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Do Mutual Recognition Agreements Reduce Geographic Barriers? Sectoral Evidence from Indonesia's Halal Exports to ASEAN

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Abstract: This study examines whether mutual recognition agreements on halal certification are associated with lower geographic barriers to Indonesia's exports to Association of Southeast Asian Nations markets across four sectors: food, pharmaceuticals, cosmetics, and fashion. It uses secondary panel data covering nine destination countries over 2014-2023 and applies a gravity-model framework with pooled ordinary least squares, fixed-effects, random-effects, and correlated random-effects estimations. The analysis incorporates economic, religious-demographic, and institutional variables and an interaction term between geographic distance and mutual recognition agreements. The findings reveal substantial sectoral differences. Food exports are mainly associated with destination-market size and cultural proximity. In pharmaceutical and cosmetics exports, the distance-agreement interaction is positive and statistically significant. By contrast, the interaction is negative and significant only at the ten-percent level for food exports and statistically insignificant for fashion exports. The included macroeconomic and institutional variables also explain fashion exports less effectively than the other sectors. These findings indicate that the relationship between halal certification recognition and geographic trade barriers is not uniform across industries. The study contributes a sectoral typology of halal exports and applies correlated random-effects estimation to examine both time-varying and time-invariant trade determinants.

Keywords: Halal exports, Mutual recognition agreements, Geographic distance, Gravity model, ASEAN.

INTRODUCTION

Indonesia's position in the global Islamic economy creates substantial opportunities for expanding its halal product exports. According to the State of the Global Islamic Economy Report 2023/24, Indonesia ranked third in the global Islamic economy, with notable positions in several halal-related industries, including second in halal food, third in fashion, and fifth in cosmetics and pharmaceuticals (DinarStandard, 2023). These achievements demonstrate Indonesia's potential to strengthen its competitiveness in the international halal market. Nevertheless, Indonesia accounted for only 1.04% of global exports in 2024 (International

Trade Centre, 2024). This condition highlights the importance of strengthening export diversification and improving market access, particularly in industries with opportunities for further development. The Indonesian government's commitment to this direction was also reflected in the Indonesian Islamic Economy Masterplan 2019-2024, which established the ambition to position Indonesia as a global center for the Islamic economy and halal industry (Komite Nasional Ekonomi dan Keuangan Syariah, 2019).

The expansion of halal exports, however, involves more than domestic production capacity and international market demand. Cross-border trade is also shaped by geographic distance, economic conditions, cultural proximity, and institutional arrangements. In the gravity model of international trade, geographic distance represents an important determinant of bilateral trade because it is associated with transportation and transaction costs (Anderson & van Wincoop, 2003; Head & Mayer, 2014). In halal trade, institutional requirements also become relevant because products must comply with specific halal standards and certification procedures. Mutual Recognition Agreements (MRAs) provide an institutional mechanism for recognizing halal certification arrangements across countries and potentially reducing non-tariff barriers associated with differences in certification requirements (Badan Penyelenggara Jaminan Produk Halal, 2023; Yusof & Jaafar, 2020). Consequently, the interaction between geographic distance and institutional recognition deserves particular attention when examining halal export performance.

Previous empirical studies have examined the determinants of halal exports, particularly in the Malaysian context. Research by Abidin et al. (2013), Masron et al. (2014), and Mazlan & Hamzah (2015) investigated the relationship between macroeconomic and trade-related factors and halal export performance. More recent research has also applied the gravity model to examine halal food exports and the role of economic and religious-demographic characteristics in international trade (A. Ali et al., 2022; M. Y. Ali et al., 2022). These studies provide an important foundation for understanding halal trade determinants. Nevertheless, the available empirical evidence remains insufficient to explain how institutional recognition interacts with geographic distance across different halal industry sectors, particularly in Indonesia's trade relations with ASEAN countries. Moreover, the determinants of food, pharmaceutical, cosmetic, and fashion exports may differ because these industries have distinct market and institutional characteristics.

This research addresses these gaps by examining Indonesia's halal exports to ASEAN countries during 2014-2023 across four sectors: food, pharmaceuticals, cosmetics, and fashion. In contrast to studies that primarily examine aggregate halal exports or specific product categories, this study conducts a sectoral analysis incorporating economic, religious-demographic, and institutional variables. Particular attention is given to the Mutual Recognition Agreement as an institutional variable and to the interaction between geographic distance and MRA. This specification enables the study to examine whether the association between geographic distance and halal exports differs according to the presence of mutual recognition arrangements. The analysis also employs the Correlated Random Effects (CRE) approach, alongside pooled Ordinary Least Squares, Fixed Effects, and Random Effects estimations, to examine the relationships involving both time-varying and time-invariant explanatory variables.

Accordingly, this study aims to examine the determinants of Indonesia's halal exports to ASEAN countries and assess whether mutual recognition arrangements are associated with changes in the geographic distance barrier across the four export sectors. Its contribution lies in developing a sectoral understanding of halal export determinants, introducing the distance-MRA interaction into the analysis, and applying the CRE approach to incorporate relevant cross-country and temporal variations. By distinguishing the characteristics of food, pharmaceutical, cosmetic, and fashion exports, this study provides empirical insights into the

heterogeneous nature of Indonesia's halal trade and offers a basis for developing sector-specific export strategies.

METHODS

Research Design and Data

This study employs a quantitative approach using a panel-data gravity model to examine the determinants of Indonesia's halal exports to ASEAN countries during the 2014-2023 period. The analysis covers four halal industry sectors: food, pharmaceuticals, cosmetics, and fashion. Secondary data were collected from existing statistical and institutional databases. The research sample comprises nine ASEAN destination countries that imported Indonesian products within the four sectors during the observation period. The countries were selected using a purposive sampling approach to ensure their relevance to the research objectives. The ten-year observation period was selected based on data availability and the development of the global Islamic economy.

Variables and Data Sources

The dependent variables consist of the export values of Indonesia's halal food, pharmaceutical, cosmetic, and fashion products, expressed in US dollars. The explanatory variables represent economic conditions, religious-demographic characteristics, institutional arrangements, and geographical and cultural proximity between Indonesia and its trading partners. These variables include exporter and importer GDP based on purchasing power parity, Muslim population, real effective exchange rate, inflation, trade openness, mutual recognition agreements, geographic distance, and common language. The variables and their corresponding data sources are presented in Table 1.

Table 1. Operational Definitions and Data Sources

No.	Variable	Notation	Data source
1	Halal Food Exports	lnfood	BPS
2	Halal Pharmaceutical Exports	lnphar	BPS
3	Halal Cosmetics Exports	lncos	BPS
4	Halal Fashion Exports	lnfas	BPS
5	Exporter GDP (PPP)	lnpppit	World Bank
6	Importer GDP (PPP)	lnpppjt	World Bank
7	Exporter Muslim Population	lnmuspopit	Derived from World Bank
8	Importer Muslim Population	lnmuspopjt	Derived from World Bank
9	Real Effective Exchange Rate	lnerijt	Bruegel
10	Exporter Inflation	infit	World Bank
11	Importer Inflation	infjt	World Bank
12	Exporter Trade Openness	toit	Derived from World Bank
13	Importer Trade Openness	tojt	Derived from World Bank
14	Mutual Recognition Agreement	mraijt	BPJPH
15	Geographic Distance	lndistij	CEPII GeoDist
16	Common Language	clijt	Not specified in source

The empirical analysis applies four panel-data estimation approaches: Pooled Ordinary Least Squares (OLS), Fixed Effects (FE), Random Effects (RE), and Correlated Random Effects (CRE). Four separate gravity-model specifications are employed, with each model corresponding to one of the halal export sectors. Logarithmic transformations are applied to the dependent and selected independent variables, particularly those expressed in monetary or quantitative terms, to examine their relationships with export values.

Model selection is conducted using the Chow test to compare Pooled OLS and Fixed Effects, the Breusch-Pagan Lagrangian Multiplier test to compare Pooled OLS and Random

Effects, and the Hausman test to assess the suitability of Fixed Effects relative to Random Effects. These procedures are used to identify the appropriate panel estimation approach for each sector.

Correlated Random Effects and Interaction Analysis

The Correlated Random Effects approach, also known as the Mundlak approach, is additionally employed to address the limitations of conventional Fixed Effects estimation in examining time-invariant variables. Geographic distance and common language are relatively constant across country pairs and therefore cannot be directly estimated in a conventional Fixed Effects specification (Mundlak, 1978; Wooldridge, 2010). The CRE approach incorporates the means of time-varying explanatory variables at the individual-country level to account for potential correlations between unobserved individual effects and explanatory variables (Baltagi, 2008; Greene, 2012).

Furthermore, the analysis introduces an interaction term between geographic distance and the Mutual Recognition Agreement (distance × MRA). This interaction is incorporated into the CRE specification to examine whether institutional recognition is associated with changes in the relationship between geographic distance and Indonesian halal exports. This approach provides a sectoral assessment of whether the association between institutional arrangements and geographic trade barriers differs across food, pharmaceutical, cosmetic, and fashion exports.

RESULTS AND DISCUSSION

Halal Food Exports

The estimation results for Indonesian halal food exports are presented in Table 1. Five estimation specifications are reported, comprising Pooled Ordinary Least Squares (OLS), Random Effects (RE), Fixed Effects (FE), Correlated Random Effects (CRE), and CRE with an interaction term. These models examine the relationships between economic conditions, religious-demographic characteristics, institutional arrangements, and geographical and cultural factors and Indonesia's halal food exports to ASEAN countries. Particular attention is given to the role of importer market characteristics, geographic distance, mutual recognition agreements, and their interaction in explaining sectoral export performance.

Table 2. Regression Result of Halal Food Export

Variables	OLS	RE	FE	CRE	CRE Interaction
lnpppit	-0.0883 (1.911)	-0.0883 (1.911)	-0.227 (2.033)	-0.227 (2.033)	0.135 (2.008)
lnpppjt	0.887*** (0.118)	0.887*** (0.118)	0.0895 (0.968)	0.0895 (0.968)	0.0837 (0.970)
lndistij	5.479*** (0.648)	5.479*** (0.648)	0 (.)	-2.135 (1.864)	
lnmuspopit	1.679 (3.764)	1.679 (3.764)	3.339 (2.971)	3.339 (2.971)	3.178 (2.971)
lnmuspopjt	1.403*** (0.141)	1.403*** (0.141)	2.202 (1.665)	2.202 (1.665)	2.403 (1.657)
lnerijt	3.438*** (1.270)	3.438*** (1.270)	5.099** (2.002)	5.099** (2.002)	4.479** (1.920)
toit	-0.0284 (0.0355)	-0.0284 (0.0355)	0.0215 (0.0283)	0.0215 (0.0283)	0.0187 (0.0282)
tojt	0.0290*** (0.00272)	0.0290*** (0.00272)	0.00536 (0.00554)	0.00536 (0.00554)	0.00477 (0.00552)
infit	0.000211 (0.0989)	0.000211 (0.0989)	-0.0823 (0.0768)	-0.0823 (0.0768)	-0.0648 (0.0751)
infjt	-0.0770 (0.0529)	-0.0770 (0.0529)	-0.0319 (0.0442)	-0.0319 (0.0442)	-0.0342 (0.0442)

Variables	OLS	RE	FE	CRE	CRE Interaction
clijt	4.344*** (1.629)	4.344*** (1.629)	0 (.)	16.45*** (2.928)	13.39*** (1.148)
mraijt	-2.065*** (0.372)	-2.065*** (0.372)	0.252 (0.595)	0.252 (0.595)	
mean_lnppppjt				1.641* (0.993)	1.408 (0.973)
mean_lnmuspopjt				-2.026 (1.665)	-1.878 (1.664)
mean_lnerjt				11.16*** (2.966)	8.670*** (2.016)
mean_infjt				-0.931*** (0.206)	-0.707*** (0.0636)
mean_tojt				-0.00909 (0.0103)	0.000723 (0.00567)
in1					-0.0500* (0.0280)
Constant	-114.8*** (41.91)	-114.8*** (41.91)	-97.32** (44.40)	-149.9*** (50.18)	-158.0*** (49.72)
R-squared	0.946		0.415		
Adj. R-squared	0.935		0.234		
Within R2		0.252	0.415	0.415	0.404

The results indicate that the determinants of Indonesian halal food exports vary across the estimation specifications. In the Pooled OLS and Random Effects models, importer GDP based on purchasing power parity has a positive and statistically significant coefficient of 0.887 ($p < 0.01$). The Muslim population of importing countries also demonstrates a positive and significant coefficient of 1.403 ($p < 0.01$). These findings indicate that destination-market economic capacity and religious-demographic characteristics are associated with Indonesian halal food exports. Furthermore, importer trade openness records a positive coefficient of 0.0290 ($p < 0.01$), suggesting a positive relationship between the openness of destination markets and Indonesian halal food exports.

Geographic distance exhibits a positive and statistically significant coefficient of 5.479 ($p < 0.01$) in both OLS and RE estimations. Common language also demonstrates a positive and significant relationship, with a coefficient of 4.344 ($p < 0.01$). Meanwhile, the MRA variable records a negative coefficient of -2.065 ($p < 0.01$) in both specifications. These results indicate that the relationships between geographical, cultural, and institutional factors and halal food exports differ in direction and statistical significance. However, these associations should be interpreted in consideration of the estimation approach and the inclusion of country-specific effects.

When country heterogeneity is considered through Fixed Effects estimation, most explanatory variables no longer demonstrate statistically significant coefficients. The real effective exchange rate remains positive and statistically significant, with a coefficient of 5.099 ($p < 0.05$). In the CRE specification without interaction, the corresponding coefficient remains positive and significant at the same level. Common language also maintains a positive and statistically significant relationship in both CRE specifications, with coefficients of 16.45 and 13.39, respectively ($p < 0.01$). These findings indicate that economic and structural characteristics provide different explanatory contributions depending on whether within-country and between-country variations are incorporated into the estimation.

The CRE interaction specification further identifies a negative coefficient of -0.0500 for the interaction variable, which is statistically significant at the ten-percent level. This result indicates that the interaction between geographic distance and MRA is negatively associated

with halal food exports. Nevertheless, the statistical interpretation of this interaction requires consideration of the underlying distance coefficient and the coding of the MRA variable. Therefore, the finding does not independently establish that MRA reduces geographic barriers in the halal food sector.

Overall, the halal food export results highlight the relevance of importer market characteristics, religious-demographic factors, and cultural proximity in selected estimation specifications. These findings are consistent with previous studies emphasizing the importance of destination-market demand and religious characteristics in halal trade (M. Y. Ali et al., 2022; Camillo et al., 2014). The discussion of halal food consumption and Islamic branding also highlights the relationship between consumer identity and halal product markets (Lever & Miele, 2012; Wilson & Liu, 2011). However, the negative distance-MRA interaction suggests that the relationship between institutional recognition and geographic distance is not uniformly positive in this sector.

Halal Pharmaceutical Exports

The estimation results for Indonesian halal pharmaceutical exports are presented in Table 2. The analysis employs five estimation specifications, consisting of Pooled Ordinary Least Squares (OLS), Random Effects (RE), Fixed Effects (FE), Correlated Random Effects (CRE), and CRE with an interaction term. These specifications examine the relationships between macroeconomic conditions, religious-demographic characteristics, institutional arrangements, and geographical and cultural factors and pharmaceutical export performance. Particular attention is given to the Muslim population of importing countries, the real effective exchange rate, trade openness, and the interaction between geographic distance and Mutual Recognition Agreements (MRA), considering their potential relevance to cross-border pharmaceutical trade.

Table 3. Regression Result of Halal Pharmaceutical Export

Variables	OLS	RE	FE	CRE	CRE Interaction
lnpppit	-1.210 (1.503)	-1.210 (1.503)	-0.631 (1.363)	-0.631 (1.363)	-0.968 (1.359)
lnpppjt	0.130 (0.0924)	0.130 (0.0924)	0.255 (0.649)	0.255 (0.649)	0.260 (0.656)
lndistij	2.601*** (0.510)	2.601*** (0.510)	0 (.)	1.966 (1.249)	
lnmuspopit	1.458 (2.961)	1.458 (2.961)	2.458 (1.991)	2.458 (1.991)	2.607 (2.010)
lnmuspopjt	1.168*** (0.111)	1.168*** (0.111)	2.204* (1.116)	2.204** (1.116)	2.016* (1.121)
lnerijt	3.393*** (0.999)	3.393*** (0.999)	-3.554** (1.342)	-3.554*** (1.342)	-2.977** (1.299)
toit	-0.0362 (0.0279)	-0.0362 (0.0279)	-0.0145 (0.0190)	-0.0145 (0.0190)	-0.0119 (0.0191)
tojt	0.0152*** (0.00214)	0.0152*** (0.00214)	-0.000502 (0.00371)	-0.000502 (0.00371)	0.0000455 (0.00373)
infit	0.0267 (0.0778)	0.0267 (0.0778)	0.0508 (0.0514)	0.0508 (0.0514)	0.0345 (0.0508)
infjt	0.0549 (0.0416)	0.0549 (0.0416)	0.0122 (0.0296)	0.0122 (0.0296)	0.0143 (0.0299)
clijt	-4.618*** (1.282)	-4.618*** (1.282)	0 (.)	-1.358 (1.962)	1.472* (0.777)
mraijt	-0.579* (0.293)	-0.579** (0.293)	-0.292 (0.399)	-0.292 (0.399)	
mean_lnpppjt				-0.0850 (0.666)	0.130 (0.658)
mean_lnmuspopjt				-1.076 (1.116)	-1.210 (1.126)

Variables	OLS	RE	FE	CRE	CRE Interaction
mean_lnerijt				10.15***	12.45***
				(1.988)	(1.364)
mean_infjt				0.0250 (0.138)	-0.181***
					(0.0430)
mean_tojt				0.0147**	0.00569
				(0.00691)	(0.00383)
in1					0.0383**
					(0.0190)
Constant	-32.43 (32.97)	-32.43 (32.97)	-32.59 (29.76)	-80.95**	-73.42**
				(33.63)	(33.64)
R-squared	0.937		0.229		
Adj. R-squared	0.924		-0.00908		
Within R2		0.00116	0.229	0.229	0.202

The estimation results reveal that the determinants of Indonesian halal pharmaceutical exports vary across the five specifications. In the Pooled OLS and Random Effects models, the Muslim population of importing countries demonstrates a positive and statistically significant coefficient of 1.168 ($p < 0.01$). Importer trade openness also exhibits a positive and significant coefficient of 0.0152 ($p < 0.01$). These findings indicate that destination-market religious-demographic characteristics and trade openness are positively associated with Indonesian pharmaceutical exports in these specifications.

Geographic distance records a positive and statistically significant coefficient of 2.601 ($p < 0.01$) in both OLS and RE models. In contrast, common language exhibits a negative and significant coefficient of -4.618 ($p < 0.01$). The MRA variable also presents a negative coefficient, amounting to -0.579 in both specifications, with significance levels of ten percent in OLS and five percent in RE. These results indicate that the relationships between geographical, cultural, and institutional characteristics and pharmaceutical exports are not uniform in direction.

The Fixed Effects estimation produces a different pattern. The Muslim population of importing countries remains positively associated with pharmaceutical exports, with a coefficient of 2.204 ($p < 0.10$). Meanwhile, the real effective exchange rate demonstrates a negative and statistically significant coefficient of -3.554 ($p < 0.05$). The CRE specification produces similar results, with the importer Muslim population recording a positive coefficient of 2.204 ($p < 0.05$), while the real effective exchange rate remains negative at -3.554 ($p < 0.01$). These differences across specifications indicate that the estimated relationships are sensitive to the treatment of country-specific heterogeneity.

The CRE interaction specification provides additional evidence regarding the relationship between institutional recognition and geographic distance. The interaction variable, reported as in1 in the original table, has a positive coefficient of 0.0383 and is statistically significant at the five-percent level. In the same specification, the Muslim population of importing countries remains positive at 2.016 ($p < 0.10$), while the real effective exchange rate records a negative coefficient of -2.977 ($p < 0.05$). Common language also changes direction, presenting a positive coefficient of 1.472 ($p < 0.10$).

The mean components provide further information regarding cross-country structural differences. The mean of the real effective exchange rate is positive and statistically significant in both CRE specifications, with coefficients of 10.15 and 12.45 ($p < 0.01$), respectively. Importer inflation also demonstrates a negative and significant coefficient of -0.181 ($p < 0.01$) in the interaction specification, while the mean of importer trade openness is significant only in the CRE specification without interaction.

Overall, the pharmaceutical export findings demonstrate that economic, religious-demographic, and institutional characteristics have different relationships with export performance depending on the estimation specification. In particular, the positive and significant distance-MRA interaction suggests that the institutional variable modifies the relationship between geographic distance and pharmaceutical exports. This finding is relevant to discussions of halal pharmaceutical certification and regulatory harmonization, which emphasize the importance of certification recognition in facilitating access to international markets (Mohd Salleh & Ab Halim, 2013; Yusof & Jaafar, 2020). However, the interaction coefficient alone does not establish that MRA reduces geographic barriers. The main distance coefficient in the interaction specification and the coding of MRA must also be examined to determine the conditional effect of distance.

Halal Fashion Exports

The estimation results for Indonesian halal fashion exports are presented in Table 4. The analysis employs five estimation specifications, consisting of Pooled Ordinary Least Squares (OLS), Random Effects (RE), Fixed Effects (FE), Correlated Random Effects (CRE), and CRE with an interaction term. These specifications examine the relationships between macroeconomic conditions, religious-demographic characteristics, institutional arrangements, and geographical and cultural factors and Indonesian halal fashion exports to ASEAN countries. Particular attention is given to importer economic capacity, Muslim population, trade openness, and the interaction between geographic distance and Mutual Recognition Agreements (MRA). The results are also examined in relation to the model selection tests to identify the appropriate estimation approach for this sector.

Table 4. Regression Result of Halal Fashion Export

Variables	OLS	RE	FE	CRE	CRE Interaction
lnpppit	-0.0365 (1.713)	-0.0365 (1.713)	-1.618 (2.203)	-1.618 (2.203)	-1.575 (2.154)
lnpppjt	0.692*** (0.105)	0.692*** (0.105)	2.071* (1.049)	2.071** (1.049)	2.071** (1.040)
lndistij	3.093*** (0.581)	3.093*** (0.581)	0 (.)	-0.266 (2.020)	
lnmuspopit	-1.092 (3.376)	-1.092 (3.376)	-0.899 (3.219)	-0.899 (3.219)	-0.917 (3.187)
lnmuspopjt	0.914*** (0.126)	0.914*** (0.126)	-0.733 (1.804)	-0.733 (1.804)	-0.709 (1.777)
lnerijt	-1.039 (1.139)	-1.039 (1.139)	-3.146 (2.170)	-3.146 (2.170)	-3.218 (2.060)
toit	-0.0406 (0.0319)	-0.0406 (0.0319)	-0.0183 (0.0307)	-0.0183 (0.0307)	-0.0187 (0.0303)
tojt	0.0231*** (0.00244)	0.0231*** (0.00244)	0.00903 (0.00600)	0.00903 (0.00600)	0.00897 (0.00592)
infit	0.0996 (0.0887)	0.0996 (0.0887)	0.0711 (0.0832)	0.0711 (0.0832)	0.0731 (0.0806)
infjt	0.0438 (0.0475)	0.0438 (0.0475)	0.0416 (0.0478)	0.0416 (0.0478)	0.0413 (0.0474)
clijt	0.428 (1.461)	0.428 (1.461)	0 (.)	6.190* (3.173)	5.813*** (1.231)
mraijt	-1.078*** (0.334)	-1.078*** (0.334)	-0.0190 (0.645)	-0.0190 (0.645)	
mean_lnpppjt				-1.024 (1.076)	-1.053 (1.044)
mean_lnmuspopjt				1.119 (1.805)	1.139 (1.784)
mean_lnerijt				8.250** (3.214)	7.940*** (2.162)
mean_infjt				-0.389* (0.223)	-0.361*** (0.0682)

mean_tojt				0.0000537 (0.0112)	0.00127 (0.00608)
in1					-0.0126 (0.0301)
Constant	-12.71 (37.59)	-12.71 (37.59)	49.59 (48.12)	23.81 (54.37)	22.83 (53.33)
R-squared	0.940		0.197		
Adj. R-squared	0.929		-0.0512		
Within R2		0.106	0.197	0.197	0.197

The estimation results reveal that halal fashion exports exhibit a different pattern compared with the other three sectors. In the Pooled OLS and Random Effects models, importer GDP based on purchasing power parity (PPP) has a positive and statistically significant coefficient of 0.692 ($p < 0.01$). The Muslim population of importing countries also demonstrates a positive and significant coefficient of 0.914 ($p < 0.01$). Furthermore, importer trade openness records a positive and statistically significant coefficient of 0.0231 ($p < 0.01$). These findings indicate that destination-market economic capacity, religious-demographic characteristics, and trade openness are associated with Indonesian halal fashion exports in these specifications.

Geographic distance also demonstrates a positive and statistically significant coefficient of 3.093 ($p < 0.01$) in both OLS and RE estimations. However, common language does not exhibit a statistically significant relationship in these two specifications, with a coefficient of 0.428. Similarly, the MRA variable records a negative coefficient of -1.078 ($p < 0.01$), indicating a negative relationship with halal fashion exports in the OLS and RE models.

The Fixed Effects and CRE estimations produce a different pattern. Importer GDP remains positive and statistically significant, with a coefficient of 2.071 in both specifications. The common language variable also demonstrates a positive and statistically significant relationship in the CRE model, with a coefficient of 6.190 ($p < 0.10$). Meanwhile, the mean of the real effective exchange rate is positive and significant, with coefficients of 8.250 ($p < 0.05$) and 7.940 ($p < 0.01$) in the CRE and CRE interaction specifications, respectively. The mean of importer inflation records negative and significant coefficients of -0.389 ($p < 0.10$) and -0.361 ($p < 0.01$), respectively. Other mean components, including importer GDP, Muslim population, and trade openness, do not demonstrate statistically significant relationships in these specifications.

Regarding institutional arrangements, the interaction variable reported as in1 records a negative coefficient of -0.0126 but is not statistically significant. This result indicates that the interaction between geographic distance and MRA does not demonstrate a statistically significant relationship with halal fashion exports. Therefore, the findings do not provide sufficient evidence that mutual recognition arrangements modify the relationship between geographic distance and exports in this sector.

The model selection results further indicate that Pooled OLS is more appropriate for the halal fashion sector. The Breusch-Pagan Lagrangian Multiplier test does not identify significant individual random effects, while the Hausman test does not indicate a significant difference between Fixed Effects and Random Effects. These results suggest that the panel estimation approaches do not provide a clear advantage over the pooled specification for this particular sector. Consequently, the CRE estimations are treated as complementary evidence rather than the principal basis for interpreting fashion export determinants.

Overall, the findings indicate that the macroeconomic and institutional variables included in the gravity model provide a comparatively limited explanation of Indonesian halal fashion exports. This pattern suggests that other sector-specific characteristics may also be relevant to understanding fashion export performance. Previous studies have discussed the importance of religious influences, consumer preferences, and fashion-related characteristics in shaping halal

fashion markets (Aytaç, 2020; Yudha et al., 2024; Yuniastuti & Pratama, 2023). Accordingly, the halal fashion sector can be characterized as a creative-oriented sector in the sectoral framework developed in this study, although its creative and non-economic determinants are not directly measured in the present regression model.

Comparative Analysis of Halal Export Determinants across Sectors

The comparative analysis of the four halal export sectors reveals substantial differences in the relationships between economic, religious-demographic, institutional, and geographical factors and Indonesia's export performance. Although the gravity model provides a common analytical framework, the estimation results indicate that its explanatory contribution varies across food, pharmaceutical, cosmetic, and fashion exports. These differences demonstrate that the determinants of halal exports cannot be interpreted uniformly across industries. This finding is consistent with the application of gravity models in international trade, which emphasizes the importance of economic scale, geographic distance, and structural characteristics in explaining trade flows (Head & Mayer, 2014; Yotov, 2022).

To provide a clearer comparison of institutional effects across the four sectors, Table 5 summarizes the estimated coefficients of the interaction between geographic distance and Mutual Recognition Agreements (MRA) from the CRE interaction specifications. This comparison highlights the differences in the direction and statistical significance of the relationship between institutional recognition and geographic distance across the halal export sectors.

Table 5. Comparative Results of Geographic Distance and MRA Interaction across Halal Export Sectors

Export sector	Interaction coefficient	Significance	Direction
Food	-0.0500	$p < 0.10$	Negative
Pharmaceuticals	0.0383	$p < 0.05$	Positive
Cosmetics	0.1190	$p < 0.01$	Positive
Fashion	-0.0126	Not significant	Negative

The comparative results demonstrate that the relationship between geographic distance and MRA differs across the four halal export sectors. The pharmaceutical and cosmetics sectors exhibit positive and statistically significant interaction coefficients, whereas the food sector presents a negative interaction coefficient that is significant at the ten-percent level. In contrast, the fashion sector shows a negative but statistically insignificant interaction coefficient. These differences indicate that the relationship between institutional recognition and geographic distance is sector-specific rather than uniform across Indonesia's halal exports to ASEAN countries.

The positive interaction coefficients in the pharmaceutical and cosmetics sectors suggest that the relationship between geographic distance and exports changes in the presence of the institutional variable. However, these coefficients should not independently be interpreted as evidence that MRA reduces geographic barriers. Such an interpretation requires the complete conditional effect of geographic distance, including its main coefficient, the interaction term, and the coding of the MRA variable. Nevertheless, the statistically significant interactions indicate that institutional considerations deserve particular attention when examining trade patterns in these two sectors.

Sectoral Characteristics and Export Determinants

The differences in the interaction estimates are also reflected in the broader characteristics of each export sector. The halal food sector demonstrates relatively strong relationships with destination-market characteristics, particularly importer GDP, the Muslim population of importing countries, and common language in selected estimation specifications.

These findings highlight the relevance of market size and cultural proximity in explaining halal food exports. Previous studies have also emphasized the importance of religiously associated demand and consumer characteristics in halal food markets (M. H. Ali et al., 2022; Camillo et al., 2014). Accordingly, food exports can be characterized as a cultural and market-structural sector.

The pharmaceutical sector demonstrates a relatively important institutional dimension. The positive and significant interaction between geographic distance and MRA distinguishes pharmaceutical exports from the food sector. This finding is relevant to the discussion of halal pharmaceutical certification requirements and regulatory recognition, in which differences in standards and certification arrangements are important considerations in international market access (Mohd Salleh & Ab Halim, 2013; Yusof & Jaafar, 2020). Therefore, pharmaceutical exports can be characterized as a regulatory-oriented sector, in which institutional arrangements form an important component of the sectoral trade relationship.

In the cosmetics sector, the estimation results indicate a combination of economic, structural, and institutional characteristics. Importer GDP, the real effective exchange rate, and common language exhibit significant relationships in selected specifications. Moreover, the positive and statistically significant geographic distance-MRA interaction distinguishes cosmetics exports from food exports. Previous research has discussed the development of halal cosmetics markets in relation to product characteristics, regulatory requirements, and consumer preferences (Azmi & Elgharbawy, 2022; Fatima et al., 2023; Khan et al., 2021; Ngah, 2022). These characteristics support the conceptual classification of halal cosmetics as a hybrid market-institutional sector.

In contrast, the halal fashion sector demonstrates a comparatively limited relationship with several macroeconomic variables included in the gravity model. Although importer GDP and importer trade openness exhibit positive and significant coefficients in selected specifications, the interaction between geographic distance and MRA is not statistically significant. The original model selection results also indicate that Pooled OLS is more appropriate for this sector than the panel alternatives. Previous studies have highlighted the relevance of fashion-related preferences, religious influences, and industry developments in understanding halal fashion markets (Aytaç, 2020; Yudha et al., 2024; Yuniastuti & Pratama, 2023). Consequently, halal fashion is characterized as a creative-oriented sector in the conceptual framework of this research. However, creative characteristics themselves were not directly measured in the regression models.

Research Contribution and Novelty

The principal contribution of this study lies in demonstrating the heterogeneous characteristics of Indonesia's halal exports through a sectoral gravity-model analysis. Rather than treating halal exports as a uniform category, this research distinguishes four sectoral characteristics based on their estimated relationships with economic, religious-demographic, institutional, and geographical variables. The resulting typology identifies food as a cultural and market-structural sector, pharmaceuticals as a regulatory-oriented sector, cosmetics as a hybrid market-institutional sector, and fashion as a creative-oriented sector. This classification provides a more differentiated understanding of the determinants of Indonesia's halal exports to ASEAN countries.

A further contribution is the incorporation of the interaction between geographic distance and Mutual Recognition Agreements into the sectoral analysis. The contrasting interaction estimates demonstrate that the relationship between institutional recognition and geographic distance differs across industries. Positive and statistically significant interactions are identified in pharmaceutical and cosmetics exports, while food exports exhibit a negative interaction and fashion exports show no statistically significant interaction. These findings suggest that the

association between institutional recognition and geographic trade barriers should be examined in accordance with sector-specific characteristics rather than through a single aggregate perspective.

Methodologically, this study applies the Correlated Random Effects approach to examine both time-varying and time-invariant explanatory variables. By incorporating the means of time-varying explanatory variables at the individual level, the approach provides an alternative means of examining country-specific structural characteristics that cannot be directly estimated through conventional Fixed Effects specifications (Mundlak, 1978; Wooldridge, 2010). The combination of sectoral analysis, the distance-MRA interaction, and CRE estimation extends the empirical examination of halal trade determinants and provides a basis for further research into the institutional and structural characteristics of international halal exports.

CONCLUSION AND RECOMMENDATIONS

Conclusion

This study examines the determinants of Indonesia's halal exports to ASEAN countries during 2014-2023 across four sectors: food, pharmaceuticals, cosmetics, and fashion. The findings demonstrate that the relationships between economic, religious-demographic, institutional, and geographical factors and export performance vary substantially across sectors. The application of the gravity model, supported by Pooled OLS, Fixed Effects, Random Effects, and Correlated Random Effects estimations, provides a sectoral perspective on the factors associated with Indonesia's halal exports.

The findings indicate that halal food exports are primarily associated with destination-market characteristics and cultural proximity, particularly importer GDP, Muslim population, and common language in selected estimation specifications. Pharmaceutical exports exhibit a stronger institutional dimension, as reflected in the positive and statistically significant interaction between geographic distance and MRA. Similarly, halal cosmetics exports demonstrate a positive and statistically significant interaction, alongside relationships involving importer GDP, the real effective exchange rate, and common language. In contrast, halal fashion exports show comparatively limited relationships with the explanatory variables included in the gravity model, while the interaction between geographic distance and MRA is statistically insignificant.

Regarding the central research question, the findings indicate that the relationship between mutual recognition arrangements and geographic distance is not uniform across the four export sectors. Positive and statistically significant interaction coefficients are identified in pharmaceutical and cosmetics exports, whereas food exports exhibit a negative and statistically significant interaction at the ten-percent level. No statistically significant interaction is identified in the fashion sector. Therefore, the findings do not support a general conclusion that MRA consistently reduces geographic barriers across all halal industries. Instead, they demonstrate that the relationship between institutional recognition and geographic trade barriers differs according to sectoral characteristics.

The main contribution of this study lies in establishing a sectoral typology of Indonesia's halal exports, categorizing food as a cultural and market-structural sector, pharmaceuticals as a regulatory-oriented sector, cosmetics as a hybrid market-institutional sector, and fashion as a creative-oriented sector. The incorporation of the geographic distance-MRA interaction and the application of the Correlated Random Effects approach further contribute to understanding the heterogeneous relationships between institutional and structural trade determinants. These findings emphasize the importance of developing sector-specific strategies for strengthening Indonesia's halal export competitiveness rather than relying on a uniform policy approach.

Limitations

This study has several limitations that should be considered when interpreting its findings. First, the analysis primarily emphasizes macroeconomic, religious-demographic, and institutional variables, while several non-economic characteristics that may be relevant to specific halal industries are not directly incorporated into the empirical model. This limitation is particularly relevant to the halal fashion sector, where consumer preferences, design, branding, aesthetic value, and creative-industry developments may contribute to export dynamics. Second, the use of panel data covering nine destination countries during 2014-2023 provides a specific geographical and temporal scope and does not fully capture micro-level trade dynamics. Third, the explanatory variables included in the gravity model may not comprehensively represent all institutional, cultural, and supply-chain characteristics affecting halal exports. Consequently, the findings should be interpreted within the scope of the countries, observation period, variables, and estimation specifications employed in this study.

Recommendations

Based on the findings, the development of Indonesia's halal exports should adopt sector-specific strategies that reflect the characteristics of each industry. In the halal food sector, strengthening domestic production and supply-chain capabilities is important for improving export competitiveness and reducing vulnerability to external pressures, particularly those associated with exchange rate fluctuations and reliance on imported inputs. For the pharmaceutical sector, greater attention should be given to international institutional cooperation and the alignment of halal certification requirements to support cross-border market access. In the cosmetics sector, institutional collaboration should be accompanied by product diversification and adaptation to the specific preferences of destination markets. Meanwhile, the development of halal fashion exports should place greater emphasis on the creative-industry ecosystem, including support for regional Muslim designers, participation in international fashion exhibitions, and strengthening Indonesia's positioning in the global halal fashion market.

Future research should expand the explanatory framework by incorporating additional institutional, cultural, and non-economic variables. In particular, the development of indicators measuring cross-national halal regulatory harmonization, Islamic cultural proximity, sectoral supply-chain capacity, industrial creativity, and halal brand digital presence could provide a more comprehensive explanation of export dynamics. Cross-national consumer preference surveys may also help capture dimensions of halal fashion and other industries that are not sufficiently represented by conventional macroeconomic variables. Furthermore, extending the geographical coverage and observation period, alongside the application of more granular analytical approaches, may improve understanding of the heterogeneous determinants of international halal trade.

Author Contributions

All authors contributed to the conceptualization of the study, development of the theoretical framework, data collection, data analysis, and interpretation of the findings. They also participated in manuscript preparation, critical revision, and refinement of the intellectual content. All authors have read and approved the final version of the manuscript and accept responsibility for its content.

AI Disclosure Statement

During the preparation of this manuscript, the authors used OpenAI's ChatGPT to assist with language editing, manuscript restructuring, and improving the clarity of the academic writing. All AI-assisted content must be reviewed and verified by the authors, who retain full

responsibility for the accuracy, originality, interpretation, and integrity of the manuscript's content.

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