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Measures of Financial Constraints in Kenya

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ABSTRACT

Understanding the effect of financial constraints on firms' real decisions requires accurate identification of financially constrained firms. Unfortunately, identifying financially constrained firms is a challenge that is yet to be resolved. Against this background, this study identified financially constrained firm-years in Kenya and evaluated how well proxies of financial constraints generated in an endogenous switching regression context measure financial constraints. About 66% of the firm-years in the sample considered are suffering from financial constraints. This suggests that financial constraint problem is affecting a higher number of firms over a longer period of time. Furthermore, there is no efficiency gain in using endogenous switching regression indices since the sample separation produced by the initial values outperformed endogenous switching regression final classification values. In particular, size-age measure does a better job of identifying financially constrained firms and producing consistent results, and is the only measure that approximates experienced financial constraints well.

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1. INTRODUCTION

A key question in corporate finance is how financial constraints affect firms' real decisions. Addressing this question requires accurate identification of financially constrained firms (Farre-Mensa and Ljungqvist, 2015). Unfortunately, identifying financially constrained firms is a challenge that is yet to be resolved. It is complicated since the financial constraints a firm faces cannot be observed and secondly, since the proxies of financial constraints such as dividend payout ratios are often correlated with key variables that affect real decisions in the presence of financial constraints such as cash flows. The former introduces errors in classification of firms, which water down the estimated effects of financial constraints and the latter cause endogeneity problem. As a result, out of the several measures that have been proposed, none has consistently performed well under all circumstances.

If proxies of financial constraints are affected by fluctuations in cash flows or macroeconomic conditions or taste and preferences (for instance; Gertler and Gilchrist, 1991), then identification of financially constrained firms based on such proxies is likely to be flawed. Some studies have taken a different direction by validating their proxies of financial constraints and even classifying firms using indices (Fazzari et al., 1988; Kaplan and Zingales, 1997; Whited and Wu, 2006; Hadlock and Pierce, 2010). However, this approach has also generated a lot of controversy. Classification is inconsistent across different indices (Farre-Mensa and Ljungqvist, 2015). Other studies have used direct measures of financial constraints (see for instance; Campello et al., 2010; Savignac, 2008). However, directly asking firms to state their financial constraints status introduces biases.

An alternative to a priori classification of firms is the switching regression model with unknown sample separation (Hu and Schiantarelli, 1998; Hovakimian and Titman, 2006; Almeida and Campello, 2007). In this case, the process by which firms are sorted into financial constraints status is endogenously related to the factors that determine the outcome variable (Almeida and Campello, 2007). Unlike the use of exogenously determined proxies and indices, sample separation under this approach is jointly estimated with the outcome equation, and this eliminates the need for ex ante sample separation. How sensitive endogenous switching regression model's classification is to the choice of initial values and the specification of the outcome and regime selection equation is unknown. Against this background, this study sought to address the challenge of identification of financially constrained firms.

This study evaluated how well proxies of financial constraints measure financial constraints and identified financially constrained firm-years in Kenya. Specifically, this study identified financially constrained firm-years in Kenya and evaluated how sensitive the classification generated by endogenous switching regressions - which eliminates the need for ex ante sample separation - is to the choice of the initial values and the specification of the outcome and selection equation. How sensitive endogenous switching regression model's classification is to the choice of initial values and the specification of the outcome and regime selection equation is unknown. Data from published financial statements of manufacturing firms that were listed on Nairobi securities exchange (NSE) between 1999 and 2016 shows 66% of the firm-years were financially constrained. The results under endogenous switching regression are sensitive to the choice of the initial values of financial constraint variable and the specification of the outcome and selection equations. Moreover, the measure based on size and age performed better in identifying financially constrained firms and producing consistent results, and is the only measures that approximate experienced financial constraints well.

This study is important in the following three ways. First, understanding factors that affect the results in an endogenous switching regression context is important in checking the robustness of endogenous switching regression results in financial constraints literature and other areas applying endogenous switching regressions. Second, there is no doubt that the measures of financial constraints should be reliable and accurate. Accurate measures of financial constraints capture the reality of firms' financial constraint status, and third, accurate measures of financial constraints improve the accuracy of the estimated effects of financial constraints on firm's real decisions. More importantly, improving accuracy in the identification of financially constrained firm-years is key in generating reliable estimates of the effects of financial constraints on firm's real decision and by minimizing classification errors this mitigate against the controversy in the interpretation of the results.

This study is related to the work of Campello et al. (2010); Hadlock and Pierce (2010) and Farre-Mensa and Ljungqvist (2015) who evaluated the accuracy of proxies or indices in the identification of financially constrained firm-years. In particular, this study is similar to the work of Farre-Mensa and Ljungqvist (2015), however, unlike their study which evaluated Kaplan and Zingales (1997), Whited and Wu (2006) and Hadlock and Pierce (2010) indices in a single equation context and therefore their criticism does not apply to studies using endogenous switching regression, which simultaneously estimate the structural (for instance, investment) equations and sample separation equation. Thus this study depart from the work of Farre-Mensa and Ljungqvist (2015) by evaluating how well firm characteristics identified by Kaplan and Zingales (1997), Whited and Wu (2006) and Hadlock and Pierce (2010) determine the financial constraints in an endogenous switching regression environment.

Secondly, this study may be considered as one of the first attempt to develop a criterion for identifying financially constrained firms in Kenya. Few studies, if any, have attempted to identify the factors that determine financial constraints in Kenya. In a country where the likelihood of financial constraints is high, a criterion for identifying financially constrained firms is important in three ways. It provides the basis for: Identification of financially constrained firm-years, estimation of the severity of financial constraint in Kenya and the design of interventions to mitigate constraints in financial constraints.

Capital markets in Kenya like in other developing countries are inefficient and illiquid (Ngugi et al., 2009), which increases the likelihood of financial constraints and thus providing a perfect setting for studying financial constraints and its effect. Financial constraints have been shown to affect listed companies in countries with advanced capital markets such as USA (Fazzari et al., 1988; Fazzari et al., 2000; Hadlock and Pierce, 2010; Kaplan and Zingales, 1997; 2000), UK (Bond and Meghir, 1994) and Japan (Hoshi et al., 1991). Compared to these countries, the level of development in capital markets in Kenya is lower and therefore the severity of financial constraints might be greater. Market statistics in Kenya shows that by mid-2012 there were only 11 corporate bonds listed in NSE, up from 5 in 2005, with a total value of 56.75 billion Kenya shillings (Capital Markets Authority, 2012). This is very low given that there were, on average, 55 listed companies during this period.

Firms in our sample rarely issue equity after initial public offer (IPO). For instance, between 1999 and 2016 only three manufacturing firms issued equity after IPO. In addition, credit to private sector by banks in Kenya averaged about 43% in 2013, which is lower than the regional average of about 50% in sub-Saharan Africa. Other developing regions such as Eastern Europe and Central Asia and Latin America and Caribbean had an average of about 50%. The low level of use of corporate bonds and credit to private sector points to a high likelihood of financial constraints in Kenya. The paper proceeds as follows. Section 2 provides a review of literature. Section 3 discusses the methodology as well as the hypotheses to be tested and describes the data. Section 4 analyses and discusses the empirical results. Section 5 concludes the paper.

2. LITERATURE REVIEW

Theoretical and empirical literature aims at identifying the determinants of financial constraints and strategies for sorting firms into their respective financial constraint statuses. Theoretical work includes those of (Whited and Wu, 2006). In (Whited and Wu, 2006) model a firm takes factor prices, output prices and interest rate as given. In this model, a firm maximizes the expected present discounted value of future dividends subject to dividend identity and capital stock accumulation identity. The firm also faces two unobservable constraints: Equity financing constraint and debt financing constraint. If dividend identity constraint is negative then the firm is able to raise outside equity finance. In the absence of taxes, negative dividends are equivalent to new share issues (for details; Whited and Wu, 2006). In this model, a binding and time-varying debt constraint affects intertemporal allocation of resources and hence investment.

Classification of firms for the purpose of estimating the effects of financial constraints date back to the work of (Fazzari et al., 1988). They used dividend payout as a proxy of financial constraints to classify firms into three classes of financial constraints. Subsequently, numerous proxies of financial constraints which include age of the firm, size of the firm, affiliation of the firm to financial institution(s), debt rating and CEOs statements on financial difficulties have been proposed. In addition, some studies have used indices to classify firms as well as validate the proxies of financial constraints (see for instance; Kaplan and Zingales, 1997; Hadlock and Pierce, 2010; Whited and Wu, 2006). These indices summarize several firm characteristics into a single measure of financial constraints status of a firm. Indices have been used for validation or as an alternative to the archival-record based measures of financial constraints due to the shortcomings of the latter.

Validation of archival-record based measures of financial constraints was first done by Fazzari et al. (1988) in their seminal work. They estimated a probit model for the probability that a firm is correctly included in class one using size, real growth in sales, Tobin Q, debt and standard deviation of earnings as explanatory variables. The probit classification was consistent with their classification based on retention ratio; however, their validation was incomplete. This study builds upon the work of Fazzari et al. (1988). However, unlike their work, which is based on natural ordering of dividend payout, this study constructs distance from the frontier for the dividend payout ratio. Distance from the frontier is better than natural ordering since it addresses stability issues of the measure across firms and over time (Whited and Wu, 2006); such as those arising from the variation in dividend payout ratio due to fluctuations in macroeconomic conditions.

Subsequently, a number of indices to measure financial constraints have been developed. Kaplan and Zingales (1997) estimated an ordered logit model and used it to verify that their classification scheme based on CEOs qualitative statements correctly classify firms into their respective financial constraints status. They used five ranked classes with financially unconstrained being the lowest state and financially constrained the highest. They used cash flows, Tobin Q, debt, dividends, dividend restricted, unrestricted retained earnings, cash and unused line of credit as independent variables. In general, the logit model provided a strong quantitative validation of their classification scheme; however, their classification is inconsistent with the results of Hadlock and Pierce (2010).

Kaplan and Zingales (1997) study, like this study, uses ordered measures of financial constraints. They used measures based on CEO's statement while this study uses a measure based on a combination of age and size, and dividend payout to measure financial constraints. Kaplan and Zingales (1997) index has been applied for instance by Baker et al. (2003), Lamont et al. (2001) and Almeida et al. (2004). Baker et al. (2003) used a variant of this index with five determinants of constraints that included: Cash flows, cash dividend, cash balances, leverage and Tobin Q, however, in their final estimation they dropped Q citing measurement problems and correlation with investment prospect which is proxied by dividend payment.

On the other hand, Lamont et al. (2001) and Almeida et al. (2004) constructed an index of financial constraints, using cash flows, Tobin Q, debt, dividend and cash, to classify firms in their sample. Hadlock and Pierce (2010) criticized the index-based measures of financial constraints, arguing that the indices developed by Kaplan and Zingales (1997) and Whited and Wu (2006) and their extensions could not correctly predict the candidate measure of financial constraint status derived using qualitative manager's statements on financial constraints. They therefore suggested the use of size and age to identify financially constrained firms, a criteria first suggested by Blinder in 1988 in the comments to the seminal work of Fazzari et al. (1988). Firm size was also discussed in Fazzari et al. (1988), however, they considered it inadequate. More specifically, Hadlock and Pierce (2010) proposed an index based on size, size squared and age as independent variables. Other measures of financial constraints that have been considered include ownership or affiliations (Hoshi et al., 1991).

An alternative approach is attributable to Cleary (1999), who classified firms using an index similar to Altman's Z factor for predicting bankruptcy. The author classified firms into two mutually exclusive groups, those that increased dividend payment and those that reduced dividend payment the previous year. This corresponds, respectively, to firms that are not likely to be financially constrained and that are likely to be financially constrained. Cleary (1999) then used multiple discriminant analysis and found that their model successfully predicted which firms will cut or increase their dividends. Their discriminant scores are likely to be biased due to exclusion of firms that do not change dividend payments in their discriminant analysis. In addition, Cleary (1999) approach cannot handle cases where the dependent variable takes more than two values. Other studies have used a cluster analysis procedure to identify unambiguous groups of constrained firms. La Rocca et al. (2015) adopted this approach and found that their classification was inconsistent with traditional criteria used to identify financially constrained firms.

Some studies have used models where the probability of a firm facing financial constraints is endogenously determined. This approach requires specification of a switching regression where regimes or the probability of a firm's financial constraint status is jointly estimated with the outcome equation. Hu and Schiantarelli (1998) used an endogenous switching regression model of investment to address static and dynamic misclassification problem. Following Hu and Schiantarelli (1998) a number of studies have adopted this approach. Hovakimian and Titman (2006), Almeida and Campello (2007), Bhaduri (2008) and Shen and Lin (2010) used endogenous switching regression to examine the effect of financial constraints on a firm's real decisions. Results under endogenous switching regression approach is likely to depend on the initial values of financial constraint variable or/and the outcome variable used or/and the specification of the outcome and selection equations. Whether endogenous switching regression is sensitive to the choice of initial values, outcome equation or selection equation is not known.

The adequateness of proxies of financial constraints based on archival records is debatable. Campello et al. (2010) evaluated various measures of financial constraints which included: Size, affiliations, credit rating, profitability, dividend payment and growth prospects and documented evidence that only credit rating predicted self-reported financial constraints. However, subjective measures of financial constraints such as those used by Campello et al. (2010) and Savignac (2008) were likely to be biased. Moreover, subjective measures of financial constraints are likely to be measured with a lot of noise. On the other hand, Farre-Mensa and Ljungqvist (2015) evaluated index based measures of financial constraints and found that Kaplan and Zingales (1997) index (henceforth, KZ index), Whited and Wu (2006) index (henceforth, WW index) and Hadlock and Pierce (2010) index (henceforth, HP Index) did not measure financial constraints.

Despite the pivotal role of identification strategy of financially constrained firms in estimation of the effects of financial constraints on real decisions, there is no consensus on which is the best approach. The main indices used in identifying financially constrained firms contradict each other. Endogenous switching regression models have been used in an attempt to address static and dynamic misclassification problem. However, the results under endogenous switching regression might be sensitive to the choice of the initial values/guess of financial constraint variable or the specification of the outcome and selection equations and this introduces classification errors. In addition, there is dearth of empirical evidence on the severity of financial constraints among listed firms in developing countries, in general, and Kenya, in particular. This study posits that final classification values generated by endogenous switching regression are sensitive to the choice of initial values and the specification of outcome equation.

3. METHODOLOGY

The effect of financial constraints can be obtained by taking the differences between the estimates of equation (1) and equation (2). However, this is possible if the financial constraint state of each firm-year is observable. In addition, the results are only valid if the assignment mechanism of firms into constrained and unconstrained statuses is random. The random assignment mechanism in experimental data ensures that those assigned to treatment and control groups are identical and hence reduce or eliminate the need to control for covariates in estimation of the treatment effect.

In the case of observational data, financial constraints status is not observed and is proxied using one or more observable firm characteristics. Therefore, firms in financially constrained and unconstrained groups are likely to be different due to non-randomness in sample separation and self-selection. The non-randomness in sample separation mechanism and the unknown sample separation threshold – caused by unobservable financial constraints - makes it difficult to measure the severity of financial constraints and estimate its effects. These challenges can be overcome by introducing a third equation in the line of Maddala (1986) to determine the threshold that assign firms into sub-samples represented by equation (1) (unconstrained) and equation (2) (constrained) or by sorting firms into constrained and unconstrained regime and estimating the two equations separately. The third equation is called a switching or disequilibrium equation.

In determining the kind of switching equation to use, two key issues were taken into consideration. First, whether the regime is known a priori or not. In this study, the regime a firm belongs to is imperfectly known. Financial constraint a firm faces is not observable. Second, the correlation between the errors of the switching equation and the errors of the outcome equations. The errors of equation assigning firms financial constraint status is likely to be correlated to the errors of the outcome equations such as investment equation. For example, financially constrained firms are likely to have lower investment expenditures than unconstrained firms. Thus, the errors of the outcome equation in this study might be correlated with the errors of the switching equation.

With imperfect information on sample separation and correlation in errors of switching and outcome equations, the most appropriate model is an endogenous switching regression model of the form given in equation (3) with equation (1) and equation (2) as outcome equation. Equation (1) and equation (2) are stated, in matrix form, as:

$$I_{jt1}=X_{jt}\beta_1+\varepsilon_{jt1} \quad \text{if} \quad FC=1 \tag{1}$$

$$I_{jt0}=X_{jt}\beta_0+\varepsilon_{jt0} \quad \text{if} \quad FC=0 \tag{2}$$

and a regime switching equation given by

$$FC^{*}_{jt}=Z_{jt}{}^{3}+\xi_{jt}, \qquad FC_{it}=\begin{cases}1 & FC^{*}_{jt}>0\\ 0 & FC^{*}_{jt}£0\end{cases} \tag{3}$$

Where, FC_{it} is a dichotomous variable and as noted earlier I_{jt1} is observed if $FC_{it}=1$ and I_{jt0} is observed if $FC_{it}=0$ Z is a vector of firm characteristics that identify financial constraint status of a firm. Let IV_{jt} be the initial values of the unobserved financial constraints FC^{*}_{jt}, such that:

$$IV_{jt}=\begin{cases}1 & \text{if} \quad I_{jt}=I_{jt1}\\ 0 & \text{if} \quad I_{jt}=I_{jt0}\end{cases} \tag{4}$$

and

$$IV_{jt}=f\left(FC_{jt},\omega_{jt}\right) \tag{5}$$

Where ω_{jt} is the errors in measurement of FC_{jt}. Two initial values were used: (i) IV_{jt} equals zero if a firm is old and large, and one, otherwise and (ii) IV_{jt} equals one if a firm pays dividend below a threshold (measured in terms of distance from frontier) and zero, otherwise. IV_{jt}, required as dependent variable in equation (3), captures the initial guess of financial constraint status of each firm and is assumed to be measured with error[1]. Endogenous switching regression improves on these initial values to yield an efficient measure of financial constraints status FC. The performance of IV_{jt} against FC is given by a transition probability matrix (Table 1):

Where, $\rho_{lk} = \text{Prob}\left(FC_{jt}=k \middle| IV_{jt}=l\right)$ for l, k=0, 1 with a row sum of 1. IV performs better than FC if $\rho_{11}=\rho_{01}$ since the indicator FC does not contain any information about equations (2) and (1) (Lee and Porter, 1984). However, when ρ_{11} f=ρ_{01} then FC conveys some information on sample separation. When $\rho_{11}=\rho_{00}=1$ there is no efficiency gain in using FC as the sample separation produced by IV and FC are exactly identical. The goodness of fit of FC relative to IV was performed using the Chi-square test for Independence and Fishers exact tests. This tests help in establishing whether FC distribution differs from IV distribution.

The main drawback of this model is its inability to determine the severity of financial constraints without the outcome equations - equation (2) and (1). In this regard, and in line with the overall objective of this thesis, two main outcomes: Choice of financing mix and the investment measures were used to facilitate the estimation of severity of financial constraints. This provides a foretaste for in-depth analysis of financing and investment decisions in chapter three and four, respectively.

For the purpose of estimating severity of financial constraints, variables identified in Frank and Goyal (2003) as the determinants of the choice of source of funds was used. The authors considered financing deficit, tangibility of assets, size as measured by log of sales, ratio of market to book value and profitability as covariates and leverage or changes in debt as the outcome variable in testing pecking order hypothesis. The empirical investment Euler equation variables include lagged investment rate, square of lagged investment rate, cash flows to capital ratio, sales to capital ratio and square of debt to capital ratio (e.g., Bond and Meghir, 1994). A detailed discussion of the choice of financing mix and the investment is postponed to Chapter 3 and 4.

The remaining part is the definition of the vector Z. Z is a vector of firm characteristics that identify financial constraint status of a firm. This study define Z as the right-hand side variables or firm characteristics that feature in the three most common index of measuring financial constraints, that is, Kaplan and Zingales (1997) index, Whited and Wu (2006) index and Hadlock and Pierce (2010) index. These indices were rigorously evaluated by Farre-Mensa and Ljungqvist (2015) who concluded that none of them measure financial constraints.

Hadlock and Pierce (2010) proposed an approach that has an advantage over other approaches, as much as it excludes financial variables which are likely to be correlated due to the nature of their constructions. Hadlock and Pierce (2010) index is based on size, size squared and age as independent variables. Thus, following Hadlock and Pierce (2010) equation (3) can be expressed as a function of age and size:

$$FC^*_{jt} = \alpha_0 - \alpha_1 size_{jt} + \alpha_2 size^2_{jt} - \alpha_3 age_{jt} + \xi_{jt} \quad (6)$$

Where FC_{jt} is a binary variable measuring financial constraints status of firm j at time t, $size_{jt}$ is the size of firm j at time t as measured by the log of fixed assets and age_{jt} is the number of years firm j at time t has been listed at NSE. FC_{jt} equals one if firm j at time t is financially constrained and zero, otherwise. The expected sign are as indicated in equation (6). The model is fitted into the data using endogenous switching regression and then used for classification of firms. Different specification will also be used, for instance, squared age to capture non-linearities as well as ensure that the results are robust to changes in the model specifications.

This study uses a version of Kaplan and Zingales (1997) index employed by Lamont et al. (2001) and Almeida et al. (2004), which has cash flows (C/K), market to book ratio (MtB) (or Tobin Q), debt (D/K), dividend (Div/K) and cash (CS/K) as the regressors. Thus, the equation (3) is defined as follows:

$$FC^*_{jt} = \beta_0 - \beta_1\left(\frac{C}{K}\right)_{jt} + \beta_2\left(MtB\right)_{jt} + \beta_3\left(\frac{D}{K}\right)_{jt} - \beta_4\left(\frac{Div}{K}\right)_{jt} + \beta_5\left(\frac{CS}{K}\right)_{jt} + \beta_j + \beta_t + \zeta_{jt} \quad (7)$$

Where, ξ is the error term, β'S are the coefficients to be estimated, β_j is the firm fixed effects, β_t is the year fixed effects and other variables are as defined earlier. The expected signs are as indicated in equation (7). KZ index is higher the severe the financial constraints.

Under Whited and Wu (2006) index, the starting point is a reduced form specification for the stochastic discount factor, $M_{t-1,t}$, using Fama and French (1993) three factor model given by:

$$M_{t-1,t=}\alpha_0 + \alpha_1 MKT_t + \alpha_2 SMB_t + \alpha_3 HML_t \quad (8)$$

Where MKT is the return on the market; SMB is the return on an arbitrage portfolio that is long small firms and short large firms; and HML is the return on an arbitrage portfolio that is long firms with high book to market ratios and short firms with low book to market ratios. The model to be used in place of equation (3) is:

$$FC^*_{jt} = \beta_0 + \beta_1\left(\frac{D}{K}\right)_{jt} - \beta_2\left(Div\right)_{jt} - \beta_3" S_{jt} - \beta_4 size_{jt} + \beta_5\left(\frac{CS}{K}\right)_{jt} - \beta_6\left(\frac{CF}{K}\right)_{jt} + \beta_7 M_{t-1,t} + \zeta_{jt} \quad (9)$$

Where FC, under Whited and Wu (2006), is the shadow cost of raising equity, D/K is the ratio of long term debt to total assets, Div equals one if the firm pays cash dividends and zero, otherwise, ΔS is the annual growth in sales, size is the natural log of total assets, CS/K is the ratio of liquid assets to total assets and CF/K is the ratio of cash flows to total assets. $M_{t-1,t}$ is the stochastic discount factor as defined in equation (8).

1 The implication of this is to take into consideration classification errors identified in a priori classification.

4. DATA AND RESULTS

This section presents the data and empirical results of this essay.

4.1. Data

This study used data of manufacturing firms that were listed on NSE between 1999 and 2016. The data was collected from published financial statements that companies filed at Capital Markets Authority. Published financial statements consist of balance sheet, income statements and cash flow statements, and are the principal source of the data used in this study. The sample consists of all (13) companies in the manufacturing sector that were listed on the NSE. To avoid survival bias, data for listed manufacturing companies that entered or exited the NSE between 1999 and 2016, were all included. In addition, observations without data on the variables of interest were dropped. All figures are expressed in 2009 constant prices. Supplementary data on variables not reported in financial statements were obtained from NSE. These included market prices of stocks and the year a company was listed at the NSE. Data on consumer price index were sourced from the World Bank.

Descriptive statistics are presented in Table 2.

The size ranges from 8.974 to 13.08 with a mean of 11.07 which is slightly higher than the median of 10.99. Compared to size, log of age is more dispersed. Age, in log form, ranges from 0.693 to 3.829 with the mean and median of 3.113 and 3.466, respectively. 75% of the firms are clustered between 3.664 and 3.829. Since 3.466 is higher than half of the maximum age, then this indicates that majority of the firms in our sample are mature. Distance from the frontier for dividend payout ranges from zero for high dividend payers to one for low dividend payout. The high concentration of the distance from frontier at values close to one, even for the median firm (0.695), implies that a large number of firms pay below average dividends. This is indicative of severe financial constraints.

The mean foreign ownership is 29.35 with the median of 23.36 and foreign control of the companies ranges from 0.89 to 77.20. Debt to capital ratio which is a measure of the proportion of capital financed by debt averaged 0.115. That is about 11.5% of total capital is financed by debt. The low value is indicative of financial constraints, as firms might not be able to issue debt. By making firms not to issue debt or to bypass debt to issue equity, financial constraints affect financing decisions and hence capital structure of the firm. Other indicators of financial constraints are low dividend payment and low cash holdings ratios. The mean of the ratio of dividend payment to capital stock is 0.138 while the mean of cash to capital stock is about 0.200, which suggest the sample might be financially constrained.

The mean of market to book value ratio is 13.59. The mean of sales to capital stock is 3.407 and it ranges from 0.313 to 30.25. Sales like assets is also a measure of size of the firm, however, unlike log of assets, the mean log of sales is 8.985 which is lower than the mean of log of assets of 11.07. The mean investment rate is 0.137 with values ranging from 0.00275 to 0.493. The mean cash flow to capital stock of 0.377 is above the mean of investment rate and its values lie between −13.20 and 3.943. The mean ratio of profit to capital stock is 1.737 with the worst performance being a loss to capital stock ratio of −1.267 and the best performance being 8.434.

4.2. Empirical Results

4.2.1. Initial values of financial constraints and identification of constrained firms

In this section, measures of financial constraints were constructed to measure experience financial constraints. In addition, two initial values or measures of financial constraints were generated using dividend payout approach[2] and a combination of age and size. These initial values formed the starting values for endogenous switching regressions. Experienced financial constraints classify 50% of the firm-years as financially constrained. Firms increased dividend payments or started paying dividend in 42% of firm-years while another 42% of the firm-years registered financing surplus - excess cash flows over investment.

The underlying statistical distribution of the data is critical in obtaining valid and informed initial values. That is, the validity of the measure of financial constraints depends on how well the data generating process fits into the assumed statistical distribution. Figure A1-A3 in the appendix plots the Kernel distribution and Histogram for age, size and dividend payout, respectively. For ease of comparison and interpretation, the two Kernel density and histogram have been presented side by side.

The age variable lies between 0 and 47 years. The first group of firms is clustered between the age of 21 and 47 years while the ages for the other group of firms lies between 0 and 20 years. The number of firms with the age of 20 years or lower is small. Young firms are more dispersed compared to mature firms, and this generates a bimodal distribution with the mode for the young firms at about 10 years and 35 years for the mature firms. The break point for this bimodal distribution is 20.5, and it is represented by the blue line in the Kernel density function graph. Thus, firms whose age is lower than 20.5 are considered young, otherwise they are mature or old. Following previous work in the literature, young firms are likely to be constrained than mature firms. Therefore, age is expected to be negatively related to financial constraints.

Size measured by the log of assets lies between 4.7 and 12.6. Like age, the distribution of size is also bimodal, with 10.2 as the value that separate the distributions. This is shown by the blue line, which divides the distribution of firms by size into two groups: Large and small. Splitting size at 10.2 and age at 20.5 years yield small and large firms on one side and young and mature, on the other. 49% of the firms are small and 36% of the firms are young. Grouping mature and large firms as financially unconstrained and any other firm as financially constrained put the severity of financial constraints for listed manufacturing firms at 67%. That is, about two in every three listed manufacturing firms suffer from financial constraints.

2 This is based on distance from frontier approach described in Section A.

To assess how well size-age measure identifies financially constrained firms, another proxy of financial constraints based on dividend payment was constructed. The construction of this proxy entailed computing distance from frontier based on yearly dividend payments by firms. That is, the yearly maximum and minimum values were used instead of the maximum and minimum values for the entire sample. This approach eliminates the effect of common shocks that have disproportionate effect on financial constraints status of a firm such as the effect of macroeconomic conditions on dividend payout and is appropriate due to movement of dividend payment over time. This yields a scaled variable, referred to as dividend payout measure, which range from 0 representing maximum dividend payout ratio to 1 representing minimum dividend payout ratio in any year.

Dividend payout lies closer to one for the majority of the firms with the median of 0.70, suggesting most of the firms pay dividend close to the dividend payout of the lowest dividend payer. Dividend payment is zero in 8.4% of the firm-years and one in 18.4% of the firm-years. 91% of the firm-years have dividend payout measure of more than 0.235. The dividend payout is not a binary variable and hence represents the financial constraint status of each firm-year. Splitting the dividend payout measure at the median puts the severity of financial constraints at 33%. Subsequent subsections analyze the determinants of financial constraints and validate the measures of financial constraints developed in this section.

4.2.2. Evaluation of financial constraints measures

In this section the regression results of endogenous switching regression are presented followed by an evaluation of the endogenous regression based classification against the initial measures. The objective was to assess the information content of Kaplan and Zingales (1997) index, Whited and Wu (2006) index and Hadlock and Pierce (2010) index about financial constraints and how endogenous switching regression used this information to improve on the initial values generated in section III B. Table 3 presents endogenous switching regression results of Hadlock and Pierce (2010) index.

Column 1 and 2 of Tables 3 presents the results for the initial values generated using size-age values while column 3 and 4 presents the results for the initial values generated using dividend payout measure of financial constraints. The columns with subtitle PoH presents results of the outcome variable used in testing the impact of financial constraints on the validity of pecking order theory. The columns with subtitle Investment presents results of the outcome variable used in testing the impact of financial constraints on investment decisions. The first part of Tables 3 gives the selection equation while the second part, immediately below the first part, gives the regression results of the outcome equation under the first regime and the last part presents the regression results of the outcome equation under the second regime. A firm dummy and a year dummy were included to remove firm-specific effects and eliminate out macro shocks, respectively.

To determine whether endogenous switching regression classification of firms are sensitive to the choice of the initial values and/or the specification of the selection and/or outcome equation, the regression results are compared across these dimensions. The classification of firms is sensitive to the choice of initial values if the coefficients and the mean probability vector vary with the choice of initial values for a given outcome and selection equations. Similarly, the classification is sensitive to the specification of the selection equation if the mean probability vector varies across Kaplan and Zingales (1997) index, Whited

Table 1: Transition probability matrix

	FCjt=1	FCjt=0
IVjt=1	ρ11	ρ10
IVjt=0	ρ01	ρ00

Table 2: Descriptive statistics

Variables	Mean	25th Perc.	Median	75th Perc.	SD	Minimum	Maximum	Kurt.	Skew.
Sales/K	3.407	1.161	1.93	4.183	4.278	0.313	30.25	24.18	4.101
Debt sq.	0.0559	0	0.0004	0.0238	0.134	0	0.642	11.42	2.981
Investment rate	0.137	0.0468	0.111	0.188	0.108	0.0028	0.493	3.926	1.082
Cash flow	0.444	0.253	0.459	0.698	0.662	−3.311	2.332	20.1	−2.899
Size (Log of TA)	11.07	10	10.99	12.09	1.16	8.974	13.08	1.79	0.0568
Age	3.113	2.674	3.466	3.664	0.769	0.693	3.829	4.137	−1.383
Debt/K (Debt/TA)	0.115	0	0.0003	0.146	0.197	0	0.855	6.402	2.042
Cash flows/K	0.377	0.245	0.45	0.696	1.267	−13.2	3.943	74.89	−7.479
Dividend/K	0.138	0.0186	0.0774	0.213	0.184	0	1.641	24.72	3.633
Cash/K	0.2	0.0319	0.0878	0.235	0.411	0	4.193	63.01	7.015
Dividend paid	0.658	0	1	1	0.475	0	1	1.444	−0.666
Growth in sales	0.0541	−0.0165	0.0752	0.149	0.241	−2.22	0.656	40.59	−4.336
Cash/TA	0.909	0.0152	0.034	0.0745	12.57	0	186.5	218	14.73
Cash flows/TA	1.223	0.104	0.183	0.297	15.27	−0.33	226.6	218	14.73
Dividend payout	0.617	0.433	0.695	0.872	0.324	0	1	2.141	−0.556
Financing deficit	0.33	−0.184	0.14	0.529	1.151	−1.618	4.22	6.324	1.563
ΔD	0.393	0	0	0.235	0.977	0	4.301	11.75	3.115
Tangibility	9.195	3.549	8.285	13.08	6.287	1.665	23.71	2.618	0.767
Sales	8.985	2.757	7.011	12.86	7.205	1.205	29.96	3.719	1.125
Market to book	13.59	2.526	5.557	21.03	16.65	−0.0737	71.51	5.603	1.726
Profitability	1.737	0.27	1.081	2.788	2.111	−1.267	8.434	4.64	1.309

Descriptive statistics including mean, 25th percentile, median, 75th percentile, standard deviation, minimum, maximum, kurtosis and Skew ness for the main variables used in empirical analysis. Source: Author's computation

Table 3: Switching regression with Hadlock and Pierce (2010) regressors

Variables	(1)	(2)	(3)	(4)
	Size-age		Dividend payout	
	PoH	Investment	PoH	Investment
Selection regression				
Age	−1.6062***	−17.6169***	0.5232***	−5.2102***
	0.000	0.000	0.000	0.000
Size	4.2768***	48.5087***	2.3841***	−6.2372***
	0.000	0.000	0.000	0.000
Size sq.	−0.1309***	−2.0672***	−0.0488***	0.1233***
	0.000	0.000	0.000	0.000
Constant	−29.0193***	−245.7641***	−19.2029***	58.8858***
	0	0	0	0
First regime regression				
Financing deficit	−0.0151		0.9641***	
	−0.410		0.000	
Constant	0.0942*		−0.117	
	−0.067		−0.198	
Cash flows		0.0111***		−0.0232***
		0.000		0.000
Second regime regression				
Financing deficit	1.0156***		0.0068	
	0.000		−0.271	
Constant	−0.3170***		0.5079***	
	−0.005		0.000	
Cash flows		−0.0048		−0.0074
		−0.192		−0.621
Observations	215	189	201	200
Adj. R^2	0.9900	0.9998	0.9508	0.9961
Mean Prob. Vector	0.76	0.47	0.27	0.50

The level of significance are: *P<0.1; **P<0.05; ***P<0.01. *P* values are in parenthesis below the coefficients. Source: Author's computation

and Wu (2006) index and Hadlock and Pierce (2010) index for a given outcome equation and initial values. Lastly, the classification is sensitive to the specification of the outcome if for a given initial values and the specification of selection equation, the mean probability vector varies with the change in the outcome equation.

The results in Table 3 show that the mean probability vector when outcome is PoH is 0.69 and 0.33, respectively, for size-age and dividend payout initial values. The mean probability for investment is 0.45 and 0.54 for size-age and dividend payout initial values, respectively. Similarly, the coefficients of the selection equation vary across the outcome due to changes in initial values. For, size-age initial values the mean probability vector 0.69 and 0.45 for PoH and Investment, respectively while for dividend payout initial values the mean probability vector is 0.33 and 0.54, respectively. These variations in mean probability vector provide evidence that the classification is sensitive to the choice of initial values and the specification of the outcome under the Hadlock and Pierce (2010) index.

In the absence of financial constraints, the coefficient of cash flows in the investment equation is hypothesized to be negative and vice versa in the presence of financial constraints. This hypothesis applies to the results in Tables 3-5. The coefficient of cash flow in the investment equation suggests that the second regime represents financial unconstrained regime. It is, however, not clear whether the first component represents an unconstrained or constrained regime under size-age initial guess. However, the positive and insignificant coefficient of cash flows for both regimes under dividend payout as initial guess and investment as the outcome equation implies that the financial constraints regime is ambiguous.

Table 4 presents endogenous switching regression results of Kaplan and Zingales (1997) index.

The mean probability vector in Table 4 when outcome is PoH is 0.69 and 0.65, respectively, for size-age and dividend payout initial values. For investment as the outcome variable, the mean probability is 0.47 and 0.46 for size-age and dividend payout initial values, respectively. Similarly, the coefficients of the selection equation vary across the outcome due to changes in initial values. Holding initial values constant and varying outcome variable gives the mean probability vector 0.69 and 0.47 for PoH and Investment, respectively for size-age initial values. Similarly, the mean probability vector is 0.65 and 0.46, respectively for dividend payout initial values. These variations in mean probability vector provide evidence that the classification is sensitive to the choice of initial values and the specification of the outcome under the Kaplan and Zingales (1997) index.

The results in Table 4 are similar to those in Table 3. The coefficient of cash flows in the PoH equation in column 2 of Table 4 is positive and significantly for the first regime and also for the second regime. This suggests that both the first regime and the second regime are financially constrained regimes. The results in column 4 show the coefficient of cash flows in the investment equation is positive and significant, providing evidence of financial constraints in the second regime. However, financial constrained state of the first

Table 4: Switching regression with Kaplan and Zingales (1997) regressors

Variables	(1)	(2)	(3)	(4)
	Size-age		Dividend payout	
	PoH	Investment	PoH	Investment
Selection regression				
Cash flows	1.2546***	−0.8226***	1.6741***	1.0644***
	0.000	0.000	0.000	0.000
Market to Book	−0.0467***	−0.6216***	0.0173***	−0.0055
	0.000	0.000	0.000	−0.201
Leverage	−5.0684***	−14.2337***	0.9644***	2.4894***
	0.000	0.000	−0.002	0.000
Dividend	4.7063***	20.1936***	−4.2686***	−10.5987***
	0.000	0.000	0.000	0.000
Cash	2.5248***	−2.8275***	−0.6754***	0.6964***
	0.000	0.000	−0.007	0.000
Constant	0.7715***	0.1165***	−1.1443***	1.1760***
	0.000	−0.002	0.000	0.000
First regime regression				
Financing deficit	−0.0164		0.0058	
	−0.331		−0.332	
Constant	0.0597		0.0887**	
	−0.249		−0.035	
Cash flows		0.0136***		0.0579**
		0.000		−0.025
Second regime regression				
Financing deficit	1.0208***		0.9624***	
	0.000		0.000	
Constant	−0.2756**		−0.2740**	
	−0.011		−0.020	
Cash flows		0.0056		−0.0178***
		−0.360		−0.008
Observations	221	207	214	201
Adj. R^2	0.9966	0.9998	0.9630	0.9813
Mean Prob. vector	0.74	0.46	0.7	0.46

The level of significance are: *P<0.1; **P<0.05;***P<0.01. P values are in parenthesis below the coefficients. Source: Author's computation

regime is ambiguous. Table 5 presents endogenous switching regression results of Whited and Wu (2006) index.

The results in Table 5 are also similar to those in Tables 3 and 4. Table 5 shows that the mean probability vector when outcome is PoH is 0.68 and 0.32, respectively, for size-age and dividend payout initial values. For investment as the outcome variable, the mean probability is 0.47 and 0.55 for size-age and dividend payout initial values, respectively. Similarly, the coefficients of the selection equation vary across the outcome due to changes in initial values. Holding initial values constant and varying outcome variable gives the mean probability vector 0.68 and 0.47 for PoH and Investment, respectively for size-age initial values. The mean probability vector is 0.32 and 0.55, respectively for dividend payout initial values. These variations in mean probability vector suggest that the classification is sensitive to the choice of initial values and the specification of the outcome under the Whited and Wu (2006) index.

In Table 5, the positive and significant coefficient of cash flows in the investment equation suggests the presence of financial constraints in both regimes regardless of the initial values. To determine whether the classification is sensitive to the specification of the selection equation, this study compares results across the selection specification defined by Hadlock and Pierce (2010) index, Kaplan and Zingales (1997) index and Whited and Wu (2006) index and used in Tables 3-5, respectively. Holding initial values constant gives the mean probability vector of 0.69, 0.69, 0.68 under investment equation for Hadlock and Pierce (2010) index, Kaplan and Zingales (1997) index and Whited and Wu (2006) index, respectively and the mean probability vector of 0.45, 0.47, 0.47 under PoH equation for Hadlock and Pierce (2010) index, Kaplan and Zingales (1997) index and Whited and Wu (2006) index, respectively. Thus, size-age initial values give consistent mean probability vector; however, it varies across the outcome variable.

This is not the case with the dividend payout initial values. The mean probability vector under investment equation is 0.33, 0.65, 0.32 for Hadlock and Pierce (2010) index, Kaplan and Zingales (1997) index and Whited and Wu (2006) index, respectively and the mean probability vector of 0.54, 0.46, 0.55 under PoH equation for Hadlock and Pierce (2010) index, Kaplan and Zingales (1997) index and Whited and Wu (2006) index, respectively. Unlike size-age initial values, dividend payout initial values do not converge to the same mean probability vector. It is clear that size-age measure, unlike dividend payout, produce consistent sub-samples. However, it is not clear which measure of financial constraints (both initial guess and indices) produce a better measure of the financial constraints of a firm. The next section assesses and discusses each of the measures of financial constraints and evaluates its efficiency relative to the initial values.

Table 5: Switching regression with Whited and Wu (2006) regressors

Variables	(1)	(2)	(3)	(4)
	Size-age		Dividend payout	
	PoH	Investment	PoH	Investment
Selection regression				
Leverage	−23.7250***	−25.8535***	−1.5602***	2.8309***
	0.000	0.000	0.000	0.000
Dividend	−4.6502***	8.8103***	−0.6434***	−0.2459*
	0.000	0.000	0.000	−0.059
Growth	4.6403***	−13.5227***	−0.9679***	1.0537***
	0.000	0.000	0.000	0.000
Size	6.8608***	1.1872***	−0.9418***	−0.6752***
	0.000	0.000	0.000	0.000
Cash	16.1430***	4.6844***	3.3113***	−3.8562***
	0.000	0.000	0.000	0.000
Cash flows	−13.1045***	−3.8097***	−2.7683***	3.1537***
	0.000	0.000	0.000	0.000
Constant	−79.3697***	−24.2745***	13.4504***	7.2158***
	0.000	0.000	0.000	0.000
First regime regression				
Financing	0.0218		0.9895***	
	−0.201		0.000	
Constant	0.0807		−0.1111	
	−0.271		−0.322	
Cash flows		0.0285**		−0.0076
		−0.015		−0.263
Second regime regression				
Financing	0.9575***		0.0043	
	0.000		−0.457	
Constant	−0.4342***		0.0826*	
	0.000		−0.094	
Cash flows		−0.0009		0.0252**
		−0.851		−0.031
Observations	206	203	206	203
Adj. R^2	0.9994	0.9995	0.9528	0.9763
Mean Prob. vector	0.75	0.45	0.3	0.42

The level of significance are: *P<0.1; **P<0.05; ***P<0.01. *P* values are in parenthesis below the coefficients. Source: Author's computation

Ideally, the endogenous switching regression should improve on initial guess of financial constraints, converging to the same classification of firms regardless of the choice of the values of initial guess, the selection equation and the outcome equation. Thus, the regression results of an outcome equation should be independent of the initial guess. Furthermore, the effects of financial constraints on firm's real decisions (dependent variable in the outcome equation) should be consistent for any given selection equation. These hypotheses, however, are not supported by the results in Tables 3-5. Similar results on the inconsistency of measures of financial constraints were documented by Campello et al. (2010) and Farre-Mensa and Ljungqvist (2015), however, not in the context of endogenous switching regression as documented by this study.

Endogenous switching regression should improve on the initial values to yield an efficient measure of financial constraints status. A measure of financial constraints status is more efficient the more the information it contains about financially constrained state to which the observed values of the outcome variable belong. An evaluation of the performance of the final values of the endogenous switching regression against the initial values gives the efficiency performance of the endogenous switching regression. Table 6 present the evaluation results for the final values of the endogenous regressions.

If the value at the intersection of 1 for each index with 0 for the initial value is equal to the value at the intersection of 1 for each index with 1 for the initial value, then the initial values identify financially constrained firms better than the index, otherwise the index performs better than the initial values. From Table 6, the Chi-square test for Independence and Fisher's exact tests showed that there is no significant association between size-age initial values and the indices at 5% level of significance. The implication is that the initial values and the final values are related. The only exception is the size-age initial values and the HP index under investment.

The Chi-square test for Independence and Fisher's exact tests showed that there is no significant association between dividend payout initial values and all the indices at 5% level of significance. The implication is that, with the exception of HP index under investment and size-age initial values, the initial values identify financially constrained firms better than all indices regardless of the outcome variable. The insignificant value of HP index under investment and size-age initial values indicates that age and size are the main determinants of financial constraints. Furthermore, if the value at the intersection of the value of 1 for each index with the value of 1 for the initial values is equal to the value at the intersection of the value of 0 for each index with the value of 0 for

Table 6: Final values of switching regression versus initial values

A: Size-age combination												
	A1: PoH						A2: Investment					
Initial values	HP index		KZ index		WW index		HP index		KZ index		WW index	
	0	1	0	1	0	1	0	1	0	1	0	1
0	0.07	0.93	0.08	0.92	0.09	0.91	0.33	0.67	0.21	0.79	0.3	0.7
1	0.3	0.7	0.32	0.68	0.28	0.72	0.55	0.45	0.64	0.36	0.59	0.41
Fisher's exact P value	0		0		0.001		0.002		0		0	
Chi-square P value	0		0		0.001		0.002		0		0	
B: Dividend payout												
	B1: PoH						B2: Investment					
Initial values	HP index		KZ index		WW index		HP index		KZ index		WW index	
	0	1	0	1	0	1	0	1	0	1	0	1
0	0.49	0.51	1	0	1	0	0.49	0.51	1	0	1	0
1	0.27	0.73	0	1	0	1	0.27	0.73	0	1	0	1
Fisher's exact P value	0.002		0.000		0.000		0.002		0.000		0.000	
Chi-square P value	0.002		0.000		0.000		0.002		0.000		0.000	

Column one present the initial values, with the first part (A) of the table giving the initial values of size-age measure and the second part (B) giving initial values for dividend payout. For each initial values there are two outcome variables: Pecking order hypothesis (PoH) and investment, represented by A1 and A2 for size-age measure and B1 and B2 for dividend payout, respectively. Under each outcome variable three index of financial constraints are considered. Similar to the initial values, each final index takes a value of either one representing financial constrained state and zero, otherwise. Source: Author's computation

the initial values, then there is no efficiency gain in using the index. In this case, the sample separation produced by initial values and index are exactly identical. From the results in Table 6, the dividend payout initial values and the KZ and WW Indices produces identical sub-samples regardless of the outcome variable. Thus, there is no efficiency gain in using KZ and WW Indices under the dividend payout initial values regardless of the outcome variable.

4.2.3. Financial constraints and its effects on financing and investment decisions

The severity of financial constraints for size-age initial values for listed manufacturing firms is 62%. That is, about two in every three listed manufacturing firms suffer some level of financial constraints. This is slightly higher than the severity of financial constraints of 33% for the dividend payout measure. Based on the hypothesis that endogenous switching regression improves on these initial values to yield efficient measures of financial constraints status. The model was estimated with two corporate decisions; financing and investment decisions as the outcome variables and used to validate the initial values. The regression results are summarized in Tables 3-5. Size-age initial values track the experienced financial constraints as measured by Chairman's statement on financial position of the company. Based on experienced financial constraints about 50% of the firm-years were financially constrained.

The regression results show that the classification of firms vary across the different measures of financial constraints, results that have been documented by a number of studies such as Hadlock and Pierce (2010); Farre-Mensa and Ljungqvist (2015); Campello et al. (2010). In summary, depending on the measure of financial constraints used the mean probability vector ranges from about 0.32 to 0.69. That is, about 32–69% of firm-years in the sample considered experienced financial constraints. Given that listed firms have an advantage in access to capital over non-listed firms then the financial constraints problem in Kenya could be much bigger. Moreover, it is clear from the results in Tables 3-5 that the classifications based on endogenous switching regression are sensitive to the choice of initial values, the selection equation and the outcome equations. In classification of financially constrained firms, size-age measure and dividend payout performs better than the endogenous switching regression indices. However, the regression results under dividend payout measure were inconsistent across the outcome equation and the initial values. The correlation between the measure based on experienced financial constraints, on one hand, and size-age and dividend payout, on the other, is 0.78 and 0.17, respectively. Thus, size-age measure is a good proxy for experienced financial constraints and therefore measures financial constraints with reasonable accuracy.

This study makes two contributions. First, it uses distance from frontier to construct dividend payout measure of financial constraints. Second, it documents evidence that the final values of HP index, KZ index and WW index generated by endogenous switching regression are sensitive to the choice of the initial guess, and the specification of the outcome and selection equation. A growing number of studies using endogenous switching regression have not taken into consideration the possibility that their results might be sensitive to the choice of initial guess and the specification of the outcome equation and the selection equation. Although classification of firms vary across the different measures of financial constraints considered, it is clear that financial constraints affect financing and investment decisions. Thus, this study joins a number of other studies documenting similar evidence for corporate investment and capital structure, however, in the context of a developing country. Fazzari et al. (1988), in their pioneering work, and several other studies such as Agca and Mozumdar (2008), Hoshi et al. (1991), Lamont (1997) and Campello et al. (2010) found that financial constraints affect real variables such as investment.

5. CONCLUSION AND POLICY IMPLICATIONS

This essay estimated the severity of financial constraints and assessed the sensitivity of estimated severity to the specification of selection and outcome equation, and the choice of the initial values in a switching regression model. Endogenous switching regression was estimated with the right hand side variables in KZ, WW and HP indices as the selection equation and the pecking order test equation and investment equation as the outcome equations, and the a priori classification served as the starting values. A priori classification based on size-age measure was used and in addition, a new measure constructed from dividend payout ratio, using distance from frontier method, was used. The dividend payout measure constructed took into consideration changes in financial constraints status of some firms over time as well as the dependence of firm response to shocks on financial constraint status. Endogenous switching regression model and two proxies of financial constraints were applied on a sample of 13 listed firms over the period 1999–2016.

This essay hypothesized that financial constraints is important, with disproportionate and asymmetrical effects, among listed manufacturing firms in Kenya. This essay hypothesized that the results under endogenous switching regression is not sensitive to the choice of the initial values/guess of financial constraint variable and/or the specification of the outcome and selection equations. To determine the accuracy of the final classification generated by endogenous switching regression models, the performance of the final classification values were evaluated against the two a priori classification criteria – size-age and dividend payout. Specifically, a null hypothesis of no significant association between the initial values and the final classification values generated by endogenous switching regression was used to assess the performance of the final classification values.

The Chi-square test for Independence and Fisher's exact tests showed that dividend payout outperformed all the indices while size-age initial values out- performed indices with the exception of the HP index under investment as the outcome variable. Dividend payout does as well as KZ and WW final classification values in the classification of financially constrained firms. Size-age initial values and dividend payout initial values outperformed final classification values, to a large extent, in identifying financially constrained firms in the context of endogenous switching regression. That is, there is no efficiency gain in using endogenous switching regression indices since the sample separation produced by the initial values outperformed endogenous switching regression final classification values. In summary, the endogenous switching regression final classification values did not improved on the initial guess of financial constraints. Moreover, the final indices generated by endogenous switching regression depended on the outcome equation, the initial guess and the selection equation.

Size-age measure does a better job of identifying financially constrained firms and producing consistent results, and is the only measure that approximates experienced financial constraints well. The correlation coefficient between size-age measures and the experienced financial constraints is 0.78. Unlike size-age measure, dividend payout produced inconsistent sub-samples across the indices, which in turn, led to mixed results on the effect of financial constraints across the sub- samples. Thus, size-age is the only measure that is a good proxy of experienced financial constraints. Hence, age and size are the major determinants of financial constraints in Kenya.

The severity of financial constraints range from 32% to 69% for measures of financial constraints generated using endogenous switching regression and is about 62% and 33% for size-age measure and dividend payout, respectively. The experienced financial constraints, which provides more accurate measure of financial constraints, puts severity of financial constraints in Kenya at 50%. That is, one in every two listed manufacturing firms suffers from financial constraints. However, size-age measure of financial constraints suggests that two in every three listed manufacturing firms suffer some level of financial constraints. Although, the different approaches used in classification of firms considered in this study does not converge to similar sub-samples, the effects of financial constraints on financing and investment decisions is clear at least for size-age initial values. Financial constraints have negative effect on firm's real decision.

This study is one of the first studies to evaluate the efficiency of endogenous switching regression in sample separation. It provided evidence that the final indices generated by endogenous switching regression are sensitive to the choice of the initial values and the specification of the outcome equation and the selection equation. Greater impact on reducing financial constraints can be achieved by targeting to ease constraints in access to capital for small and young firms. For instance, by improving information disclosures through financial reporting and disclosure while making reporting less costly.

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PROXIES OF FINANCIAL CONSTRAINTS

The observable characteristics that are correlated with financial constraints are chosen as proxies of financial constraints. Two approaches are used: Dividend payout ratio and a measure based on a combination of age and size. By using dividend payout ratio as a proxy, the first approach is closely related to Fazzari et al. (1988) approach. However, unlike Fazzari et al. (1988) this study used distance from frontier to construct dividend payout measure of financial constraints. This modification corrects for the effects of changes in macroeconomic conditions on financial constraint status, when firm's response to shocks vary with financial constraint status. Distance from the frontier was computed using, $DF_{it} = \frac{\left(max_t\text{-}div_{jt}\right)}{\left(max_t\text{-}min_t\right)}$ where DF_{it} is the distance from the frontier for firm j at time t, max_t is the highest dividend payout ratio in year t, div_{jt} is the dividend payout by firm j at time t and min_t is the lowest dividend payout in year t. Here, the dividend payout gives the financial constraints status.

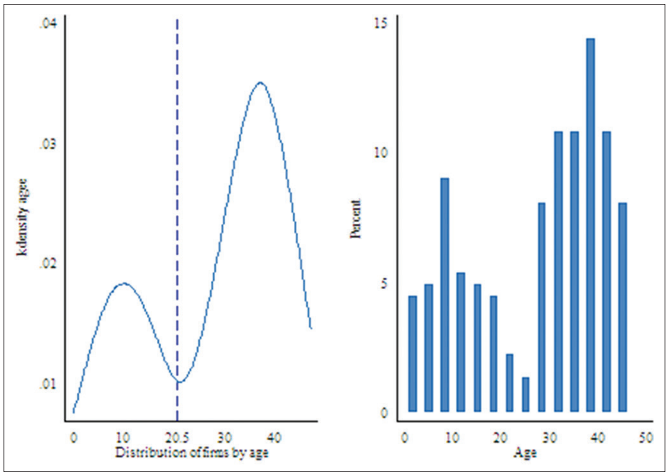
The second approach uses age and size. Here, the distribution of size and age is used to identify the points at which to split the observations. Where there are no clear break points in the distributions, age and size were broken down at the median into two. Using the break points, firms were divided based on age and size. This was followed by classification of firms into three categories: (i) Young and small; (ii) young and large or old and small, and (iii) old and large. Finally, a firm is classified as financially unconstrained if it is old and large, otherwise it is financially constrained. Mature and large firms faces less informational problem and hence no or less severe financial constraints, since investors are able to gather information on larger firms with ease (Bernanke et al., 1996) and mature firms have well established track records (Schiantarelli, 1996).

To measure the experienced financial constraints, for every firm-year this study gleaned information on difficulty in financing operations and investment from financial statements, specifically the Chairman's statements. A firm-year was considered financially unconstrained if it indicated in that it had a financing surplus (excess of cash flows over investment). A firm-year was also classified as unconstrained if it started paying dividend or it increased dividend payment. Therefore, financial unconstrained sub-sample is likely to be similar to those of Kaplan and Zingales (1997) and include only financially healthy firm-years with high profitability, high value of tangible assets, high cash and low debt. Any other firm-year that does not meet the criteria of financially unconstrained firm-years was classified under financially constrained sub-sample.

APPENDIX IMAGES

Figure A1 plot kernel density function and histogram for age.

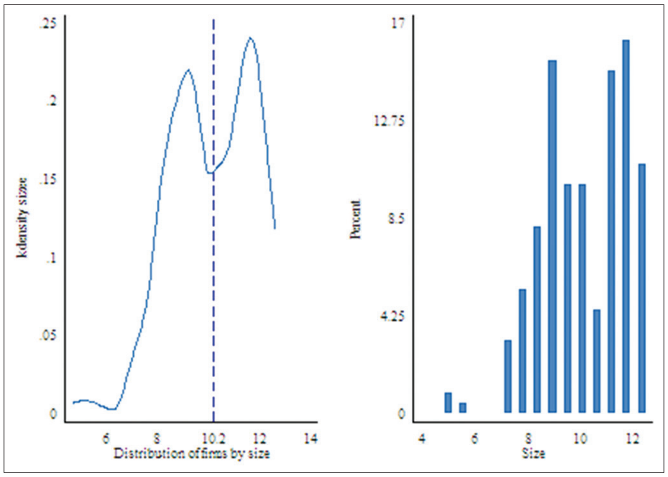
Figure A1: Distribution of firms by age (Kernel density and histogram)



Age is the number of years a company has been listed on NSE. Source: Author's calculation based on published financial statements

Figure A2. Graphs Kernel density curve and histogram for size variable.

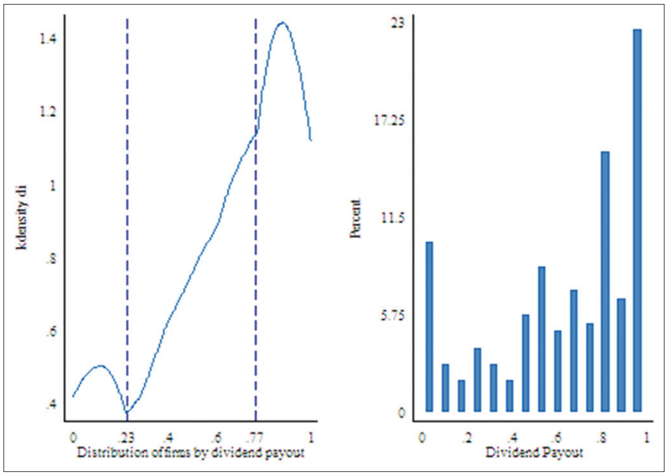
Figure A2: Distribution of firms by size (Kernel density and histogram)



Size is the log of the book value of assets. Source: Author's calculation based on published financial statements

Figure A3. Plots the Kernel distribution and histogram for the dividend payout

Figure A3: Distribution of firms by dividend payout (Kernel density and histogram)



Dividend payout is given by $DF_{it} = \frac{(max_t \text{-} div_{jt})}{(max_t \text{-} min_t)}$, where DF_{it} is the distance from the frontier for firm i at time t, max_t is the highest dividend payout ratio in the entire sample, div_{jt} is the dividend payout by firm j at time t and min_t is the lowest dividend payout in the entire sample. Source: Author's calculation based on published financial statements