MODELING FINANCIAL PERFORMANCE OF MANUFACTURING FIRMS ON CAPITAL STRUCTURE. DOES THE PANEL DATA MODEL USED MATTER? EVIDENCE FROM THE NAIROBI SECURITIES EXCHANGE

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ABSTRACT

Manufacturing firms contribute a significant proportion to Kenya's Gross Domestic Product (GDP), putting them at the center of her development. To optimize production, most manufacturing stakeholders have taken cognizance of the capability of econometric panel data models to maximize output on minimal input. Yet, a gap exists on whether the panel data used in modeling financial performance on capital structure matters. Therefore, this research used the financial performance-capital structure nexus in listed manufacturing firms trading at the Nairobi Securities Exchange (NSE) to establish whether the panel data model in use mattered. Using 85 observations drawn from 14 firms, and covering the period 2016 to 2022 inclusive, the study compared the pooled Ordinary Least Squares (OLS), the random effects (RE), and the fixed effects (FE) models. The study revealed that parameters such as model restrictiveness, estimation consistency and efficiency, and temporal variations dictate the model to be used, confirming that the panel data model indeed matters. Retrospectively, the pooled OLS model suits situations without unobservable entity-specific effects, the RE model suits situations where differences across firms do not correlate with the predictors, and the FE model is preferred when some time-invariant characteristics such as company culture are omitted. The significance of this finding to manufacturers is that robust decision making regarding leveraging financial performance of manufacturing firms on capital structure is a function of careful consideration of available panel data models as defined by existing parameters. Future studies can strengthen this finding by including dynamic panel data models.

Keywords: manufacturing firms, panel data, financial performance, capital structure, model restrictiveness, temporal variations

INTRODUCTION

Econometric panel data models are gaining popularity in production functions following the optimization objective of minimizing input and maximizing output (Rashidghalam et al., 2016). Panel data models differ significantly in the manner in which they account for exogeneity, endogeneity, time-variance, heterogeneity, heteroskedasticity, and individual effects among others. Scholars have shown immense interest in comparing panel data estimators. For instance, Moundigbaye et al. (2018) compared panel data estimator in conducting a corrigendum and extension. Musau et al. (2015) compared robust covariance matrix estimation and GLS estimation in modeling panel data. Rashidgalam et al. (2016) estimated technical efficiency across several panel data models. This research contributes to this array of literature by examining whether the choice of pooled Ordinary Least Squares (OLS), Generalized Least Squares (GLS) random effects

(RE), or GLS fixed effects (FE) models in modeling financial performance on capital structure in manufacturing firms listed at the NSE matters.

In Kenya, manufacturing is recognized as the pillar of socioeconomic transformation contributing to among others, food security, housing sector, health sector, and employment both directly and indirectly (Okeyo, 2022). Agriculture as an element of manufacturing particularly plays a vital role in the country's economy, providing 22.4% of the GDP and generating employment for 40% of the population. According to Mwangi (2022), the Chief Executive Officer of the Kenya Association of Manufacturers, Agri-based manufacturing, including all related processes such as jute production and rice milling contributes approximately 48 percent of the total manufacturing share of GDP making it central to the country's development. Yet, influenced by increasing incidents of financial distress that occasion the delisting of manufacturing firms from the NSE, stakeholders agree that improving production and value addition through growth in manufacturing can revive the economy, create jobs, and eradicate poverty (Mwangi, 2022). The question then is how firms in the manufacturing sector can leverage capital structure to improve financial performance.

Capital structure, a firm's combination of debt and equity finance during its overall operations and growth (Tuovila, 2024) has emerged as a critical area of theoretical and practical finance, gaining acceptance by Google, McDonald's, as well as start-up and small companies (Miglo, 2016). Several scholars have explored the capital structure–financial performance nexus in manufacturing firms (Ayaz et al., 2021; Sdiq & Abdullah, 2022; Ullah et al., 2020; Xu & Liu, 2021). However, many have not used panel data models and those who have used panel data models, have not confirmed the robustness of the findings by comparing results derived from different panel data models.

For instance, Ajibola et al. (2018) demonstrated a statistically significant nexus between the total debt ratio and financial performance of manufacturing firms listed in the Nigerian Securities Exchange on one hand and between return on equity and financial performance on the other. However, they used the panel ordinary least squares model which is reportedly quite restrictive and non-realistic (Barigozzi et al., 2016). Odipo and Obbayi (2023) established that debt ratio impacted financial performance negatively, while equity had a positive effect on financial performance. However, by using the OLS multiple regression approach, they did not address the potential of temporal variations. Meanwhile, Vatavu (2015) used the Romanian listed firm's context to show that capital structure impacts the financial performance of manufacturing companies. However, Vatavu relied on the fixed effects (FE) model which is less efficient for using within firm variation of regressors.

The econometrics panel data approach is particularly relevant in measuring and comparing financial performance of individual manufacturing firms listed at the NSE. Extensive body of literature has shown the prevalence of econometrics techniques in studies involving financial performance including examining the link between corporate governance and financial performance (Gitundu et al., 2016), exploring the nexus between intellectual capital and financial performance (Gul et al., 2022), relating sustainability with financial performance (Seyras et al., 2019), and in testing determinants of financial performance (Alhialy & Alsaegh, 2021) among many others.

Panels address large volumes of data points and are able to isolate individual firms' effects from time-specific effects in the combined effects (Hsiao, 2022). Moreover, in the event that financial performance is time-invariant, panel data allows estimation of financial performance consistently disregarding distributional assumptions (Greene & Chang, 2019). Therefore, besides modeling, financial performance on capital structure using econometrics panel data, this paper also examined robustness in estimates by comparing estimates from the various panel data models used.

LITERATURE REVIEW

Financial Performance

Financial performance is an indicator of a firm's viability to raise and generate profits by maximizing the utilization of its assets. Tarigan et al. (2019) contend that financial performance defines the profit level achieved by a firm over time. Several monetary proxies, including return on assets (ROA) and return on equity (ROE) are used to measure financial performance. Besides, scholarly evidence shows that a firm's financial records are mostly assessed for overall performance prior to investment decision-making (Curtis et al., 2020).

Financial indicators remain a common feature in defining financial performance. Altmeppen et al. (2017) argue that key financial performance indicators such as net bonus payout, return on assets, and return on equity among others, are critical in demonstrating a firm's economic resilience. Alam et al. (2018) posit that a firm's financial performance involves a combination of its growth in margin rate and its financial ratio analysis. Meanwhile, Soboleva et al. (2018) recognize the different approaches and proxies used to measure financial performance, including using total sales, cash flow, and operating revenue to draw financial statements.

Firm's financial performance and investor confidence largely rest on the selected financial indicators together with the strategies adopted. Still, financial performance is a function of financing decisions made. Capital structure has emerged as a significant financial source across firms and correlates directly with a firm's financial performance (Marimuthu et al., 2021). Equity financing, a critical facet of capital structure has been associated with company funding, demonstrating an avenue for long-term funding and enhanced performance of SMEs (Atidhira & Yustina, 2017; Njagi et al., 2017). In contrast, debt financing which occurs by selling debt also features in financial discourse as another source of finance across firms (Chen, 2024). Research has shown that through debt financing, a firm can leverage competitive advantage to boost financial performance (Rita et al., 2022).

Manufacturing firms

Manufacturing which is the process of turning and refining raw materials into finished products is an integral and huge element of the economy. Experts highlighted in Nabila (2021) have given divergent definitions of manufacturing firms whose convergence remains turning raw materials into finished products. For instance, CIRP 1983 defined manufacturing firms as a united set of operations that begin with product design, planning, selecting materials or commodities, manufacturing methods, guaranteeing quality control, and implementing corporate administration. Heizer (cited in Nabila, 2021) viewed manufacturing firms as industries that manufacture something by hand or machine in order to make a product. Technically, a manufacturing firm processes raw materials through physical and chemical processes, altering the form, appearance, or characteristics to make goods and their elements (Groover, 2020). From an economic perspective, a manufacturing firm leverages a transformative process that adds value to raw materials and progressively gives them market value (Lieder & Rashid, 2016).

The manufacturing sector in Kenya is multifarious, including automobile, metal, agriculture, and plastics, among others. In addition, it involves large corporations and SMEs; both contribute to economic growth in one way or another. The largest manufacturing subsector is the one concerning food and beverage, which incorporates such businesses as cocoa and confectionery manufacturers; dairies that make butter and milk; and distilleries and breweries that make alcoholic beverages. Kenyan beer production has an annual turnover of $280 million, thus contributing considerably to the economy (Kibui et al., 2023). The other sub-sectors include apparel and textiles, such as those made from hand-woven or stitched materials. According to Peter Biwott, the CEO of the Export Promotion Council, there is a rising demand for Kenyan handicrafts, which are known for their authenticity (KAM, 2024).

The manufacturing sector in Kenya ranks among sectors earmarked to actualize the realization of Vision 2030 (Mwasiaji, 2019). Consequently, the sector seeks manufacturing processes that besides being competitive, also offer diversification. These processes are therefore boosted by having manufacturing firms get listed at the Nairobi Securities Exchange (NSE). However, both listed and non-listed manufacturing firms have failed to realize their full potential in financial performance owing to financial constraints and poor business environment that have occasioned some of them to relocate to other countries (Audax, 2018; Njoroge, 2015). To realize the key component of Vision 2030 dubbed "Buy Kenya Build Kenya Policy" to enhance competitiveness and promote the consumption of made goods and services, continued research on determinants of financial performance of firms in this sector bearing the temporal variation is imperative.

Empirical Literature

Debt Financing and Financial Performance

Conflicting results are reported in existing literature regarding the effect of debt financing and financial performance depending on the research approach given to the study. For instance, Onchong'a et al. (2016) analyzed the effect of debt financing on firms financial firms. They used 60 firms drawn from the Nairobi Securities Exchange (NSE) and OLS Multiple regression to show that debt financing (both short term and long term) had a negative effect on financial performance.

In a study conducted among quoted Nigerian companies, Otekunrin et al. (2018) used panel data approach to show that debt financing impacted positively on financial performance. Although the variation in the study context may have contributed to the positive effect as opposed to the negative effect reported in the study by Onchong'a et al. (2016), the difference in regression models (OLS and panel) may also have contributed significantly to this difference in direction. Research has shown that varying models give varying estimates with models having time-varying coefficients dominating those with constant coefficients models such as the OLS model (Kalli & Griffin, 2014).

Rachman et al. (2023) used the Indonesian Stock Exchange to explore among other relationships, the effect of Debt to Equity financing decisions on financial performance of property and real estate companies. Using a combination of panel data models, they demonstrated that when using the common effects model, debt to equity financing ratio had a negative but non-significant effect on financial performance. Similarly, using the RE model yielded a negative but non-significant effect on financial performance. However, the FE model yielded a negative but significant effect. These results corroborate the notion that the model selected is likely to dictate the nature of the estimates. Similarly, Omollo et al. (2018) analyzed the effect of debt financing options on financial performance among listed firms at the NSE. They equally used three panel data approaches namely, pooled OLS, fixed effects, and random effects to establish the effect of debt financing on financial performance measured using ROE. They demonstrated that total debt impacted negatively and significantly under the OLS and RE models, but negatively and non-significantly under the FE model, an indication that the model used mattered. The question then was "Could we replicate the studies by Rachman et al. (2023) and Omollo, et al. (2018) by investigating the effect of capital structure on financial performance including debt financing with a bias on listed manufacturing firms in Kenya?".

Equity Financing and Financial Performance

Omollo et al. (2018) used the NSE context to explore how equity financing options impact the financial performance of listed non-financial firms. Supported by Modigliani and Miller's capital structure theory, they used the pooled OLS, RE, and FE panel data models to investigate the effects. They established that total equity had positive and significant effects on financial performance of the firms using the pooled OLS and RE models. However, when using the FE model, the effect was positive but non-significant. Such results warranted replication using a specific set of non-financial firms, which in this case related to manufacturing.

In contrast, Muturi and Njeru (2010) used the OLS regression to investigate how equity finance impacts financial performance in the context of SMEs in Kenya. Their results revealed a positive and highly significant effect of equity financing on financial performance. When compared to the findings by Omollo et al. (2018) which revealed a positive but non-significant effect of equity financing on financial performance, we surmise that the model chosen in addition to contextual variations dictates the nature of estimates made.

In another study, Chindengwike (2021) used small business firms in the East African region to analyze how equity affects financial performance across these firms. Using the FE models, the study by Chindengwike demonstrated that equity financing impacted negatively on the firms when ROE was the financial performance proxy, but had a positive effect on the financial performance of the same firms when ROA was the proxy for financial. Such findings suggest that the financial performance proxy used could also have a say in the estimates. Therefore, this study employed the three panel data models on regressions involving ROE and ROA to probe the robustness of such findings.

Yator and Gitagia (2023) employed manufacturing firms listed at the NSE to explore the effect of equity financing on financial performance. They used ROA as a proxy measure for financial performance and the OLS linear regression approach to conclude that equity financing had a minimal positive but significant effect on the firms. Although their study targeted manufacturing firms similar to this research, lack of reference to the temporal and between firm variations required that a study comparing panel data models on the same data sets be undertaken to test the robustness of findings relating capital structure to financial performance in listed manufacturing firms.

Based on the review of empirical literature showing the preference for single panel data model studies, and a difference in the significance of estimates when multiple panel data models are used, the following hypotheses were formulated.

$H_0$1: The effect of debt financing on financial performance of listed manufacturing firms is the same across panel data models.

$H_0$2: The effect of equity financing on financial performance of listed manufacturing firms is the same across panel data models.

RESEARCH MATERIALS AND METHODS

This research used panel data collected from 14 manufacturing firms listed at the Nairobi Securities Exchange (NSE). The data panels included 85 observations for the study period from 2016 to 2022. Data were obtained annually by variable type. The study focused on two primary variables. Financial performance was conceptualized as the dependent variable and was measured using return on assets (ROA) and return on equity (ROE) on a percentage scale. Conversely, capital structure was measured using Equity and Debt financing measured in Kenya shillings. Since there was a mix of percentage and on-level measurements, the log transformation of financial performance proxies and capital structure measures was used in panel data regressions.

This study used the panel regression models that included the pooled Ordinary Least Squares (OLS), the random effects (RE), and the fixed effects (FE) models. The Breusch-Pagan Langrage multiplier (LM) and the Hausman tests were then used to identify the most robust estimates.
We postulated the models in equation 1 and equation 2 as the pooled OLS models for the two regressions.

$\text{Ln ROE}_{it} = \beta_0 + \beta_1 \text{ Ln EF}_{it} + \beta_2 \text{ Ln DF}_{it} + \varepsilon_{it}$…………………………………… eqn. 1
$\text{Ln ROA}_{it} = \beta_0 + \beta_1 \text{ Ln EF}_{it} + \beta_2 \text{ Ln DF}_{it} + \varepsilon_{it}$ …………………………………… eqn. 2

In the models, observations were pooled together from different years irrespective of whether they belonged to specific firms. Therefore, the panel data was combined into a cross-sectional data set whose model coefficients were estimated using Ordinary Least Squares (OLS) methodology. The error term ε_{it} was idiosyncratic and in these models was assumed to be strictly exogenous, independent, and identically distributed (i.i.d). The assumption made was that the error term was not correlated with independent variables allowing for consistent estimates of β_0 , β_1, and β_2.

The postulated RE models for this research were as shown in equations 3 and 4.
$\text{Ln ROE}_{it} = \beta_0 + \beta_1 \text{Ln EF}_{it} + \beta_2 \text{ Ln DF}_{it} + \alpha_i + \varepsilon_{it}$ ………………………eqn. 3

$Ln\ ROA_{it} = \beta_0 + \beta_1 Ln\ EF_{it} + \beta_2\ Ln\ DF_{it} + \alpha_i + \varepsilon_{it}$ ……………………….eqn. 4

The RE model treated the unobserved firm-specific effects as random and uncorrelated with the regressors. In this model, the individual-firm error component α_i captured the unobserved heterogeneity across individual firms, and remained constant over time. The assumption was that α_i was uncorrelated with both equity financing and debt financing. In contrast, ε_{it} accounted for within-firm variation in financing performance over time. This idiosyncratic error captured the variations and changes occurring within individual firms over different periods. They were assumed to be uncorrelated across firms.

The two FE models consistent with the two financial performance measures were formulated as represented in equations 5 and 6.

$Ln\ ROE_{it} = \beta_0 + \beta_1\ Ln\ EF_{it} + \beta_2\ Ln\ DF_{it} + \alpha i + \mu_{it}$ ………………………… eqn. 5

$Ln\ ROA_{it} = \beta_0 + \beta_1\ Ln\ EF_{it} + \beta_2\ Ln\ DF_{it} + \alpha_i + \mu_{it}$…………………………eqn. 6

By maintaining the endogenous term as constant, the FE model estimated β_0, β_1, and β_2 consistently. The FE model had the advantage that the time-constant endogeneity was eliminated by timewise first differencing (See equation 7), enabling the removal of the fixed effects.

$$lnFP_{it} - lnFP_{it-1} = \beta_i(X_{it} - \bar{X}_{it-1}) + (\alpha_i - \bar{\alpha}_{it-1}) + (U_{it} - \bar{U}_{it-1}) \text{……eqn. 7}$$

RESULTS AND DISCUSSIONS

Results of diagnostic tests

Diagnostic tests were run in terms of unit roots, heteroskedasticity, and cross-sectional dependence. Unit root tests examined whether the statistical properties of the data were stationary over the period, a requirement for panel data methods. Heteroskedasticity test examined whether variances of error terms differed across observations or panels, in which case a suitable set of standard errors could be identified. The cross-sectional test examined whether the residuals were correlated across firms.

Testing for unit roots

The Levin-Lin-Chu approach was used to examine stationarity of the transformed study variables. Under this test, the null hypothesis was that of unit roots in the panel data against the alternative that the panels were stationary. The Levin-Lin-Chu unit root test results (Table 1) indicate that panels were strongly stationary demonstrated by the highly significant statistics.

Table 1: Results of Unit Root Tests

H0: Panels contain unit roots		Number of panes	= 42
Ha: Panels are stationary		Avg. number of periods	= 7
		Stat.	p-value
Ln ROA	Unadjusted t	-13.0672	
	Adjusted t*	-10.4594	.000
Ln ROE	Unadjusted t	-13.1918	
	Adjusted t*	-10.5941	.000
Ln DF	Unadjusted t	-4.8574	
	Adjusted t*	-3.1770	.001
Ln EF	Unadjusted t	-4.9375	
	Adjusted t*	-3.2670	.000

Source: Survey data

Testing for heteroskedasticity

The Modified Wald test for group-wise heteroskedasticity was used to test for heteroskedasticity in the two models for Ln ROA and Ln ROE. The null hypothesis for this test was that of homoskedastic models. The results show an overwhelming presence of heteroskedasticity as demonstrated by significant Wald test statistics (Table 2). Therefore, heteroskedasticity-robust standards errors (also called Huber/White estimators) were employed in the models.

Table 2: Results for the Heteroskedasticity Test

Model Ln ROA	Model Ln ROE
. xttest3	. xttest3
Modified Wald test for group-wise heteroskedasticity	Modified Wald test for group-wise heteroskedasticity
in fixed effect regression model	in fixed effect regression model
H0: sigma(i)^2 = sigma^2 for all i	H0: sigma(i)^2 = sigma^2 for all i
chi2 (12) = 749.49	chi2 (12) = 1815.28
Prob>chi2 = 0.0000	Prob>chi2 = 0.0000

Testing for Cross-Sectional Dependence

The Pesaran CD test was used to test correlation of residuals across panels. Under this test, we postulated that residuals were not correlated and therefore, there was no contemporaneous correlation. Results highlighted below indicate that there was evidence of cross-sectional dependence (Pesaran's test statistic was significant) justifying the use of robust standard errors.

. xtcsd, pesaran abs
Pesaran's test of cross sectional independence = 4.068, Pr = 0.0000
Average absolute value of the off-diagonal elements = 0.341

Regressing ROA on Debt Financing and Equity Financing.

Pooled OLS Model

Under the pooled OLS model (Table 3) the coefficient for In DF without time dummies (β=0.121, Robust SE = 0.078, p>/t/=0.114) was slightly lower than the coefficient of In DF with time dummies (β= 0.128, Robust SE = 0.102, p>/t/=0.215). However, this increase was not statistically significant. The regression coefficient for In EF (β=-0.001) decreased marginally when time dummies were introduced (from β=-0.001 to β=-0.005). However, this decrease was not statistically significant (p = 0.952).

Table 3: Regressing Ln ROA on Ln DF and Ln EF

Approach	Var		Coeff.	Robust Std. Err.	t/z	p>|z| or p>|t|
Pooled OLS	Ln DF	Without time dummies	.121	.078	1.60	0.114
		With time dummies	.128	.102	1.25	0.215
	Ln EF	Without time dummies	-.001	.076	1.64	0.106
		With time dummies	-.005	.087	-0.06	0.952
Random Effects	Ln DF	Without time dummies	.101	.116	0.87	0.384
		With time dummies	.139	.104	1.34	0.179
	Ln EF	Without time dummies	-.111	.098	-1.12	0.261
		With time dummies	-.147	.084	-1.76	0.078
Fixed Effects	Ln DF	Without time dummies	-.339	.277	-1.22	0.225
		With time dummies	-.207	.285	-0.73	0.482
	Ln EF	Without time dummies	-.137	.150	-0.91	0.365
		With time dummies	-.186	.085	-2.19	0.051

Random Effects Model

For the RE model, the coefficient for Ln DF (β=0.139) was larger with time dummies compared to the coefficient of Ln DF (β = 0.101) without time dummies. However, this largeness was not statistically significant (p = 0.179). On the contrary the coefficient of Ln EF (β= -0.111) was larger without time dummies than the coefficient (β= -0.141) with time dummies though the difference was not statistically significant (p = 0.261).

Fixed Effects Model

Under the FE model time dummies increased the coefficient of In DF slightly (from β= -0.339 to β= -0.207) but the increase was not significant. However, there was a marginally statistically significant decrease in EF (p=0.051) with the introduction of time dummies. These results show that when ROA was used as the financial performance proxy, both debt financing and equity financing had no significant predictive power on financial performance irrespective of the panel data model used. Time dummies also lacked a significant impact on debt and equity financing in the case of the OLS and RE models. However, in the FE model, time dummies tended to reduce the effect of equity financing marginally significantly on financial performance.

Regressing ROE on Debt Financing and Equity Financing.

The results of regressing ROE on debt financing and equity financing confirmed theoretical postulations showing that estimates under the pooled OLS and RE models are consistent across different specifications due to the assumption of the error term being independent, identically distributed (i.i.d). As shown in Table 4, estimates for In DF (debt financing) and EF (Equity financing) were largely similar in the pooled OLS and RE models. However, the coefficients for debt financing in the fixed effects model were very different.

Table 4: Regressing Ln ROE on Ln DF and Ln EF

Approach	Var		Coeff.	Robust Std. Err.	t/z	p>$\|z\|$ or p>$\|t\|$
	Ln DF	Without time dummies	.631	.081	7.79	0.000
Pooled OLS		With time dummies	.636	.084	7.53	0.000
	Ln EF	Without time dummies	-.456	.099	-4.62	0.000
		With time dummies	-.458	.103	-4.44	0.000
	Ln DF	Without time dummies	.607	.129	4.69	0.000
Random Effects		With time dummies	.640	.129	4.98	0.000
	Ln EF	Without time dummies	-.634	.151	-4.21	0.000
		With time dummies	-.693	.127	-5.47	0.000
	Ln DF	Without time dummies	.014	.404	0.03	0.973
Fixed Effects		With time dummies	.153	.374	0.41	0.691
	Ln EF	Without time dummies	-.676	.095	-7.10	0.000
		With time dummies	-.736	.090	-8.19	0.000

Pooled OLS or Random Effects Model

The Breusch-Pagan Langrage Multiplier (LM) test was run to decide between the RE and pooled OLS models. The null hypothesis was that the RE model was appropriate. The test results shown below Table 5 indicate that there was evidence of significant differences across firms (p = 0.000), therefore the RE model was appropriate.

Table 5LnROE[FIRM,t] = Xb :+ u[FIRM] + e[FIRM,t]

	Var	sd = sqrt (Var)
Ln ROE	1.585	1.259
e	.592	.769
u	.506	.711

Test: Var (u) = 0

Chibar2 (01) = 29.84

Prob > chibar2 = 0.0000

Random Effects or Fixed Effects

The Hausman Test was next run to decide between the RE and FE model. Results shown in Table 6 reveals that the Hausman test statistic was significant (p=0.0025), an indication that the FE model was suitable in this case.

Table 6: Hausman fe re

	Coefficients			
	(b)	(B)	(b-B)	Sqrt(Diag(V_b-V_B))
	fe	re	Difference	S.E.
Ln DF	.014	.607	-.593	.220
Ln EF	-.676	-.634	-.041	.052

chi2 (4) = (b-B)'[(V_b-V_B) ^ (-1)] (b-B)

= 12.01

Prob>chi2 = 0.0025

Discussion

The results confirmed that when ROA is a proxy of financial performance, both debt financing and equity financing may not impose significant predictive power on financial performance irrespective of the panel data model used. While these findings give an inconclusive picture on how debt and equity financing affect return on assets of manufacturing firms listed at the NSE, they add to the controversial nature of the FE model. While the coefficients of Ln DF in the pooled OLS and RE models were positive, the FE model yielded negative effects. Such a finding is consistent with

Plumber and Troeger (2019) who hitherto argued that FE models can give biased estimates compared with the other models. Such findings by Plumber and Troeger were equally shared by Collischon and Eberl (2020). Meanwhile, the results showing non-significant effects across the three panel data models reflect findings that have shown that pooled OLS models are as good as the FE and RE models in most cases (Collischon & Eberi, 2020;Wooldridge, 2019).

The finding showing the marginally significant effect of equity financing on return on assets in the FE model is perhaps explained by the knowledge that the FE model allowed for the control of the firm-specific contextual factors, making the effect of equity financing to be almost significant. Research shows that the fixed effects models control for, or partial out, the effects of time-invariant variables with time-invariant effects (Williams, 2015). Besides, like in this study, the FE model has been used to show that state-owned equity financing negatively and significantly impacts the performance of family enterprises in China (Jian & Zhou, 2020).

In modelling ROE, the assumption of i.i.d allowed errors in the pooled OLS model to be unrelated to debt and equity financing and uncorrelated within and across firm-specific covariates, yielding consistent estimations of coefficients (Berk et al., 2019). On the other hand, the error term in the RE model was not related to any of the regressors, making the coefficients estimated consistently like in the case of the pooled OLS (Cornell et al., 2014). The inclusion of time dummies depicted a similar picture where no significant impacts on the coefficient estimates in the pooled OLS and RE models were experienced. However, in the case of the FE model, remarkable changes in the estimates were experienced. These results highlight the potential of fixed effects to confound coefficient estimates and impact standard errors (Breuer & deHaan, 2023).

By showing the preference of the RE model over the pooled OLS model, the study reflected the panel nature of the data and the desire to maintain data within panels defined by the different manufacturing farms. The OLS model pools together observations without reference to their respective panels. On the contrary, scholars have shown that random effects estimation takes into account the panel structure of the data, assuming that each entity has a unique constant term (intercept), but the coefficients of the independent variables are the same across all entities (Ceesay & Moussa, 2022). Random effects estimation accounts for both the individual-specific and time-specific effects, considering them as random components. Considering the presence of panels, it would then be difficult to disagree that the RE model is more suitable than the pooled OLS model in this case.

The choice of the FE model against the RE model as the most robust stems from its capacity to control for firm effects. The negative and significant coefficient of equity financing reflected the effect of equity financing on return on equity without the possible influence of the firm-specific contextual factors. Once those factors were controlled, the effect of equity financing was found to be almost the same as that in RE. However, this model being less restrictive, and ignoring the time dummy created an avenue for time to influence the relationship between equity financing and ROE. The FE model represents the ideal model for the effects of equity financing and financial performance and supports the previous literature's findings (Muturi & Njeru, 2019; Tanko et al., 2021; Tretiakova et al., 2021).

Conclusion

This research used the effect of capital structure on financial performance to compare parameters given by the pooled OLS, random effects, and fixed effects models. The study also examined the temporal variations by infusing time dummies. It can be inferred that different panel data models are bound to give different estimates that may be consistent or efficient depending on the specific model. The model selected and the exclusion or inclusion of time dummies give different estimates of coefficients for respective predictors. Based on the inclusion of time dummies the FE model depicts more variability possibly due to the capacity to play a confounding role. However, other factors such as the financial performance measures can also account for the variation in estimates. The ideal panel data model may depend on parameters such as model restrictiveness, consistency in estimations, efficiency, and time variability. It is therefore conceivable to argue that in modeling financial performance of manufacturing firms listed at the Nairobi securities exchange on capital structure, the panel data model in use bears a lot of significance.

Implications of the findings

Financial models are critical in capturing a company's operations in the past, present, and future. These models provide tools for decision-makings. Company executives often use them to estimate the costs and project the profits of a proposed new project. Moreover, financial analysts use them to explain or predict how events, whether internal (like a change in strategy or business model) or external (like a change in economic policy or regulation), will affect a company's stock price. Therefore, the findings of this research show that the panel data model used in modeling financial performance of non-financial firms listed at the NSE goes a long way to offering practical opportunities to optimize decision making in the firms. There will be times when the pooled OLS model will be suitable. Similarly. The RE and FE models will also suit given decisions.

For instance, The Pooled OLS model considers that all entities in the data set have the same underlying features, i.e., that there are no unobservable entity-specific effects. As a result, the residual error term is taken to be constant among individuals and there is no reliance on particular firms. Meanwhile, the RE model assumes that variations across firms are random and have no relationship with the predictor variables in the model. Therefore, the RE model would be suitable where differences across firms are suspected to influence financial performance, without any evidence of their correlation with the predictors. On the contrary, the FE model is likely to be preferred over the RE model when some time-invariant characteristics such as company culture are omitted. The FE model controls for such time-invariant differences, making estimated coefficients to be unbiased.

Considering the central role of financial models in comparing companies' performance to that of industry peers and in strategic planning to evaluate potential outcomes, estimate project costs, establish budgets, and distribute company resources, the findings of this research show the suitability of specific models for specific situations contributes to the array of mechanisms for non-financial firms listed at the NSE to remain competitive. Moreover, while many models exist that explain the same recurring relationships, few of them can explain the consequences of such relationships on fiscal and financial policy. Therefore, the findings of this study confirm that robust decisions directed toward modeling financial performance on capital structure in non-financial firms are a function of appropriate panel data models defined by existing parameters.

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