technical simplification to avoid the challenge of respecting a continuum of incentive compatibility conditions.15

It would be worthwhile to pursue further empirical investigation linking the features of our simple model of heterogeneous Shariah-compliance policies and market segmentation to field data and testing in the experimental lab.

Appendix.

Proof of Proposition 1. If \( z_B^* = 1 + (\Delta M + M \Delta H) / t \), the condition for \( M \) types to not mimic type \( H \), which is given by inequality (8), is satisfied, and all \( M \) types prefer \( m = A \) over \( m = B \). If \( -t(z_A - x) + H M \leq \frac{H(H-M)}{t} \), the previous inequality is satisfied. Therefore, all \( H \) types prefer \( m = B \) over \( m = A \). And if \( -t(z_B - x) + H L \leq H L \), then it is also true that all \( H \) types prefer \( m = B \) over \( m = A \). Because \( -t(z_A - x) + H M \leq \frac{H(H-M)}{t} \), we observe that \( H \) types located at any \( M \) and \( B \) will choose \( m = A \).

Proof of Proposition 2. Define \( x_M(z_B) \) as the value of \( x \) that satisfies \( -t(z_B - x) + M H = M(\frac{H + M}{M} + \frac{M}{M} L) \). This value of \( x \) makes an \( M \) type at that location indifferent between \( m = A \) and \( m = B \).

Lemma 2. In equilibrium, it must be the case that \( x_M = x_M \).

Proof. Suppose \( x_M < x_M \). Consider \( x \in (x_M, x_M) \). Because all \( M \) types at \( x > x_M \) are supposed to choose \( m = A \), it must be the case that \( x_M = x_M \). Since \( M \) types at \( x \in (x_M, x_M) \) prefer \( m = B \), this is a contradiction. If \( x_M = x_M \), then \( M \) types at \( x \in (x_M, x_M) \) are supposed to choose \( m = A \); but they prefer \( m = 0 \) over \( m = A \), because \( x < x_M \). This is also a contradiction. The equality in the statement of the Lemma can be similarly proved in the case where \( x_M > x_M \).

Lemma 3. In a partially separating equilibrium, it must be the case that \( z_B^* < z_B^* \).

Proof. By definition of \( x_M(z_B) \), we have:

\[-t(z_B - x_M(z_B)) + M H = M \left( \frac{H + M}{M} + \frac{M}{M} L \right) \]

At \( z_B = z_B^* \), it follows that:

\[x_M(z_B^*) = 1 + \frac{L(M - L) - M \left( \frac{H + M}{M} - \frac{L}{M} \right)}{t} \geq 1 - \frac{(M - L)^2}{t} = x_M \]

Because \( x_M \) is increasing in \( z_B \), the equality \( x_M(z_B^*) = x_M \) implies that \( z_B^* < z_B^* \).

We will show that the condition guarantees that \( M \) types located at \( x_M \) will prefer \( m = A \) over \( m = B \) is \( z_B - z_A > \frac{M H - M}{t} \). Given that \( z_A = 1 + \frac{L(M - L)}{t} \), it must be the case that \( z_B \geq 1 + \frac{L(M - L)}{t} + \frac{M H - M}{t} = z_B^*. \) This is a contradiction.

---

15 While D’Aspremont et al. explains market segmentation in equilibrium, Gabszewicz and Thissen’s model cannot explain it because both firms choose the same location in their model. Moreover, Gabszewicz and Thissen obtain the result that \( z_B = z_B = 1 \) (using the notation of our model above) by arbitrarily restricting the strategy space of the firms to \( z_e \in [1, \infty) \). In contrast, we obtain the result that \( z_B, z_B > 1 \) without restricting any customer or IFI’s strategy space to be bounded.
References


