Profitability: Do Leverage and Firm Size Matter? Empirical Evidence from the Egyptian Stock Exchange

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Abstract

This study examines to what extent financial leverage and firm size can impact the profitability of Egyptian firms. The aim is to assist investors in making better investment decisions and to support Egyptian firms in optimizing their capital structure and size. Panel data is tested for 70 non-financial firms listed on the Egyptian Stock Exchange from 2018 till 2023. Statistical techniques such as descriptive statistics and regression analysis, implemented using Stata 13, are utilized. A fixed-effect model, selected according to the Hausman test results, is employed in order to observe the impact of independent variables on the dependent variable. The results reveal that firm size, measured by the natural logarithm of total assets, exhibit a significant positive impact on firm profitability, as measured by return on assets. Conversely, the financial leverage, as measured by the debt ratio, showed no significant impact on profitability.

Keywords: Leverage, Firm Size, Profitability, ROA, Egyptian Stock Exchange, Panel Data, Hausman Test, Fixed Effect Model.

ملخص البحث:
هذه الدراسة تفحص كيف تؤثر الرافعة المالية وحجم الشركة على ربحية الشركات المصرية. الهدف هو مساعدة المستثمرين في اتخاذ قرارات استثمارية أفضل ودعم الشركات المصرية في تحسين هيكلها الرأسمالي وحجمها. تم اختبار البيانات اللوحية لـ ٧٠ شركة غير مالية مدرجة في البورصة المصرية بين عامي ٢٠١٨ و٢٠٢٣. تم استخدام تقنيات إحصائية مثل الإحصاءات الوصفية والتحليل الانحداري، باستخدام برنامج ستاتا ١٣. تم استخدام نموذج التأثيرات الثابتة، المحدد بناءً على اختبار هاوسمان، لتحليل تأثير المتغيرات المستقلة على المتغير التابع. كشفت النتائج أن حجم الشركة، المقاس باللوغاريتم الطبيعي للأصول الإجمالية، له تأثير إيجابي كبير على ربحية الشركة، كما يقاس بعائد الأصول. على العكس من ذلك، فإن الرافعة المالية، المقاسة بنسبة الدين إلى حقوق الملكية، ليس لها تأثير على الربحية.

الكلمات المفتاحية: الرافعة المالية، حجم الشركة، الربحية، العائد على الأصول، البورصة المصرية، بيانات لوحية، اختبار هاوسمان، نموذج التأثيرات الثابتة.

1. Introduction

One of the primary goals of any business is to generate high financial returns for its owners or shareholders. Strong financial performance is essential in achieving this objective. A company's financial health is typically assessed through its financial statements, which offer a comprehensive outline of its activities over a precise period. Financial statements act as a crucial tool for both owners and management in assessing a company's current financial health and potential which is essential for informed decision-making about future strategies. Stakeholders rely on these statements to detect areas for improvement, maintain the firm's position, in addition to enhancing future

returns. Profitability is a primary focus for both shareholders and managers as it directly impacts dividend payouts to shareholders.

Consequently, numerous studies emphasize profitability alongside other financial metrics, such as liquidity, efficiency, and solvency, in order to deliver a comprehensive understanding of a firm's overall performance. This paper employs return on assets (ROA) as a measure of firm's profitability. Profitability reflects a firm's ability to make profits within a specific period of time. Consequently, the higher the ROA the greater the profit generation (Akram et al., 2021). In addition, in order to operate successfully, businesses require adequate funding. This funding must be sufficient to meet operational needs without excessive idle resources. Debt is one funding source. As Islam et al. (2023) pointed out, both shareholders and creditors should monitor debt levels along with the company's ability to service debt taking into consideration that excessive debt increases the risk of default.

The leverage ratio, often used to compare companies' debt levels, indicates how much a firm relies on borrowed funds to finance its assets. Also, known as the solvency ratio, it measures the percentage of a firm's assets funded by creditors. The debt ratio, calculated by dividing total liabilities by total assets, provides a similar measure of a firm's financial leverage. According to Kartikasari and Merianti in 2016, a higher debt ratio can positively impact a firm's profitability. Similar to the impact of debt levels, a company's size is positively associated

with its profitability (Prasanjaya & Ramantha, 2013). While production capacity or service range can signify size in certain industries, researchers often use total assets as a broader measure of company size (Chaklader and Chawla, 2016; Ghardallou, 2023; Yudha et al., 2023). Studies consistently support a positive relationship between company size and profitability (Devi & Devi, 2014).

This research is empirically investigating the financial health of Egyptian listed firms by examining their leverage, size, and profitability. Specifically, the study aims to determine how a firm's size and debt levels could impact its profitability using the latest data and advanced panel data analysis techniques.

Research Problem

A comprehensive review of existing literature suggests a lack of studies on the impact of leverage and firm size on firm profitability in the Egyptian market. This study aims to bridge this important gap by providing empirical evidence that can be valuable for both investors and firms. By analyzing the Egyptian stock market, this study provides practical insights into the impact of leverage and firm size on profitability. These findings can contribute to economic growth by attracting foreign direct investment (FDI) and helping international investors make informed decisions about investment opportunities in Egypt.
Therefore, the research question are as follows:

1) Does financial leverage influence the profitability of Egyptian firms?
2) Does firm size influence the profitability of Egyptian firms?

2. Litterature Review

A company's profitability represents its capacity to earn profits at a specific point in time (Hana & Halim, 2007). Moreover, it serves as a gauge of a company's overall performance and profit growth (Kartikasari & Merianti, 2016). Profit growth is intrinsically linked to a company's financial health (Zaitoun & Alqudah, 2020). Financial ratios, calculated from income statement and balance sheet data are usually used to assess profitability (Wahyuni et al., 2022).

Return on Assets (ROA) as a financial measurement reflecting how effectively a firm can generates profits from its assets. Essentially, it reflects a business's aptitude to convert assets into net income. This study examines profitability through the lens of ROA. Notably, a high ROA indicates superior asset management and overall managerial efficiency (Gunawan & Ramli, 2023). As for the firm size, it reflects a company's capacity to deliver services through economies of scale (Shaheen, 2012). Essentially, it's a measure of a company's scale based on its assets (Kartikasari & Merianti, 2016). Additionally, Common indicators of firm size include total assets, sales, employee count, and market value (Nurminda et al., 2017). According to Akram et al. (2021), Larger firms often attract more investor interest,

leading to increased company valuation. Yet, this study measures firm size using the natural logarithm of total assets (Gunawan & Ramli, 2023; Islam et al., 2023).

And concerning leverage, it might be defined as a financial metric that assesses a company's reliance on debt to fund its operations (Kumar, 2015; Kartikasari and Merianti, 2016). It measures the proportion of assets financed by liabilities and reflects a company's debt levels relative to its operational activities (Sutama & Lisa, 2018). Leverage is also used to evaluate a debt-financed company's performance and its ability to meet both short-term and long-term debt obligations (Zaitoun & Alqudah, 2020; Rahman et al., 2020; Islam et al., 2023). Nevertheless, A broader measure of a company's ability to meet its financial obligations is the solvency ratio (Daruwala, 2023). A high debt ratio indicates greater financial leverage, which can increase shareholder returns but also amplifies risk (Gunawan & Ramli, 2023). Yet, in this investigation, the debt ratio is employed in order to measure the financial leverage (Ghardallou, 2023).

Firm Size and Profitability

Several researches have tested the relationship between firm size and firm profitability, with a special focus on understanding how the total value of a business's assets (TA) and its efficiency in generating profits (ROA) can influence financial performance. Velnampy and Nimalathasan (2010) argued that larger firms can

increase profitability by leveraging their increased total assets, total employees, and total sales. Amato and Wilder (2015) supported this notion, stating that larger firms are more likely to experience higher profitability. Alarussi and Alhaderi (2018) further emphasized the positive impact of large amounts of assets on firm efficiency and profitability.

Some investigations have found a significant positive impact of firm size on profitability. The empirical literature has also explored the relationship between the logarithm of total assets (LnTA) and ROA, finding a positive association. Amato and Burson (2007) examined the implications of firm size on profitability in the financial sector and concluded that larger firms tend to have higher profitability. Additionally, Pervan and Višić (2012) evaluated the influence of firm size on profitability, focusing on the neoclassical view of economies of scale. Their research, conducted between 2002 and 2010, established a positive link between firm size and firm profitability. Moreover, Babalola (2013) conducted a similar study on Nigerian companies, finding a positive relationship between firm size and profitability but a negative relationship when measured through leverage and total debt. Besides, Doğan (2013) measured the impact of firm size on profitability using return on assets as the dependent variable and total assets, total sales, and total number of workers as independent variables. The study revealed a significantly positive impact of total assets on firm profitability.

Likewise, Niresh and Velnampy (2014) examined the relationship between firm size and profitability in Colombian manufacturing companies and found a weak positive correlation. They attributed this to managerial focus on maximizing utility rather than profits. Devi and Devi (2014) conducted research in Pakistan to identify factors determining company profitability. Their study of 50 firms listed on the Karachi Stock Market found a significant positive impact of firm size on firm profitability. Furthermore, Sritharan (2015) investigated the travel and hotel sector in Sri Lanka and concluded that the influence of firm size on profitability may vary across businesses within a specific market. Also, Diaz & Pandey (2019) analyzed US technology and financial corporations and found a positive relationship between total assets and return on assets. Irman & Purwati (2020) examined the impact of financial ratios, including total assets, on return on assets in Indonesian automotive and component companies. Their investigation showed that total assets have a positive impact on profitability.

Contrarily, Amato and Burson (2007) examined the relationship between firm size and profitability in the financial services sector through testing both linear and cubic form. While the linear specification showed a negative impact of firm size on profitability, a cubic relationship was detected between return on assets and firm size. In addition, Becker et al. (2010) conducted a

study on manufacturing firms in the USA to investigate the effects of firm size on profitability. Using data from 1987 to 2002, significant negative relationships were found between total sales, total assets and the number of employees and firm profitability.

On the other hand, Kartikasari and Merianti (2016) studied manufacturing companies and found a negative relationship between firm size and profitability when considering leverage. As for Azhar and Ahmed (2019) who conducted research on Pakistani textile companies and found no significant association between firm size and profitability in that specific industry.

As most of the empirical studies showed significant impact of firm size on firm profitability, the following hypothesis can be generated:

H1: *There is a significant impact of firm size on profitability.*

Leverage and Profitability

Leverage and Return on Assets (ROA) are two important financial measures that help in assessing firm performance. Leverage, calculated by the Debt-to-Assets Ratio (D Ratio), indicates the extent to which a firm relies on debt to fund its operations. ROA, on the other hand, shows how effectively a firm uses its assets to create profits.

Some research suggests a positive association, arguing that high leverage can increase a company's earning power and maximize its profitability along with shareholder wealth. As, Singapourwoko and El-Wahid (2011) who conducted a study on 48 Indonesian companies and found a significant positive relationship between leverage and profitability. So, AlGhusin (2015) conducted a study to examine the relationship between financial leverage, company growth, noncurrent/total assets ratio, firm size, and profitability (measured by ROA). The study revealed a significant positive impact of leverage on firm profitability. Moreover, Kartikasari & Merianti (2016) focused on investigating the impact of leverage and firm size on the profitability of public manufacturing companies in Indonesia. They highlighted that leverage had a significant positive impact on profitability, indicating that higher leverage levels can lead to increased ROA.

Still, Nugraha et al. (2020) investigated the effect of leverage and liquidity on the financial performance of Indonesian property and real estate companies. They discovered that a firm’s financial performance was somewhat influenced by its use of debt, particularly as measured by the debt-to-assets ratio, suggesting that while leverage can positively impact profitability, other factors like liquidity also play a role. Additionally, Sulieman et

al. (2020) conducted a cross-sectional time-series analysis of 35 industrial enterprises listed on the Amman Stock Exchange from 2001 to 2015. They discovered that debt could positively impact a firm's performance as long as the amount of debt did not surpass the amount of equity, suggesting that moderate levels of leverage can be beneficial. Similarly, Dona et al. (2021) investigated Sri Lanka's publicly traded industrial enterprises and found a significant and positive association between financial leverage and firm performance.

Contrary, some research suggests that high leverage can increase financial risk and reduce profitability due to increased interest expenses (Widyastuti, 2019; Mboka and Cahyono, 2020; Larasati and Purwanto, 2022). Equally, Hamid et al. (2015) studied the impact of capital structure on the profitability of Malaysian family and nonfamily firms. They found that increased leverage, reflected by long-term debt ratio, short-term debt ratio, and debt ratio, is associated with decreased profitability as measured by return on equity (ROE). Too, Ullah (2019) also examined the impact of financial leverage on the profitability of Pakistani fertilizer companies and found a significant negative impact. In addition, Chang et al. (2019) analyzed the four Asian Tiger economies and found a negative link between leverage and profitability. Correspondingly, Rahman et al. (2020) investigated textile companies in

Bangladesh and found a substantial negative association between leverage and business profitability using various econometric models. Nevertheless, Gharaibeh and Khaled (2020) studied Jordanian service sector enterprises and found that higher debt levels tend to reduce firms' profitability.

However, some studies have found insignificant impact of leverage on ROA. Like, Phillips and Sipahioglu (2004) observed no significant link between leverage and profitability in their study on UK lodging firms. Followed by El-Sayed Ebaid (2009) who found no significant impact of debt on ROE, ROA, or OPM in a study of Jordanian enterprises.

In conclusion, the impact of leverage on ROA is intricate and subject to change based on multiple factors such as industry characteristics, economic conditions, and the specific strategies of individual companies. While some studies suggest that high leverage can increase profitability, others caution against excessive debt levels, which can increase financial risk and reduce performance.

As most of the empirical studies showed significant impact of leverage on firm profitability, the following hypothesis can be generated:

H2: *There is a significant impact of leverage on profitability.*

3. Research Methodology

a. Research Strategy

This study aims to determine the impact of leverage and firm size on firm profitability testing a sample of 70 Egyptian firms from various industries. It tests two hypotheses to see if these factors have a significant impact on profitability. To do this, statistical methods are used to analyze financial data from company financial statements and online websites. These methods include descriptive statistics to summarize the data and a fixed-effect model, a suitable regression model for panel data, to assess how leverage and firm size can impact a firm's profitability.

b. Research Methods

The secondary data required for this study was collected from the financial statements of Egyptian firms, which were obtained from the companies' online websites and the Egyptian Company for Information Dissemination (EGID). Financial sector companies, from banking and non-banking sectors, were eliminated as they have different operating practices. Due to data availability, the study included 70 Egyptian firms listed on the Egyptian stock market, covering a period of 6 years from 2018 to 2023. This resulted in a total of 420 observations, which is significantly more than the minimum of 140 observations required for multiple regression analysis according to Siddiqui (2013). All statistical analyses were implemented using STATA Statistical Software Package version 13.

Table 3.1 shows the sectoral classification of the sample. The Egyptian stock exchange has 17 sectors, but after excluding the financial sector, 16 sectors remained. The food and beverage sector had the highest number of companies in the sample, making up 21.4%, followed by the real estate sector with 18.6%.

Table (3.1)
Sample Sector Classification

Sector	Number of firms	%
Basic Resources	6	8.6%
Building Materials	3	4.3%
Contracting and Construction engineering	4	5.7%
Educational services	1	1.4%
Energy and support services	1	1.4%
Food, beverage and tobacco	15	21.4%
Healthcare and pharmaceuticals	7	10%
Industriel Goods, Services and automobiles	3	4.9%
IT, Media and Communication Services	4	5.7%
Paper and packaging	1	1.4%
Real Estate	13	18.6%
Shipping and Transportation Services	3	4.9%
Textile and Durables	4	5.7%
Trade and Distributors	3	4.9%
Travel and Leisure	1	1.4%
Utilities	1	1.4%
Total	70	100%

c. Definition of Variables

Table (3.2)
Variables Definition and Measurements

Variable	Indicators	Definition	Reference
Independent Variables			
Financial Leverage	**LEV**	***Debt Ratio= Total Debt/Total Assets***	**(Kartikasari & Merianti, 2016; Islam et al., 2023; Ghardallou, 2023)**
Firm Size	**SIZE**	***Natural logarithm of Total Assets***	**(Kartikasari & Merianti, 2016; Akram et al., 2021; Gunawan & Ramli, 2023; Daruwala, 2023)**
Dependent Variable			
Profitability	**ROA**	***Net Income/ Total Assets***	**(Kartikasari & Merianti, 2016; Zaitoun & Alqudah, 2020; Akram et al., 2021; Gunawan & Ramli, 2023)**

d. Research Model

This research employs multiple regression analysis in order to examine how financial leverage and firm size can impact the profitability of Egyptian firms. Based on research models by Kartikasari and Merianti (2016), Gunawan & Ramli (2023), and Islam et al. (2023), the following regression model was developed to assess the impact of the independent variables on the dependent variable.

$ROA = \beta_0 + \beta_1 LEV + \beta_2 SIZE + \varepsilon$

Where:

ROA= Firm Profitability (Net Income/Total Assets)

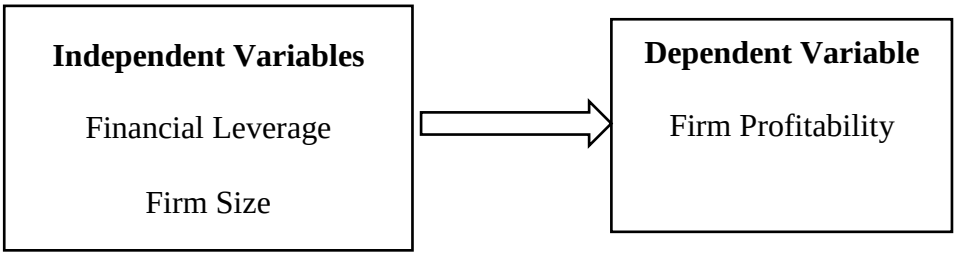
β_0 = Coefficient of Intercept

LEV = Financial Leverage (Total Debt / Total Assets)

$\beta_{1.....}\beta_2$ = regression coefficients of independent variables

ε = error term

Figure (3.1): The Relationship between Independent variables and the Dependent Variable



4. Analysis and Findings

This section presents and analyzes all the tests that were conducted in this research representing 420 observations for each of the respective variables. The data is collected for a 6-year period ranging from 2018-2023 in order to assess the impact of leverage and firm size on firm profitability.

4.1 Descriptive Statistics

The following table 4.1 shows the descriptive statistics results

representing the dependent and independent variables for standard deviation, mean, minimum and maximum values.

Table (4.1)
Descriptive Statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
LEV	**420**	**0.611478**	**1.009177**	**0.008785**	**11.43362**
SIZE	**420**	**8.855041**	**0.75489**	**7.234783**	**11.21144**
ROA	**420**	**0.031681**	**0.200167**	**-1.44065**	**0.438**

The mean, a statistical measure, represents the average value of a dataset. In this analysis, the mean ROA is 0.031681, while the mean leverage and firm size are 0.611478 and 8.855041, respectively. Standard deviation gauges the data's dispersion from the mean. The standard deviations of ROA, leverage, and firm size are 0.200167, 1.009177, and 0.75489, respectively. These values suggest a normal distribution for the data, as they fall within the typical range of plus or minus 2 standard deviation. The table also provides the minimum and maximum values for each variable. The minimum and maximum ROA are -1.44065 and 0.438, respectively. For leverage, the range is 0.008785 to 11.43362, and for firm size, it's 7.234783 to 11.21144.

4.2Stationarity Test

In this research two stationarity tests were employed, the Fisher type unit root test based on augmented Dicky Fuller tests

and the Hadri LM test (Hadri, 2000). Starting by the Fisher type unit root test, as it's shown in table 4.2, 4.3 and 4.4, the p-values of the three studied variables are 0.0000 rejecting Ho and accepting Ha assuming that at least one panel is stationary.

Table (4.2)

Fisher Type Unit Root test for ROA

```
Fisher-type unit-root test for ROA
Based on augmented Dickey-Fuller tests
------------------------------------------------
Ho: All panels contain unit roots           Number of panels  =      70
Ha: At least one panel is stationary        Number of periods =       6

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Included
Drift term:   Not included                  ADF regressions: 0 lags
------------------------------------------------------------------------------
                                     Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(140)  P        332.5528       0.0000
 Inverse normal            Z         -2.1375       0.0163
 Inverse logit t(344)      L*        -4.9746       0.0000
 Modified inv. chi-squared Pm        11.5072       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------
```

Table (4.3)

Fisher Type Unit Root test for Leverage

Table (4.4)

```
Fisher-type unit-root test for LEV
Based on augmented Dickey-Fuller tests
------------------------------------------------
Ho: All panels contain unit roots           Number of panels  =      70
Ha: At least one panel is stationary        Number of periods =       6

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Included
Drift term:   Not included                  ADF regressions: 0 lags
------------------------------------------------------------------------------
                                     Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(140)  P        591.0795       0.0000
 Inverse normal            Z         -6.7726       0.0000
 Inverse logit t(344)      L*       -14.4713       0.0000
 Modified inv. chi-squared Pm        26.9572       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------
```

Fisher Type Unit Root test for Firm Size

```
Fisher-type unit-root test for SIZE
Based on augmented Dickey-Fuller tests
------------------------------------

Ho: All panels contain unit roots          Number of panels  =     70
Ha: At least one panel is stationary       Number of periods =      6

AR parameter: Panel-specific               Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Included
Drift term:   Not included                 ADF regressions: 0 lags
```

		Statistic	p-value
Inverse chi-squared(140)	P	667.8496	0.0000
Inverse normal	Z	-6.5106	0.0000
Inverse logit t(334)	L*	-16.7623	0.0000
Modified inv. chi-squared	Pm	31.5450	0.0000

```
P statistic requires number of panels to be finite.
Other statistics are suitable for finite or infinite number of panels.
```

Essentially, the Hadri LM test is added as a complementary test to the Fisher type unit root test in order to make sure that all panels are stationary. As shown in table 4.5, 4.6 and 4.7, the p-values of the three studied variables are insignificant rejecting Ha and accepting Ho assuming all panels are stationary. Therefore, the stationarity tests indicated that ROA, leverage and firm size are stationary.

Table (4.5)
Hadri LM test for ROA

Hadri LM test for ROA

Ho: All panels are stationary		Number of panels =	70
Ha: Some panels contain unit roots		Number of periods =	6
Time trend:	Included	Asymptotics: T, N -> Infinity	
Heteroskedasticity:	Not robust		sequentially
LR variance:	(not used)		

	Statistic	p-value
z	-1.1545	0.8758

Table (4.6)
Hadri LM test for Leverage

Hadri LM test for LEV

Ho: All panels are stationary		Number of panels =	70
Ha: Some panels contain unit roots		Number of periods =	6
Time trend:	Included	Asymptotics: T, N -> Infinity	
Heteroskedasticity:	Not robust		sequentially
LR variance:	(not used)		

	Statistic	p-value
z	-2.6314	0.9957

Table (4.5)
Hadri LM test for Firm Size

Hadri LM test for SIZE

Ho: All panels are stationary		Number of panels =	70
Ha: Some panels contain unit roots		Number of periods =	6
Time trend:	Included	Asymptotics: T, N -> Infinity	
Heteroskedasticity:	Not robust		sequentially
LR variance:	(not used)		

	Statistic	p-value
z	1.6192	0.0527

4.3Panel Data Regression
Fixed and Random Effect

Panel data is a research method that tracks changes in specific variables over time for individual subjects. This allows researchers to control for factors that are difficult to measure directly, such as individual differences or long-term trends. In this research, the fixed and random effects are conducted followed by the Hausman test in order to choose the best model to be employed.

Fixed effects are useful when the goal is to isolate the impact of variables that differ over time. This model considers the relationship between each individual subject (e.g., a firm) and the

changing variable. It controls for unique characteristics of each subject that might influence the variable, such as firm decisions or practices. However, fixed effects may not be effective if the variable changes very slowly. Table 4.6 shows the results of the fixed effect model.

Table (4.6)

Panel Data Regression (Fixed Effect Model)

```
Fixed-effects (within) regression               Number of obs      =       420
Group variable: CompanyCode                     Number of groups   =        70

R-sq:  within  = 0.1710                         Obs per group: min =         6
       between = 0.2966                                        avg =       6.0
       overall = 0.2757                                        max =         6

                                                F(2,348)           =     35.90
corr(u_i, Xb)  = -0.1257                        Prob > F           =    0.0000
```

ROA	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
SIZE	.1458909	.0252982	5.77	0.000	.0961343	.1956474
LEV	-.0676974	.0108699	-6.23	0.000	-.0890765	-.0463184
_cons	-1.218793	.2241259	-5.44	0.000	-1.659605	-.7779817
sigma_u	.15609395					
sigma_e	.08008151					
rho	.79163783	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(69, 348) =     8.06             Prob > F = 0.0000
```

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Random effects assume that the relationship between variables is random or uncorrelated. When using random effects, researchers must specify individual characteristics that might affect the variables' performance. Table 4.7 shows the results of the random effect model.

Table (4.7)
Panel Data Regression (Random Effect Model)

```
Random-effects GLS regression                   Number of obs      =       420
Group variable: CompanyCode                     Number of groups   =        70

R-sq:  within  = 0.1269                         Obs per group: min =         6
       between = 0.7609                                        avg =       6.0
       overall = 0.6377                                        max =         6

                                                Wald chi2(2)       =    232.25
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000
```

ROA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
SIZE	.0617802	.012997	4.75	0.000	.0363064	.0872539
LEV	-.1210836	.0082191	-14.73	0.000	-.1371926	-.1049745
_cons	-.4413451	.1154231	-3.82	0.000	-.6675703	-.2151199
sigma_u	.07893823					
sigma_e	.08008151					
rho	.49281086	(fraction of variance due to u_i)				

Hausman test

To choose between random and fixed effects models, a Hausman test was performed (Akram et al., 2021). The test assumes certain conditions to select the most appropriate model for the data:

Ho = Random effect is appropriate H1 = Fixed effect is appropriate

In order to determine either to accept the null or alternate hypothesis, the "Prob> chi2" value is checked. If the examined value is below 0.05, the H1 is accepted, which is the fixed effect. Conversely, if the "Prob>chi2" value is higher than 0.05, the Ho is accepted, which is the random effect. Table 4.8 shows the results of the Hausman test.

Table (4.8)
Hausman Test

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
SIZE	.1458909	.0617802	.0841107	.0217042
LEV	-.0676974	-.1210836	.0533862	.0071136

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 69.44
Prob>chi2 = 0.0000

As it's shown in table 4.8, the "Prob> chi2" value is 0.000 that is below 0.05, then, the H1 is accepted, which is the fixed effect (table 4.6).

4.4Multicollinearity Test

Classical assumptions should be encountered in order to attain an appropriate regression model. An appropriate regression model is considered to be free of multicollinearity once VIF value is <5 (Kartikasari and Merianti, 2016). Table 4.9 shows the variance inflation factor (VIF) for each company in order to determine whether there is a problem of multi collinearity in any model.

Table (4.9)
Multicollinearity Test

Company Code	Collinearity Statistics	
	Tolerance	VIF
1	0.986	1.014
2	0.493	2.03
3	0.935	1.07
4	0.757	1.32
5	0.924	1.082
6	0.405	2.469
7	0.139	7.179
8	0.894	1.119
9	0.008	122.257
10	0.861	1.162
11	0.126	7.928
12	0.159	6.293
13	0.606	1.65
14	0.558	1.793

15	0.519	1.928
16	0.707	1.414
17	0.592	1.689
18	0.01	104.022
19	0.066	15.257
20	0.792	1.262
21	0.166	6.018
22	0.367	2.726
23	0.52	1.924
24	0.43	2.327
25	0.772	1.295
26	0.437	2.289
27	0.744	1.343
28	0.401	2.492
29	0.019	52.88
30	0.173	5.765
31	0.603	1.658
32	0.267	3.745
33	0.484	2.068
34	0.202	4.947
35	0.822	1.216
36	0.793	1.261
37	0.989	1.011
38	0.123	8.115
39	1	1
40	0.111	9.049
41	0.577	1.734
42	0.898	1.114
43	0.969	1.032
44	0.767	1.303
45	0.953	1.049
46	0.028	36.032
47	0.995	1.005
48	0.612	1.634
49	0.236	4.243
50	0.39	2.564

51	0.985	1.015
52	0.721	1.387
53	0.718	1.392
54	0.046	21.901
55	0.222	4.496
56	0.984	1.017
57	0.708	1.413
58	0.946	1.057
59	0.873	1.145
60	0.507	1.974
61	0.157	6.361
62	0.049	20.576
63	0.012	82.472
64	0.281	3.559
65	0.829	1.207
66	0.904	1.106
67	0.715	1.398
68	0.499	2.005
69	0.02	49.094
70	0.929	1.077

The multicollinearity test presented in table 4.9 showed that there is a multicollinearity problem in 17 firms out of 70 as their VIF values are higher than 5. The problem of variance inflation resulting from multicollinearity has been solved using the standard error relying on ROBUST standard error followed by a rerun for the panel data regression using the fixed effect model in order to verify the previous results.

4.5 Panel Data Regression Results using Fixed Effect Model after solving the Multicollinearity Problem

For the sake of testing the impact of financial leverage and firm size on firm profitability the fixed effect model was

conducted for the second time after treating the multicollinearity problem (Kartikasari & Merianti, 2016 ; Rahman et al., 2020 ; Akram et al., 2021). The results are presented in table 4.10.

Table (4.10)

Panel Data Regression (Fixed Effect Model) after fixing the Multicollinearity Problem

```
Fixed-effects (within) regression               Number of obs      =       420
Group variable: CompanyCode                     Number of groups   =        70

R-sq:  within  = 0.1710                         Obs per group: min =         6
       between = 0.2966                                        avg =       6.0
       overall = 0.2757                                        max =         6

                                                F(2,69)            =      5.59
corr(u_i, Xb)  = -0.1257                        Prob > F           =    0.0056

                          (Std. Err. adjusted for 70 clusters in CompanyCode)
------------------------------------------------------------------------------
             |               Robust
         ROA |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        SIZE |   .1458909   .0443452     3.29   0.002     .0574247    .2343571
         LEV |  -.0676974   .0475401    -1.42   0.159    -.1625373    .0271425
       _cons |  -1.218793    .376525    -3.24   0.002     -1.96994   -.4676466
-------------+----------------------------------------------------------------
     sigma_u |  .15609395
     sigma_e |  .08008151
         rho |  .79163783   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

As it's indicated in table 4.10, the fixed effect model revealed that the R-square value for this specific model is 27.57%, which means that only 27.57% of the changeability of profitability can be explained by the leverage and size, while the remaining 72.43% of profitability variability must be justified by other variables which are not taken into consideration in the regression model. Additionally, the regression exhibited a probability value

(F-statistics) of 0.0056 ($P < 0.05$) what supports the significance of the model. Yet, when observing each variable separately, it can be realized that only the firm size that has a significant negative impact on the profitability of Egyptian listed firms along with an insignificant impact of the financial leverage. This assumption is based on the p-value of 0.159 ($P>0.05$) for debt ratio and 0.002 ($P<0.05$) for natural logarithm of total assets accompanied by a positive coefficient of 0.1458909. Therefore, H1 assuming a significant impact of firm size on profitability is accepted while H2, assuming a significant impact of leverage on profitability is rejected.

These results are supported by Dogan (2013), Babalola (2013), Prasanjaya and Ramantha (2013), Devi and Devi (2014), Sritharan (2015), Diaz & Pandey (2019) Irman & Purwati (2020) who revealed a positive significant impact of firm size on firm profitability along with arguing that larger companies tend to engender higher profitability. They also claimed that the more assets a firm owns, the higher the revenue it is able to engender by efficiently exploiting its assets what will eventually result in a higher profitability. As for the insignificant impact found by leverage of firm profitability, this finding is supported by Phillips and Sipahioglu (2004), El-Sayed Ebaid (2009) and Islam et al. (2023) who stated that a surge in debts results in an inefficiency in assets utilization.

5. Conclusion

In summary, this research explored the effects of leverage (debt ratio) and firm size (natural log of total assets) on a company's profitability (ROA) within the Egyptian stock market. Using financial data from 70 Egyptian companies across various industries of the Egyptian stock exchange, the study analyzed data from 2018 to 2023. Descriptive statistics, stationarity test multicollinearity test, and a fixed-effects model based on Haussman test were employed in order to analyze the panel data. The findings revealed a significant positive impact of firm size on profitability, supporting the hypothesis that larger firms tend to be more profitable. However, leverage was found to have no significant impact on profitability, contradicting the hypothesis that higher leverage would lead to higher profitability. These results suggest that while larger asset bases can contribute to increased revenue and profitability, excessive debt may not necessarily lead to improved performance and can even hinder it.

Research Limitations

The study's limitation lies in its reliance on only two independent variables: leverage and firm size. In reality, numerous other factors can influence profitability. Additionally, the analysis is constrained by a sample of just 70 Egyptian firms from the stock exchange, spanning 2018-2023. This restricted sample size is due to data accessibility challenges and the significant cost associated with obtaining financial statements from the Egyptian Company

for Information Dissemination (EGID).

Suggestions for Future Research

Future research could enhance the study's generalizability by increasing the study period. Additionally, exploring other performance metrics and incorporating more independent variables could offer a more nuanced understanding of firm performance. Lastly, a comparative analysis with other countries during the same time period, using the same research approach, could provide valuable insights for international investors

Managerial Implications

The managerial implications of this research highlight the importance of factors influencing company profitability. Specifically, the study suggests that increasing company size can positively impact ROA. Moreover, the results indicate that changes in leverage or debt ratio have no significant effect on ROA.

References

Akram, T., Farooq, M. U., Akram, H., Ahad, A., & Numan, M. (2021). The Impact of Firm Size on Profitability - A Study on the Top 10 Cement Companies of Pakistan. Jurnal Aplikasi Manajemen, Ekonomi Dan Bisnis, 6(1), 14-24.

Alarussi, A. S., & Alhaderi, S. M. (2018). Factors affecting profitability in Malaysia. Journal of Economic Studies, 45(3), 442–458.

AlGhusin, N. A. S. (2015). The impact of financial leverage, growth, and size on profitability of Jordanian industrial listed companies. Research journal of Finance and Accounting, 6(16), 86-93.

Amato, L. H., & Burson, T. E. (2007). The Effects of firm size on profit rates in the financial services. Journal of Economics and Economic Education Research, 8(1), 67–81.

Amato, L., & Wilder, R. P. (2015). The effect of firm size on profit rates in U.S. Manufacturing. Southern Economic Association, 52(1), 181–190.

Azhar, K. A., & Ahmed, N. (2019). Relationship between firm size and profitability: investigation from textile sector of Pakistan. International Journal of Information, Business and Management, 11(2), 62-73.

Becker-Blease, J. R., Kaen, F. R., Etebari, A. and Baumann, H. (2010). Employees, firm size and profitability in US manufacturing industries. Investment Management and Financial Innovations, 7(2), 7-23.

Babalola, Y. A. (2013). The effect of firm size on firms profitability in Nigeria. Journal of economics and sustainable development, 4(5), 90-94.

Chaklader, B., Chawla, D. (2016), A study of determinants of capital

structure through panel data analysis of firms listed in NSE CNX 500. Vision, 20(4), 267-277.

Chang, C.C., Batmunkh, M.U., Wong, W.K. and Jargalsaikhan, M. (2019), "Relationship between capital structure and profitability: evidence from four Asian tigers", Journal of Management Information and Decision Sciences, Vol. 22 No. 2, pp. 54-65.

Daruwala, Z. (2023). Influence of Financial Leverage on Corporate Profitability: Does it Really Matter?. International Journal of Economics and Financial Issues, 13(4), 37-46.

Devi, A., Devi, S. (2014), Determinants of firms' profitability in Pakistan. Research Journal of Finance and Accounting, 5(19), 87-91.

Diaz, J. F., & Pandey, R. (2019). Factors affecting return on assets of US technology and financial corporations. Jurnal Manajemen dan Kewirausahaan, 21(2), 134-144.

Doğan, M. (2013). Does firm size affect the firm profitability? Evidence from Turkey. Research Journal of Finance and Accounting, 4(4), 53-59.

Dona, G.P.K., Fernandob, A.A.J. and Raveendra, M. (2021), "The relationship between financial leverage and the performance of Sri Lankan listed manufacturing companies", Journal of Accounting Finance and Auditing Studies (JAFAS), Vol. 7 No. 4, pp. 99-118.

El-Sayed Ebaid, I. (2009), The impact of capital-structure choice on firm performance: Empirical evidence from Egypt. Journal of Risk Finance, 10(5), 477-487.

Gharaibeh, O. and Khaled, M. (2020), "Determinants of profitability in Jordanian services companies", Investment Management and Financial Innovations, Vol. 17, pp. 277-290.

Ghardallou, W. (2023). The heterogeneous effect of leverage on firm performance: a quantile regression analysis. International Journal of Islamic and Middle Eastern Finance and Management, 16(1), 210-225.

Gunawan, T., & Ramli, A. H. (2023). The Influence Of Firm Size, Leverage, Liquidity, Cash Turnover On Profitability: Empirical Study of a Food And Beverage Sub-Sector Companies In 2018-2022. Jurnal Ilmiah Akuntansi Kesatuan, 11(3), 637-652.

Hadri, K. (2000). Testing for stationarity in heterogeneous panel data. The Econometrics Journal, 3(2), 148-161.

Hamid, M.A., Abdullah, A. and Kamaruzzaman, N.A. (2015), "Capital structure and profitability in family and non-family firms: Malaysian evidence", Procedia Economics and Finance, Vol. 31, pp. 44-55.

Irman, M., & Purwati, A. A. (2020). Analysis on the influence of current ratio, debt to equity ratio and total asset turnover toward return on assets on the otomotive and component company that has been registered in Indonesia Stock Exchange Within 2011-2017. International Journal of Economics Development Research (IJEDR), 1(1), 36-44.

Islam, H., Rahman, J., Tanchangya, T., & Islam, M. A. (2023). Impact of firms' size, leverage, and net profit margin on firms' profitability in the manufacturing sector of Bangladesh: An empirical analysis using GMM estimation. Journal of Ekonomi, 5(1), 1-9.

Kartikasari, D., & Merianti, M. (2016). The effect of leverage and firm size to profitability of public manufacturing companies in Indonesia. International Journal of Economics and Financial Issues, 6(2), 409-413.

Kumar, D. M. R. (2015). An empirical study on the relationship between leverage And profitability: a special reference to selected cement companies in India. Issues and Challenges of Commerce and Management, 2(5), 77.

Larasati, C. I., & Purwanto. (2022). How financial ratios and firm size affect profitability: evidence from food and beverages industry in Indonesia. Journal The Winners, 23(1), 43–50.

Memon, F., Bhutto, N. A., & Abbas, G. (2012). Capital structure and firm performance: A case of textile sector of Pakistan. Asian Journal of Business and Management Sciences, 1(9), 9-15.

Mboka, A., & Cahyono, L. (2020). The effect of leverage and company size to profitability pharmaceutical sub-sector companies period of 2013-2017. Advance: Jurnal Akuntansi, 7(1), 15–25.

Niresh, A., & Thirunavukkarasu, V. (2014). Firm size and profitability: A study of listed manufacturing firms in Sri Lanka. International Journal of Business and Management, 9(4).

Nugraha, N. M., Sulastri, L., Nugraha, D., Puspitasari, D., & Putra, R. (2020). Effect of Leverage and Liquidity on Financial Performance of Companies in the Property and Real Estate Sub Sector in Indonesia. PalArch's Journal of Archaeology of Egypt/Egyptology, 17(10), 3675-3688.

Nurminda, A., Isynuwardhana, D., & Nurbaiti, A. (2017). The Influence Of Profitability, Leverage, and Firm Size Toward Firm Value (Study Of Manufacture Companies Goods And Foods Sub Sector Listed in Indonesia Stock Exchange 2012-2015). E-Proceeding of Management, 4(1), 542-549.

Pervan, M., & Višić, J. (2012). Influence of firm size on its business success. Croatian Operational Research Review, 3(1), 213-223.

Phillips, P., & Sipahioglu, M. (2004). Performance implications of capital structure: Evidence from quoted UK organizations with hotel interests. The Service Industries Journal, 24(5), 31–51.

Prasanjaya, A.A.Y., Ramantha, I.W. (2013), Analysis of CAR, ROA, LDR, and company size to profitability bank listed on the stock exchange. E-Journal of Accounting University of Udayana, 4(1), 230-245.

Rahman, M. M., Saima, F. N., & Jahan, K. (2020). The impact of financial leverage on firm's profitability: an empirical evidence from listed textile firms of Bangladesh. Asian Journal of Business Environment, 10(2), 23-31.

Shaheen, S. (2012). The impact of capital intensity, size of firm and profitability on debt financing in textile industry of Pakistan. Interdisciplinary Journal of Contemporary Research in Business, 3(10).

Singapurwoko, A., & El-Wahid, M.S. (2011). The Impact of Financial Leverage to Profitability, Study of Non-Financial Companies Listed in Indonesia Stock Exchange. European Journal of Economics, Finance and Administrative Sciences, 32, 136-148.

Sritharan, V. (2015). Does firm size influence on firm‟ s Profitability? Evidence from listed firms of Sri Lankan Hotels and Travels sector.

Research Journal of Finance and Accounting, 6(6), 201-207.

Sulieman, M., Adnan, M., Hamdan, A. and Weshah, S. (2020), "Capital structure, firm growth and firm performance: evidence from Jordan", International Journal of Innovation, Creativity and Change, Vol. 10 No. 12, pp. 655-667.

Siddiqui, K. (2013), "Heuristics for Sample Size Determination in Multivariate Statistical Techniques", World Applied Sciences Journal, Vol.2, No. 27, pp. 285-287.

Sutama, D. R., & Lisa, E. (2018). Effect of leverage and profitability on firm value. Journal of Management and Accounting Science, 10(1), 21-39.

Ullah, H. (2019). The Impact of Financial Leverage on the Profitability of Fertilizer Companies of Pakistan. Specialty Journal of Accounting and Economics, 5(4), 8-13.

Velnampy, T., & Nimalathasan, B. (2010). Firm size on profitability: A comparative study of Bank of Ceylon(BOC) and Commercial Bank of Ceylon Ltd (CBC) in Sri Lanka. Global Journal of Management and Business Research, 10(2), 96–103.

Wahyuni, Kadir, M. A., & Sohilauw, M. I. (2022). The effect of financial performance on profit growth in state-owned mining companies listed on the Indonesian Stock Exchange. Business Management Journal, 18(2), 181–193.

Widyastuti, M. (2019). Analysis of liquidity, activity, leverage, financial performance and company value in food and beverage companies listed on the Indonesia Stock Exchange. SSRG International Journal of Economics and Management Studies, 6(5), 52–58.

Yudha, J. O. M., Oktavia, R., & Desriani, N. (2023). The effect of foreign debt, liquidity, firm size, and exchange rate on hedging decision. Journal of Indonesian Economy and Business, 38(2), 133–146.

Zaitoun, M., & Alqudah, H. (2020). The impact of liquidity and financial leverage on profitability: The case of listed Jordanian industrial firm's. International Journal of Business and Digital Economy, 1(4), 29-35.