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ARAŞTIRMA MAKALESİ / RESEARCH ARTICLE

THE DETERMINANTS OF DEBT MATURITY STRUCTURES IN DEVELOPING COUNTRIES

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ABSTRACT

The study contributes to the literature by examining the firm- and country-specific determinants of the debt maturity structures in developing countries. The sample panel data set comprises of 3981 firms from 30 countries for 8 years from 2011 to 2018. Countries are selected among developing and transition economies based on data availability. A multilevel modelling methodology is employed in order to decompose the determinants of debt maturity. Variance components analysis revealed that country-level and firm-level are the causes of 15% and 50% of the total variability in debt maturity structures, respectively. Asset maturity, firm quality, firm size, leverage and growth opportunity are detected as firm-specific determinants of debt maturity. Besides, it is found that bank concentration and stock market development are also effective on the debt maturity structures of firms.

Keywords: Debt Maturity Structure, Determinants of Debt Maturity, Developing Countries, Panel Data Analysis, Multilevel Modelling.

JEL Classification Codes: G3, G32.

ÖZ

Bu çalışma, gelişmekte olan ülkelerdeki firmaların borç vade yapılarının firma ve ülkeye özgü belirleyicilerini inceleyerek literatüre katkıda bulunmaktadır. Kullanılan panel veri seti, 2011'den 2018'e kadar 8 yıl boyunca 30 ülkeden 3981 firmayı kapsamaktadır. Çalışma kapsamına alınan ülkeler, verilerin ulaşılabilirliğine bağlı olarak gelişmekte olan ekonomiler ve geçiş ekonomileri arasından seçilmiştir. Borç vade yapılarının ülkeye ve firmaya özgü belirleyicilerini ayrıştırmak için çok düzeyli (hiyerarşik) bir modelleme yöntemi kullanılmıştır. Varyans bileşenleri analizi sonucunda borç vade yapılarındaki toplam değişkenliğin sırasıyla% 15 ve% 50'sinin ülke ve firma düzeyindeki faktörlerden kaynaklandığı bulgulanmıştır. Aktif vade yapısı, firma kalitesi, firma büyüklüğü, kaldıraç oranı ve büyüme imkânı değişkenleri, borç vade yapısının firmaya özel belirleyicileri olarak tespit edilmiştir. Bunlara ek olarak banka yoğunlaşması ve borsa gelişmişliğinin de firmaların borç vade yapılarını etkilediği gözlemlenmiştir.

Anahtar Kelimeler: Borç Vade Yapısı, Borç Vade Yapısının Belirleyicileri, Gelişmekte Olan Ülkeler, Panel Veri Analizi, Çok Düzeyli Modelleme.

JEL Sınıflandırma Kodları: G3, G32.

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1. INTRODUCTION

How to meet the external financing needs of a firm is one of the most interesting research questions of corporate finance. External financing choice can be investigated in two parts as capital structure and debt maturity structure. The previous literature mainly focused on leverage decisions and increased our knowledge on this area to a great extent (Rajan and Zingalez, 1995; Giannetti, 2003; Antoniou, Guney and Paudyal, 2006; Kayo and Kimura, 2011; Agca, De Nicolo and Detragiache, 2015; Gonzalez, 2017; Orman and Koksal, 2017; Bilgin, 2019). It is found out that this decision is a function of various firm, industry and country-specific factors (Venanzi, 2017). Even though debt maturity choice is recently started to draw some attention, its determinants have not yet been researched as much to have a general consensus on the subject (Alvarez-Botas and Gonzalez-Mendez, 2019; Gonzalez, 2017; Pour and Lasfer, 2019; Peisen, Houjian and Huang, 2018).

As many other theories of corporate finance, theories of debt maturity are developed and tested empirically mainly within the framework of developing economies (Myers, 1977; Kane, Marcus and McDonald, 1985; Diamond, 1991; Stohs and Mauer, 1996; Antoniou et al., 2006; Pour and Lasfer, 2019). Even though some international level studies include firms from both developing and developed countries, the dominance of developed firms in their samples cannot be suppressed (Demirguc-Kunt and Maksimovic, 1999; De Jong, Kabir, and Nguyen, 2008; Fan, Titman and Twite, 2012; Agca et al, 2015; Gonzalez, 2017; Peisen et al., 2018; Alvarez-Bostas and Gonzalez-Mendez, 2019). This study makes an extension to the debt maturity literature by using a sample of only developing country firms to investigate the determinants of debt maturity. Thus, we are providing out of sample test results for the theories of debt maturity structure. Moreover, multilevel modelling methodology is employed in order to deal with the possible cross-country heterogeneity of the sample data set used in this study. To our knowledge, this is the first time this methodology is employed in order to analyze the determinants of debt maturity strucures of firms.

The rest of the paper is organized as follows. The theoretical background of the debt maturity literature is given in the next section. Section three details the factors accepted as the determinants of debt maturity by the previous literature. Section four and five explains the sample data set and the research methodology, respectively. Section six reports and analyzes the results of the study. Finally, section seven concludes.

2. THEORETICAL BACKGROUND

Capital structure and debt maturity choices are interconnected. Firms decide their capital structure and debt maturity ratios simultaneously considering the relative costs, advantages and availability of short-term debt, long-term debt and equity financing options. Thus, both demand side factors such as firm size, tax effects and firm reputation as a debtor on the debt market and supply side factors such as the abundance of cash on the credit market, expectations of financial stability, term structure of interest rates and the development level of the stock market might affect the debt maturity structures of firms. Indeed, recent empirical literature argues that debt maturity choices are a function of various firm, industry and country-specific factors (Antoniou et al, 2006; Gonzalez, 2017; Mendez, 2013).

Barclay and Smith (1995) classified theoretical approaches of debt maturity choice as agency costs, signaling and tax considerations. Likewise, Stohs and Mauer (1996) mentions four theoretical approaches to explain debt maturity choices as agency costs, signaling and liquidity risk, maturity matching, and tax based approach. Since these theories are not mutually exclusive, previous literature is full of supportive and unsupportive evidences for each.

Agency costs approach explains debt maturity choices as a result of the agency conflicts which emerge from shareholder-managers' and shareholders-bondholders' relationships. If a firm's debt has short term maturity, it should repeatedly apply to the banks for the renewal of the debt. Thus, banks have to monitor its quality again and again in short time intervals. This repeated evaluation process will act as a control mechanism and will reduce the agency conflicts between managers and shareholders.

Furthermore, under the assumption of managers' being faithful agents of the shareholders, their optimal investment policy is to accept all future positive net present value projects for an unleveraged firm. However, managers of a leveraged firm may not be able to act in the same way. Because they may not be able to create required return of equity from a positive net present value project if a large portion of its profits has to be transferred to the creditors.

Myers (1977) argued that leveraged firms should use short term debt as a solution to this underinvestment problem. Since this type of agency conflict is more severe for small firms, their debt maturity ratio should be smaller (Smith and Warner, 1979). Barclay and Smith (1995) provides supporting evidence to the agency cost view. The empirical implication of this approach is the expectation of a negative relationship between growth opportunities and debt maturity. It can also be assumed that growth opportunities generally exist in larger amounts for small firms with respect to large firms. Thus, firm size might have a negative relationship with debt maturity.

Signaling hypothesis assumes that market comprehends short term debt as a signal of firm quality since managers' information set about the firm is much bigger than the information sets of investors and creditors (Flannery, 1986). Thus, high quality firms with serious information asymmetry problems prefer short term debt in order to signal their quality. In addition, since high quality firms can afford rollover costs of short term debt, they opt for signaling their quality to the market.

By using a similar line of argument, Diamond (1991) explains debt maturity choices with liquidity risk. Firms with high risk of liquidity had to borrow short-term debt while firms with very low liquidity risk prefers long term debt.

Maturity matching principle (i.e. firms should match the maturities of their assets with the maturities of their liabilities) is proposed as another explanation of debt maturity choices. It is assumed that maturity matching mitigates agency problems (Myers, 1977; Stohs and Mauer, 1996).

Moreover, Kane et al. (1985) gives a tax based explanation for debt maturity choices. They propose a trade-off model between the tax advantage of debt, floatation costs of new debt and bankruptcy costs of debt. If tax advantage of debt is one of the main motivations of debt usage for the firms, they prefer long term debt financing. Thus, a positive relationship between a firm's effective tax rate and its debt maturity may be expected.

To sum up, both short and long term debt has their own consequences. When firms have short term debt, they are subject to rollover risk and the present value of their tax shields decrease. (Pour and Lasfer, 2019). However, short term debt is an effective solution to agency conflicts because of constant monitoring of banks. Even though rollover risk is an important implication of short term debt reliance, decreasing the maturity of corporate debt can mitigate agency problems.

All of the aforementioned arguments emphasis the firm characteristics and provides a demand side explanation of debt maturity choices. However, the potential effects of supply side (macroeconomic) factors on debt maturity structures are also investigated by the recent studies (Fan et al., 2012; Peisen et al., 2018). Supply side factors can be classified in two subgroups as macroeconomic factors and debt market conditions. Several studies have investigated the effects of macroeconomic factors on debt maturity choices. Kim, Mauer and Stohs (1995) predicts that firms prefer long term debt when they expect an increase in interest rates. Demirguc-Kunt and Maksimovic (1999) conclude that institutional characteristics of a country like the prevalence of corruption and legal effects like the protection of creditor rights by law and its enforcement affect debt maturity choices of firms operating in this country. Agca et al., 2015, found that firms in developing economies opt for shorter debt maturities with an easier access to international debt markets. Pourand and Lasfer (2019) emphasis the importance of creditor rights protection and tax considerations as determinants of debt maturity. Alvarez-Botas and Gonzalez-Mendez (2019) found out that corporate debt maturity increases with legal system efficiency and bank concentration. These relations are stronger in developing countries. Similarly, Gonzalez (2017) emphasis the cross-country variability of debt maturities and investigates the effects of institutional structure and banking sector characteristics on capital structure. He found out that, efficiency of legal system, protection of creditors' rights and bank concentration has a positive effect on debt maturities. The positive relationship between debt maturity and bank concentration is stronger for small firms since information asymmetry is most severe in their case. Besides, in countries with poor protection of creditor rights, banks tend to form long term relationship with their creditors in order to decrease information asymmetry. When a firm apply for a loan from a bank, the bank needs to investigate the credibility of this firm and whether it can do its debt service successfully at maturity. This process generates a transaction cost for the bank due to the information asymmetry, and the cost increases for certain firms such as the unknown, small firms with no previous credit history with the bank. Thus, especially small and mid-size banks prefer not to lend small and financially constrained firms in order to decrease their transaction costs. Moreover, large banks can reduce the information asymmetry and decrease transaction costs due to economies of scale. Also, they can handle the remaining transaction costs much more easily (Gonzalez and Gonzalez, 2008). Besides, relationship banking (i.e. having long term relationships between banks and debtors) may decrease cost of debt by mitigating

information asymmetries. On the other hand, high bank concentration causes less competition on the supply side and thus, higher cost of debt (Gonzalez, 2015).

3. DETERMINANTS OF DEBT MATURITY

3.1. Firm Level Determinants of Debt Maturity Structure

Previous literature suggests a number of firm level determinants of debt maturity. Growth opportunities, firm size, leverage ratio, firm quality (Z"-Score), profitability, tax rate and asset maturity are the most frequently tested firm level factors in the literature. These factors, their expected effects on debt maturity structures and their proxies used in this study are explained in this section.

3.1.1. Growth Opportunities

It is argued that firms with a numerous growth opportunities have serious agency conflicts which may result an underinvestment incentive (Myers, 1977). In order to mitigate it, these firms will prefer debt with maturities shorter than the decision date of the future investments. Thus, a negative relationship between growth opportunities and debt maturity structure is anticipated. Previous literature presents contradictory findings about the effect of growth opportunities on debt maturity structure. Some researchers report a negative relationship in accordance with the agency approach (Gonzalez, 2015; Fan et al., 2012). Others found no relationship at all (Gonzalez and Gonzalez, 2008; Kirch and Terra, 2012; Deesomsak, Paudyal and Pescetto, 2009; Antoniou et al.,2006, Orman ve Koksal, 2017) On the other hand, Gonzalez (2017) and Alvarez-Bostas and Gonzalez-Mendez (2019) found a positive relationship only valid for the mid-size firms. In this study, a negative relationship between debt maturity structure and growth opportunities are expected following the agency approach. Growth opportunity is proxied with the ratio of earnings before interest and taxes to total assets.

3.1.2. Firm Size

Agency problems between shareholders and creditors and asymmetric information problem between creditors and managers are most severe for small firms. Since large firms have a reputation in the debt market, have more collateral as a guarantee and have long term relationships with banks, they can easily borrow long term. Thence, a positive relationship is expected between firm size and debt maturity structure. However, a negative relationship is detected in the early literature (Titman and Wessels, 1988; Kim et al., 1995; Barclay and Smith, 1995). On the other hand, recent studies found a positive relationship (Pur and Lasfer, 2019; Orman ve Koksal, 2017; Gonzalez, 2017; Ağca et al, 2015; Alvarez-Bostas and Gonzalez-Mendez, 2019). In accordance with the later set of studies, a significant positive relationship between debt maturity structure and firm size is expected in this study. Firm size is proxied with the natural logarithm of total assets.

3.1.3. Leverage

Capital structure and debt maturity choices are strongly related. The decision of debt or equity financing effect the riskiness of the firm. Thus, leveraged firms should prefer long term debt. On the other hand, dynamics of the debt market (i.e. availability and relative costs of short and long term borrowing) effects the leverage choice. Because of this simultaneous relationship the leverage ratio will be an endogenous variable in the model. Following Wooldridge (2015), a control function approach can be employed in order to address this problem. This approach is used during the model building process. However, the coefficient of the control function becomes insignificant. Thus, it is concluded that the leverage ratio is an endogenous variable. Since both theoretical arguments and empirical findings provided conflicting results, no previous expectation is made about the sign of the relationship between leverage and debt maturity structure in this study. Leverage ratio is estimated as the book value of long term interest bearing debt over book value of total assets.

3.1.4. Asset Maturity

It is argued that firms should match the maturities of their assets with the maturities of their debts. Firms may match these maturities in order to have cash when they need to make debt service. Thence, a positive effect of asset maturity on debt maturity may be expected. A positive relationship between debt maturity and asset maturity is reported in some recent studies (Agca et al., 2015; Alvarez-Bostas and Gonzalez-Mendez, 2019). Gonzalez (2017) reported a positive effect of asset maturity for large and mid-size firms while the effect becomes negative

for small size firms. Orman and Koksal (2017) detect a positive effect for private firms but they do not found any effect for public firms.

3.1.5. Tax Rate

According to Kane et al. (1985), a positive relationship between tax rate and debt maturity is expected. However, recent literature does not report any tax effect on debt maturity structure (Orman and Koksal, 2017). In this study tax rate is proxied with the tax payment divided by the pretax income.

3.1.6. Firm Quality

According to liquidity risk and signaling hypotheses firms with high quality prefers short-term debt. Besides, low quality firms opt for long term debt in order to escape from rollover risk (Flannery, 1986). Following Orman and Koksal (2017), Altman's Z"-Score is used as a proxy for firm quality in this study. Since higher Z"-Score indicates lower default risk, a negative relationship between Z"-Score and debt maturity is expected.

3.2. Country Level Determinants of Debt Maturity Structure

In this study, bank concentration, inflation rate, stock market and bond market development are investigated as country level determinants of debt maturity. These factors, their expected effects on debt maturity structures and their proxies used in this study are explained in this section.

3.2.1. Bank Concentration

It is argued that bank concentration mitigates information asymmetry between firms and their potential creditors (Petersen and Rajan, 1995). Moreover, Gonzalez (2017) argues that creditors wants to increase debt maturity in a highly competitive debt market. In case of a few large banks in the banking market, transaction costs of banks may be lower because of economies of scale. Thus, a positive relationship between bank concentration and debt maturity is expected. Bank concentration is proxied with the ratio of the largest five bank's market capitalization to the total market capitalization of the banking sector.

3.2.2. Inflation

All other things equal when the yield curve is upward sloping firms prefer long term debt financing. Current interest rate is used as a proxy for the expected inflation. Thus, during high inflation periods, firms prefer long term debt financing. A positive and significant effect of inflation on debt financing is expected in this study.

3.2.3. Stock Market and Banking Sector Development

In countries with a well-developed stock markets, the direct and indirect costs of equity issuance are affordable even for mid/small size firms. When the number of public firms increases asymmetric information problems decrease and firms can easily borrow long term debt. On the other hand, a developed debt market decreases the direct and indirect costs of debt issuance and make long term debt issuance affordable. Thus, in countries with developed stock markets and bond markets, debt maturities should be longer. Both stock market and banking sector development levels are measured as the stock market capitalization to GDP and domestic credit to private sector by banks to GDP, respectively.

4. DATA

Sample data set consist of firm and country level data of 3951 firms from 30 developing countries for 8 years from 2011 to 2018. Financial firms and firms with a negative shareholder's equity value for the sample period are excluded. Yearly financial statement data of public firms are obtained from Compustat Global IQ database. It is a well-known financial database which covers in-depth firm-level data as well as market information for many countries around the globe. However, its coverage is more restricted for firms from developing countries compared to the firms from developed countries. Hence, sample countries are selected among developing economies based on data availability in this database. IMF's country classification based on the development level of countries are employed in order to detect the developing countries. All developing countries with stock price and financial statement data are available in Compustat Global IQ database for the sample period are included in the study. Since a sample data set which includes almost 4000 firms from the largest developing countries in terms of their

economy, the results of this study can be safely generalized to the population of developing countries. Country level data is extracted from World Bank database.

Dependent variable is the debt maturity which is measured as the long term debt to total debt ratio. By definition, it takes a value within the range of 0 to 1 inclusive. Table 1 gives the mean debt maturity ratios by countries. The overall mean debt maturity ratio of the sample countries is 38% while the standard deviation is 34%. China has the lowest average debt maturity as 28% while Mexico has the highest as 77%.

Table 1. Descriptive Statistics of Debt Maturity Ratio for each Country

Country	Mean	Median	St. Dev.	Skewness	Kurtosis	Firms	Observations
China	0.281	0.200	0.287	0.812	2.571	1791	14314
Jordan	0.285	0.170	0.308	0.723	2.175	60	478
Egypt	0.285	0.192	0.293	0.744	2.387	62	495
Ukraine	0.321	0.242	0.329	0.793	2.378	5	48
Sri Lanka	0.323	0.277	0.293	0.214	1.519	16	126
Vietnam	0.325	0.209	0.326	0.577	1.836	165	1320
Bangladesh	0.349	0.357	0.336	0.243	1.534	4	32
Thailand	0.382	0.349	0.315	0.262	1.688	305	2428
Morocco	0.384	0.348	0.353	0.399	1.734	42	336
Turkey	0.387	0.390	0.288	0.125	1.826	203	1621
Malaysia	0.418	0.406	0.308	0.201	1.747	278	2220
Kenya	0.420	0.431	0.349	0.137	1.644	5	40
Tunisia	0.428	0.423	0.216	-0.073	2.214	20	160
Pakistan	0.428	0.440	0.307	0.093	1.789	23	184
Bulgaria	0.446	0.407	0.298	0.140	1.879	30	240
Indonesia	0.472	0.500	0.326	-0.102	1.657	270	2142
Nigeria	0.480	0.498	0.356	-0.049	1.564	27	216
Serbia	0.490	0.506	0.352	-0.089	1.444	6	47
Philippines	0.521	0.572	0.347	-0.238	1.592	79	630
Cote d'Ivore	0.528	0.481	0.403	-0.030	1.345	8	63
Russia	0.580	0.669	0.319	-0.634	2.138	124	980
Peru	0.583	0.668	0.310	-0.609	2.155	57	456
South Africa	0.600	0.672	0.306	-0.490	1.974	25	199
Mauritius	0.619	0.570	0.242	0.324	2.360	4	32
Colombia	0.632	0.741	0.317	-0.907	2.488	28	224
Jamaica	0.637	0.723	0.229	-0.428	1.790	4	32
Brazil	0.639	0.702	0.256	-0.876	3.001	213	1654
India	0.661	0.739	0.326	-1.039	2.870	8	64
Kazakhstan	0.717	0.813	0.274	-1.509	4.463	6	48
Mexico	0.767	0.865	0.262	-1.639	4.926	83	656
Total	0.379	0.335	0.324	0.336	1.760	3951	31485

Following the previous literature, growth opportunities, firm size, leverage ratio, firm quality, profitability, tax rate and asset maturity are investigated as the potential firm-specific determinants of debt maturity. Bank concentration, inflation rate, stock market development and bond market development levels are also included in the model as potential country-specific determinants of debt maturity. Definitions and sources of these explanatory variables are given at Appendix A1.

5. METHODOLOGY

The sample panel data set is a slightly unbalanced one which shows large N, small T property. Since firm-year observations are nested within firms and these are nested within countries (i.e. data set has a multilevel structure), a multilevel model with three layers is employed in this study. This approach has a number of advantages over other panel data analysis methods. First, multilevel (hierarchical) modelling is a suitable tool for unbalanced panels like the sample data set in which some firms have observations for all of the sample years while others have observations for only a few. Second, possible heteroscedasticity and autocorrelation problems can also be easily handled with multilevel modelling methodology. Third, heterogeneity across countries can be modelled with a multilevel structure besides cross-sectional and overtime heterogeneities.

In this study, a multilevel structure is chosen because of the aforementioned advantages. However, this methodology results spurious regression in case of nonstationarity. Even though the time dimension of the sample data set is only eight years in this study, stationarity assumption is tested for each variable.

Panel unit root tests are classified into two subgroups as first and second generation tests based on their treatment of cross-sectional dependence. The first generation tests assume cross-sectional independence between panels while the second generation tests relax this assumption. Thence, as a preliminary to panel unit root testing, the existence of cross-sectional dependence between units are tested using Pesaran CD test (Pesaran, 2004). Test results shows strong cross-sectional dependence between panels. Nonetheless cross-sectional dependence across panels is an expected property in multilevel modelling. However, cross-sectional dependence lead to the usage of a second-generation panel unit root test. Pesaran (2007) CIPS test is employed in this study. Since the null hypothesis of nonstationarity is rejected for all variables in the model, none of them are differenced.

Multilevel models are employed for modeling hierarchical/nested data structures. This approach enables the examination of the relationship between the variables measured at different levels. Moreover, the missing data problem of unbalanced micro panels can be handled very easily in multilevel analysis. Hierarchical approach provides simultaneous analyze of within level and across level relationships (Woltman, Feldstain, MacKay and Rocchi, 2012). A straightforward explanation of the multilevel modelling methodology is presented below.

Let's start with the general panel data model with $\boldsymbol{k}$ explanatory variables which is given by Hsiao (2014) as:

$$y_{it} = \sum_{k=1}^{K} \beta_{kit}\, x_{kit} + u_{it} \qquad i = 1, \dots, N \qquad t = 1, \dots, T \tag{1}$$

Where x_{kit} is the matrix of explanatory variables including the intercept. This general model is not estimable since number of parameters ($N \times T \times K$) exceeds number of observations ($N \times T$) when $K > 1$. In order to reduce the number of parameters to be estimated, a fixed effect model can be employed by imposing the following variance structure on β_{kit} :

$$\beta_{kit} = \beta_k + \mu_{ki} + \lambda_{kt} \tag{2}$$

$$\sum_{i=1}^{N} \mu_{ki} = 0 \qquad \sum_{t=1}^{T} \lambda_{kt} = 0$$

Alternatively, a random coefficient model where μ_{ki} and λ_{kt} are random variables can be used. This approach reduces the number of estimated parameters without any loss of variability between units. Under a stationary random coefficient model, β_{kit} can be specified as:

$$\beta_{kit} = \beta_k + \xi_{kit} \tag{3}$$

where ξ_{kit} is a stationary random variable with zero mean and constant variance (Hsiao and Pesaran, 2004). Since early 1970s random coefficient models are used. Swamy is the pioneer of this kind of models and his earliest specification depicts the variance structure of the coefficient as consist of a constant and a random time invariant component (Swamy, 1970). Hsiao added a time effect to Swamy's model by making some further assumptions (Hsiao, 1974):

$$\beta_{it} = \beta + \mu_i + \lambda_t \tag{4}$$

$$E(\mu_i) = 0 \quad E(\lambda_t) = 0$$

$$E(\mu_i x_{it}) = 0 \quad E(\lambda_i x_{it}) = 0$$

$$E(\mu_i\mu_j) = \begin{cases} \Delta & if\ i \neq j \\ 0 & if\ i = j \end{cases} \qquad E(\lambda_i\lambda_j) = \begin{cases} \Lambda\ if\ i \neq j \\ 0\ if\ i = j \end{cases}$$

Random Coefficient Model is a special case of mixed linear models. A panel representation of mixed linear model can be written as:

$$y_{it} = \sum_{k=1}^{K} \beta_k\, x_{kit} + \sum_{q=1}^{Q} \delta_{qit}\, z_{qit} + u_{it} \qquad i = 1, \dots, N \qquad t = 1, \dots, T \tag{5}$$

where x_{kit} and z_{qit} are explanatory variables while δ_{qit} represent the random effect. If δ_{qit} is equal to zero, the model becomes identical to the classical linear regression model (De Leeuw, Meijer and Goldstein, 2008). Random coefficient model can be obtained from mixed linear model equation by letting $z_{qit} = x_{kit}$ and $\delta_{qit} = \xi_{kit}$:

$$y_{it} = \sum_{k=1}^{K} \beta_k\, x_{kit} + \sum_{k=1}^{K} \xi_{kit}\, x_{kit} + u_{it} \tag{6}$$

$$y_{it} = \sum_{k=1}^{K} \beta_{kit}\, x_{kit} + u_{it}$$

$$\beta_{kit} = \beta_k + \xi_{kit}$$

It should be noticed that the fixed part of β_{kit} $(i.e.\beta_k)$ is same for all groups. With this condition, the number of parameters to be estimated decreases substantially and model can be identified (De Leeuw et al., 2008). In a random coefficient model, all coefficients have random components. In other words, all slopes are allowed to vary between groups (panels).

Random intercept model is a simpler subclass of mixed models where all coefficients except the intercept are accepted as fixed:

$$y_{it} = \sum_{k=1}^{K} \beta_k x_{k,it} + \upsilon_i + u_{it} \tag{7}$$

where υ_i are fixed effects and u_{it} are residuals. ($E(\upsilon_i) = 0$, $E(u_{it}) = 0$). A further simplification process results variance components model which is the base model of multilevel analysis (Goldstein, 2011):

$$y_{it} = \alpha_i + u_{it} \tag{8}$$

$$\alpha_i = \alpha + \mu_i + u_{it}$$

$$y_{it} = \alpha + \mu_i + u_{it}$$

In this study, a variance components model and random intercept model is estimated. Time (year) and cross-sectional dimensions (firm) of the panel data set are the third and second levels of the multilevel structure, respectively. Firms are further nested in countries.

6. RESULTS

6.1. Variance Components Model

First of all, variance components model given at Equation (9) is employed to understand the country, firm and time level variability in debt maturities.

$$DebtMaturity_{tij} = \beta_0 + \varepsilon_j + \vartheta_{ij} + \epsilon_{tij} \tag{9}$$

$$\varepsilon_j \sim N(0, \sigma_\varepsilon^2)$$

$$\vartheta_{ij} \sim N(0, \sigma_\vartheta^2)$$

$$\epsilon_{tij} \sim N(0, \sigma_\epsilon^2)$$

where y_{ijkl} is the debt maturity ratio at year i of firm j in country k, β_0 is the overall mean debt maturity of the sample. $\varepsilon_j, \vartheta_{ij}$ and ϵ_{tij} are country, firm and time level error terms respectively. Country effect ε_j changes from country to country but constant for the same firm and over time. Firm effect ϑ_{ij} changes from firm to firm but time invariant. ϵ_{tij} is the random error term.

Estimate results as well as the interclass correlation coefficients can be seen at Table 2. The percentage of variability caused from country, firm and time-specific factors are estimated as 14.92%, 49.55% and 35.54%, respectively. These results indicate the existence of a hierarchical structure and validate the use of a multilevel approach. Besides they show the importance of firm characteristics on debt maturity choices.

Table 2. Variance Components Model

Overall (Grand) Mean	0.474 (0.025)
Variance Components	
Country-specific	0.016 (0.004)
Firm-level	0.052 (0.005)
Time Level	0.037 (0.002)
Interclass Correlation Coefficients	
Country-specific	14.92%
Firm-level	49.55%
Time Level	35.54%

Variance Components Model of Equation (9) results are presented here. Grand mean of the sample, variance component estimates of each level of the hierarchical model and the interclass correlation coefficients are presented at Table 1. Asymptotic standard errors are given in parentheses.

6.2 Random Intercepts Model

Second, Random Intercepts Model given at Equation (10) is employed to investigate the country-specific and firm-specific determinants of debt maturity structures.

$$DebtMaturity_{tij} = \beta_0 + \sum_{k=1}^{K} \beta_k x_{k,tij} + \sum_{l=1}^{L} \gamma_l z_{l,tj} + \varepsilon_j + \vartheta_{ij} + \epsilon_{tij} \quad (10)$$

here, y_{tij} is the leverage ratio of firm i in country j at year t. Seven firm-specific and four country-specific independent variables are included in the model. $x_{k,tij}$ is the kth firm specific explanatory variable of firm i in country j in year t. Growth opportunities, firm size, leverage ratio, firm quality, profitability, tax rate and asset maturity are included in the model as firm-level independent variables. $z_{l,tj}$ is the lth country-level independent variable of the country j in year t. Bank concentration, inflation, banking sector development and stock market development are country-specific explanatory variables. A backward stepwise modelling approach is employed in the model estimation process. Model 1 is estimated with all candidate variables. Based on the estimation results of this initial model bond market development, the variable with the highest p-value (i.e. the one with the most insignificant coefficient) is excluded and Model 2 is estimated. Similarly, tax rate and Inflation variables are also excluded from Model 2 and Model 3 respectively. Model 4, the final model, consist only significant variables. Table 3 presents the coefficient estimates of this models as well as the variance components.

Table 3. Random Intercept Model

Fixed Coefficient Estimates				
Variables	Model 1	Model 2	Model 3	Model 4
Asset Maturity	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Firm Quality	0.016***	0.016***	0.016***	0.016***
	(0.004)	(0.005)	(0.005)	(0.005)
Firm Size	0.027*	0.027*	0.027*	0.027*
	(0.016)	(0.014)	(0.014)	(0.014)
Growth Opportunity	-0.098	-0.097*	-0.097*	-0.099*
	(0.060)	(0.058)	(0.058)	(0.058)
Leverage Ratio	0.183***	0.184***	0.184***	0.182***
	(0.026)	(0.027)	(0.027)	(0.027)
Bank Concentration	0.003**	0.002**	0.002**	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)
Stock Market Development	0.000*	0.000*	0.000*	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Inflation	-0.001	-0.001	-0.001	-
	(0.001)	(0.001)	(0.001)	
Tax Rate	0.000	0.000	-	-
	(0.000)	(0.000)		
Bond Market Development	0.000	-	-	-
	(0.001)			
Constant	0.044	0.039	0.038	0.027
	(0.142)	(0.155)	(0.155)	(0.153)
Variance Components				
Country Level	0.012	0.013	0.013	0.013
	(0.005)	(0.005)	(0.005)	(0.005)
Firm Level	0.050	0.050	0.050	0.050
	(0.006)	(0.006)	(0.006)	(0.006)
Time Level	0.034	0.033	0.033	0.033
	(0.001)	(0.001)	(0.001)	(0.001)

The table presents the results of random intercept model. Dependent variable is debt maturity ratio. Fixed coefficient estimates and variance components are presented. Asymptotic standard errors for the hierarchical model are presented in parentheses. "*", "**" and "***" represents statistical significance at 10%, 5% and 1%, respectively.

Consistent with the earlier studies, asset maturity, firm quality, firm size, growth opportunity and leverage are found to have statistically significant effects on debt maturity structure (Pur and Lasfer, 2019; Orman ve Koksal,2017; Gonzalez, 2017; Ağca et al, 2015; Alvarez-Bostas and Gonzalez-Mendez, 2019).

The positive relationship between asset maturity and debt maturity structure supports maturity matching hypothesis. This hypothesis argues that firms match the maturities of their assets with the maturities of their debts. By doing this, they aim to balance the timings and the magnitudes of their cash inflows with those of their cash outflows. Otherwise firms may face a shortage of cash problem. In line with the previous literature, our findings revealed that maturity matching is an applied strategy in debt maturity decisions (Agca et al., 2015; Alvarez-Bostas and Gonzalez-Mendez, 2019; Orman ve Koksal,2017). Agency costs and information asymmetry between the firm and the potential creditors are most severe for small firms. These firms are usually not well-known in the debt market and it is not easy to evaluate their riskiness. Besides they cannot afford the relatively higher cost of long term debt. Thus, they prefer short term borrowing. A positive relationship between firm size and debt maturity ratio is also detected. Similar results are reported by the recent empirical literature (Pur and Lasfer, 2019; Orman ve Koksal,2017; Alvarez-Bostas and Gonzalez-Mendez, 2019). The negative and significant relationship between growth opportunity and debt maturity supports the view that firms with high growth opportunities prefer short term debt in order to solve the underinvestment problem (Myers, 1977). Besides, agency problem between stockholders and managers can be mitigated by the constant monitoring of the banks as a result of short term borrowing. The positive relationship between firm quality and debt maturity suggests that firms with lower liquidity risk opt for long term financing (Diamond, 1991). Similarly, leverage is also found to have a positive and significant effect on debt maturity. As the indebtedness increases, the riskiness of the firm increases. Thence, more

leveraged firms prefer long term debt in order to decrease liquidity risk. In line with the recent empirical literature the coefficient of tax rate is found to be insignificant (Antoniou et al., 2006; Orman and Koksal, 2017).

Only bank concentration and stock market development have significant coefficients among the macroeconomic variables used in the model. When a few large bank dominates the banking sector, the transaction costs of banks may be lower because of economies of scale. Then, the probability of bank's lending money to financially constrained firms becomes greater (Gonzalez, 2017). Besides, the asymmetric information problem may be solved to a great extent in a highly concentrated banking sector. The positive relationship between bank concentration and debt maturity structures detected in this study, supports this view. Stock market development is also found to have a positive effect on debt maturity. A developed stock market can be thought as an alternative to the long term debt market and may decrease the cost of long term debt. Besides, transparency of firms increases and information asymmetry problem decreases for publicly listed firms. Thus, stock market development facilitates the long term indebtedness of firms.

7. CONCLUSION

In this study, the country-specific and firm-specific determinants of debt maturity in developing countries are investigated. A multilevel methodology is used where the panel data set is thought as a three-level hierarchical structure. Country is the first level of this hierarchical structure. Firms are nested within the countries to create the second level. The third and the lowest level of the hierarchy is the yearly time series observations which are nested in firms.

First, a variance components model is estimated in order to analyze the effect of each layer on the total variance of debt maturity ratios of the sample firms. The analysis revealed that almost half of the variability in debt maturity ratios are the result of firm-specific factors. This finding emphasis that most important determinants of debt maturity structure are firms' intrinsic characteristics. Moreover, %14 percent of the total variability in debt maturity ratios is explained by country level factors. This result validates the use of a multilevel analysis and indicates the importance of macroeconomic environment. Policy makers in developing countries should not ignore country-specific determinants of debt maturity in order to increase debt maturities of firms.

Consistent with the previous studies, asset maturity, firm quality, firm size and leverage are found to have statistically significant and positive effects on debt maturity structure. On the other hand, profitability, as a proxy for growth opportunity, is found to have a significant and negative effect. Country-specific determinants of debt maturity are found to be bank concentration and stock market development level. Both of them has a positive effect on debt maturities.

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Appendix 1. Variable Definitions and Sources

Names	Description	Source
Debt Maturity	The Ratio of Long Term Debt to Total Debt	Compustat Global IQ Database
Asset Maturity	The Ratio of Net Plant Property And Equipment to Total Assets	
Leverage	The Ratio of Long-Term Debt Short-Term Debt to The Sum Of Long-Term Debt, Short-Term Debt And The Book Value Of Equity	
Growth Opportunity	The Ratio of Earnings Before Interest And Taxes to Total Assets	
Firm Quality (Altman's Z''-Score)	$3.25 + 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$ X_1: $Current\ Assets - Current\ Liabilities$ X_2: $\frac{Retained\ Earnings}{Total\ Assets}$ X_3: $\frac{Earnings\ Before\ Interest\ and\ Taxes}{Total\ Assets}$ X_4: $\frac{Book\ Value\ of\ Equity}{Total\ Liabilities}$	
Firm Size	Natural Logarithm of Total Assets	
Tax Rate	The Ratio of Tax Payment Divided to the Pretax Income	
Inflation	Inflation Rate	World Bank Database
Bank Concentration	The Ratio of the Largest Five Bank's Market Capitalization to the Total Market Capitalization of the Banking Sector.	