# Determinants of capital structure for firms in an Islamic equity index: comparing developed and developing countries

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## Abstract

**Purpose** – The paper aims to identify the differences between developed and developing country firms with respect to firm-specific and country-level determinants of their capital structure. For this purpose, all constituent firms in one of the oldest Islamic equity indices, Dow Jones Islamic Market World Index (DJIM), are considered and the Muslim-majority status of each firm's domicile country is recognized.

**Design/methodology/approach** – The study employs Hausman–Taylor random effects regression with endogenous covariates to explain the debt ratios of firms in DJIM by separating them into developed and developing country subsamples in an unbalanced panel data setting. Developing country subsample is further split into two based on the Muslim-majority status of each firm's domicile country.

**Findings** – Consistent with the previous literature, this study finds that firm-specific characteristics are the main determinants of their capital structure. Additionally, the paper shows that country-level characteristics have an impact on the debt ratio, however, the types of factors vary across developed and developing countries. Debt ratios in developing country firms are lower than those in developed country firms, largely due to the significantly smaller leverage ratios of firms in Muslim-majority countries. Although the debt ratios of DJIM firms are higher in "non-Muslim" countries, the set of firm-level capital structure determinants are not statistically explained by operating in a "Muslim" country. The study also documents that, before the global financial crisis of 2008, companies in developing countries have gradually become less leveraged worldwide.

**Originality/value** – This paper provides a new perspective into the differences between developed and developing country firms' capital structures by focusing on a relatively homogeneous data set restricted by leverage screening rules of an Islamic equity index and recognizing the Muslim-majority status of each firm's domicile country.

**Keywords** Capital structure, Debt ratio, Islamic finance, Developed and developing countries

**Paper type** Research paper

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# 1. Introduction

In corporate finance, capital structure is one of the main areas of research. Since 1990s, great effort has been spent in order to understand how firms determine their sources of capital and what factors affect this structure. Prior literature has also focused on differences in these choices between developed and developing countries, mostly motivated by the institutional differences across these two domains. Besides the expansive literature on capital structure, the recent growth in Islamic finance throughout the world creates an opportunity to address the same question for a group of firms that are relatively more similar with respect to their debt ratios. A more recent strand of the literature has focused on the determinants of capital structure for firms with an Islamic finance focus, however, they have been restrictive in terms of country or industry. By focusing on a large universe with no such restrictions, this paper attempts to discover the determinants of the capital structure of the firms classified as "Islamic" with a special emphasis on the differences between developed and developing country firms. In addition, by analyzing the capital structure of firms in Muslim-majority countries, we shed light on the religion of the domicile country as a possible explanation for any differences.

Firms in an Islamic index are selected based on screens that comply with Islamic law (i.e. Shariah). These screens are typically set by a Shariah Board and consist of restrictions or limitations on getting bank loans, selling certain goods and doing certain business activities, among other things. Since one of the common accounting screens is a limit on debt levels, these indexes create a more homogenous set of firms than non-Islamic indexes with respect to the capital structure [1]. More specifically, one can argue that capital structure differences among companies in developed and developing countries may not be significant for those with stringent limits on their leverage, a common metric used to identify the capital structure. Consequently, this study attempts to shed light on the capital structure of firms in these Islamic indexes. More specifically, we investigate firm-specific and country-specific determinants of capital structure for these "Islamic" firms in both developed and developing countries. We further split the Muslim-majority country subsample from the developing country sample to generate further insights. Using year dummies, we investigate the effect of the 2008 financial crisis on capital structure. We estimate panel regressions on the firms included in the Dow Jones Islamic Market World Index (DJIM) from 56 countries using 28,543 firm-year observations.

Our results indicate that the determinants of capital structures of the "Islamic" firms are not that different from those of non-Islamic firms established in the prior literature. However, differences arise between "Islamic" firms in developed countries and those in developing countries. Specifically, we find that debt ratios of "Islamic" firms are higher in countries which have both developed capital and banking sectors whereas in developing countries this effect seems to be insignificant. We argue that in the countries that have developed capital and banking sectors, "Islamic debt" instruments are also abundant and the firms benefit from these instruments. We also show that some of the differences between developed and developing country firms can be explained by the presence of Muslim-majority countries in the second group. This group has significantly lower total debt ratios and differ from other country groups with respect to country-level determinants. Lastly, even before the 2008 Global Financial Crisis has begun (starting from 2006), the debt levels of the "Islamic" firms in developing countries began to decrease which continued through 2010.

To the best of our knowledge, this study is the first to analyze the capital structure of "Islamic" companies by differentiating for its country of origin with respect to its economic development and Muslim-majority statuses and does so with a larger data set compared to previous research. Main contributions of this work can be grouped into three themes: (1) Even for a relatively homogenous group of firms, the economic development and Muslim-majority statuses of a firm's domicile country create a difference in the capital structure and its determinants. (2) These characteristics may have helped "Islamic" firms in developing countries reduce leverage before the 2008 Global Financial Crisis. (3) Both the trade-off theory

and the pecking order theory find support with respect to different determinants of capital structure, regardless of the type of domicile country.

The remainder of the paper is organized as follows. Section 2 outlines the literature on capital structure theory and Islamic finance, Section 3 describes the data and methodology, Section 4 presents the empirical results and Section 5 summarizes and concludes.

## 2. Literature survey

The research on capital structure can be traced to 1950s. Modigliani and Miller (1958) argued that, in the presence of perfect capital markets, financing decisions do not affect the value of the firm. Since then, considerable work has been done to understand the determinants of capital structure.

Currently, there are three important theories opposing Modigliani and Miller. To start with, Kraus and Litzenberg's (1973) Trade-off Theory states that the trade-off between tax advantage of loaning and bankruptcy cost settles optimal debt ratio of a firm. This theory argues that capital structure is affected by such factors as tax rate, business risk, profitability, bankruptcy code, and asset type. Accordingly, the expected cost of distress diminishes because of higher returns and lets firms raise tax benefits by increasing leverage. On the other hand, the Agency Theory launched by Jensen and Meckling (1976) focuses on the costs generated from the conflicts of interest among managers, shareholders and debt holders. The theory states that new investment decisions create a conflict between shareholders and managers or that interest of a given loan creates a conflict between debt holders and shareholders. Finally, Myers and Majluf (1984) developed the Pecking Order Theory which argues that demand of a firm to finance new investments affects its capital structure. Hence, internal financing, low-risk debt and equity financing are preferred in respective order. Myers and Majluf (1984) also state that capital structure of a firm is affected by growth, profitability, and liquidity.

Aside from these milestone theories, the effects of various determinants have been investigated. For example, Ross (1977) and Heinkel (1982) study the effect of firm quality on indebtedness and show that higher quality firms, having higher firm values, exhibit higher levels of debt. As Myers and Majluf (1984) and Jensen (1986), Stulz (1990) analyze the effect of free cash flows available to management on the use of debt. Myers and Majluf (1984) find that leverage increases with declines in free cash flows while the latter two find the opposite. Bradley et al. (1984) investigate whether there is an optimal capital structure by using a cross-sectional model. Accordingly, leverage is inversely related to the level of expected bankruptcy costs and non-debt tax shields available to the firm.

Titman and Wessels (1988) use a form of linear structural model to capture the effects of the latent variables used to define the role of capital structure. They try to explain the effects of asset structure, non-debt tax shields, growth, uniqueness, industry classification, size, earnings volatility and profitability. Their results suggest that a firm's debt level is negatively related to its level of uniqueness. Harris and Raviv (1991) argue that the use of debt allows investors to liquidate the company in the case of poor performance by managers. Likewise, Stohs and Mauer (1996) examine the empirical determinants of debt maturity structure using a maturity structure measure and find that less risky firms with longer-term asset maturities use longer-term debt, debt maturity varies inversely with earnings surprises and a firm's effective tax rate, but there is only mixed support for an inverse relation with growth opportunities. They find strong support for the prediction of a non-monotonic relation between debt maturity and bond rating; firms with high or very low bond ratings use shorter-term debt.

In subsequent research, wider ranges of data set are analyzed in order to generalize the effect of these aforementioned factors on indebtedness. For instance, Rajan and Zingales (1995) analyze the determinants of capital structure such as asset tangibility, investment opportunities (measured by market-to-book ratio), firm size and profitability in public firms of

major industrialized (G-7) countries using a censored Tobit model and an OLS model. They find that firm size is positively correlated with debt level in all the countries except Germany and asset tangibility is positively correlated with debt level in all seven countries examined. Wald (1999) examine the factors correlated with capital structure in France, Germany, Japan, the United Kingdom and the United States. He finds that mean leverage and many factors appear to be similar across countries, but the correlation between long-term debt/asset ratios and the firms' riskiness, profitability, size and growth differs. His findings point out to links between varying choices in capital structure across countries and legal and institutional differences. Booth et al. (2001) analyze the developing countries and explain total debt and long-term debt (dependent variables) with average tax rate, asset tangibility, business risk, size, market-to-book ratio and return on assets (explanatory variables). Chen (2004) analyze 88 China-listed companies for the period 1995–2000 and find that some of the insights from modern finance theory of capital structure observed in developed countries (e.g. some firm-specific factors) are portable to China. However, neither the trade-off model nor the pecking order hypothesis provides convincing explanations for the capital choices of the Chinese firms. He argues that the capital choice decision of Chinese firms seems to follow a "new Pecking order"—retained profit, equity and long-term debt. This is because the fundamental institutional assumptions underpinning the Western models are not valid in China.

Inspired by Titman and Wessels (1988), Maquieira et al. (2007) study the determinants of capital structure for Chilean firms using Linear Structural Relations (LISREL). Octavia and Brown (2008) analyze the capital structure of 121 banks in ten developing countries from 1996 to 2005. They indicate that there are five determinants to be tested: size, profitability, market-to-book ratio, collateral value and dividend paying status including some lags. They found that size and profits yield statistically significant results. Bas (2012) states that, as firms get larger, they become more diversified and risk of failure is reduced, hence th ey can have higher leverage.Some researchers study country-level factors -in addition to firm-level factors- to explain the capital structure of firms. For example, Demirgüç-Kunt and Maksimovic (1999) state that debt maturity was higher for firms in countries where legal system has more "integrity". Demirgüç-Kunt and Maksimovic (1999) as well as De Jong et al. (2008) examine the roles of stock/bond market size, turnover and bank total assets in capital structure choices. Booth et al. (2001) investigate if the capital structure determinants revealed significant in previous research with industrialized countries data are portable to less industrialized countries from differing regions including South America, Central America, Asia and the Middle East. They study a sample of 631 firms from ten emerging markets in the time period 1980–1990 with panel data techniques within each country and running an unbalanced panel with fixed effects. Antoniou et al. (2008), comparing capital structure determinants of two market-oriented countries (the United Kingdom and the United States) with three banking-focused countries (France, Germany, and Japan), show the importance of economic environment, corporate governance practices, level of investor protection and other institutional variables in corporate financing decisions. Mitton (2008), based on a sample of 34 emerging markets, find a positive impact of financial openness (cumulative capital flows to GDP) on debt ratios.

Other factors used to explain the capital structure of firms include expected inflation, shareholder rights, asymmetric information, corruption level, industry and institutional environment. For instance, Frank and Goyal (2009) find that expected inflation is one of the most reliable variables to explain market leverage. Alves and Ferreira (2011), considering a panel of 31 countries, study the impact of law on capital structure and conclude that the interaction between shareholder rights and profitability negatively impacts market leverage, suggesting that the more shareholders, the fewer asymmetric information problems. Hovakimian et al. (2012), on the other hand, find high bankruptcy costs for smaller firms with lower asset tangibility, contradicting the trade-off theory. Kayo and Kimura (2011) analyze

the influence of time-, firm-, industry- and country-level determinants of firm leverage for 40 countries. Gungoraydınoglu and Öztekin (2011) analyze the determinants of capital structure across 37 countries and assess the impact of country-specific factors on leverage variation. Fan *et al.* (2012) examine how the institutional environment influences capital structure and debt maturity choices of firms in 39 developed and developing countries and find that a country's legal and tax systems, corruption and the preferences of capital suppliers explain a significant portion of the variation in leverage and debt maturity ratios. They depict that firms in more corrupt countries and those with weaker laws tend to use more debt (especially short-term debt); explicit bankruptcy codes and deposit insurance are associated with higher leverage and more long-term debt and more debt is used in countries where there is a greater tax gain from leverage. Alves and Francisco (2015) review the impact of environmental variables on capital structure throughout the recent financial crises (dot.com, subprime and European sovereign debt crises). They find that the sovereign's irrational exuberance of debt was mimicked by firms and state that under-stress firms firstly increase leverage and rely, or are forced to rely, secondly on short-term borrowings, heightening rollover risks.

Before moving on to the few studies that examine the capital structure of Shariah-compliant firms, it is worth discussing the screening methodology used by index providers to establish compliance. Shariah is formally based on Quran, considered as God's word by Muslims, and the reported sayings and actions of the Prophet Mohammad. Hayat and Malik (2014) note that even though Islamic investments are guided by Shariah principles such as prohibition of *riba* (interest or usury), *gharar* (excessive risk) and *maysir* (gambling/speculation), many aspects of Islamic finance are governed by Islamic jurisprudence, defined as the interpretation of these principles by scholars. As a result, Shariah screening does not have globally accepted standards and is overseen by the Shariah supervisory boards of the respective index providers.

Guided by the Shariah boards, index providers identify qualitative (or sector-based) and quantitative (or account-based screens (Derigs and Marzban, 2008). Qualitative screens are present to restrict investment in firms that generated revenue through prohibited sources of income such as alcohol and gambling. Qualitative screens are needed because a strict exclusion of firms that partially deal with interest (and possibly other types of prohibited income) is practically impossible rendering Shariah-compliant investing in modern capital markets infeasible. As a result, Shariah scholars have proposed additional layers of quantitative screens around qualitative screens in order to relax rigid constraints. For example, DJIM qualitative screen excludes firms whose income from alcohol and other prohibited sources exceed 5% of their revenue (S&P Dow Jones Indices, 2019). Other quantitative screens include upper limits on debt and liquidity ratios.

There are not many studies in the literature that focus exclusively on the capital structure of Shariah-compliant firms. In this area, the Malaysian companies are studied by several authors. Thabet and Hanefah's (2014) is the first study on the firms listed in Bursa Malaysia in which the authors utilize balanced panel data of 263 companies during the period of 2006–2011. They check the relationship between the capital structure of the firms with tangibility, profitability, liquidity, tax, risk, zakah, firm size, firm age and managerial ownership through both fixed effect and random effect model. The authors conclude that profitability, liquidity, risks, firm size and firm age are main determinants for the selected firms. These results favor the pecking order theory by indicating that the firms prefer to finance their investments through internal funds and the agency theory by showing that managerial ownership affects the liquidity structure of the firms in a positive manner that reduces the agency conflict. Lastly, checking for the risks associated with the firms the authors find that the Shariah-compliant firms are exposed to higher risks which is line with the trade-off theory. Sahudin *et al.* (2019) is another study concentrating on 305 Shariah-compliant firms listed in Bursa Malaysia. The authors find that country-, industry-, and firm-specific factors affect the capital

structure of the investigated firms and all of the capital structure theories mentioned in their study (pecking order theory, trade-off theory and agency theory) can be used to explain the firms for different industries. There are two other country-specific studies on the capital structure of the Shariah compliant firms. We should indicate that the number of firms analyzed in those two studies are too few so that the conclusions from those studies should be analyzed carefully. Cheema *et al.* (2017) study the relationship between the financial performance (return on equity and return on asset) and long term debt ratio, short term debt ratio, non-debt tax shields, sale growth ratio and insider holding for a total of 8 Shariah-compliant and non-Shariah-compliant firms listed in Pakistan Stock Exchange via multivariate regression. The authors find that Shariah-compliant firms work more with long term debt to finance their operations and the capital structure of the non-Shariah-compliant firms affects the financial performance of those firms. Husaeni (2018) study the relationship between the capital structure of the 20 firms listed in Jakarta Islamic Index and firm size, liquidity, return on asset, and sales through multiple linear regression and find that liquidity and return on asset have a statistically significant impact on capital structure of the firms.

Yildirim *et al.* (2018) is a multi-country study that focuses on a subset of DJIM constituents in select countries and industries and analyzes their capital structure using static panel data methods. More specifically, they compare the determinants of capital structure for "Islamic" and "Non-Islamic" firms in seven countries and seven industries over the 2004–2014 period. Their results are inconclusive in that the determinants display different effects for both types of firms.

To the best of our knowledge, our study is the first to analyze the determinants of the capital structure of all constituents of in an Islamic index with an explicit focus on both the economic development and the Muslim-majority statuses of the country of origin. We also differ from Yildirim *et al.* (2018) in our choice of extensive set of determinants and use of dynamic panel data methods.

## 3. Data and methodology

We focus on all firms included in Dow Jones Islamic Market World Index (DJIM) as of December 31, 2017. This index is chosen as it is one of the commonly used benchmarks dues to its global coverage and long history. In order to be included in the Dow Jones Islamic Market Indices, companies should satisfy certain criteria for their products, business activities and debt levels, among others (S&P Dow Jones Indices, 2019). More specifically, total debt, accounts receivables and the sum of cash and interest-bearing securities must each be less than 33% of the 24-months average market capitalization. Sector-based screens include exclusion of all financial institutions other than Islamic finance and insurance firms and ineligibility of companies whose income from alcohol, tobacco, pork-related products, conventional financial services, entertainment and weapons and defense exceed 5% of their total revenue. The Shariah compliance of the index is currently overseen by a supervisory board consisting of four Shariah scholars.

Based on DJIM constituent names provided by S&P, firm-level data is obtained from FactSet while country-level data is obtained from the World Bank annually for the period 2004–2018. After applying filters on missing data, we have 28,543 firm-year observations out of 35,142 potential ones (2,759 companies out of 2,899) [2] in the form of unbalanced panel data.

The geographic distribution of companies is given in Table 1. In Panel A, we provide information on the number of companies in 30 countries classified as developed countries, while the same information is provided for 26 developing countries in Panel B. The dataset covers years 2004–2018 inclusive and the variables are taken from calendarized year-end

| Country | Country code | Minimum | Maximum | Mean |
|---|---|---|---|---|
| *Panel A. Developed countries* | | | | |
| Australia | AU | 8 | 79 | 54 |
| Austria | AT | 3 | 4 | 4 |
| Belgium | BE | 3 | 5 | 5 |
| Canada | CA | 33 | 81 | 61 |
| Czech Republic | CZ | 0 | 1 | 0 |
| Denmark | DK | 11 | 19 | 15 |
| Estonia | EE | 0 | 1 | 1 |
| Finland | FI | 12 | 16 | 15 |
| France | FR | 16 | 24 | 20 |
| Germany | DE | 25 | 41 | 33 |
| Greece | GR | 2 | 3 | 3 |
| Hong Kong SAR, China | HK | 18 | 59 | 37 |
| Ireland | IE | 4 | 8 | 7 |
| Italy | IT | 7 | 14 | 11 |
| Japan | JP | 23 | 286 | 194 |
| Korea, Rep | KR | 90 | 289 | 187 |
| Lithuania | LT | 1 | 3 | 2 |
| Luxembourg | LU | 0 | 1 | 0 |
| Netherlands | NL | 10 | 15 | 13 |
| New Zealand | NZ | 3 | 25 | 14 |
| Norway | NO | 4 | 6 | 5 |
| Portugal | PT | 1 | 2 | 2 |
| Singapore | SG | 3 | 12 | 9 |
| Slovenia | SI | 1 | 1 | 1 |
| Spain | ES | 4 | 7 | 5 |
| Sweden | SE | 20 | 31 | 26 |
| Switzerland | CH | 24 | 38 | 33 |
| Taiwan, China | TW | 126 | 248 | 197 |
| United Kingdom | GB | 40 | 93 | 74 |
| United States | US | 319 | 437 | 382 |
| *Total (Developed)* | | *823* | *1820* | *1409* |
| | | | | |
| *Panel B. Developing countries* | | | | |
| Brazil | BR | 4 | 15 | 9 |
| Bulgaria | BG | 0 | 4 | 2 |
| Chile | CL | 3 | 5 | 4 |
| China | CN | 20 | 86 | 50 |
| Egypt, Arab Rep | EG | 1 | 9 | 6 |
| Hungary | HU | 1 | 1 | 1 |
| India | IN | 18 | 215 | 99 |
| Indonesia | ID | 12 | 43 | 27 |
| Jordan | JO | 1 | 1 | 1 |
| Kuwait | KW | 1 | 8 | 6 |
| Malaysia | MY | 41 | 127 | 98 |
| Mexico | MX | 7 | 14 | 10 |
| Morocco | MA | 3 | 8 | 6 |
| Oman | OM | 5 | 7 | 6 |
| Pakistan | PK | 1 | 42 | 17 |
| Peru | PE | 4 | 4 | 4 |
| Philippines | PH | 6 | 16 | 9 |
| Poland | PL | 16 | 44 | 32 |
| Qatar | QA | 0 | 5 | 4 |
| Romania | RO | 0 | 3 | 2 |
| Russian Federation | RU | 1 | 8 | 5 |
| South Africa | ZA | 4 | 23 | 17 |
| Sri Lanka | LK | 0 | 4 | 2 |
| Thailand | TH | 8 | 112 | 54 |
| Turkey | TR | 17 | 22 | 20 |
| United Arab Emirates | AE | 0 | 3 | 2 |
| *Total (Developing)* | | *187* | *823* | *494* |
| *Total (Muslim-majority)* | | *89* | *275* | *192* |
| *Total (Developing ex-Muslim)* | | *98* | *548* | *301* |

**Table 1.**
Number of companies
per year and their
origins [3]

balance sheet and income statements. The panel data is unbalanced, meaning that we do not have a firm-level data for every single year. In addition, the number of companies from developed countries is significantly higher than that from developing countries. In Panel B, we also italicize the names of 11 Muslim-majority countries in the sample. In our empirical analysis, we focus on these four sub-samples: 30 developed countries, 26 developing countries, 11 Muslim-majority countries and 15 non-Muslim-majority developing countries.

In Table 2, we provide a list of the variables used in our analysis. We have seven firm-level and four country-level independent variables. Below, we give the expected relationship between the independent variables and the dependent variable (total debt ratio) in more detail.

*Leverage*: Booth *et al.* (2001) uses three separate proxies for leverage: total debt ratio, long-term book debt ratio and long-term market debt ratio. We choose the total debt ratio based on book values since it is less noisy than market-based leverage proxies and broader than long-term debt-based ratios. Robustness analyses with a market-based leverage measure are available with the authors due to space considerations. Although the specifications of those tests are slightly different due to the presence of market leverage in other independent variables such as Altman *Z*-score, the findings remain largely the same except for price-to-book whose correlation with market leverage is negative due to the strong opposite impact of market value of equity in these two measures.

*Profitability*: Following the literature (Booth *et al.*, 2001; Ozkan, 2001; Alves and Ferreira, 2011), we expect a negative relationship between profitability and debt ratio.

*Moral Hazard*: Wald (1999) proposed three indicators for moral hazard: research and development expenses over sales, inventories divided by total assets, and property, plant, and equipment divided by total assets. The higher these ratios, the higher the debt ratio since potential

| Concept | Variable | Definition | Abbreviation |
|---|---|---|---|
| *Panel A. Firm-level data* | | | |
| Leverage | Total Debt Ratio | Total Liabilities / Total Assets | TD |
| Profitability | Return on Assets | Net Income / Total Assets | P |
| Moral hazard | Inventory to Assets Ratio | Inventory / Total Assets | MH1 |
| Moral hazard | Property, Plant and Equipment to Assets Ratio | Property, Plant and Equipment / Total Assets | MH2 |
| Liquidity | Current Ratio | Current Assets / Current Liabilities | L |
| Size | Sales | Ln(Sales) | S |
| Market valuation | Price to Book Ratio | Market Value / Book Value of Equity per Share | PB |
| Distance from bankruptcy | Altman Z-score | 3.3(EBIT / Total Assets) + 0.999(Sales / Total Assets) + 1.4(Retained Earnings / Total Assets) + 1.2(Working Capital / Total Assets) + 0.6(Market Value of Equity / Total Liabilities) | AZ |
| *Panel B. Country-level data* | | | |
| | Inflation Rate | Annual Consumer Price Change | INF |
| | GDP Growth | Real GDP Growth in USD | GDP |
| | Strength of Legal Rights Index | A World Bank index that changes from 1 to 12 where 12 represents the most developed legal system | STR |
| | Stock Market Capitalization | Stock Market Capitalization/GDP | SMC |

Table 2.
Concepts and variables used in the analysis

costs of bankruptcy are reduced. In our analysis, as the research and development expenses are not available for half of the dataset, we use the other two variables to measure moral hazard.

*Liquidity*: The impact of liquidity on capital structure is not obvious. For some, the more liquid the firm, the more easily it can use its assets to meet obligations (Stohs and Mauer, 1996; Ozkan, 2001). On the other hand, as liquidity suggests short-term financing, it can lead to an increase in long-term debt and leverage. In our case, we expect a negative relation between liquidity and book leverage, as in "Islamic" context, whenever a fund is available, it is preferable to use it in operations rather than financing with debt.

*Size*: We expect that larger firms are more levered since they are more eligible to raise funds from banks and financial markets (Booth *et al.*, 2001). Sales is used as a proxy of firm size. In the model, size (i.e. sales) is assumed to be an endogenous variable due to the fact that retained earnings which is affected by net income and sales is part of the balance sheet and therefore is determinant in the calculation of debt ratio.

*Market Valuation*: We expect that, when the market value of a firm increases, the cost of capital decreases, since more valuable firms can access cheaper credits and enjoy higher debt ratios. We exclude firms with negative price-to-book ratios, as such values are not meaningful for market valuation. This ratio can also serve as a proxy for firm growth opportunities (Adam and Goyal, 2008).

*Distance from Bankruptcy*: Since 1990s, it is common to measure the distance from bankruptcy by the Altman Z-score. Normally, we expect lower debt ratios for firms that are distant from bankruptcy. However, in literature there are competing findings. Kayo and Kimura (2011) find a positive relationship whereas Harris and Raviv (1991) find a negative relationship by using another measure of distance from bankruptcy.

*Strength*: We expect that the higher the strength of legal rights in a country, the better both the money and stock market so that the more optimal the capital structure is. Since the methodology of this index changed in 2014 resulting in an increase in the maximum value from 10 to 12, we normalize the values in 2004–2013 period to have a maximum of 12. This variable is time-invariant for New Zealand.

*Stock Market Capitalization*: Stock market capitalization can be considered as a proxy for the development of stock market (Gonenc and de Haan, 2014). We expect that, if stock market is developed, firms will borrow less as they will be more inclined to approach stock market to finance their operations.

*Inflation*: We expect that, when inflation is high, economic environment is worsened and borrowing becomes harder for firms. As a result, we expect a negative relationship between inflation and debt ratio. On the other hand, the trade-off theory posits a positive relationship between leverage and expected inflation.

*GDP Growth*: We follow Booth *et al.* (2001), who find that real economic growth will positively influence book leverage.

*Country Dummy Variables*: We suspect that country-specific factors have considerable impact on firm leverage. This also helps cover cultural aspects regarding borrowing habits. For instance, whether leverage ratios are lower in Muslim countries where interest is forbidden is an interesting question. Australia and Russia were dropped from the set of dummy variables for the developed and developing countries, respectively, since they resembled the average leverage ratios for the 2004–2018 period in their respective groups. Similarly, Turkey and Mexico dummies were dropped for Muslim-majority and non-Muslim-majority developing countries, respectively.

*Industry Dummy Variables*: We use Fact Set's sector classification to identify each firm's industry and control for it. The dummy for the Producer Manufacturing sector was dropped as it was the only industry that ranked in the top three for each of the four sub-samples with respect to the frequency of observations.

*Year Dummy Variables*: In financial distress periods, the level of funds available to firms decreases. Consequently, we expect lower leverage ratios during crisis periods. 2005 was dropped from the set of dummy variables as it was the first year in the panel.

In similar studies, Booth *et al.* (2001) use a cross sectional panel data regression with pooling and fixed effects while Rajan and Zingales (1995) use censored Tobit and ordinary least squares (OLS) models. More recently, scholars have a tendency to use Generalized Method of Moments (GMM) procedure. In this study, we use Hausman–Taylor Random Effects regression, which allows for time-invariant variables such as industry and country dummies. In fixed effects model, as the mean values of the independent variables are taken out from the regression, the effects of time-invariant variables cannot be obtained directly. On the other hand, in the random effects regression, the time trend arising from the total debt ratio cannot be included. Moreover, it is evident from the definitions of the variables given in the last section that the company-specific variables and the dependent variable (total debt ratio) are affected from the same variables. This leads to the fact that we need to include instrumental variables and make them as endogenous. As a result, we estimate the following regression for all four subsamples of interest, separately:

$$TD_{t,i} = TD_{t-1,i} + P_{t,i} + MH1_{t,i} + MH2_{t,i} + L_{t,i} + S_{t,i} + PB_{t,i} + AZ_{t,i} + SMC_{t,j} + STR_{t,j}$$
$$+ INF_{t,j} + GDP_{t,j} + Country_j + Industry_i + Year_t + Individual_i + \varepsilon_{it}$$

where

$TD_{t,i}$: Total debt ratio at time $t$ for firm $i$

$TD_{t-1,i}$: Total debt ratio at time $t$-1 for firm $i$ (denoted by TDLAG in Table 5)

$P_{t,i}$: Profitability (return on assets) at time $t$ for firm i

$MH1_{t,i}$: Moral hazard 1 (inventory to assets ratio) at time $t$ for firm $i$

$MH2_{t,i}$: Moral hazard 2 (tangible assets ratio) at time $t$ for firm $i$

$L_{t,i}$: Liquidity (current ratio) at time $t$ for firm i

$S_{t,i}$: Size (log (Sales)) at time $t$ for firm $i$

$PB_{t,i}$: Price to book ratio at time $t$ for firm $i$

$AZ_{t,i}$: Altman $Z$-score at time $t$ for firm $i$

$SMC_{t,j}$: Stock market capitalization as of GDP at time $t$ of country $j$

$STR_{t,j}$: The strength of legal rights index for country $j$ at time $t$

$INF_{t,j}$: Inflation rate at time $t$ of country $j$

$GDP_{t,j}$: Gross Domestic Product growth at time $t$ of country $j$

$Country_j$: Country dummy

$Industry_i$: Fact Set sector category for firm $i$

$Year_t$: Year dummy

$Individual_i$: The combined individual time-invariant error terms of $i$th firm of country $j$

$\varepsilon_{it}$: The time-variant idiosyncratic error term for firm $i$

## 4. Empirical results and discussion

We offer empirical results in several steps. First, we illustrate the time dimension of the capital structure differences among the four subsamples so that the need to study these

groups separately becomes more obvious. Next, we present some descriptive statistics and the correlations between the variables. Finally, we provide the empirical results brought about by the panel data analysis.

We present the cross-sectional average of total debt ratio of all firms within their respective groups over time in Figure 1. In this simple analysis, we also suggest one potential explanation for the group differences because all eleven of the Muslim-majority countries in our data set are categorized as developing countries. As Figure 1 illustrates, these countries consistently have lower debt ratios over time. Put differently, firms from non-Muslim-majority developing countries have historically shown greater similarity with firms from developed countries although this seems to have reversed recently due to an increase in the debt ratios of Muslim-majority countries. Another important insight Figure 1 provides is the difference in capital structure responses to the 2008 Global Financial Crisis among the firms in developed and developing countries. It appears that developing country firms have begun deleveraging in 2006 and have continued to do so after the capital markets have begun recovering. The debt ratios of developed country firms, on the other hand, continued to deteriorate as they entered the global recession and only improved afterwards. Also noteworthy is the recent increase in the average total debt ratio of the Muslim-majority countries, which brings them back to pre-2008 levels.

Table 3 gives the descriptive statistics of the variables used in our analysis for developed and developing countries (country-based descriptive statistics are in the Appendix Tables A1 and A2). Firm-specific variables are winsorized at 1 and 99% level and all statistics are computed over firm-year observations.

Based on Table 3, in developed countries, average total debt ratio can be defined as low-mid level (0.423). For developing countries, the average total debt ratio (0.383) is lower than that of the developed countries. The difference is statistically significant per the $t$-test results presented in Table A3. Notwithstanding this difference, in both developed and developing countries, an average firm finances less than half of its operations by debt and prefers equity and internal financing. This is consistent with the strict screening requirements of the DJIM Indices.

Looking at the independent variables and starting with the firm-level variables, as expected, the average profitability in developing countries is higher than the developed countries (0.098 vs 0.063), a difference that is statistically significant. Furthermore, profitability is also more stable in firms operating in developing countries (0.082 vs. 0.092) and this is also significant based on $F$-tests. The Moral Hazard variable based on inventories (MH1) is higher in firms based in developing countries as well as the Moral Hazard variable based on plant, property and equipment (MH2). The average liquidity ratios are higher for firms based in developed countries (2.583 vs. 2.373) with higher variability (standard deviations of 2.139 vs 1.940). Developed country firms are also larger in average size (20.63 vs 19.7) with larger variation (1.999 vs 1.66). Both the Price-to-Book ratios (3.684 vs. 3.844) and Altman $Z$-scores (5.91 vs 6.487) of developed country firms are smaller on average. While the price-to-book ratios for developed country firms are less dispersed (3.956 vs. 4.607), their Altman $Z$-scores display a greater variability (6.405 vs. 6.291), as compared with the developing country firms. All the differences are statistically significant at the 1% level, except for the variance difference for the $Z$-score, which is statistically significant at the 10% level.

When analyzing country-level data, Stock Market Capitalization is larger on average but more dispersed in developing countries while inflation and GDP growth are smaller and less dispersed. Strength, on the other hand, is not only higher on average but also more stable. All these results are statistically significant at the 1% level.

Confronted with very strong statistical significance of the differences between developed and developing country firms in all but one of the cases above, we are encouraged in our endeavor for analyzing these two groups separately.

Panels C and D in Table 3 as well as Panel B in Appendix Table A3 illustrate that there are significant differences between firms in Muslim-majority countries and those in other

**Figure 1.**
Average total debt
ratio of firms in various
country groups
over time
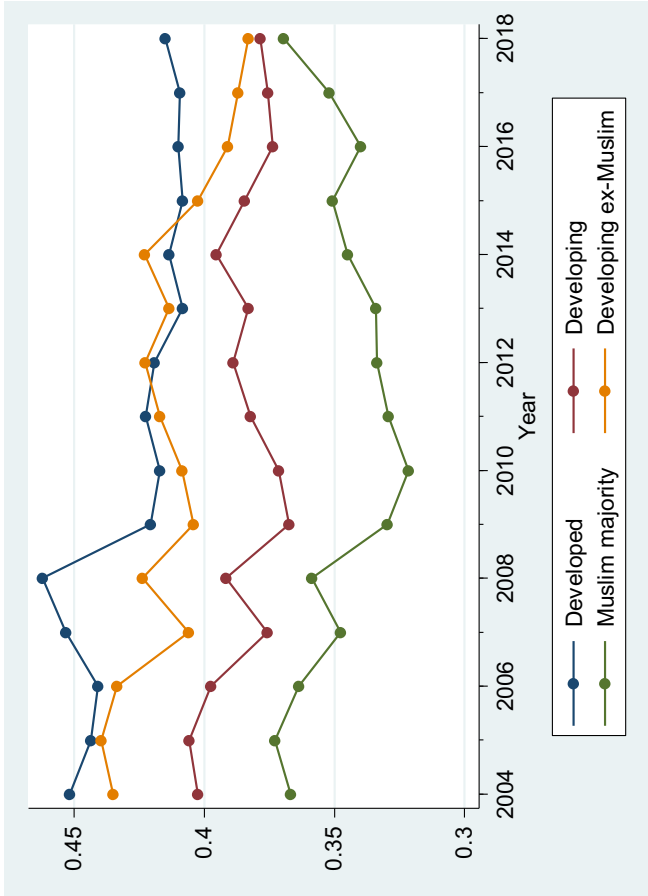
**Note(s):** Average number of firms in each group are as reported in Table 1.

| Variable | Mean | Median | Minimum | Maximum | Standard Deviation | Mean | Median | Minimum | Maximum | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Panel A: Developed countries (21,136 firm-year observations)* | | | | | *Panel B: Developing countries (7,407 firm-year observations)* | | | | |
| TD | 0.423 | 0.420 | 0.047 | 0.905 | 0.184 | 0.383 | 0.369 | 0.0307 | 0.958 | 0.174 |
| P | 0.063 | 0.068 | −0.518 | 0.316 | 0.092 | 0.098 | 0.090 | −0.301 | 0.424 | 0.082 |
| MH1 | 0.113 | 0.096 | 0 | 0.615 | 0.102 | 0.128 | 0.104 | 0 | 0.620 | 0.117 |
| MH2 | 0.260 | 0.219 | 0.004 | 0.876 | 0.196 | 0.355 | 0.340 | 0.005 | 0.894 | 0.208 |
| L | 2.583 | 1.942 | 0.426 | 16.53 | 2.139 | 2.373 | 1.788 | 0.166 | 20.37 | 1.940 |
| S | 20.63 | 20.82 | 15.05 | 25.15 | 1.999 | 19.70 | 19.65 | 14.10 | 24.34 | 1.660 |
| PB | 3.684 | 2.558 | 0.251 | 35.30 | 3.956 | 3.844 | 2.505 | 0.182 | 44.76 | 4.607 |
| AZ | 5.910 | 4.066 | −1.081 | 61.66 | 6.405 | 6.487 | 4.558 | −1.605 | 52.91 | 6.291 |
| SMC | 137.6 | 115.3 | 7.375 | 1,273 | 154.4 | 81.99 | 72.08 | 7.069 | 352.8 | 51.92 |
| STR | 8.097 | 8.4 | 2 | 12 | 2.801 | 6.724 | 6 | 0 | 12 | 2.933 |
| INF | 1.601 | 1.547 | −4.478 | 10.93 | 1.26 | 4.075 | 3.383 | −4.863 | 29.5 | 3.199 |
| GDP | 2.195 | 2.292 | −14.81 | 25.12 | 2.227 | 5.275 | 5.43 | −7.8 | 19.59 | 2.747 |
| | *Panel C: Muslim-Majority Countries (2,885 firm-year observations)* | | | | | *Panel D: Non-Muslim-Majority Developing Countries (4,522 firm-year observations)* | | | | |
| TD | 0.347 | 0.329 | 0.0307 | 0.932 | 0.174 | 0.406 | 0.394 | 0.0423 | 0.958 | 0.170 |
| P | 0.100 | 0.0905 | −0.251 | 0.424 | 0.0875 | 0.0971 | 0.0900 | −0.301 | 0.424 | 0.0790 |
| MH1 | 0.126 | 0.102 | 0 | 0.620 | 0.111 | 0.129 | 0.106 | 0 | 0.620 | 0.120 |
| MH2 | 0.386 | 0.378 | 0.005 | 0.894 | 0.204 | 0.335 | 0.309 | 0.005 | 0.894 | 0.208 |
| L | 2.753 | 2.024 | 0.166 | 20.37 | 2.319 | 2.130 | 1.678 | 0.166 | 16.96 | 1.606 |
| S | 19.21 | 19.14 | 14.10 | 23.47 | 1.643 | 20.01 | 19.90 | 14.53 | 24.34 | 1.593 |
| PB | 3.115 | 2.009 | 0.182 | 44.76 | 4.237 | 4.309 | 2.957 | 0.191 | 44.76 | 4.771 |
| AZ | 6.508 | 4.585 | −1.605 | 52.91 | 6.474 | 6.474 | 4.541 | −1.014 | 52.91 | 6.172 |
| SMC | 89.82 | 88.33 | 10.01 | 298.8 | 51.90 | 76.99 | 71.74 | 7.069 | 352.8 | 51.31 |
| STR | 7.022 | 7 | 0 | 12 | 3.674 | 6.533 | 6 | 1 | 10.80 | 2.321 |
| INF | 4.232 | 3.174 | −4.863 | 29.50 | 3.554 | 3.975 | 3.641 | −1.545 | 22.56 | 2.947 |
| GDP | 4.976 | 5.167 | −7.076 | 19.59 | 2.456 | 5.465 | 6.386 | −7.800 | 14.23 | 2.902 |

**Note(s):** INF and GDP are in percentage terms

**Table 3.**
Descriptive statistics of
all variables with
respect to developed
and developing
countries [4]

developing countries. Among other differences, the most striking one is that when Muslim-majority countries are excluded, developing country firms look more like developing country firms with respect to leverage. This could imply that any differences between developed and developing country firms with respect to determinants of capital structure may arise from the religion in the domicile country. Therefore, our panel data analysis will be repeated for these two sub-groups within developing countries.

Country-level differences also exist across all variables of interest based on summary statistics reported in the Appendix Tables A1 and A2. Firms in Belgium (BE), Switzerland (CH), Germany (DE), Spain (ES), Finland (FI), France (FR), United Kingdom (GB), Ireland (IE) and Sweden (SE) appear to prefer debt financing with book leverage ratios exceeding fifty percent. Because of their equity finance preference, Czech (CZ), Estonian (EE) and Slovenian (SI) firms have the lowest debt ratios. This separation clearly shows capital structure differences between Western and Eastern Europe. Within the developing countries, Brazilian (BR) firms appear to have the highest debt ratios, while Jordanian (JO) firms have the lowest.

Next, we turn to the relationship between variables of interest and present the correlation between each variable in Table 4 by taking into consideration the panel structure of the data.

Consistent with the prior empirical literature, Total Debt ratio is positively correlated with Size and Price/Book ratio (0.392 and 0.278, respectively) and negatively correlated with Liquidity ratio (−0.575), which seems to be the highest among other variables. Another important thing to note is that Altman Z-score and Liquidity ratio have a high positive correlation (0.599). None of these correlation values are high enough to consider multicollinearity. With respect to theories of capital structure, the relationship between the Profitability and Asset Tangibility (MH2 and MH1) ratios and the Total Debt ratio are compatible with Pecking Order Theory. On the other hand, the relationship between Size ratio and Bankruptcy value and Total Debt ratio are compatible with Trade-off Theory.

After examining our data using basic statistical techniques, we conduct panel data analysis. For this purpose, we use Hausman–Taylor random effects model as discussed in the previous section. Each column of Table 5 presents the main results of our analysis for one of the four sub-samples. Appendix Tables A4 and A5 show the results of the diagnostic tests for the choice of endogenous variables.

In Table 5, one can see that the firm-specific characteristics are the main determinants of the capital structure of DJIM firms. The coefficients of profitability ratio, size, Altman Z-score, P/B ratio, liquidity ratio and previous year's total debt ratio are all statistically significant at 1% level. This result is valid for both developed or developing country sub-sample. Tangibility ratios present mixed results both in terms of sign and significance across samples.

The results for the country-specific variables are strikingly different. For developing country firms, the inflation rate and the strength of legal rights index appear to be the only significant variables, both with a positive impact on the total debt ratios. For developed country firms, the GDP growth rate has a positive significant impact, but a closer look reveals that this result is driven by Muslim-majority countries. A similar situation but with a negative significance exists for the financial market development variable. The strength of legal rights index appears insignificant for the two developing country sub-samples but has a negative significance for overall developing country group. On the contrary, inflation, which is insignificant for the larger developing country sample appears to be have a positive impact for Muslim-majority countries.

Year dummies clearly show the deleveraging over time, however, for firms in developed countries, this takes place slowly following a major increase in 2008 while the downward trend is much more obvious for developing country firms. A closer look reveals that this pattern is driven by Muslim-majority countries. As a matter of fact, controlling for all other variables, 2008-years dummy shows that firms in Muslim-majority firms were able to

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| | TD | P | MH1 | MH2 | L | S | PB | AZ | SMC | STR | INF | GDP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TD | 1 | | | | | | | | | | | |
| P | -0.142 | 1 | | | | | | | | | | |
| MH1 | 0.104 | 0.082 | 1 | | | | | | | | | |
| MH2 | 0.013 | -0.017 | -0.079 | 1 | | | | | | | | |
| L | -0.575 | 0.009 | -0.042 | -0.21 | 1 | | | | | | | |
| S | 0.392 | 0.162 | 0.056 | -0.008 | -0.319 | 1 | | | | | | |
| PB | 0.278 | 0.172 | -0.058 | -0.151 | -0.018 | -0.007 | 1 | | | | | |
| AZ | -0.488 | 0.276 | -0.083 | -0.165 | 0.599 | -0.243 | 0.37 | 1 | | | | |
| SMC | -0.03 | -0.048 | -0.028 | -0.075 | 0.032 | -0.057 | 0.044 | 0.039 | 1 | | | |
| STR | 0.197 | -0.044 | -0.051 | -0.09 | -0.037 | 0.24 | 0.088 | -0.054 | 0.155 | 1 | | |
| INF | 0.041 | 0.108 | 0.054 | 0.087 | -0.06 | -0.087 | 0.039 | 0.001 | -0.055 | 0.005 | 1 | |
| GDP | -0.067 | 0.116 | 0.033 | 0.106 | -0.023 | -0.22 | 0.066 | 0.063 | 0.007 | -0.147 | 0.355 | 1 |

**Table 4.**
Correlation matrix of
the variables in the
panel data (28, 543
firm-year
observations)

| Variable | Developed countries (N = 18,915) | Developing countries (N = 6,359) | Muslim-majority countries (N = 2,538) | Developing non-Muslim countries (N = 2,538) |
|---|---|---|---|---|
| *Firm-level time-variant endogenous variables* | | | | |
| P | −0.2428*** (0.0073) | −0.3445*** (0.0143) | −0.3517*** (0.0236) | −0.3436*** (0.0179) |
| MH1 | 0.1248*** (0.0142) | 0.0682*** (0.0204) | 0.0539* (0.0303) | 0.0746*** (0.0275) |
| MH2 | −0.0125* (0.007) | −0.0387*** (0.0097) | −0.0604*** (0.0141) | −0.0032 (0.0133) |
| L | −0.0074*** (0.0004) | −0.0097*** (0.0007) | −0.0088*** (0.0009) | −0.0116*** (0.0011) |
| S | 0.0186*** (0.0012) | 0.0234*** (0.0019) | 0.0361*** (0.0032) | 0.0131*** (0.0024) |
| PB | 0.0106*** (0.0002) | 0.008*** (0.0003) | 0.0063*** (0.0006) | 0.0095*** (0.0004) |
| AZ | −0.0072*** (0.0001) | −0.0061*** (0.0003) | −0.0048*** (0.0004) | −0.0079*** (0.0004) |
| TDLAG | 0.4888*** (0.0052) | 0.5025*** (0.0086) | 0.5234*** (0.0136) | 0.4836*** (0.0111) |
| *Country-level time-variant exogenous variables* | | | | |
| SMC | 0.00001 (0.00002) | −0.00012** (0.00005) | −0.00018* (0.0001) | −0.00003 (0.00006) |
| STR | 0.00269*** (0.00047) | −0.00136** (0.00067) | −0.00023 (0.00122) | −0.00008 (0.00091) |
| GDP | 0.00004 (0.00058) | 0.00199*** (0.00039) | 0.00307*** (0.00064) | 0.0005 (0.00059) |
| INF | 0.00119*** (0.00034) | 0.00064 (0.00042) | 0.00158** (0.00066) | 0.00026 (0.0006) |
| *Year dummies* | | | | |
| yr_2006 | −0.003 (0.003) | −0.005 (0.006) | −0.009 (0.008) | −0.004 (0.008) |
| yr_2007 | −0.001 (0.003) | −0.009 (0.006) | −0.002 (0.009) | −0.018** (0.008) |
| yr_2008 | 0.015*** (0.003) | −0.013* (0.006) | −0.025*** (0.009) | 0.004 (0.008) |
| yr_2009 | −0.015*** (0.004) | −0.03*** (0.006) | −0.021** (0.009) | −0.03*** (0.008) |
| yr_2010 | −0.01*** (0.003) | −0.03*** (0.005) | −0.027*** (0.008) | −0.03*** (0.008) |
| yr_2011 | −0.002 (0.003) | −0.026*** (0.005) | −0.035*** (0.008) | −0.014* (0.007) |
| yr_2012 | −0.009*** (0.003) | −0.034*** (0.005) | −0.04*** (0.008) | −0.025*** (0.007) |
| yr_2013 | −0.02*** (0.003) | −0.035*** (0.005) | −0.035*** (0.008) | −0.03*** (0.007) |
| yr_2014 | −0.005* (0.003) | −0.037*** (0.006) | −0.039*** (0.009) | −0.029*** (0.007) |
| yr_2015 | −0.011*** (0.003) | −0.042*** (0.005) | −0.033*** (0.009) | −0.04*** (0.007) |
| yr_2016 | −0.009*** (0.003) | −0.044*** (0.005) | −0.04*** (0.009) | −0.039*** (0.007) |
| yr_2017 | −0.016*** (0.003) | −0.046*** (0.005) | −0.044*** (0.009) | −0.043*** (0.007) |
| yr_2018 | −0.01*** (0.003) | −0.043*** (0.005) | −0.036*** (0.008) | −0.041*** (0.007) |
| *Time-invariant exogenous variables* | | | | |
| Countries | Positive: Taiwan | Positive: Sri Lanka, Morocco, Pakistan, Thailand | Positive: Malaysia, Pakistan | None |
| Industries | Positive: Commercial Services Negative: Consumer Durables, Energy Minerals, Non-Energy Minerals | None | Positive: Commercial Services, Technology Services | Negative: Non-Energy Minerals |

**Table 5.**
Results of Hausman-Taylor random effects regression analysis

**Note(s)**: The table shows the results of Hausman-Taylor Random Effects regression analysis for developing and developed country firms' debt ratios against a set of country- and firm-level variables. Firm- and country-level variables are defined as in Table 2. Country, industry, and year dummy variables are used. *, ** and *** denote significance at 10, 5 and 1% levels, respectively. For country and industry dummies, only the ones statistically significant at 1% level are reported.

decrease book leverage throughout the financial crisis, distinguishing themselves from both developed and non-Muslim developing country firms. Country dummies do not clearly display much dispersion among the developed countries while several developing countries deviate upwards from the average.

We summarize the expected direction of the relationships as well as the findings for each subsample in Table 6.

| Concept | Expected relationship | Developed countries | Developing countries | Muslim-majority countries | Developing non-Muslim countries |
|---|---|---|---|---|---|
| Profitability | −** | − | − | − | − |
| Moral hazard | +*/** | +/− | +/− | +/− | +/? |
| Liquidity | −** | − | − | − | − |
| Size | +* | + | + | + | + |
| Market valuation | +** | + | + | + | + |
| Distance from Bankruptcy | −* | − | − | − | − |
| Financial development | − | ? | − | − | ? |
| Strength of legal rights | + | + | − | ? | ? |
| GDP growth | + | ? | + | + | ? |
| Inflation rate | − | + | ? | + | ? |

**Note(s)**: Insignificant relationships are marked with "?", while significant relationships are shown with their signs. For Moral Hazard, we report the significance of two measures side-by-side. In the expected relationship column, * denotes prediction by the Trade-off Theory whereas ** denotes prediction by the Pecking Order Theory

As summarized in Table 6, the results in Table 5 reveal several insights regarding the four subsamples and how they are aligned with the capital structure theories. The firm-specific determinants yield consistent results for all country groups. Profitability has a negative impact on the firms' debt ratios, as predicted by the pecking order theory. On the other hand, firm size affects book leverage positively, which supports the trade-off theory. Moral Hazard measured by inventories has a positive impact on debt ratio, a resulted expected by both theories. In contrast, being distant from bankruptcy has a negative impact on the firms' debt ratios which is in line with the results of Harris and Raviv (1991), thus supporting the trade-off theory. In a result supporting the pecking order theory, liquidity is statistically significant and has a negative impact on the book leverage which confirms that firms operating in line with the "Islamic" principles use their liquid funds to finance their operations. Finally, the lagged value of total debt ratio (TDLAG) is positive and significant in all regressions affects the total debt ratio pointing to the presence of a time trend in leverage ratios.

Country-specific determinants are inconsistent across the four subsamples. In developing countries, the GDP growth positively affects the total debt ratio of the companies whereas, in advanced economies, the inflation rate and the strength of legal rights index have a positive impact. In Muslim-majority countries, GDP growth and inflation has a positive relationship while financial development has a negative relationship with book leverage. For developing non-Muslim countries, none of the country-specific determinants are significant.

Considering the country dummy variables, we find that the companies operating in Sri Lanka, Morocco, Pakistan and Thailand have higher debt ratios compared to other developing countries. Despite the lower average debt ratio of Muslim-majority country firms observed in the univariate analyses, it appears that the capital structure of the companies included in DJIM index is not affected by the main religion adopted in the firms' country. For advanced economies, even though the univariate analyses found a clustering effect with higher debt ratios in Western Europe and lower in Eastern Europe and Far East, the panel analysis did not find a significant country-specific effect other than that of Taiwan.

An analysis of the year dummies reveals the gradual decrease of total debt ratios for developing country firms. For developed country firms, 2008 crisis displays a significant increase which is followed by a significant decrease in the subsequent years.

There is no clear winner between the two capital structure theories. Some consistent findings (profitability, liquidity, market valuation) support pecking order theory, while others (moral hazard based on inventories, size, distance from bankruptcy) support the trade-off theory. For the country-level variables, the trade-off theory appears to work better although there is no consensus across the subsamples. Since the general results for all four subsamples do not favor either theory, our findings are in line with those of Sahudin *et al.* (2019) and Yildirim *et al.* (2018) while they are in contrast with Thabet and Hanefah (2014), whose results support the pecking order theory.

## 5. Conclusions

This paper analyzes the firm- and country-level determinants of the capital structure of the firms selected to the Dow Jones Islamic Market World Index (DJIM). We include all countries represented in the index, barring data limitations and consider the economic development category of each country as well as their Muslim-majority status. To the best of our knowledge, this paper is the first to carry out such a comprehensive analysis of the capital structure of Islamic index firms in the literature.

We find a time trend in the debt structure of the analyzed firms. In addition, we find that firm-specific determinants of capital structure of DJIM firms such as profitability, size, moral hazard, and liquidity are not very different than those of other conventional firms and is similar for all four country groups. The analysis also reveals that, even though the main firm-specific determinants of leverage remain the same across the developed and developing countries included in the DJIM, doing a mixed analysis may be misleading since the effect magnitudes vary and country-specific determinants differ. The latter aspect is important as those country specific factors may also contribute to the economic development status of the countries.

Even though the debt ratios of the firms complying with "Islamic" rules are higher in "non-Muslim" countries over time, operating in a "Muslim" country does not affect the capital structure after controlling for all variables under consideration. The clustering effect observed in the total debt ratios for developed country firms also disappear in the panel data regression. With respect to time variables, we observe that even before the Global Crisis, leverage ratios for developing country firms have gradually declined and continued to do so as soon throughout the market crash. For developed country firms, firms have increased leverage prior to the global recession.

These findings have implications for "Islamic" firms and their investors across the world. For the firms, it is shown that they can control their leverage through managing their own firm characteristics irrespective of the country they operate in, since those are the main determinants of their capital structure. Therefore, operating in a developed or developing market should be considered as secondary in capital structure decisions. For the investors who expect global market uncertainty, these results demonstrate that they may benefit from diversifying into developing markets as deleveraging can be achieved more quickly in those countries.

As further research, one can investigate industry-level factors, corruption level within the country, and some debt market indicators among others as determinants of firm leverage. It would also be interesting to compare the determinants of capital structure for "non-Islamic" firms with those of "Islamic" firms in a comprehensive setting.

## Notes

1. For example, to be included in DJIM, a firm must have total debt less than 33% of its trailing 24-months average market capitalization (S&P Dow Jones Indices, 2019).

2. Firm-year observations that do not have data for all the variables are excluded.

3. The number of companies included in the analysis varies across years, which leads to different minimum and maximum values. Countries are classified as "developed" and "developing" according to International Monetary Fund (2019).

4. The results for the mean difference test and variance equality test that compare the developed and developing countries as well as Muslim-majority and non-Muslim majority developing countries are available in the Appendix Table A3.

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**Appendix**

Table A1.
Average and standard deviation (in parentheses) of the variables for developed countries

| Country | TD | P | MH1 | MH2 | L | S | PB | AZ | STR | SMC | INFL | GDP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AT (N = 57) | 0.484 (0.09) | 0.067 (0.036) | 0.134 (0.077) | 0.391 (0.11) | 2.006 (0.656) | 21.114 (0.857) | 2.292 (0.89) | 3.518 (0.834) | 6.133 (1.561) | 31.887 (12.474) | 1.917 (0.783) | 1.63 (1.833) |
| AU (N = 808) | 0.428 (0.168) | 0.075 (0.101) | 0.08 (0.093) | 0.307 (0.231) | 2.021 (1.522) | 20.447 (1.614) | 3.92 (3.73) | 5.375 (5.755) | 11.027 (0.406) | 107.583 (25.923) | 2.441 (0.828) | 2.898 (0.684) |
| BE (N = 69) | 0.527 (0.116) | 0.105 (0.084) | 0.152 (0.11) | 0.272 (0.132) | 1.5 (0.849) | 22.075 (1.388) | 3.701 (2.104) | 5.41 (4.871) | 5.6 (1.121) | 69.005 (18.037) | 1.977 (1.19) | 1.521 (1.45) |
| CA (N = 909) | 0.374 (0.17) | 0.048 (0.099) | 0.073 (0.098) | 0.526 (0.275) | 2.736 (2.776) | 20.262 (1.603) | 3.008 (3.332) | 5.632 (7.319) | 8.6 (0.293) | 119.015 (19.524) | 1.757 (0.644) | 1.921 (1.589) |
| CH (N = 489) | 0.509 (0.156) | 0.085 (0.053) | 0.144 (0.097) | 0.22 (0.14) | 2.105 (1.136) | 21.931 (1.364) | 4.374 (3.51) | 5.314 (3.497) | 8.4 (3.51) | 214.238 (34.406) | 0.373 (0.903) | 2.068 (1.498) |
| CZ (N = 5) | 0.274 (0.046) | 0.072 (0.035) | 0.007 (0.001) | 0.666 (0.048) | 0.96 (0.307) | 21.777 (0.185) | 1.744 (0.276) | 3.938 (1.004) | 8.16 (0.537) | 26.096 (7.099) | 3.273 (1.769) | 5.316 (1.661) |
| DE (N = 492) | 0.505 (0.184) | 0.069 (0.086) | 0.125 (0.103) | 0.191 (0.131) | 2.064 (1.443) | 22.03 (1.809) | 3.502 (2.601) | 4.98 (4.748) | 7.92 (1.491) | 45.602 (9.307) | 1.458 (0.68) | 1.518 (2.305) |
| DK (N = 219) | 0.485 (0.166) | 0.092 (0.123) | 0.11 (0.1) | 0.257 (0.198) | 2.081 (2.162) | 21.019 (1.509) | 6.176 (6.078) | 7.052 (7.914) | 9.707 (1.313) | 82.311 (25.365) | 1.52 (0.919) | 1.255 (2.012) |
| EE (N = 12) | 0.217 (0.042) | 0.16 (0.079) | 0.315 (0.044) | 0.201 (0.029) | 3.899 (0.775) | 18.39 (0.474) | 2.471 (1.199) | 7.847 (1.942) | 7.517 (0.658) | 13.195 (7.813) | 2.669 (2.304) | 3.033 (6.177) |
| ES (N = 74) | 0.54 (0.154) | 0.075 (0.059) | 0.117 (0.088) | 0.306 (0.218) | 1.494 (0.67) | 22.043 (1.309) | 3.46 (2.69) | 3.71 (3.007) | 6.467 (1.073) | 78.102 (18.996) | 1.875 (1.536) | 1.368 (2.601) |
| FI (N = 227) | 0.567 (0.115) | 0.07 (0.063) | 0.15 (0.074) | 0.232 (0.163) | 1.652 (0.751) | 22.082 (1.004) | 3.023 (1.888) | 3.616 (2.101) | 8.733 (1.269) | 92.441 (24.425) | 1.391 (1.277) | 1.293 (3.265) |
| FR (N = 296) | 0.509 (0.158) | 0.061 (0.049) | 0.088 (0.069) | 0.168 (0.127) | 1.704 (1.409) | 22.258 (1.491) | 3.394 (2.269) | 4.244 (4.785) | 4.933 (1.065) | 79.862 (16.586) | 1.335 (0.845) | 1.262 (1.403) |
| GB (N = 1112) | 0.513 (0.176) | 0.089 (0.075) | 0.15 (0.151) | 0.192 (0.167) | 1.957 (1.483) | 21.393 (1.384) | 4.486 (4.77) | 5.407 (5.594) | 10.333 (2.44) | 111.394 (17.464) | 2.18 (0.887) | 1.544 (1.801) |
| GR (N = 43) | 0.433 (0.13) | 0.071 (0.046) | 0.124 (0.087) | 0.449 (0.25) | 2.654 (0.986) | 19.543 (0.622) | 2.306 (1.322) | 3.281 (1.359) | 4.2 (0.878) | 34.672 (21.866) | 1.626 (2.106) | −0.777 (4.328) |
| HK (N = 550) | 0.356 (0.173) | 0.038 (0.121) | 0.104 (0.138) | 0.202 (0.211) | 2.805 (2.53) | 19.269 (2.097) | 4.123 (5.716) | 7.148 (9.132) | 10.6 (2.063) | 978.059 (239.451) | 2.612 (1.61) | 3.988 (2.89) |
| IE (N = 110) | 0.576 (0.117) | 0.064 (0.032) | 0.097 (0.062) | 0.248 (0.143) | 1.629 (0.306) | 21.949 (0.805) | 2.919 (1.347) | 3.559 (0.958) | 9.533 (1.854) | 45.681 (15.742) | 1.174 (2.346) | 4.874 (6.898) |
| IT (N = 162) | 0.431 (0.148) | 0.084 (0.057) | 0.168 (0.088) | 0.2 (0.111) | 2.064 (0.808) | 21.568 (1.023) | 3.463 (2.732) | 5.004 (2.826) | 3.067 (0.781) | 33.343 (9.907) | 1.557 (1.057) | 0.126 (2.076) |
| JP (N = 2903) | 0.345 (0.156) | 0.06 (0.06) | 0.119 (0.079) | 0.247 (0.137) | 2.982 (2.106) | 21.144 (1.436) | 2.388 (2.812) | 6.098 (5.941) | 7.107 (1.658) | 86.345 (22.443) | 0.282 (0.958) | 0.862 (2.103) |
| KR (N = 2812) | 0.36 (0.173) | 0.021 (0.115) | 0.104 (0.083) | 0.286 (0.168) | 2.952 (2.849) | 18.643 (1.693) | 3.05 (3.347) | 6.166 (7.713) | 6.467 (1.073) | 86.548 (16.884) | 2.359 (1.143) | 3.544 (1.454) |
| LT (N = 32) | 0.342 (0.22) | 0.102 (0.072) | 0.193 (0.208) | 0.563 (0.193) | 2.967 (2.518) | 18.538 (0.649) | 2.682 (2.425) | 6.5 (3.518) | 6.16 (0.62) | 14.711 (9.182) | 2.987 (2.839) | 3.409 (5.669) |
| LU (N = 7) | 0.459 (0.029) | 0.029 (0.037) | 0.258 (0.04) | 0.39 (0.032) | 1.396 (0.171) | 22.341 (0.091) | 0.972 (0.411) | 2.302 (0.629) | 3.514 (0.878) | 102.013 (20.714) | 1.293 (0.86) | 2.582 (1.612) |
| NL (N = 191) | 0.507 (0.157) | 0.051 (0.057) | 0.12 (0.075) | 0.169 (0.125) | 2.033 (1.232) | 21.738 (1.223) | 2.81 (2.854) | 3.268 (1.941) | 4.587 (1.918) | 88.989 (22.566) | 1.527 (0.684) | 1.508 (1.885) |
| NO (N = 75) | 0.407 (0.118) | 0.065 (0.058) | 0.125 (0.084) | 0.228 (0.15) | 2.165 (0.567) | 21.771 (1.495) | 2.044 (0.996) | 3.956 (1.726) | 6.467 (1.073) | 58.442 (15.014) | 1.994 (0.961) | 1.649 (1.326) |
| NZ (N = 211) | 0.431 (0.142) | 0.07 (0.064) | 0.09 (0.127) | 0.395 (0.287) | 1.695 (1.269) | 19.512 (1.148) | 3.123 (3.157) | 4.962 (6.093) | 12 (0) | 35.364 (7.653) | 2.086 (1.142) | 2.501 (1.428) |
| PT (N = 27) | 0.643 (0.091) | 0.05 (0.029) | 0.12 (0.041) | 0.469 (0.07) | 0.976 (0.618) | 23.384 (0.486) | 4.332 (1.928) | 3.181 (0.908) | 3.067 (0.781) | 34.067 (8.85) | 1.549 (1.322) | 0.556 (2.095) |
| SE (N = 394) | 0.525 (0.148) | 0.061 (0.075) | 0.146 (0.11) | 0.224 (0.202) | 1.751 (1.453) | 21.516 (1.451) | 2.942 (2.102) | 4.136 (4.183) | 7.92 (1.558) | 117.265 (20.95) | 1.121 (1.172) | 2.22 (2.701) |
| SG (N = 142) | 0.354 (0.173) | 0.1 (0.066) | 0.068 (0.08) | 0.312 (0.23) | 2.162 (1.537) | 19.978 (1.794) | 2.775 (2.032) | 4.922 (3.128) | 10.667 (1.952) | 225.775 (40.189) | 1.891 (2.123) | 5.589 (3.752) |
| SI (N = 15) | 0.289 (0.069) | 0.103 (0.02) | 0.15 (0.015) | 0.493 (0.058) | 2.527 (0.397) | 20.918 (0.312) | 2.296 (1.459) | 4.774 (1.158) | 4.52 (1.218) | 21.439 (12.909) | 1.96 (1.582) | 2.149 (3.735) |
| TW (N = 2957) | 0.346 (0.151) | 0.082 (0.089) | 0.133 (0.091) | 0.305 (0.174) | 2.85 (2.318) | 18.988 (1.501) | 2.729 (2.274) | 6.622 (7.683) | 4.613 (1.533) | 149.482 (23.395) | 1.223 (1.042) | 3.597 (3.009) |
| US (N = 5736) | 0.486 (0.187) | 0.068 (0.095) | 0.102 (0.109) | 0.212 (0.19) | 2.598 (1.918) | 21.742 (1.582) | 5.128 (4.999) | 6.14 (5.839) | 10.867 (0.098) | 129.899 (22.759) | 2.103 (1.183) | 1.97 (1.558) |

| Country | TD | P | MH1 | MH2 | L | S | PB | AZ | STR | SMC | INFL | GDP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AE (N = 26) | 0.389 (0.109) | 0.088 (0.017) | 0.003 (0.004) | 0.209 (0.115) | 1.47 (0.608) | 21.668 (1.289) | 2.161 (0.708) | 3.202 (1.168) | 3.891 (1.54) | 48.086 (13.15) | 2.764 (3.311) | 2.79 (3.239) |
| BG (N = 34) | 0.311 (0.119) | 0.065 (0.093) | 0.181 (0.06) | 0.5 (0.164) | 2.07 (1.13) | 18.317 (0.621) | 1.784 (0.956) | 5.461 (4.223) | 9.527 (1.462) | 15.082 (5) | 2.56 (3.689) | 2.031 (2.537) |
| BR (N = 133) | 0.473 (0.171) | 0.113 (0.069) | 0.068 (0.095) | 0.283 (0.232) | 1.897 (0.874) | 21.003 (1.339) | 4.761 (5.7) | 4.72 (2.904) | 3.067 (0.781) | 52.483 (18.686) | 5.757 (1.71) | 2.415 (3.227) |
| CL (N = 59) | 0.445 (0.142) | 0.05 (0.085) | 0.067 (0.082) | 0.396 (0.257) | 1.953 (1.177) | 21.214 (0.98) | 2.679 (1.822) | 3.382 (1.63) | 5.013 (1.189) | 106.007 (22.507) | 3.2 (1.991) | 3.9 (2.403) |
| CN (N = 756) | 0.366 (0.16) | 0.088 (0.064) | 0.086 (0.097) | 0.284 (0.215) | 2.278 (1.812) | 20.765 (1.557) | 3.886 (4.614) | 6.104 (5.528) | 4.773 (1.074) | 55.251 (26.127) | 2.684 (1.743) | 9.175 (2.35) |
| EG (N = 90) | 0.351 (0.205) | 0.152 (0.14) | 0.132 (0.101) | 0.383 (0.165) | 2.652 (2.322) | 19.495 (0.963) | 3.664 (4.932) | 7.323 (8.747) | 3.267 (0.867) | 39.999 (29.05) | 11.951 (5.817) | 4.452 (1.714) |
| HU (N = 15) | 0.161 (0.067) | 0.091 (0.045) | 0.12 (0.032) | 0.306 (0.088) | 4.455 (0.924) | 20.98 (0.237) | 1.851 (0.536) | 9.85 (5.272) | 8.6 (0.293) | 20.637 (7.883) | 3.595 (2.467) | 1.987 (3.067) |
| ID (N = 410) | 0.362 (0.183) | 0.102 (0.1) | 0.13 (0.116) | 0.451 (0.229) | 2.708 (2.618) | 19.644 (1.99) | 4.884 (6.845) | 8.84 (9.197) | 5.8 (0.561) | 40.762 (9.055) | 6.341 (2.836) | 5.49 (0.56) |
| IN (N = 1487) | 0.454 (0.177) | 0.107 (0.074) | 0.154 (0.117) | 0.288 (0.168) | 1.933 (1.208) | 19.933 (1.233) | 6.18 (5.882) | 7.736 (6.743) | 8.333 (1.481) | 78.291 (24.322) | 7 (2.886) | 7.055 (1.462) |
| JO (N = 15) | 0.203 (0.098) | 0.153 (0.082) | 0.068 (0.021) | 0.345 (0.064) | 4.617 (1.757) | 20.179 (0.43) | 3.444 (1.561) | 11.268 (4.625) | 1.6 (1.171) | 125.137 (73.458) | 3.897 (3.568) | 4.508 (2.729) |
| KW (N = 83) | 0.363 (0.171) | 0.068 (0.084) | 0.053 (0.079) | 0.233 (0.253) | 2.26 (2.371) | 19.087 (0.893) | 1.966 (1.491) | 3.901 (4.224) | 1.933 (0.683) | 83.596 (24.586) | 3.769 (2.302) | 3.105 (5.263) |
| LK (N = 31) | 0.439 (0.138) | 0.23 (0.137) | 0.229 (0.097) | 0.37 (0.134) | 1.913 (0.9) | 18.851 (0.555) | 8.388 (8.389) | 9.328 (5.935) | 3.527 (1.647) | 22.619 (5.686) | 7.991 (6.073) | 5.475 (1.979) |
| MA (N = 84) | 0.445 (0.159) | 0.129 (0.075) | 0.112 (0.093) | 0.404 (0.175) | 2.071 (2.431) | 20.154 (1.093) | 3.841 (1.911) | 5.085 (3.022) | 3.067 (0.781) | 59.502 (13.754) | 1.591 (0.905) | 4.089 (1.513) |
| MX (N = 155) | 0.4 (0.187) | 0.075 (0.055) | 0.082 (0.087) | 0.265 (0.185) | 3.033 (1.877) | 21.034 (1.221) | 2.671 (1.576) | 4.516 (2.452) | 7.44 (1.716) | 34.43 (6.791) | 4.179 (0.907) | 2.382 (2.398) |
| MY (N = 1475) | 0.335 (0.167) | 0.089 (0.084) | 0.117 (0.105) | 0.38 (0.2) | 2.917 (2.326) | 18.828 (1.634) | 2.816 (3.993) | 6.151 (5.853) | 10.333 (2.44) | 136.58 (21.167) | 2.448 (1.266) | 5.076 (2.008) |
| OM (N = 96) | 0.301 (0.16) | 0.131 (0.057) | 0.1 (0.078) | 0.476 (0.142) | 3.207 (2.802) | 19.303 (1.219) | 2.539 (1.762) | 6.272 (3.065) | 3.533 (1.854) | 42.903 (10.452) | 2.915 (3.055) | 3.933 (2.927) |
| PE (N = 60) | 0.374 (0.155) | 0.136 (0.119) | 0.083 (0.061) | 0.448 (0.181) | 2.57 (1.557) | 21.274 (0.864) | 3.473 (2.284) | 6.441 (4.522) | 7.293 (1.637) | 44.949 (13.154) | 2.91 (1.16) | 5.35 (2.449) |
| PH (N = 131) | 0.396 (0.176) | 0.098 (0.08) | 0.117 (0.098) | 0.313 (0.213) | 2.224 (2.069) | 19.796 (1.461) | 2.949 (3.143) | 4.628 (3.361) | 3.533 (1.854) | 68.159 (21.599) | 3.995 (1.959) | 5.713 (1.684) |
| PK (N = 248) | 0.411 (0.167) | 0.119 (0.073) | 0.23 (0.128) | 0.392 (0.21) | 2.128 (1.347) | 19.152 (1.09) | 3.013 (2.469) | 5.547 (3.366) | 4.571 (1.989) | 25.986 (9.557) | 8.881 (4.792) | 4.395 (1.739) |
| PL (N = 485) | 0.368 (0.142) | 0.076 (0.087) | 0.164 (0.149) | 0.334 (0.219) | 2.132 (1.684) | 19.264 (1.619) | 2.746 (3.636) | 5.574 (6.843) | 9.133 (1.642) | 33.164 (7.972) | 2.07 (1.658) | 4.048 (1.558) |
| QA (N = 54) | 0.228 (0.124) | 0.083 (0.078) | 0.059 (0.047) | 0.345 (0.246) | 3.107 (3.374) | 19.707 (1.457) | 1.998 (0.913) | 8.138 (9.274) | 2.517 (1.339) | 86.477 (15.35) | 3.073 (5.811) | 8.538 (7.047) |
| RO (N = 28) | 0.285 (0.108) | 0.089 (0.04) | 0.043 (0.026) | 0.473 (0.25) | 2.593 (1.798) | 21.25 (1.239) | 0.995 (0.37) | 3.35 (2.19) | 10.015 (0.896) | 15.379 (5.592) | 3.764 (2.884) | 3.532 (4.31) |
| RU (N = 80) | 0.378 (0.126) | 0.115 (0.083) | 0.076 (0.062) | 0.477 (0.228) | 2.048 (0.948) | 22.516 (1.276) | 2.754 (2.26) | 5.888 (4.548) | 6.4 (1.242) | 51.172 (28.457) | 8.806 (3.676) | 2.974 (4.283) |
| TH (N = 817) | 0.373 (0.171) | 0.096 (0.077) | 0.138 (0.134) | 0.424 (0.204) | 2.292 (2.054) | 18.806 (1.246) | 3.426 (3.123) | 6.834 (7.135) | 5.533 (1.356) | 81.467 (21.866) | 2.265 (1.953) | 3.722 (2.377) |
| TR (N = 304) | 0.336 (0.184) | 0.115 (0.08) | 0.132 (0.095) | 0.362 (0.156) | 2.692 (1.937) | 19.794 (1.552) | 2.664 (3.032) | 6.573 (6.791) | 4.333 (1.356) | 27.321 (8.039) | 9.002 (2.411) | 5.617 (4.018) |
| ZA (N = 251) | 0.445 (0.133) | 0.102 (0.098) | 0.118 (0.099) | 0.428 (0.217) | 1.641 (0.763) | 21.328 (1.094) | 3.308 (3.12) | 4.634 (2.92) | 7.267 (1.659) | 247.633 (48.581) | 5.041 (2.428) | 2.607 (2.034) |

Table A2.
Average and standard deviation (in parentheses) of the variables for developing countries

| | Panel A<br>Developed vs developing | | | | Panel B<br>Muslim-majority vs developing non-Muslim | | | |
| | Mean difference tests | | Variance ratio tests | | Mean difference tests | | Variance ratio tests | |
| Variable | T-stat | p-value | F-stat | p-value | T-stat | p-value | F-stat | p-value |
|---|---|---|---|---|---|---|---|---|
| TD | 16.65 | 0 | 1.11 | 0 | −14.44 | 0 | 1.044 | 0.197 |
| P | −30.57 | 0 | 1.254 | 0 | 1.83 | 0.068 | 1.107 | 0.002 |
| MH1 | −9.49 | 0 | 0.772 | 0 | 1.63 | 0.103 | 1.226 | 0 |
| MH2 | −34.12 | 0 | 0.886 | 0 | −1.22 | 0.222 | 0.847 | 0 |
| L | 7.8 | 0 | 1.216 | 0 | 10.55 | 0 | 0.957 | 0.194 |
| S | 39.5 | 0 | 1.45 | 0 | 12.62 | 0 | 2.085 | 0 |
| PB | −2.66 | 0.0077 | 0.737 | 0 | −20.84 | 0 | 1.064 | 0.064 |
| AZ | −6.77 | 0 | 1.036 | 0.0623 | −11.25 | 0 | 0.789 | 0 |
| SMC | 45.54 | 0 | 8.848 | 0 | −12.05 | 0 | 0.683 | 0 |
| STR | 35.07 | 0 | 0.912 | 0 | 0.22 | 0.823 | 1.1 | 0.004 |
| INFL | −64.81 | 0 | 0.155 | 0 | 10.42 | 0 | 1.023 | 0.501 |
| GDP | −86.97 | 0 | 0.657 | 0 | 6.38 | 0 | 2.506 | 0 |

**Note(s)**: Observation numbers for each group are as reported in Table 3

**Table A3.**
Test statistics and *p*-values for mean and variance difference tests

| Variable | | Mean | Std. Dev | Min | Max |
|---|---|---|---|---|---|
| TD | Overall | 0.422523 | 0.183583 | 0.047434 | 0.904959 |
| | Between | | 0.167475 | 0.05542 | 0.880359 |
| | Within | | 0.088405 | −0.17417 | 1.002848 |
| P | Overall | 0.063216 | 0.092274 | −0.51774 | 0.315762 |
| | Between | | 0.075764 | −0.3728 | 0.290535 |
| | Within | | 0.061772 | −0.49185 | 0.56242 |
| MH1 | Overall | 0.113249 | 0.10241 | 0 | 0.614604 |
| | Between | | 0.098798 | 0 | 0.538768 |
| | Within | | 0.0301 | −0.15223 | 0.561066 |
| MH2 | Overall | 0.260328 | 0.195915 | 0.003582 | 0.875585 |
| | Between | | 0.188152 | 0.003985 | 0.869125 |
| | Within | | 0.06222 | −0.39245 | 0.835986 |
| L | Overall | 2.582516 | 2.138752 | 0.426296 | 16.53037 |
| | Between | | 2.099206 | 0.465242 | 15.80519 |
| | Within | | 1.134728 | −7.86571 | 15.65479 |
| S | Overall | 20.63339 | 1.99886 | 15.04722 | 25.14527 |
| | Between | | 1.967088 | 15.27915 | 25.02343 |
| | Within | | 0.462734 | 15.59866 | 24.25465 |
| PB | Overall | 3.684022 | 3.956337 | 0.250669 | 35.30286 |
| | Between | | 3.660202 | 0.540512 | 28.98254 |
| | Within | | 2.45393 | −13.6999 | 34.27983 |
| AZ | overall | 5.909514 | 6.404838 | −1.08104 | 61.65548 |
| | Between | | 6.099757 | −0.4888 | 52.15465 |
| | Within | | 3.774782 | −25.9197 | 56.92387 |

**Table A4.**
Overall, between and within summary statistics for each variable in developed country firms (21136 observations for 1896 firms)

| Variable | | Mean | Std. Dev | Min | Max |
|---|---|---|---|---|---|
| TD | Overall | 0.382792 | 0.174269 | 0.030741 | 0.958241 |
| | Between | | 0.157172 | 0.072164 | 0.824262 |
| | Within | | 0.089951 | −0.07605 | 0.929605 |
| $P$ | Overall | 0.098336 | 0.082396 | −0.30111 | 0.423896 |
| | Between | | 0.063669 | −0.08935 | 0.379474 |
| | Within | | 0.053752 | −0.25151 | 0.514288 |
| MH1 | Overall | 0.127741 | 0.116579 | 0 | 0.620497 |
| | Between | | 0.117816 | 0 | 0.59326 |
| | Within | | 0.036074 | −0.21525 | 0.530862 |
| MH2 | Overall | 0.354812 | 0.208191 | 0.004593 | 0.893881 |
| | Between | | 0.199277 | 0.004617 | 0.859421 |
| | Within | | 0.077851 | −0.2437 | 0.975195 |
| $L$ | Overall | 2.372519 | 1.939564 | 0.166208 | 20.36642 |
| | Between | | 1.566235 | 0.453756 | 10.14125 |
| | Within | | 1.2122 | −4.65238 | 19.19309 |
| $S$ | Overall | 19.69775 | 1.659752 | 14.1042 | 24.33546 |
| | Between | | 1.540707 | 14.99341 | 24.01783 |
| | Within | | 0.47574 | 14.35112 | 23.61778 |
| PB | Overall | 3.844022 | 4.607053 | 0.181853 | 44.76461 |
| | Between | | 4.430393 | 0.4559 | 32.75404 |
| | Within | | 2.485184 | −15.5259 | 42.69898 |
| AZ | Overall | 6.487108 | 6.291314 | −1.60497 | 52.91187 |
| | Between | | 5.928035 | 0.861071 | 46.9741 |
| | Within | | 3.648032 | −26.397 | 50.48972 |

**Table A5.**
Overall, between and
within summary
statistics for each
variable in developing
country firms (7,407
observations for
863 firms)

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