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INTEGRATING *FATANAH* INTO CONDITION 3 OF THE HUSTON–SPENCER ADVERSE SELECTION MODEL: EFFECTS ON INFORMATION UNCERTAINTY AND EQUILIBRIUM

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Abstract:

Asymmetric information may generate adverse selection when buyers cannot distinguish the true quality of goods, and Huston and Spencer showed that the range R of quality that buyers cannot distinguish determines whether the lemons problem persists; nevertheless, the model excludes the Islamic value dimension that could explain how such uncertainty is reduced. Accordingly, this study aims to integrate *Fatanah* into Condition 3 of the Huston–Spencer adverse selection model through the development of a conceptual mathematical model that reproduces the original equilibrium formula and Condition 3 without altering them, introducing *Fatanah* as a normalised variable that acts through the quality range rather than through the buyer's valuation parameter. The proposed functional form $R_F = R_0(1 - F)$ yields $F \uparrow \Rightarrow R_F \downarrow$, so the range eventually satisfies $R_F \leq 2q_m(1 - \frac{1}{d})$, the boundary at which Condition 3 ceases to hold and buyers become sufficiently informed, moving the equilibrium out of the lemons region; the proposed model thus provides a formal Islamic economic interpretation of *Fatanah* as an information-enhancing mechanism capable of reducing adverse selection.

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Introduction

Akerlof (1970) showed that sellers' private knowledge of quality leaves buyers uncertain, compelling them to bid the average expected quality, overpaying for "lemons" and undervaluing good cars (Henide, 2021). As Olabarrieta et al. (2023) observed, such asymmetry may cause high-quality sellers to exit, allowing inferior goods to displace superior ones and depressing prices. Eventually, Ronteau et al. (2022) argued, such erosion of quality may shrink the market and culminate in its non-existence.

Huston and Spencer (2002) extended the lemons framework to markets where buyers cannot distinguish quality across a range R , modelling q_m as maximum quality and d as the buyer valuation parameter. Their equilibrium price, $P^* = \frac{q_m - R}{2/d - 1}$, equivalently $P^* = \frac{d(q_m - R)}{2 - d}$, may decline as the undifferentiated range R widens. They further suggested that information enters the model through R , since greater information shrinks R and raises the equilibrium price.

Huston and Spencer (2002) specified Condition 3, $R > 2q_m \left(1 - \frac{1}{d}\right)$, which requires the indistinguishable quality range R to remain sufficiently wide. When Condition 3 is violated, buyers may be sufficiently well-informed to avoid the lemons problem, and equilibrium occurs on the vertical supply segment at a price above q_m . Information enters the model through R , so better-informed buyers may narrow R , potentially overturning this condition and raising the equilibrium price.

Huston and Spencer (2002) explained how expanded information narrows the quality range and raises equilibrium prices, yet their account remains purely economic. Consequently, the ethical and intellectual mechanism that generates information quality from an Islamic economics perspective appears to remain underexplained. This gap invites a framework linking Islamic ethical cognition to the formal conditions of information uncertainty.

To address this void, the present study introduces *Fatanah*, which Thamrin et al. (2021) identify as a fundamental value of spiritual entrepreneurship. *Fatanah* is not advanced as a substitute for the Huston–Spencer framework, but rather as its ethical–intellectual complement. Formally, *Fatanah* may generate an information capability that compresses the range of indistinguishable quality, R , thereby reducing information uncertainty.

This study aims to integrate the *Fatanah* element into Condition 3 of the Huston–Spencer adverse selection model and mathematically demonstrate its effect on information uncertainty and equilibrium. Drawing on Thamrin et al. (2021), it formalises *Fatanah* as wisdom, intelligence, and competence, which narrow the undifferentiated quality range, R . The study suggests that integrating *Fatanah* into Condition 3 may shrink R , thereby reducing information uncertainty and potentially raising the equilibrium price, consistent with Huston and Spencer's (2002) prediction.

Literature Review

Akerlof (1970) is generally credited with founding adverse selection theory by demonstrating that quality uncertainty forces buyers to bid only the average expected quality. Henide (2021) explained that buyers consequently systematically overbid for lemons and underbid for good cars. Olabarrieta et al. (2023) observed that bad cars displace good cars and prices decline, with Yao and Drábek (2021) concluding that above-average-quality cars exit the market.

Huston and Spencer (2002) assume sellers know true quality, whereas buyers cannot distinguish items within $q_m - R \leq q \leq q_m$. Expected quality supplied is $q_s = \frac{p+q_m-R}{2}$, demand is $q_d = \frac{p}{d}$, and equilibrium yields $P^* = \frac{d(q_m-R)}{2-d}$. The price may decline as the undifferentiated range R widens, because buyers discount for quality uncertainty.

Huston and Spencer (2002) imposed four conditions for the lemon's equilibrium, but only Condition 3, $R > 2q_m \left(1 - \frac{1}{d}\right)$, is analysed here. This inequality requires that the range of quality buyers cannot differentiate remains sufficiently wide. When R is small enough that Condition 3 is violated, consumers may be sufficiently informed to avoid the lemons problem altogether.

In such cases, Huston and Spencer (2002) suggested that equilibrium occurs on the vertical portion of the supply curve rather than on its upward-sloping segment. Information therefore appears to enter the model primarily through R , because greater information compresses the range of indistinguishable quality. A sufficiently narrow R may therefore move the market beyond the lemon's region, where adverse selection no longer depresses equilibrium prices (Masters & Finaret, 2024).

Fatanah, one of the four prophetic traits, denotes intelligence, wisdom, and competence in Islamic thought, epitomised by Prophet Muhammad, peace be upon him (Asutay et al., 2023). Mariyono (2024) treated *Fatanah* as "intelligence" or "wisdom" that extends beyond profit-seeking, encompassing continuous learning, adaptability, and openness to new information. Likewise, Haron et al. (2022) described *Fatanah* as intellectual knowledge and wisdom, interpreted as wise, smart, innovative, creative, and strategic conduct in business management. In the Qur'an, wisdom (*hikmah*) is presented in Surah al-Baqarah, verse 269, as a divine gift conferring abundant good (Syafira & Lubis, 2023). The hadith narrated by Shaddād ibn Aus

likewise defines the intelligent person as one who holds his soul to account and works for the afterlife, recorded in Sunan al-Tirmidhī (no. 2459) and graded hasan (Ismail & Fatah, 2023). Muliyanthy et al. (2024) added that *Fatanah* obliges leaders to possess intelligence and skill in understanding and solving problems, reflecting sound judgement.

Collectively, these attributes may constitute the information-processing capability that distinguishes *Fatanah* entrepreneurs, who, as Mariyono (2024) observed, continuously learn, absorb new information, and adjust their strategies. Ardiansyah et al. (2024) concurred that *Fatanah* fosters creativity and innovation because its possessor constantly acquires knowledge and information. Within the Huston–Spencer framework, such improved information processing may lower uncertainty, expressed as *Fatanah* → better information processing → lower uncertainty.

Huston and Spencer (2002) suggest that the range of quality R appears to be contingent upon the buyers' information set I . This study extends that logic through the chain $F \rightarrow I \rightarrow R \rightarrow P^* \rightarrow$ Adverse Selection, positing that since $\frac{\partial R}{\partial F} < 0$, *Fatanah* compresses R , raises the equilibrium price P^* , and curbs adverse selection. This bridge leads directly to the mathematical integration of *Fatanah* into Condition 3 in the methodology.

Methodology

The present study is a conceptual and mathematical model-extension, not an empirical paper. The analysis proceeds through three methodological steps: first, it reproduces the original Huston–Spencer equilibrium without altering its formulas. Second, Condition 3 is treated as the theoretical boundary that identifies when the lemons equilibrium may prevail.

Third, *Fatanah* is conceptualized as a variable that may influence R rather than d . The parameter is normalised as $0 \leq F \leq 1$, where $F = 0$ denotes the lowest and $F = 1$ the highest level of *Fatanah*. Accordingly, this study proposes $R_F = R_0(1 - F)$, such that greater *Fatanah* may proportionally compress the quality range.

Notably, the present study introduces this functional form, which is not part of the original Huston–Spencer model. This modification serves to operationalise how Islamic ethical intelligence may reduce information uncertainty within that framework. This clarification may assist reviewers, as it distinguishes the present contribution from the base model.

Mathematical Integration of *Fatanah* Into Condition 3

Huston and Spencer (2002) posited that sellers know true quality, while buyers cannot distinguish items within $q_m - R \leq q \leq q_m$. Expected quality supplied is $q_s = \frac{p + q_m - R}{2}$, demand is $q_d = \frac{p}{d}$, and market equilibrium $q_s = q_d$ yields $P^* = \frac{d(q_m - R)}{2 - d}$. This appears to reproduce the original Huston–Spencer solution without modifying any formulas.

Substituting the equilibrium price into demand gives $q^* = \frac{P^*}{d}$, which simplifies to $q^* = \frac{q_m - R}{2 - d}$. Huston and Spencer (2002) used this quality outcome to delineate trade under adverse selection. Equilibrium quality may therefore decline as the undifferentiated range R widens.

When all goods are sold, average quality equals $q_K = \frac{(q_m - R) + q_m}{2}$, which simplifies to $q_K = q_m - \frac{R}{2}$, where supply turns vertical. Huston and Spencer (2002) located this supply kink at the price where all sellers are willing to sell. Consequently, q_K marks the boundary between the upward-sloping and vertical segments of supply.

For the lemons equilibrium to occur before the vertical segment, equilibrium quality would need to satisfy $q^* < q_m - \frac{R}{2}$. Substituting $q^* = \frac{q_m - R}{2 - d}$ and solving the resulting inequality appears to yield $R > 2q_m(1 - \frac{1}{d})$. This appears to recover Condition 3 of Huston and Spencer (2002).

Economically, when $R > 2q_m(1 - \frac{1}{d})$ holds, information uncertainty may remain sufficiently high for the lemons problem to persist (Huston & Spencer, 2002). Olabarrieta et al. (2023) likewise suggested that unresolved information asymmetry allows inferior goods to displace superior ones and depress prices. Conversely, when $R \leq 2q_m(1 - \frac{1}{d})$, buyers may be sufficiently well informed to avoid the lemons problem completely.

Fatanah is conceptualised in this study as a normalised variable $0 \leq F \leq 1$, where $F = 0$ denotes the lowest and $F = 1$ the highest level of *Fatanah*. Building on Thamrin et al. (2021), who associated *Fatanah* with entrepreneurial competence, $R_F = R_0(1 - F)$. This functional form, which the present study introduces, does not appear in the original Huston–Spencer model.

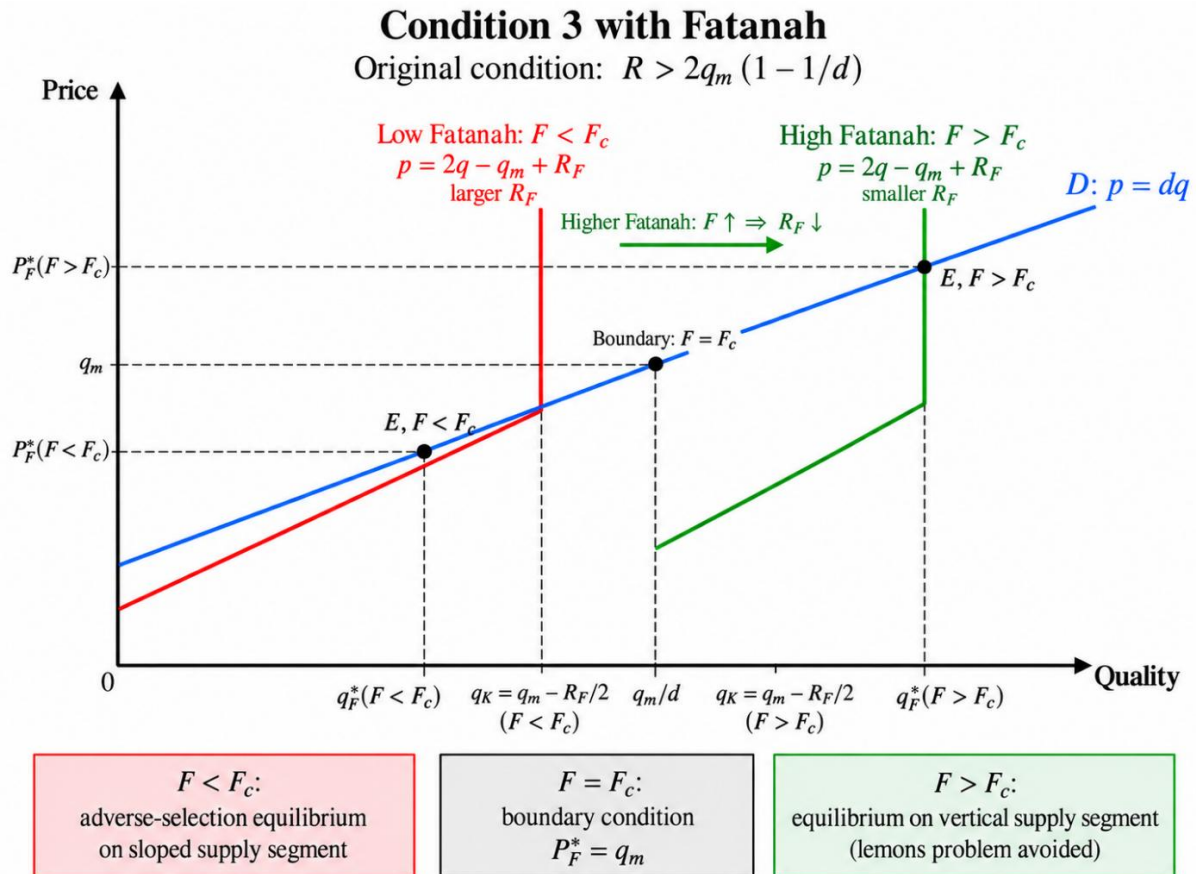
At the boundaries, $F = 0$ yields $R_F = R_0$, the full original range, whereas $F = 1$ yields $R_F = 0$, implying fully informed buyers. Differentiating yields $\frac{\partial R_F}{\partial F} = -R_0 < 0$, suggesting that higher *Fatanah* may compress the quality range. Huston and Spencer (2002) showed that a smaller R implies better-informed consumers who can distinguish finer gradations of quality. Substituting R_F into quality supply, building on the Huston–Spencer model, gives $q_s(F) = \frac{p + q_m - R_0(1 - F)}{2}$. Demand, $q_d = \frac{p}{d}$, remains unchanged. This specification is deliberate, as *Fatanah* appears to operate through the perceived quality range rather than through buyers' valuation parameter d .

Setting $q_s(F) = q_d$ and solving yields the *Fatanah*-integrated equilibrium price $P_F^* = \frac{d[q_m - R_0(1 - F)]}{2 - d}$. This expression mirrors the original solution with R replaced by $R_0(1 - F)$. At $F = 0$, the model appears to reduce to the original Huston–Spencer equilibrium.

The comparative static derivative is $\frac{\partial P_F^*}{\partial F} = \frac{dR_0}{2 - d} > 0$. Accordingly, increases in *Fatanah* may raise the equilibrium price, consistent with the increase in information reported by Huston and Spencer (2002). Hopenhayn and Saeedi (2023) likewise found that improved information aligns prices more closely with true quality.

Replacing R with R_F in Condition 3 gives $R_0(1 - F) > 2q_m(1 - \frac{1}{d})$. This inequality appears to delineate the direct role of *Fatanah* in the lemons boundary. Huston and Spencer (2002) defined Condition 3 as the threshold above which adverse selection persists.

Solving the inequality for F yields the critical *Fatanah* threshold $F_c = 1 - \frac{2q_m(1-\frac{1}{d})}{R_0}$. This threshold may constitute a principal mathematical contribution of the present study. At $F = F_c$, the integrated range coincides exactly with the boundary value; consequently, $P_F^* = q_m$.



This threshold distinguishes three regimes. When $F < F_c$, $R_F > 2q_m(1 - \frac{1}{d})$, so adverse selection persists; when $F = F_c$, $P_F^* = q_m$. When $F > F_c$, $R_F < 2q_m(1 - \frac{1}{d})$, and equilibrium moves to the vertical portion of supply, consistent with Huston and Spencer's (2002) prediction for sufficiently informed buyers.

The complete model is therefore piecewise, with $P_F^* = \frac{d[q_m - R_0(1-F)]}{2-d}$ for $F < F_c$, $P_F^* = q_m$ at $F = F_c$, and $P_F^* = d[q_m - \frac{R_0(1-F)}{2}]$ for $F > F_c$, where $F_c = 1 - \frac{2q_m(1-\frac{1}{d})}{R_0}$ (Huston & Spencer, 2002). The mechanism is $F \uparrow \Rightarrow R_F \downarrow \Rightarrow$ information asymmetry $\downarrow \Rightarrow P_F^* \uparrow \Rightarrow$ adverse selection $\downarrow$. Yao and Drábek (2021) confirmed that unresolved information asymmetry likewise generates adverse selection in peer-to-peer lending, underscoring, at least to a certain extent, the apparent generality of this mechanism.

Discussion

In the proposed model, *Fatanah* functions not merely as an ethical attribute but as an information-enhancing capability grounded in wisdom, intelligence, and competence. Such traits equip entrepreneurs to learn continuously, absorb knowledge, and work intelligently (Mariyono, 2024). Within the extended framework, this capability appears to compress the quality range that buyers cannot distinguish, thereby strengthening information quality and reducing uncertainty.

Huston and Spencer (2002) defined R as the range of quality that buyers cannot distinguish, whereas d captures buyers' valuation of quality. Modifying d would imply that *Fatanah* changes buyers' preferences, but *Fatanah* instead improves their information, not their tastes. Accordingly, linking *Fatanah* to R may be more consistent with the original framework than linking it to d , because information enters the model exclusively through R .

The critical threshold F_c is not merely a numerical value but a theoretical boundary where information capability becomes sufficiently high. At this point, the market transitions from a lemons equilibrium, in which adverse selection depresses prices, to a no-lemons equilibrium on the vertical supply segment (Huston & Spencer, 2002). Olabarrieta et al. (2023) observed that unresolved asymmetry drives high-quality sellers to exit and depresses prices, underscoring, at least in part, the apparent significance of crossing this threshold.

The principal contribution of this article may be understood as the integration of Islamic ethical and intellectual values with information economics within a formal mathematical model. *Fatanah* does not appear to replace Akerlof's lemons theory or the Huston–Spencer framework but may instead extend the latter's information mechanism through a *Fatanah*-based interpretation. Huston and Spencer (2002) demonstrated how additional information raises equilibrium prices, while appearing to leave the production of information theoretically unspecified.

This integration may offer Islamic economics a rigorous, testable channel through which spiritual values can affect market outcomes, rather than remain a purely normative appeal. Thamrin et al. (2021) showed that spiritual values can sharpen entrepreneurial competitiveness. In this sense, the model may bridge Islamic scholarship and mainstream information economics, thereby assigning *Fatanah* a more precise operational meaning within an established theoretical framework.

Conclusion

This study integrated *Fatanah* into Condition 3 of the Huston–Spencer adverse selection model. Huston and Spencer (2002) demonstrated that information enters their framework solely through the undifferentiated quality range, R , so the integration targeted that range rather than the demand parameter. Accordingly, the objective was to formalise how Islamic ethical intelligence reduces information uncertainty within their original structure.

The proposed functional form $R_F = R_0(1 - F)$ suggests that higher *Fatanah* may compress the quality range, since $F \uparrow$ implies $R_F \downarrow$. The comparative static, $\frac{\partial P_F^*}{\partial F} = \frac{dR_0}{2-d} > 0$, is consistent with the conclusion that increasing *Fatanah* may raise the equilibrium price. Moreover, the

critical threshold $F_c = 1 - \frac{2q_m(1-1/d)}{R_0}$ may demarcate the lemons equilibrium, in which adverse selection persists, from the no-lemons equilibrium, in which consumers may be sufficiently informed.

A key limitation may be that the proposed *Fatanah* function is theoretical and requires empirical validation with real market data. Future research might calibrate R_0 and d in Islamic financial markets, where screening mechanisms may reduce adverse selection. The model may therefore provide a mathematical foundation for interpreting *Fatanah* as an information-enhancing mechanism capable of mitigating adverse selection without replacing the original structure of the Huston–Spencer model.

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