Yaman, S. (2024). "Sectoral Differences in Fixed Asset Financing: Evidence from Turkish Manufacturing Sub-sectors", Eskişehir Osmangazi Üniversitesi İİBF Dergisi, 19(3), 685 – 712.
Doi: 10.17153/oguiibf.1417300

Başvuru: 09.01.2024 Kabul: 23.02.2024 *Araştırma Makalesi/Research Article*

Sectoral Differences in Fixed Asset Financing: Evidence from Turkish Manufacturing Sub-sectors

Serdar Yaman[1]

Duran Varlık Finansmanında Sektörel Farklılıklar: Türkiye İmalat Alt Sektörlerinden Kanıtlar

Öz

Bu çalışma, 2010-2022 döneminde Borsa İstanbul'da (BIST) işlem gören 123 firmanın verilerini kullanarak duran varlık finansmanında imalat alt sektörleri arasındaki farklılıkları belirlemeyi amaçlamaktadır. Çalışmada beş aşamalı bir panel regresyon metodolojisi takip edilmiştir. İmalat alt sektörleri için ayrı ayrı oluşturulan panel regresyon modelleri kullanılarak kısa vadeli borçlanma kararları, uzun vadeli finansman seçenekleri ve finansal performansın duran varlık yatırımları üzerindeki etkileri incelenmiştir. Bulgular, tüm imalat alt sektörlerinde kısa vadeli borçlanma kararlarının duran varlık yatırımları üzerinde önemli bir azaltıcı etki yarattığını göstermektedir. Ayrıca, uzun vadeli finansman seçenekleri ve finansal performansın duran varlık yatırımları üzerindeki etkilerinin imalat alt sektörleri arasında önemli farklılıklar gösterdiği ortaya konulmuştur. Bulgular, sektörel karakteristiklerin duran varlık finansmanı planlamasında önemli bir rol oynadığını ve vade uyumu ilkesinin finansman stratejilerinde belirleyici bir yaklaşım olduğunu göstermektedir.

Anahtar Kelimeler: Finansman Politikası, Duran Varlık Yatırımları, İmalat Sektörü, Borsa İstanbul, Panel Veri Analizi

JEL Kodları: G30, G31, G32

Sectoral Differences in Fixed Asset Financing: Evidence from Turkish Manufacturing Sub-sectors

Abstract

This paper aims to identify the differences in fixed asset financing across Turkish manufacturing sub-sectors using data from 123 firms traded on the Borsa Istanbul (BIST) during the period 2010-2022. A five-stage panel regression methodology is followed. Employing panel regression models separately built for each manufacturing sub-sector the study examines the impact of short-term borrowing decisions, long-term financing options, and financial performance on fixed asset investments. The findings reveal a significant dampening effect of short-term borrowing decisions on fixed asset investments across all manufacturing sub-sectors. Moreover, the study underscores significant variations in the effects of long-term financing options and financial performance on fixed asset investments across manufacturing sub-sectors. The findings emphasize that sectoral characteristics play an important role in fixed asset finance planning and that the principle of maturity matching is a determining approach in financing strategies.

Keywords: Financing Policy, Fixed Asset Investments, Manufacturing Sector, Borsa Istanbul, Panel Data Analysis

JEL Codes: G30, G31, G32

Research and Publication Ethics Declaration	This study was prepared in accordance with the rules of scientific research and publication ethics.
Authorship Contribution Statement	All processes of the study were conducted and completed by a single author.
Declaration of Interest	There is no conflict of interest for the author or third parties arising from the study.

[1] Assoc. Prof. Dr., Sirnak University, Faculty of Economics and Administrative Sciences, Department of Business Administration, serdaryaman@sirnak.edu.tr

1. Introduction

Investment decisions play a pivotal role in the strategic management of businesses, involving the optimal selection of real and financial assets to align with both short-term objectives and long-term strategic goals (Santoso et al., 2020). Investment decisions regarding fixed assets hold particular significance as they constitute a substantial portion of a company's assets and exert a profound influence on its sustainability by shaping future cash flows (Frezatti et. al., 2013; Soylu et. al., 2018). Akgüç (2010) states that fixed asset investment decisions emerge as critical determinants of a firm's future success due to their requirement of long-term and substantial financial expenditures, their characteristic integrity and indivisibility, and their consequential impact on the firm's liquidity and risk profile. Accordingly, the criteria of profit maximization and market value maximization come to the fore in making investment decisions. The profit maximization criterion signifies that the physical assets add value to the firm if firm owners' net profits increase. Conversely, the market value maximization criterion signifies that the physical assets generate value if the value of the shares of the business owners increase (Modigliani and Miller, 1958: 262). In this context, fixed asset investments emerge as elements necessitating vigilant oversight by both investors and firm managers and investment decisions concerning fixed assets are pivotal in shaping a firm's trajectory, demanding meticulous consideration to ensure alignment with overarching strategic objectives and to optimize shareholder value.

Decisions regarding long-term capital investments are integral to firms' strategic planning and are aligned with their long-term objectives (Papadakis, 1995). Despite the potential of increasing cost of capital and operational risks in the short-term, fixed asset investments may yield substantial contributions to profitability and financial performance over the long-term, thereby supporting firms' sustainable growth policies (Alkaraan and Northcott, 2007; Temiz and İpci, 2018). Fixed asset investments, characterized by low liquidity and substantial financing requirements, significantly impact risk management strategies (Akgüç, 2010). Insufficient fixed asset investment levels may lead to undercapacity issues and detrimentally affect a firm's profitability and market value. Conversely, excessive investment in fixed assets may result in diminished liquidity and heightened operational risk. The optimal level of fixed asset investment, determined by considering firms' financing capabilities and prevailing macroeconomic conditions, can enhance operational cash flows and firm value in the long run. Whittred and Chan (1992) and Smith (1993) argue that constrained borrowing capacity may limit firms' investment prospects, potentially causing them to miss out on highly profitable projects. In this context, Harc (2015) asserts that asset structure and financing strategies are significantly influenced by firms' financing capabilities and managers' capital structure decisions. This perspective underscores the importance of examining the impact of firms' financing opportunities and capital structure decisions on long-term capital investments for stakeholders seeking to enhance firm value and sustainable growth in the dynamic business environment.

By employing robust econometric methodologies, this study aims to elucidate the intricate relationships between financing decisions and fixed asset investments. Specifically, it seeks to understand how different modes of financing, including short and long-term borrowings, equity financing, and auto financing, influence managerial decisions regarding fixed asset investments. Moreover, the study endeavors to shed light on the unique characteristics and financing preferences observed across various manufacturing sub-sectors in Türkiye. By identifying and analyzing these sectoral differences, the current study aims to provide valuable insights into the drivers of fixed asset financing within the Turkish industrial landscape. Through empirical analyses and sectoral comparisons, this study aspires to contribute to the existing body of knowledge on corporate finance and investment behavior. By offering nuanced insights into the determinants of fixed asset financing decisions, the research seeks to contribute both academic literature and practical decision-making processes in the Turkish manufacturing sector. Revealing the sub-sectoral differences in fixed asset financing through empirical analyses presents the unique value of the study. Additionally, the limited scope of existing literature on fixed asset financing underscores the potential significance of this study in contributing to academic literature.

The contributions of this study to the literature are threefold. (1) Determining the effects of financing decisions on fixed asset investments: By empirically investigating the impacts of financing decisions—such as short and long-term borrowings, equity financing, and auto financing—on fixed asset investments, the study contributes to our understanding of the drivers and implications of capital allocation choices in the manufacturing sector. The analysis offers valuable insights into the factors influencing firms' investment decisions and their subsequent impact on financial performance and sustainable growth. (2) Determining the characteristics of manufacturing sub-sectors in fixed asset financing: The study aims to elucidate the distinct characteristics and preferences observed across different manufacturing sub-sectors concerning fixed asset financing. This exploration allows for a more granular understanding of the financing dynamics within the manufacturing industry, considering factors such as industry-specific risks and capital intensity. Identifying the sector-specific nuances can help stakeholders develop financing strategies and make investment decisions to better align with the unique requirements of each sub-sector. (3) Identifying sectoral differences in fixed asset financing: By uncovering the sectoral differences in fixed asset financing, the study highlights the heterogeneity that exists within the manufacturing landscape. Understanding these variations is essential for policymakers, investors, and managers to develop targeted approaches and interventions aimed at promoting sustainable growth and competitiveness across different manufacturing sub-sectors. Moreover, recognizing sectoral differences in fixed asset financing can inform strategic decision-making processes, enabling firms to optimize their capital allocation strategies and mitigate potential risks associated with financing choices. The study's contribution to the literature is further enhanced by its methodological approach, which involved conducting a five-stage panel regression analysis with robust estimators to elucidate the relationship between fixed asset investments and financing opportunities. By providing robust and unbiased results the econometric pre-tests and robust estimators used in the analyses offer a new methodological perspective to the literature.

The current study covers annual financial statements data spanning from 2010 to 2022 for firms listed on Borsa Istanbul and operating within the Food, Textiles, Chemicals, Non-Metal, Basic Metal, and Metal Products sectors. Although the widest range of data on manufacturing firms traded in BIST is preferred, this study has limitations in both time and cross-sectional dimensions. Additionally, the study's focus solely on publicly traded manufacturing firms presents another constraint. Furthermore, the study's modeling framework excludes variables beyond financing policies and performance indicators related to fixed asset investments. In terms of the modeled variables, the study provides important findings in the context of corporate finance but does not provide findings on the relationship between fixed asset investments and market performance and macroeconomic variables. The study is structured into six main sections. Section 1 outlines the theoretical framework, research questions, unique value of the study and its contributions to the literature. Section 2 reviews the relevant academic literature. Section 3 provides information on the data and variables used in the study. Section 4 explains the econometric methodology followed in the analysis in detail. Section 5 presents the findings, evaluations and discussions. Finally, the Section 6 offers insights, conclusions, and policy recommendations.

2. Literature Review

Studies examining the factors affecting fixed asset revaluation and investment decisions have indicated profitability, sales growth, and financing decisions to be the most important determinants. A review of the literature reveals substantial evidence that fixed asset revaluation and investment decisions have significant effects on firms' operating cash flows, financial distress, cost of borrowing, financial leverage, and financial flexibility. Studying Australian firms, Easton et al. (1993) argue that the main reason for fixed asset revaluation is the need to reduce financial leverage. Welch and Wessels (2000) examined the relationship between firms' stock returns and fixed asset investments in Japanese, UK, European, US, and Canadian stock markets and determined that firm profitability is positively effective on fixed asset investment decisions in Japanese and US stock markets. The authors also found that fixed asset investment decisions lead to significant increases in stock returns for up to 2 years. Similar to Welch and Wessels (2000), Jiang et al. (2006), who examined the factors affecting fixed asset investments in Taiwan manufacturing sectors, also found positive significant relationship between firm profitability and fixed asset investments. Examining the determinants of fixed asset revaluation practices in New Zealand firms, Seng and Su (2010) found positive significant relationships between firm size and upward fixed asset revaluation practices. In another study examining the factors affecting fixed asset investments, Dalbor and Jiang (2013) focused on the US restaurant industry and found positive significant relationships between operational cash flows, firm size, growth opportunities, and long-term capital investments.

Çelik and Boyacıoğlu (2013) analyzed the relationship between fixed asset investments and working capital for Turkish firms and found that increases in fixed asset investments have statistically significant negative effects on working capital. Investigating the relationship between fixed asset investments and firm profitability for Nigerian firms, Olatunji and Adegbite (2014) determined a positive significant relationship between fixed asset investments and firm profitability. Hamidi (2015), on the other hand, analyzed the determinants of fixed asset investment in Malaysian firms within the scope of agency costs and the pecking order hypothesis and found internal financial sources to have a positive significant effect on long-term investment decisions, and agency costs to have a negative significant effect. Abdioğlu and Aytekin (2016) compared the relationship between financial flexibility and long-term capital investments in manufacturing firms operating in Türkiye for the periods before and after the 2008 financial crisis. The authors found that firms with higher financial flexibility rely less on internal resources for their long-term capital investments both before, during, and after the financial crisis. Abedin et al. (2017), who examined fixed asset investments in the pharmaceutical industry, found a positive significant relationship between firm size and firm age, and fixed asset investments, while a negative significant relationship was found between financial leverage and fixed asset investments. In another study examining the factors affecting fixed asset investments in the US restaurant industry, Jiang and Dalbor (2017) found that profitability, free cash flows, and firm size have a positive significant effect on fixed asset investments.

Nunes et al. (2017) examined the determinants of fixed assets and intangible assets based on a sample of 141 Portuguese high-tech firms for the period 2004-2012. They found that debt financing stimulates investment in fixed assets, while firm age restricts such investment. Additionally, firm size, age, self-financing, and GDP were identified as determinants stimulating investment in intangible assets. Conversely, debt financing and interest rates were found to restrict investment in intangible assets. In another study on Malaysian companies, Hisham et al. (2019) drew attention to the impact of cash flows and firm size on fixed asset investments. Examining the relationship between fixed asset revaluation practices and financial performance in Indonesian firms, Azmi and Ali (2019) found that fixed asset revaluations lead to significant increases in operating profit in the following year and cash flow in the following two years. Nguyen and Nguyen (2019) examined the determinants of fixed asset investments in Vietnamese firms and found that free cash flows have a positive significant effect on fixed asset investments, while dividend payout decisions and increases in interest payments have negative significant effects. Examining the determinants of fixed asset investments for US hospitality firms, Akron et al. (2020) found that firm profitability and growth in sales have a positive significant effect on fixed asset investments, and firm size and financial leverage have negative significant effects.

Can et al. (2021) examined the relationship between firm size and fixed asset investments in Turkish firms and indicated that firm size is a significant factor that increases fixed asset investments. The authors also found that dividend payout decisions and profitability have a negative effect on fixed asset investments, while financing decisions have no significant effect. Milojević et al. (2021) examined the level and movement of solvency indicators and financing of fixed assets in Serbian agricultural enterprises. The authors indicate that the largest number of observed enterprises finance not only fixed assets but also a part of current assets by long-term financing options. However, no statistically significant relationships were found between the changes in solvency ratios and fixed asset financing ratios. In another study on Turkish companies, Açıkgöz and Alp (2022) investigated the determinants of fixed asset investments in micro, small, medium, and large-scale firms. The authors found a negative significant relationship between profitability and liquidity and fixed asset investments in all firm scales. Açıkgöz and Alp (2022) found that the impact of financial structure on fixed asset investments varies significantly based on firm size. They found that financial structure has no significant effect on fixed asset investments in micro and small-scale enterprises but has a negative significant effect in medium and large-scale enterprises.

Kalusová and Badura (2022) examined the factors influencing capital allocation into fixed assets in Slovak companies across six sectors during the period 2009-2018. They found that the investment activity of companies is influenced by both macro-environmental factors and internal corporate factors, particularly financial structure, non-debt tax shield, and risk. The authors also noted significant differences between sectors in terms of investment activity and capital allocation into fixed assets. Using data from the period 1994-2019, encompassing 22,694 firms operating in 76 countries, Çam and Özer (2022) discovered that firm-specific factors significantly influence investment finance decisions. The authors noted that increased profitability correlates with heightened utilization of long-term financial debt and cash reserves in financing tangible fixed asset investments. Köroğlu et al. (2023) investigated the motivations for tangible fixed asset revaluation in Turkish companies for the period 2017-2021 and determined that financial leverage is not considered one of the significant motivations for revaluation. Chistik et al. (2023) conducted inter-regional comparisons of investments in fixed assets in Russia. They employed a qualitative hierarchical classification of regions by cluster analysis based on homogeneous characteristics of the regions. The authors found that the availability of financing is a significant factor influencing fixed asset investments across all regions. Öndeş and Barakalı (2023) focused on the effects of macroeconomic factors on fixed asset investments of enterprises. They identified significant relationships for the period spanning from 2012/Q3 to 2022/Q2.

The literature review reveals that financing decisions constitute one of the primary determinants of fixed asset investments, alongside profitability, sales growth, and various macroeconomic variables. However, existing studies in the literature have not thoroughly examined financing decisions with respect to financing sources and maturities. In this context, there exists a significant gap in the literature regarding the impacts of financing sources such as short and long-term borrowings, equity financing, and auto financing on fixed asset investments. Another gap that the study aims to address is identifying sectoral differences in fixed asset financing. By examining financing decisions in detail according to different financing options this study provides a comprehensive understanding of how different financial options impact fixed asset investments, and how these impacts differ across manufacturing sub-sectors.

3. Data and Variables

This study examines the financial determinants of fixed asset investments and explores differences in fixed asset financing across sub-sectors within the manufacturing industry. The sample of the study consists of manufacturing firms operating in Türkiye and listed on Borsa Istanbul (BIST). The dataset encompasses annual financial statement data spanning from 2010 to 2022, focusing on 123 manufacturing firms listed in BIST, for which data are regularly accessible. The study period was determined based on the most recent dates suitable for obtaining consistent findings and reliable data that could be generalized to larger populations. In this regard, crisis-period data, which may yield inconsistent results in econometric analyses, were excluded from the scope when determining the study period. Commencing from 2010 serves to mitigate the potential influence of the 2008 mortgage crisis, thereby ensuring more reliable and unbiased econometric analyses. By 2010, the effects of the crisis had largely subsided in Turkey. Furthermore, the study's end period is determined by the most recent available annual financial statement data of the firms within the sample. It's important to note that the study faces limitations in both time and cross-sectional dimensions. Focusing solely on publicly traded manufacturing firms and excluding market performance and macroeconomic indicators present another limitation of the study. The sub-sector datasets were generated by considering the BIST Manufacturing sub-sector breakdowns available on the official website of the Public Disclosure Platform (KAP) (https://www.kap.org.tr). To enhance consistency and representativeness in econometric models, manufacturing sub-sectors with more than 10 firms traded on BIST and with regularly accessible data throughout the study period were included in the analysis. In this context, the following manufacturing sub-sectors were included in the study: Food, Beverages and Tobacco (Food); Textiles, Wearing Apparel and Leather (Textiles); Chemicals, Petroleum Rubber and Plastic Products (Chemicals); Non-Metallic Mineral Products

(Non-Metal); Basic Metal; Fabricated Metal Products Machinery Electrical Equipment and Transportation Vehicles (Metal Products), as depicted in Table 1. To unveil sectoral differences in fixed asset financing, separate datasets were prepared for each manufacturing sub-sector. Distinct models were developed on the same basis, and subsequent findings were compared and interpreted. All sub-sector datasets are panel datasets comprising 13-time dimensions and as many cross-sectional dimensions as the number of firms outlined in Table 1.

Table 1: Sub-sectors and Number of The Companies

No	Manufacturing Sub-Sectors	Number of Companies at the Study Date	Number of Companies for 2010-2022 Period
1	Food, Beverages and Tobacco	40	22
2	Textiles, Wearing Apparel and Leather	26	20
3	Chemicals, Petroleum Rubber and Plastic Products	45	22
4	Non-Metallic Mineral Products	25	19
5	Basic Metal	25	14
6	Fabricated Metal Products Machinery Electrical Equipment and Transportation Vehicles	41	26
7	Wood Products Including Furniture	6	4
8	Paper and Paper Products Printing	13	8
9	Other Manufacturing Industry	1	1

As indicated in Table 1, there are more than 10 firms in six sectors for which data were accessible during the study period. Consequently, a total of six panel regression models were developed for the analysis. The panel regression models incorporate fixed asset investment ratios of manufacturing firms as dependent variables. As representatives of financing policies, short-term debt (*SHORT*), long-term debt (*LONG*), shareholders' equity (*EQUITY*), and auto financing (*AUTO*) ratios are included as independent variables in the models. Furthermore, return on assets (*ROA*) and growth in sales (*SALES*) ratios are also included as independent variables to evaluate the effects of profitability and sales performance on fixed asset investments. To enhance the significance levels of econometric models and minimize inconsistencies and deviations in estimations, the one-period lagged value of the dependent variable (FIA_{t-1}) and tangible fixed asset investment ratio (*TANG*) are included as control variables in the models. For clarity, Table 2 provides the variables included in the models, their abbreviations, and the formulas used in their calculation.

Table 2: Variables

Variable Group	Variable Definition	Acronym	Calculation
Dependent Variable	Fixed Asset Investments	*FAI*	Total Fixed Assets/Total Assets
Explanatory Variables	Short-Term Financing	*SHORT*	Short-Term Debts/Total Assets
	Long-Term Financing	*LONG*	Long-Term Debts/Total Assets
	Shareholder's Equity	*EQUITY*	Total Equity/Total Assets
	Auto financing	*AUTO*	Retained Earnings/Net Profit
	Profitability	*ROA*	Net Profit/Total Assets
	Growth in Sales	*SALES*	Percentage change in Net Sales
Control Variables	FAI Lagged Variable	FAI_{t-1}	1-period lagged value of *FAI*
	Tangible Fixed Assets	*TANG*	Tangible Fixed Assets/ Total Assets

Percentage transformation was employed on the variables to elucidate the change induced by a 1-unit alteration in an independent variable on the dependent variable. The financial statement data forming the datasets were sourced from the Financial Information News Network (FINNET) Hisse Expert financial database.

4. Methodological Design and Econometric Models

Given the multidimensional structure of the datasets, panel regression analysis emerges as the most appropriate method for analyzing the financial determinants of fixed asset financing and determining differences among manufacturing sub-sectors. The panel data analyses in this study entail both time series and cross-sectional series, necessitating adherence to the assumptions of both types of analyses. A five-stage methodological approach, which includes pre-tests and robust estimator specification tests, is followed to attain robust and consistent results. The first stage is to investigate whether the series cause multi-collinearity in the models. Multi-collinearity is examined by Spearman correlation analysis and Variance Inflation Factor (*VIF*) analysis. The second stage is to examine cross-section dependence and slope homogeneity. Pesaran (2004) *CD* test is used for examining the cross-section dependence, and Pesaran and Yamagata (2008) delta ($\tilde{\Delta}$) ve adjusted delta ($\tilde{\Delta}_{adj}$) tests are used for examining the slope homogeneity. The third stage is to examine the stationarity of the series. In line with the results of *CD* test and, $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ tests two first generation unit root tests and one second generation unit root tests are used to determine the stationarity level of the series. The diagnostic tests are run in the fourth stage. The autocorrelation is tested using Baltagi and Li (1991) LM_p and Born and Breitung (2016) LM_p^* tests, and the heteroskedasticity is tested using Breusch and Pagan (1979) LM_h test. Estimating the models that are found to have time or cross-sectional heteroskedasticity and autocorrelation problems, the Period SUR (PCSE) robust estimator based on the Period Corrected Standard Error (PCSE) methodology developed by Beck and Katz (1995) is used. İn the fifth and final stage panel regression models are estimated, and empirical results are obtained. Assumption pre-tests, estimator specification tests, and model estimations were conducted using EViews 12 and the Gauss 22 econometric package programs. These software tools are commonly employed in econometric analyses for their robust features and capabilities.

4.1. Multi-collinearity

Multi-collinearity is defined as a high level of correlation among explanatory variables in regression models. It can lead to various issues such as infinite standard error values, findings that significantly contradict expectations and theory, statistically insignificant variables, and erroneous interpretations (Gujarati, 2004; Asteriou and Hall, 2007). The study examines the multi-collinearity through Spearman correlation analysis and Variance Inflation Factor (VIF) analysis. Spearman correlation analysis assesses the correlation between two explanatory variables, such as *x* and *y*, within the same regression model. It involves calculating the sums-of-squared cross-products (SSCP) using equation (1), the covariance coefficient using equation (2), and the correlation coefficient using equation (3), respectively (Çil, 2018; Kaya, 2021). Addressing the multi-collinearity is essential to ensure the validity and reliability of regression model results and interpretations. By employing these analyses, the study aims to identify and mitigate potential multi-collinearity issues, thereby enhancing the robustness of the regression models and their findings.

$$SSCP(x,y) = \sum_{i=1}^{n}(x_i - \hat{\mu}_x)(y_i - \hat{\mu}_y) \tag{1}$$

$$COV_{(x,y)} = \frac{\sum_{i=1}^{n}(x_i - \hat{\mu}_x)(y_i - \hat{\mu}_y)}{n-k} \tag{2}$$

$$\rho_{(x,y)} = \frac{COV_{(x,y)}}{\left(COV_{(x,x)}COV_{(y,y)}\right)^{1/2}} \tag{3}$$

$\hat{\mu}_x$ and $\hat{\mu}_y$ are the mean values of the variables *x* and *y*, respectively, *COV* is the covariance coefficient, *n* is the number of observations, *k* is the degree of freedom and *ρ* is the correlation coefficient. *ρ* representing the correlation coefficient, it is accepted that variables with $\rho>0.75$ or $\rho<-0,75$ may cause multi-collinearity. This correlation threshold helps identify highly correlated variables that may contribute to multi-collinearity issues in regression models. The *VIF* values for each independent variable was calculated by using the formula $1/(1-R^2)$ over the R^2 values obtained by estimating ordinary least squares regression models for each independent variable, where one is the dependent variable and the others are independent variables (Asteriou and Hall, 2007; O'Brien, 2007). This study is accepting that explanatory variables with *VIF*>4 may cause multi-collinearity. The threshold value of 4 accepted in this study for identifying potential multi-collinearity issues is also acknowledged as 5, 7, and even 10 in some other studies (Açıkgöz vd., 2015). These criteria and thresholds are commonly employed in regression analysis to detect and address multi-collinearity, which can undermine the reliability and interpretability of regression model results.

4.2. Panel Cross-section Dependency and Slope Homogeneity

Testing cross-sectional dependence in a panel is crucial for understanding the characteristics of the data set and selecting the correct stationarity test (De Hoyos and Safaridis, 2016). Another important point for the selection of stationarity test is the homogeneity of the slope coefficients of the series. Horizontal cross-section dependence in the series is tested using the Pesaran (2004) *CD* test, while the homogeneity of slope coefficients is tested using the Pesaran and Yamagata (2008) $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ tests, which are improved versions of the Swamy (1970) model. The *CD*, $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ test statistics are calculated as in equations (4), (5) and (6), respectively (Pesaran, 2004; Pesaran and Yamagata, 2008).

$$CD = \sqrt{\left(\frac{2T}{N(N-1)}\right)}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}\right) \tag{4}$$

In Equation (4), *T* represents the time dimension, *N* denotes the cross-sectional dimension, and $\hat{\rho}$ signifies the pairwise correlation coefficient of the error terms acquired from the individual least squares estimation. Given that the *CD* test is suitable for assessing cross-sectional dependence when *N*>*T*, it is employed in this study to examine cross-sectional dependence. The *CD* test statistic tests the null hypothesis of no cross-sectional dependence in the series.

$$\tilde{\Delta} = \sqrt{N}\left(\frac{N^{-1}\tilde{S}-k}{\sqrt{2K}}\right) \tag{5}$$

$$\tilde{\Delta}_{adj} = \sqrt{N}\left(\frac{N^{-1}\tilde{S}-E(\tilde{Z}_{it})}{\sqrt{Var(\tilde{z}_{it})}}\right) \tag{6}$$

In equations (5) and (6) $\tilde{Z}_{it}$ represents random independent variables with limited mean variance, $\tilde{S}$ denotes adjusted Swamy statistic, $E(\tilde{Z}_{it})$ indicates *k*, and $Var(\tilde{z}_{it})$ indicates *2k(T-K-1)/T+1* (Demir and Görür, 2020). The $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ statistics are utilized for testing the null hypothesis of no heterogeneity in the slope coefficients in large and small samples, respectively (Pesaran and Yamagata, 2008).

4.3. Panel Unit Root

All variables included in a panel regression model should exhibit stationarity either at the level or after a certain difference. Stationarity of a series (no unit root) implies that the mean, variance, and covariance of the series remain constant regardless of the level at which they are measured, and that the difference between two values of the series depends only on the difference between different time values (Gujarati, 2004).

Unit root tests are classified as first-generation and second-generation unit root tests based on whether they account for horizontal cross-section dependence. In this study, the Pesaran (2007) *CIPS* test is employed to test the stationarity of series with cross-sectional dependence. For series without cross-sectional dependence, the stationarity test is conducted using the Levin, Lin, and Chu (2002) *LLC* test or the Im, Pesaran, and Shin (2003) *IPS* test, considering the results of the $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ tests. The *LLC* test statistic is calculated as in equation (7), the *IPS* test statistic is calculated as in equations (8-9), and the *CIPS* test statistic is calculated as in equations (10-11) (Levin et al., 2002; Im et al., 2003; Pesaran, 2007).

$$\Delta y_{it} = \delta y_{it-1} + \sum_{L=1}^{P_i} \theta_{iL} \Delta y_{it-L} + \alpha_{mi} d_{mt} + \varepsilon_{it} \quad (i = 1, \dots, N), (t = 1, \dots, T), (m = 1,2,3.) \qquad (7)$$

$$\Delta y_{it} = \alpha_i + \beta_i y_{i,t-1} + \sum_{j=1}^{P_i} \rho_{ij} \Delta y_{i,t-j} + \varepsilon_{it} \qquad (i = 1, \dots, N), (t = 1, \dots, T) \qquad (8)$$

$$IPS = \frac{1}{N} \sum_{i=1}^{N} t_{iT}(p_i, \rho_i) \qquad (9)$$

In the *IPS* test, the test statistics calculated for each cross-section using equation (8) are converted into panel-wise test statistics using equation (9). Similarly, in the *CIPS* test, the Augmented Dickey-Fuller (ADF) regression model is expanded as in equation (10) by incorporating the lagged levels and first differences of the series related to the cross-sections, and ADF statistics related to cross-sections are converted into panel-wise test statistics using equation (11). This extended panel model is referred to as CADF.

$$\Delta y_{it} = a_i + b_i y_{i,t-1} + c_i \bar{y}_{t-1} + d_i \Delta \bar{y}_t + \varepsilon_{it} \qquad (i = 1, \dots, N), (t = 1, \dots, T) \qquad (10)$$

$$CIPS = N^{-1} \sum_{i=1}^{N} CADF_i \qquad (11)$$

In equation (10), *t* represents the period, ε_{it} stands for the unit-specific error term, a_i, b_i and c_i denote the fixed effect coefficients, $\bar{y}_t$ signifies the mean value at *t*, and y_i represents the initial values with a certain density function (Demir and Görür, 2020). As shown in equation (11), *CIPS* statistic is the arithmetic mean of the CADF values, which is calculated for each cross-section as in equation (10). The calculated *CIPS* values are compared with the critical values provided by Pesaran (2007). If the calculated *CIPS* test statistic is lower than the critical value for a given significance level, it indicates that the series are stationary at the relevant significance level (Pesaran, 2007). All three-unit root tests test the null hypothesis of no stationarity.

4.4. Serial Correlation and Heteroskedasticity

Autocorrelation (serial correlation), which refers to the correlation of successive values of the error terms, and heteroskedasticity, which refers to the variability of error term variances across cross-sections and the non-zero covariances of error terms, may lead to inconsistent and biased results. These issues may yield findings that do not accurately reflect the actual relationships between variables (Güriş et al., 2013; Tatoğlu, 2013). Autocorrelation causes the coefficient variances estimated in the model to be smaller, deviant and inconsistent than the actual variance value, while heteroskedasticity causes the least squares estimators in the model to lose their minimum variance properties although they retain their properties of being unbiased and consistent (Güriş et al., 2013).

The assumption of serial correlation is tested using Baltagi and Li (1991) LM_p and Born and Breitung (2016) LM_p^* tests, while the assumption of heteroskedasticity is tested using Breusch and Pagan (1979) LM_h test. LM_p , LM_p^* LM_h test statistics are calculated as in equations (12), (13) and (14), respectively. In equation (12), E^2 equals to $(2(T\text{-}1)/NT)LM_\mu$ and F^2 equals to $((T\text{-}1)/NT^2)LM_\rho$.

$$LM_p = \frac{NT^2}{2(T-1)(T-2)}\left[E^2 - 4EF + 2TF^2\right] \quad (12)$$

$$LM_p^* = \frac{(T-1)^3}{(T+1)(T-2)^2}\left(\sqrt{LM_p} + \sqrt{\frac{N}{T-1}}\right)^2 \quad (13)$$

$$LM_h = \frac{1}{2}\left[\frac{N}{n(N-n)}\right]\left[\sum_t^n \left(\frac{\hat{u}_t^2}{\hat{\sigma}^2}\right) - n\right]^2 \quad (14)$$

LM_p and LM_p^* tests statistics test the null hypothesis of no serial correlation in the model, and LM_h test tests the null hypothesis of no heteroskedasticity in the model.

4.5. Panel Regression Models and Hypothesis

To discern sectoral differences in fixed asset financing, a separate panel regression model is formulated for each manufacturing sub-sector, adhering to the same methodological approach. The fixed asset investment function is defined as in equation (15).

$$FAI_{i_st} = f(SHORT_{i_st}, LONG_{i_st}, EQUITY_{i_st}, AUTO_{i_st}, ROA_{i_st}, SALES_{i_st}, FAI_{t-1_{i_st}}, TANG_{i_st}) \quad (15)$$

In the panel regression models, the fixed asset investment ratios of firms are included as the dependent variable. Financial ratios representing financing policies and financial ratios representing profitability and sales performance are included as independent variables, while the 1-period lagged value of the dependent variable and the tangible fixed asset investment ratio serve as control variables. The panel regression model structure is articulated in equation (16).

$$FAI_{i_st} = \beta_0 + \beta_1 SHORT_{i_st} + \beta_2 LONG_{i_st} + \beta_3 EQUITY_{i_st} + \beta_4 AUTO_{i_st} + \beta_5 ROA_{i_st} + \beta_6 SALES_{i_st} + \beta_8 FAI_{t-1_{i_st}} + \beta_9 TANG_{i_st} + u_{i_st} \quad (16)$$

In Equation (16), β_0 represents the constant term, β_n signifies the slope coefficient of the independent variable, and the subscripts *t* and *i* denote that the variables contain values for each firm and each period, respectively. The subscript *s* indicates the manufacturing sub-sector in which firm *i* operates. In all models developed separately for each manufacturing sub-sector, the null hypothesis, which posits that financing decisions have no effect on fixed asset investments, is tested. In the literature, numerous studies have explored the factors affecting fixed asset investments by developing models within the econometric framework of panel data analysis. However, it is noted that many studies did not adopt an approach where comprehensive pre-tests and estimator specification tests, as in this study. The econometric pre-tests and robust estimators used in the analyses offer a new methodological perspective to the literature by providing robust and unbiased results. The model developed in this study diverges from the literature regarding the variables included. Unlike previous studies, which often aggregate financing options into composite measures, this study adopts a more granular approach by considering companies' financing options as distinct variables. Consequently, the effects of each financing option on fixed asset investments are examined separately. This nuanced modeling approach allows for a more comprehensive understanding of the relationships between specific financing choices and fixed asset investments, offering insights that may not have been fully elucidated in previous research.

5. Findings and Discussion

This section initially examines the characteristics of the variables comprising the models via descriptive statistics. Subsequently, the test outcomes derived from analyses of multi-collinearity, cross-sectional dependence, slope homogeneity, stationarity, serial correlation, and heteroskedasticity are outlined. Based on the results of estimator specification tests, panel regression estimation is conducted, and the findings are subsequently reported and interpreted.

5.1. Descriptive Statistics

Descriptive statistics and Jarque-Bera normality test (*J-B*) results for the series in the balanced panel data sets for Food, Textiles, Chemicals, Non-Metal, Basic Metal and Metal Products sectors are presented in Table 3. In Food and Textiles sectors, the variable *LONG* exhibits the highest mean value, while in Chemicals, Non-Metal, Basic Metal, and Metal Products sectors, the variable *AUTO* has the highest mean value. Skewness statistics indicate that all series are skewed to the right, except for the variable *EQUITY* in the Textiles sector and the variable *ROA* in the Basic Metal sector. Kurtosis statistics reveal that all series are leptokurtic across all sub-sectors. The *J-B* statistic of all series in all sub-sectors are statistically significant, indicating that the series are not normally distributed.

Table 3: Descriptive Statistics and Test of Normality

				Food Sub-Sector				
Variables	***Mean***	***Median***	***Max.***	***Min.***	***Std. Dev.***	***Skewness***	***Kurtosis***	***J-B***
FAI	0.033	-0.007	2.862	-0.568	0.319	4.831	40.059	17479.0***
SHORT	0.053	0.012	2.016	-0.787	0.375	1.106	5.791	151.2***
LONG	0.631	-0.035	37.427	-0.931	3.244	7.410	70.327	56634.4***
EQUITY	0.072	-0.005	3.056	-2.886	0.477	1.533	16.767	2370.5***
AUTO	0.231	0.000	1.000	0.000	0.422	1.278	2.633	79.5***
ROA	0.629	0.024	72.585	-49.422	9.522	2.727	29.930	8996.7***
SALES	0.320	0.172	6.355	-0.818	0.621	4.584	37.737	15380.8***
FAI_{t-1}	0.033	-0.007	2.862	-0.568	0.310	5.234	44.825	22151.7***
TANG	0.026	-0.021	3.490	-0.984	0.385	4.891	42.253	19501.1***
				Textiles Sub-Sector				
Variables	***Mean***	***Median***	***Max.***	***Min.***	***Std. Dev.***	***Skewness***	***Kurtosis***	***J-B***
FAI	0.018	-0.013	1.695	-0.793	0.243	2.425	17.427	2509.7***
SHORT	0.074	0.003	3.184	-0.896	0.472	3.204	18.826	3158.2***
LONG	0.987	0.012	124.678	-1.000	8.123	13.895	209.137	468700.5***
EQUITY	0.024	-0.010	7.948	-8.339	0.771	-0.665	97.171	96090.6***
AUTO	0.188	0.000	1.000	0.000	0.392	1.593	3.538	113.1***
ROA	0.651	0.204	65.447	-47.630	7.459	1.550	37.161	12746.5***
SALES	0.340	0.168	15.821	-0.754	1.110	10.851	147.734	232036.8***
FAI_{t-1}	0.026	-0.002	1.695	-0.793	0.240	2.519	18.445	2859.2***
TANG	0.043	-0.041	6.020	-0.988	0.552	5.992	58.027	34358.4***
				Chemicals Sub-Sector				
Variables	***Mean***	***Median***	***Max.***	***Min.***	***Std. Dev.***	***Skewness***	***Kurtosis***	***J-B***
FAI	0.004	-0.035	1.504	-0.406	0.234	2.685	14.667	1965.8***
SHORT	0.076	0.023	1.860	-0.902	0.340	1.439	7.888	383.5***
LONG	0.215	-0.041	14.129	-0.939	1.293	6.442	58.281	38395.6***
EQUITY	0.027	-0.036	4.247	-3.723	0.499	1.476	33.071	10879.6***
AUTO	0.427	0.000	1.000	0.000	0.495	0.297	1.088	47.8***
ROA	1.009	0.146	192.308	-95.541	14.653	7.503	113.117	147181.5***
SALES	0.306	0.199	2.159	-0.422	0.389	1.897	7.240	385.7***
FAI_{t-1}	-0.002	-0.033	1.504	-0.406	0.225	2.995	17.187	2825.8***
TANG	0.024	-0.063	10.471	-0.708	0.726	11.539	157.516	290859.0***

Non-Metal Sub-Sector								
Variables	***Mean***	***Median***	***Max.***	***Min.***	***Std. Dev.***	***Skewness***	***Kurtosis***	***J-B***
FAI	-0.002	-0.022	2.309	-0.678	0.211	5.661	61.484	36520.2***
SHORT	0.138	0.084	2.830	-0.799	0.441	2.515	14.912	1720.7***
LONG	0.125	0.001	9.429	-0.830	0.775	7.620	86.861	74768.7***
EQUITY	0.009	-0.031	3.542	-1.171	0.366	5.662	48.904	23005.6***
AUTO	0.437	0.000	1.000	0.000	0.497	0.253	1.064	41.2***
ROA	0.429	0.021	27.100	-20.851	3.941	1.011	22.924	4127.5***
SALES	0.333	0.147	9.957	-0.506	0.791	7.817	90.487	81287.8***
FAI_{t-1}	0.007	-0.017	2.309	-0.678	0.207	5.972	65.629	41835.7***
TANG	-0.018	-0.043	3.712	-0.725	0.302	8.016	97.200	93969.2***
Basic Metal Sub-Sector								
Variables	***Mean***	***Median***	***Max.***	***Min.***	***Std. Dev.***	***Skewness***	***Kurtosis***	***J-B***
FAI	0.011	-0.035	1.622	-0.443	0.273	2.447	12.886	922.7***
SHORT	0.073	0.048	1.658	-0.698	0.330	1.362	7.826	232.9***
LONG	0.292	-0.049	11.060	-0.905	1.509	4.979	31.050	6718.3***
EQUITY	0.017	-0.039	2.040	-1.128	0.342	2.075	11.860	725.8***
AUTO	0.451	0.000	1.000	0.000	0.499	0.199	1.040	30.3***
ROA	-0.163	0.170	37.629	-94.982	8.337	-7.861	96.064	67553.2***
SALES	0.341	0.193	2.029	-0.517	0.444	1.241	4.438	62.4***
FAI_{t-1}	0.012	-0.035	1.622	-0.443	0.283	2.465	12.280	837.4***
TANG	0.018	-0.036	1.918	-0.647	0.320	2.775	14.777	1285.4***
Metal Products Sub-Sector								
Variables	***Mean***	***Median***	***Max.***	***Min.***	***Std. Dev.***	***Skewness***	***Kurtosis***	***J-B***
FAI	0.016	-0.028	1.569	-0.612	0.258	1.957	10.648	1039.5***
SHORT	0.041	0.018	1.761	-0.603	0.275	1.476	9.265	675.6***
LONG	0.265	0.003	17.209	-0.788	1.423	7.637	76.766	79918.6***
EQUITY	0.042	-0.029	7.531	-0.882	0.595	8.760	96.928	128571.6***
AUTO	0.482	0.000	1.000	0.000	0.500	0.071	1.005	56.3***
ROA	1.579	0.089	311.283	-28.138	18.188	15.236	253.529	897017.2***
SALES	0.306	0.218	2.438	-0.869	0.425	1.635	7.653	455.6***
FAI_{t-1}	0.012	-0.028	1.317	-0.612	0.236	1.585	8.654	590.1***
TANG	0.006	-0.045	2.478	-0.708	0.319	2.772	16.877	3144.9***

Note: The sign *** indicates 1% significance level.

5.2. Correlation Analysis and VIF Analysis Results

Whether the independent variables in equation (16) cause multi-collinearity in the panel regression model is analyzed separately for each sector. The correlation matrix and *VIF* analysis results for the independent variables are presented in Table 4. According to Table 4, in the Food sector data set, the highest correlation is observed between *SHORT* and *EQUITY* (ρ=-0.377), and *SHORT* has the highest *VIF* value (1.388). In the Textiles sector dataset, the highest correlation is observed between *SALES* and *EQUITY* (ρ=0.605), and *EQUITY* has the highest *VIF* value (2.239). In the Chemicals sector dataset, the highest correlation is observed between *SHORT* and *EQUITY* (ρ=-0.350), and *SHORT* has the highest *VIF* value (1.344). In the Non-Metal sector dataset, the highest correlation is observed between *SHORT* and *EQUITY* (ρ=-0.338), and *SHORT* has the highest *VIF* value (1.311). In the Basic Metal sector data set, the highest correlation is observed between *SHORT* and *EQUITY* (ρ=-0.485), and SHORT has the highest *VIF* value (1.638). In the Metal Products sector dataset, the highest correlation is observed between *SHORT* and *EQUITY* (ρ=-0.316), and *EQUITY* series has the highest *VIF* value (1.207).

Table 4: Testing for Multi-collinearity

Food Sub-Sector

Variables	*SHORT*	*LONG*	*EQUITY*	*AUTO*	*ROA*	*SALES*	FAI_{t-1}	*TANG*	R^2	*VIF*
SHORT	1.000								0.280	1.388
LONG	-0.275	1.000							0.139	1.162
EQUITY	-0.377	-0.040	1.000						0.214	1.271
AUTO	-0.046	-0.043	-0.079	1.000					0.039	1.041
ROA	-0.112	0.162	0.120	0.047	1.000				0.061	1.065
SALES	0.123	-0.027	0.113	-0.072	0.076	1.000			0.070	1.075
FAI_{t-1}	-0.048	0.004	0.077	-0.092	-0.025	-0.049	1.000		0.038	1.040
TANG	-0.152	-0.007	0.041	-0.017	-0.050	-0.102	-0.123	1.000	0.056	1.060

Textiles Sub-Sector

Variables	*SHORT*	*LONG*	*EQUITY*	*AUTO*	*ROA*	*SALES*	FAI_{t-1}	*TANG*	R^2	*VIF*
SHORT	1.000								0.286	1.401
LONG	0.005	1.000							0.010	1.010
EQUITY	-0.379	-0.059	1.000						0.553	2.239
AUTO	-0.061	-0.046	-0.017	1.000					0.031	1.032
ROA	-0.152	-0.015	0.076	0.015	1.000				0.150	1.177
SALES	0.046	-0.029	0.605	0.024	0.047	1.000			0.482	1.929
FAI_{t-1}	0.075	-0.009	-0.117	-0.092	-0.055	-0.036	1.000		0.033	1.034
TANG	-0.108	0.027	0.121	-0.058	0.355	-0.035	-0.078	1.000	0.162	1.193

Chemicals Sub-Sector

Variables	*SHORT*	*LONG*	*EQUITY*	*AUTO*	*ROA*	*SALES*	FAI_{t-1}	*TANG*	R^2	*VIF*
SHORT	1.000								0.256	1.344
LONG	-0.279	1.000							0.149	1.175
EQUITY	-0.350	-0.131	1.000						0.200	1.250
AUTO	-0.033	0.018	-0.008	1.000					0.039	1.041
ROA	-0.057	-0.040	0.088	0.159	1.000				0.047	1.050
SALES	0.124	-0.148	0.087	0.062	0.083	1.000			0.122	1.139
FAI_{t-1}	0.037	0.009	0.040	-0.052	0.066	-0.161	1.000		0.055	1.058
TANG	0.026	-0.019	0.004	-0.078	-0.026	0.010	-0.066	1.000	0.020	1.021

Non-Metal Sub-Sector

Variables	*SHORT*	*LONG*	*EQUITY*	*AUTO*	*ROA*	*SALES*	FAI_{t-1}	*TANG*	R^2	*VIF*
SHORT	1.000								0.237	1.311
LONG	-0.173	1.000							0.110	1.123
EQUITY	-0.338	-0.152	1.000						0.313	1.456
AUTO	-0.073	-0.024	-0.062	1.000					0.068	1.073
ROA	-0.022	-0.095	0.143	0.036	1.000				0.131	1.151
SALES	-0.036	-0.073	0.055	-0.110	0.218	1.000			0.095	1.105
FAI_{t-1}	0.082	-0.007	-0.127	-0.067	-0.193	-0.162	1.000		0.118	1.134
TANG	0.023	0.045	0.324	-0.054	-0.126	-0.078	-0.196	1.000	0.238	1.312

Basic Metal Sub-Sector

Variables	*SHORT*	*LONG*	*EQUITY*	*AUTO*	*ROA*	*SALES*	FAI_{t-1}	*TANG*	R^2	*VIF*
SHORT	1.000								0.389	1.638
LONG	-0.210	1.000							0.062	1.066
EQUITY	-0.485	0.097	1.000						0.287	1.403
AUTO	-0.064	0.008	-0.047	1.000					0.054	1.058
ROA	0.049	0.013	-0.004	0.178	1.000				0.085	1.093
SALES	0.066	-0.026	0.126	0.036	0.203	1.000			0.147	1.172
FAI_{t-1}	0.344	0.001	-0.056	-0.099	0.012	-0.084	1.000		0.179	1.218
TANG	-0.150	0.122	0.066	-0.062	-0.120	-0.161	-0.153	1.000	0.097	1.107

Metal Products Sub-Sector

Variables	*SHORT*	*LONG*	*EQUITY*	*AUTO*	*ROA*	*SALES*	FAI_{t-1}	*TANG*	R^2	*VIF*
SHORT	1.000								0.162	1.193
LONG	-0.204	1.000							0.068	1.073
EQUITY	-0.316	-0.046	1.000						0.172	1.207
AUTO	-0.018	0.017	-0.078	1.000					0.018	1.018
ROA	-0.072	0.036	0.073	-0.022	1.000				0.081	1.088
SALES	0.036	0.037	-0.107	0.051	0.237	1.000			0.118	1.134
FAI_{t-1}	0.038	-0.009	-0.092	-0.066	-0.012	-0.012	1.000		0.018	1.018
TANG	-0.093	0.095	0.190	-0.030	-0.067	-0.011	0.040	1.000	0.064	1.069

5.3. Panel Cross-section Dependency and Slope Homogeneity Tests Results

The Pesaran (2004) *CD* test reveals that *FAI*, *SHORT*, *LONG*, FAI_{t-1} and *TANG* in the Food sector; *TANG* in the Textiles sector; *EQUITY* in the Non-Metal and Basic Metal sectors; and *ROA* series in the Metal Products sector do not exhibit cross-sectional dependence, while the other series are cross-sectionally dependent. As a result of the Pesaran and Yamagata (2008) $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ tests, it was determined that the slope coefficients of the *LONG* in the Textiles sector; *FAI* in the Chemicals sector; *EQUITY* and *SALES* in the Non-Metal sector; and *SALES* in the Metal Products sector are heterogeneous, while the slope coefficients of all other series are homogeneous.

Table 5: Testing for Cross-section Dependency and Slope Homogeneity

Food Sub-Sector								
Variable	***FAI***	***SHORT***	***LONG***	***EQUITY***	***ROA***	***SALES***	FAI_{t-1}	***TANG***
CD	0.6906	0.9876	1.2733	1.7824*	2.4768**	32.258**	0.8398	0.5227
$\tilde{\Delta}$	-1.048	-0.987	-2.158	0.078	-1.786	-0.874	-0.963	-0.787
$\tilde{\Delta}_{adj}$	-1.194	-1.125	-2.460	0.089	-2.036	-0.996	-1.098	0.0897
Textiles Sub-Sector								
Variable	***FAI***	***SHORT***	***LONG***	***EQUITY***	***ROA***	***SALES***	FAI_{t-1}	***TANG***
CD	4.5794***	1.72016	3.6244***	3.3282***	1.9468*	27.045**	5.6207***	1.5695
$\tilde{\Delta}$	-1.669	-0.950	-1.350*	-2.014	-1.231	-1.292	-0.222	-1.030
$\tilde{\Delta}_{adj}$	-1.902	-1.083	-1.539*	-2.296	-1.404	-1.474	-0.253	-1.174
Chemicals Sub-Sector								
Variable	***FAI***	***SHORT***	***LONG***	***EQUITY***	***ROA***	***SALES***	FAI_{t-1}	***TANG***
CD	4.6544***	5.8410**	7.6148***	4.4868***	2.1361**	36.859**	4.6418***	2.4369**
$\tilde{\Delta}$	1.482*	0.296	-1.380	-0.889	0.018	-0.058	-1.556	0.307
$\tilde{\Delta}_{adj}$	1.690**	0.337	-1.573	-1.014	0.020	-0.066	-1.775	0.350
Non-Metal Sub-Sector								
Variable	***FAI***	***SHORT***	***LONG***	***EQUITY***	***ROA***	***SALES***	FAI_{t-1}	***TANG***
CD	7.0021***	4.5622**	3.8402***	0.3425	6.1625**	33.020**	5.6508***	8.9746***
$\tilde{\Delta}$	-0.068	-0.355	-0.216	2.988***	-1.747	4.240***	-0.821	-0.746
$\tilde{\Delta}_{adj}$	-0.077	-0.405	-0.246	3.407***	-1.992	4.835***	-0.936	-0.850
Basic Metal Sub-Sector								
Variable	***FAI***	***SHORT***	***LONG***	***EQUITY***	***ROA***	***SALES***	FAI_{t-1}	***TANG***
CD	7.9033***	2.9286**	3.4583***	0.4836	3.0153**	25.260**	7.0504***	5.3704***
$\tilde{\Delta}$	-0.840	0.730	-0.275	-0.649	-0.145	0.910	0.247	-1.482
$\tilde{\Delta}_{adj}$	-0.958	0.832	-0.313	-0.741	-0.166	1.038	0.281	-1.689
Metal Products Sub-Sector								
Variable	***FAI***	***SHORT***	***LONG***	***EQUITY***	***ROA***	***SALES***	FAI_{t-1}	***TANG***
CD	5.0946***	3.2962**	1.9382*	2.0652**	1.0830	35.608**	6.6347***	2.2891**
$\tilde{\Delta}$	-1.336	-0.997	-1.277	0.016	1.692	1.711**	0.594	-0.156
$\tilde{\Delta}_{adj}$	-1.524	-1.136	-1.457	0.018	1.929	1.950**	0.677	-0.178

Null hypothesis for *CD* Test — H_0: No cross-section dependence

Null hypothesis for $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ Tests — H_0: No heterogeneity in slope coefficients

Note: Signs ***, and ** indicate 1%, and 5% significance levels respectively.

5.4. Panel Unit Root Test Results

The unit root tests used for examining the stationarity of the series were selected based on the outcomes of *CD*, $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ tests. The stationarity of *FAI*, *SHORT*, *LONG*, FAI_{t-1} and *TANG* in the Food sector; *TANG* in the Textiles sector; *EQUITY* in the Basic Metal sector; and *ROA* in the Metal Product sector are tested using the Levin et al. (2002) *LLC* test, which is a first-generation unit root test that considers common factors. The stationarity of *EQUITY* in the Non-Metal sector is tested using the Im et al. (2003) *IPS* test, which is a first-generation unit root test that considers individual factors. For the remaining series, the Pesaran (2007) *CIPS* test, a second-generation unit root test, was employed. The outcomes of both first and second-generation unit root tests are presented in Table 6.

Table 6: First and Second-Generation Panel Unit Root Tests

		Sub-sector Variables	Food	Textiles	Chemicals	Non-Metal	Basic Metal	Metal Products
First-Generation Panel Unit Root Tests	*LLC* and *IPS* Tests with Intercept		*LLC*	*LLC*		*IPS*	*LLC*	*LLC*
		FAI	-15.6579***					
		SHORT	-13.5874***					
		LONG	-39.2822***					
		EQUITY				-6.76016***	-9.71425***	
		ROA						-150.232***
		FAI_{t-1}	-14.7018***					
		TANG	-14.2861***	-14.2280***				
	LLC and *IPS* Tests with Intercept and Trend	**Sub-sector Variables**	**Food** *LLC*	**Textiles** *LLC*	**Chemicals**	**Non-Metal** *IPS*	**Basic Metal** *LLC*	**Metal Products** *LLC*
		FAI	-13.4510***					
		SHORT	-11.4327***					
		LONG	-32.5697***					
		EQUITY				-3.35560***	-11.6089***	
		ROA						-134.717***
		FAI_{t-1}	-13.8646***					
		TANG	-14.0888***	-13.4182***				
Second-Generation Panel Unit Root Test	*CIPS* Test with Intercept	**Sub-sector Variables**	**Food** *CIPS*	**Textiles** *CIPS*	**Chemicals** *CIPS*	**Non-Metal** *CIPS*	**Basic Metal** *CIPS*	**Metal Products** *CIPS*
		FAI		-3.28978***	-2.76324***	-3.73233***	-3.86011***	-2.88851***
		SHORT		-3.25168***	-3.84567***	-3.22501***	-5.00923***	-3.43679***
		LONG		-2.86457***	-3.61286***	-3.60429***	-3.14740***	-3.09511***
		EQUITY	-3.05724***	-2.87540***	-3.09008***			-2.86048***
		ROA	-4.04744***	-3.44372***	-3.69243***	-3.02183***	-3.87458***	
		SALES	-3.24727***	-2.29759**	-2.56641***	-2.84521***	-4.38189***	-2.89133***
		FAI_{t-1}		-3.06741***	-2.67799***	-3.66664***	-4.41438***	-2.98238***
		TANG			-3.25373***	-3.57606***	-4.25326***	-2.54887***
		CV *1%*	-2.54	-2.56	-2.54	-2.58	-2.70	-2.49
		CV *5%*	-2.27	-2.29	-2.27	-2.30	-2.37	-2.25
		CV *10%*	-2.14	-2.15	-2.14	-2.16	-2.21	-2.12
	CIPS Test with Intercept and Trend	**Sub-sector Variables**	**Food** *CIPS*	**Textiles** *CIPS*	**Chemicals** *CIPS*	**Non-Metal** *CIPS*	**Basic Metal** *CIPS*	**Metal Products** *CIPS*
		FAI		-2.93911**	-2.80334*	-3.71529***	-5.67171***	-3.02921**
		SHORT		-2.99999**	-3.63664***	-3.06684**	-4.53805***	-3.39637***
		LONG		-4.41958***	-3.58796***	-3.35660***	-3.37346**	-3.48518***
		EQUITY	-3.20462**	-3.04320***	-2.81227*			-3.49325***
		ROA	-3.81712***	-3.34162***	-3.43089***	-3.22207**	-3.35475**	
		SALES	-4.10483***	-3.04396**	-3.10664**	-2.91782**	-3.59810***	-3.21779***
		FAI_{t-1}		-3.00314**	-2.91401**	-3.49854***	-4.09020***	-3.21713***
		TANG			-2.99733**	-3.44737***	-4.30706***	-3.12004***
	Critical Values	1%	-3.25	-3.28	-3.25	-3.30	-3.45	-3.19
		5%	-2.90	-2.92	-2.90	-2.94	-3.03	-2.87
		10%	-2.74	-2.75	-2.74	-2.76	-2.83	-2.72

Null hypothesis for *LLC*, *IPS* and *CIPS* tests H_0: No stationarity.
Note 1: Lag lengths were determined using the Akaike Info Criterion.
Note 2: Signs ***, and ** indicate 1%, and 5% significance levels respectively.

The findings presented in Table 6 indicate that the null hypothesis is rejected for all variables in both models, with intercept and with intercept and trend, for the *LLC*, *IPS*, and *CIPS* tests. Consequently, based on the results of the *LLC*, *IPS*, and *CIPS* tests, all variables included in the models exhibit stationarity at the level.

5.5. Diagnostic and Estimator Specification Tests Results

Table 7 presents the outcomes of diagnostic tests examining the assumptions of autocorrelation and heteroskedasticity in the models, along with the results of the *F* test assessing variation in the fixed parameter. Additionally, the table presents the findings of the Breusch and Pagan (1980) *LM* and Honda (1985) tests used to determine the presence of random effects in the models.

Table 7: Diagnostic and Estimator Specification Tests

Diagnostic Tests		Food	Textiles	Chemicals	Non-Metal	Basic Metal	Metal Products
	LM_p	0.004827	4.935386**	2.153216	26.614990***	26.840630***	18.50375***
	LM_p^*	2.066975	12.58577***	8.120013***	42.007990***	39.985850***	34.00302***
	LM_h	376.1940***	300.3600***	276.0846***	729.87850***	254.45240***	183.12850***
Tests	**Models**	**Food**	**Textiles**	**Chemicals**	**Non-Metal**	**Basic Metal**	**Metal Products**
F Test	Group FE	0.727595	0.304580	0.585279	0.876140	0.389110	0.422852
	Time FE	0.486480	1.834449**	0.814646	1.935610**	2.825754***	1.486480
	Two-way FE	0.626185	0.900178	0.673282	1.298940	1.551417*	0.774169
LM Test	Group RE	1.180263	5.404425**	1.976921	0.424357	3.443854*	4.673593**
	Time RE	2.361539	3.542212*	0.311144	2.189082	10.69602***	1.179162
	Two-way RE	3.541802	8.946637**	2.288065	2.613438	14.13987***	5.852755*
Honda Test	Group RE	-1.086399	-2.324742	-1.406030	-0.651427	-1.855762	-2.161849
	Time RE	-1.536730	1.882076**	-0.557803	1.479555*	3.270477***	1.085892
	Two-way RE	-1.854832	-0.313012	-1.388640	0.585575	1.000354	-0.760816
Hausman Test		13.488340***	2.496521	0.798800	0.790262	2.748918	4.589051
Null hypothesis	LM_p and LM_p^*	H_0: No serial correlation.					
	LM_h	H_0: No heteroskedasticity.					
	Group FE/RE	H_0: While there is a cross-section effect, there is no time effect.					
	Time FE/RE	H_0: While there is a time effect, there is no cross-section effect.					
	Two-way FE/RE	H_0: No cross-section or time effect.					

Note: Signs ***, and ** indicate 1%, and 5% significance levels, respectively.

LM_p^* test statistics reject the null hypothesis for Chemicals sector, both LM_p and LM_p^* test statistics reject the null hypothesis for Textiles, Non-Metal, Basic Metal and Metal Product sectors. Conversely, for Food sector, both LM_p and LM_p^* test statistics can not reject the null hypothesis. The findings from the LM_p and LM_p^* tests indicate the presence of autocorrelation problem in the models developed for Textiles, Chemicals, Non-Metal, Basic Metal, and Metal Product sectors, while there is no autocorrelation problem in the Food sector. LM_h test statistics, on the other hand, reject the null hypothesis for all sector models. The Period SUR (PCSE) robust estimator developed by Beck and Katz (1995) is used to estimate the econometric models, since the presence of autocorrelation and heteroskedasticity problems in panel regression models may cause inconsistencies and high deviations in the analysis results. This approach aims to mitigate inconsistencies and deviations in the analysis results stemming from the presence of autocorrelation and heteroskedasticity issues.

The *F* test outcomes in Table 7 indicate that the group fixed effects statistical values are statistically insignificant for all models, whereas the time fixed effects statistical values are statistically significant for the Textiles, Non-Metal, and Basic Metal sector models, yet statistically insignificant for other sector models. Specifically, the *F* test results suggest the presence of one-way time fixed effects in the models of Textiles, Non-Metal, and Basic Metal sectors, while there are no group or time fixed effects in the models of Food, Chemicals, and Metal Products sectors. Furthermore, the *LM* test reveals that the models for Textiles and Basic

Metal sectors encompass two-way random effects. The Honda test, on the other hand, indicates that the models for Textiles, Non-Metal, and Basic Metal sectors involve one-way time random effects, while the remaining models do not contain group or time random effects. According to Baltagi (2014), the selection of the appropriate model in panel regression analysis depends on the nature of the dataset. If the dataset focuses on a specific set of individuals, and the results are confined to the behavior of this group, the fixed effects model is deemed most suitable. Conversely, the random effects model is preferred when individuals in the dataset are randomly selected from a large population. Lastly, the pooled model is appropriate when it is assumed that there are no distinctions among individuals in the dataset. Given that this study focuses on firms within BIST manufacturing sub-sectors, in accordance with Baltagi (2014) approach, the fixed effects model is presumed to be appropriate, and accordingly the *F* test results are taken into consideration in the estimations.

5.6. Panel Regression Results

The estimation outcomes of the panel regression models formulated to examine the relationship between financing decisions and fixed asset investments, and to determine the differences in fixed asset financing among BIST Food, Textiles, Chemicals, Non-Metal, Basic Metal and Metal Products sectors are presented in Table 8.

Table 8: Panel Regression Results

Sub-sector	**Food**		**Textiles**		**Chemicals**	
Ind. Variables	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**
SHORT	-0.075470	-6.655413***	-0.070262	-6.746061***	-0.196812	-11.431280***
LONG	-0.002108	-2.009755**	0.002205	3.552918***	-0.002583	-1.220621
EQUITY	0.054920	5.643469***	-0.008070	-1.013086	-0.012842	-1.149056
AUTO	-0.027654	-3.455084***	-0.016711	-1.684127*	-0.012055	-1.408408
ROA	0.000252	0.631519	-0.005147	-8.440253***	0.000310	0.717827
SALES	-0.024980	-3.625369***	-0.004768	-0.827889	-0.043144	-2.459707**
FAI_{t-1}	-0.050186	-3.759948***	-0.098827	-5.652175***	-0.014445	-2.66931**
TANG	0.717550	59.377620***	0.239991	19.425470***	0.216842	18.374400***
C	0.030710	6.847787***	0.021095	5.070837***	0.025815	3.837323***
R^2	0.935253		0.770495		0.668609	
Adjusted R^2	0.933383		0.751290		0.659038	
F-Statistic	500.15100***		40.11861***		69.85883***	
Prob(F-Statistic)	0.000000		0.000000		0.000000	
D-W Stat.	1.997209		1.959660		1.925353	
Sub-sector	**Non-Metal**		**Basic Metal**		**Metal Products**	
Ind. Variables	**Coefficient**	**t-Statistics**	**Coefficient.**	**t-Statistic**	**Coefficient.**	**t-Statistic**
SHORT	-0.026221	-4.229140***	-0.133624	-35.489480***	-0.050127	-3.646320***
LONG	-0.004008	-1.425953	-0.014165	-25.354910***	-0.000928	-0.238060
EQUITY	-0.073647	-6.961396***	-0.001147	-0.328472	-0.061323	-7.574132***
AUTO	0.001348	0.349607	-0.003019	-1.561358	-0.006831	-0.935788
ROA	0.000653	1.073479	-0.001206	-11.496220***	-0.000666	-3.535592***
SALES	-0.011054	-4.448518***	-0.061033	-9.859743***	0.001304	0.135531
FAI_{t-1}	-0.019987	-2.489862**	-0.089446	-24.963610***	-0.093122	-5.943658***
TANG	0.627550	83.371110***	0.615595	216.240700***	0.636660	40.021570***
C	0.016983	6.036967***	0.037085	16.121600***	0.018188	3.195849***
R^2	0.973531		0.997203		0.828993	
Adjusted R^2	0.971189		0.996856		0.824822	
F-Statistic	415.6207***		2870.013***		198.7562***	
Prob(F-Statistic)	0.000000		0.000000		0.000000	
D-W Stat.	2.018033		1.996260		2.067230	

Note 1: Panel EGLS (Period SUR) method and Period SUR (PCSE) standard errors & covariances robust estimators were used in all models.
Note 2: Signs ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively.

The panel regression results, in Table 8, show that all models are statistically significant at the 1% significance level (F-probability values<0.01 for all models). Thus, the null hypothesis tested by equation (16) is rejected for all manufacturing sub-sectors and it is concluded that financing policies, financial performance and sales growth have statistically significant impacts on the changes in fixed asset investments in manufacturing sub-sectors. The Basic Metals sector model registers the highest F-statistic (2870.01), suggesting that this sector has the greatest explanatory power regarding the influence of financing policies, financial performance, and sales growth on fixed asset investment decisions. Conversely, the Textiles sector model exhibits the lowest F-statistic (40.11). The R^2 values are also consistent with the F-statistic values. The R^2 values indicate that the independent variables collectively explain the changes in fixed asset investments by 93% in the Food sector, 77% in the Textiles sector, 67% in the Chemicals sector, 97% in the Non-Metal sector, 99% in the Basic Metal sector and 83% in the Metal Products sector. Moreover, the Durbin-Watson (D-W) statistics, which are close to 2 in all models, suggest that the autocorrelation issue within the models has been effectively eliminated by the robust estimators. This indicates that serial correlation among the error terms is minimized, enhancing the reliability of the regression results.

The analysis results reveal significant findings regarding the impact of different financial factors on the changes in fixed asset investments, and differences in fixed asset financing across manufacturing sub-sectors. Firstly, changes in short-term borrowings have statistically significant negative impacts on fixed asset investments across all manufacturing sub-sectors at the 1% significance level. Specifically, a 1-unit increase in short-term borrowings leads to a 0.075 unit decrease in the Food sector, a 0.07 unit decrease in the Textiles sector, a 0.196 unit decrease in the Chemicals sector, a 0.026 unit decrease in the Non-Metal sector, a 0.133 unit decrease in the Basic Metal sector, and a 0.05 unit decrease in the Metal Products sector. Contrary to the short-term borrowings, the effects of changes in long-term borrowings on changes in fixed asset investments are not statistically significant in all manufacturing sub-sectors and vary across sub-sectors. Analysis results show that the effects of changes in long-term borrowings on fixed asset investments are statistically significant at 5% significance level in the Food sector, at 1% significance level in the Textiles and Basic Metal sectors, and statistically insignificant in the other sub-sectors. The effects of long-term borrowing decisions on fixed asset investments are negative in the Food and Basic Metal sectors but are positive in the Textiles sector. Specifically, a 1-unit increase in long-term borrowings results in a 0.002 unit decrease in the Food sector, a 0.04 unit increase in the Textiles sector, and a 0.014 unit decrease in the Basic Metal sector. The analysis also highlights the significance of financing decisions with shareholders' equity. Financing decisions with shareholders’ equity significantly impact changes in fixed asset investments at the 1% significance level in the Food, Non-Metal, and Metal Products sectors. However, this effect is insignificant in other sectors. Findings show that the financing decisions with shareholders’ equity are positively effective on fixed asset investments in Food sector, but negatively effective in Non-Metal and Metal Products sectors. Notably, a 1-unit increase in shareholders’ equity rate leads to a 0.054 unit increase in the Food sector, a 0.073 unit decrease in the Non-Metal sector, and a 0.061 unit decrease in the Metal Products sector. Moreover, findings indicate that decision on auto financing negatively effects the fixed asset investments at 1% significance level in Food sector and at 10% significance level in Textiles sector. These effects are found to be insignificant in other sectors. Analysis results show that a 1-unit increase in auto financing leads to a 0.027 unit decrease in Food sector and a 0.016 unit decrease in Textiles sector.

The results regarding the impact of return on assets shows that financial performance has statistically significant negative impacts at the 1% significance level in the Textiles, Basic Metal, and Metal Products sectors. Conversely, these impacts are found to be insignificant in other sectors. Specifically, a 1-unit increase in return on assets leads to a 0.005 unit decrease in the Textiles sector, a 0.001 unit decrease in the Basic Metal sector, and a 0.0006 unit decrease in the Metal Products sector. Furthermore, the findings concerning the effects of changes in sales growth, representing sales performance crucial for firms' operating cycles, on fixed asset investments reveal statistically significant negative effects at the 1% significance level in the Food, Non-Metal, and Basic Metal sectors, and at the 5% significance level in the Chemicals sector. Specifically, a 1-unit increase in sales growth results in a 0.024 unit decrease in the Food sector, a 0.043 unit decrease in the Chemicals sector, a 0.011 unit decrease in the Non-Metal sector, and a 0.061 unit decrease in the Basic Metal sector.

As anticipated, the control variables significantly explain the variations in fixed asset investments across all sectors. The impact of the 1-period lagged value of the fixed asset investment rate on the changes in the current period fixed asset investment rate is consistently negative across all sectors. This effect is statistically significant at the 1% significance level in the Food, Textiles, Basic Metal, and Metal Products sectors, and at the 5% significance level in the Chemicals and Non-Metal sectors. Moreover, tangible fixed asset investments exhibit positive effects on fixed asset investments, which are statistically significant across all sectors at the 1% significance level.

5.7. Discussion

The study's findings highlight the significant influence of sectoral characteristics on the planning of long-term investment finance within manufacturing sub-sectors. Moreover, the principle of maturity matching emerges as a crucial factor in financing strategies across manufacturing sub-sectors. By aligning the maturity profiles of assets and liabilities, firms can mitigate risks and optimize their financial structures to better support long-term investment objectives within the manufacturing landscape. This emphasizes the importance of adopting a nuanced approach that considers both sector-specific dynamics and financial principles when crafting investment finance plans in manufacturing sectors.

Table 9: Summary of the Results

Variables	Food	Textiles	Chemicals	Non-Metal	Basic Metal	Metal Products
SHORT	Negative	Negative	Negative	Negative	Negative	Negative
LONG	Negative	Positive	Insignificant	Insignificant	Negative	Insignificant
EQUITY	Positive	Insignificant	Insignificant	Negative	Insignificant	Negative
AUTO	Negative	Negative	Insignificant	Insignificant	Insignificant	Insignificant
ROA	Insignificant	Negative	Insignificant	Insignificant	Negative	Negative
SALES	Negative	Insignificant	Negative	Negative	Negative	Insignificant

Table 9 provides a comparative summary of the findings across manufacturing sub-sectors. Asset financing through short and long-term borrowings and internal capital is determined to have negative effects on fixed asset investments in Food sector. Conversely, financing via shareholders' equity is yields positive effects. The findings suggest that resources obtained through capital increment are crucial for financing long-term investments in food, beverage and tobacco companies, while resources obtained through borrowing or auto financing have a dampening effect. Although the growth in sales rates of Food sector companies is expected to lead to a decline in fixed asset investments, surprisingly, return on assets is not expected to have a significant impact on long-term investments. Debt maturity emerges as a crucial factor influencing the impact of debt financing on fixed asset investments in the Textiles sector. The findings reveal that short-term borrowing diminishes fixed asset investments, while long-term borrowing enhances them, aligning with the principle of maturity matching in financing. Although auto financing decisions were found to decrease fixed asset investments, the impact of total equity financing on such investments was found to be insignificant. In contrast to companies in the Food, Chemicals, and Non-Metal sectors, return on assets exerts negative effects on long-term investment decisions in the textiles sector. Growth in sales rates, on the other hand, is not expected to significantly affect fixed asset investments in Textiles sector. Only short-term borrowings are expected to affect fixed asset investments in Chemicals sector significantly, due to the sector's intensive use of working capital. The findings suggest that working capital financing policies play an important role in fixed asset investments strategies in chemical, pharmaceutical, petroleum, tire and plastic manufacturing companies. Sales growth also exerts a negative impact on the fixed asset investment rate, due to the resources it allocates to the operating cycle.

The findings suggest that fixed asset investment decisions in Non-Metal sector are significantly affected by short-term debt and shareholders’ equity, whereas auto financing and long-term debt financing do not emerge as significant parameters. For companies within the Non-Metal sector, it appears that working capital financing policies and capital increment decisions play pivotal roles in fixed asset investment determinations. The effects of return on assets and sales growth on fixed asset investments in the Non-Metal sector mirror those observed in the Food and Chemical sectors. The findings in the Basic Metal sector regarding debt financing are similar to those observed in the Food sector, while the results concerning equity financing resemble those found in the Chemical sector. Similarly to the Food sector, debt financing in Basic Metal sector has a dampening effect on fixed asset investments due to the financial risks it causes in the short-term and the increase in the cost of capital in the long-term. Equity financing, on the other hand, is not among the significant determinants of fixed asset investments, as in Chemical sector. Based on the findings, it is evident that the enhancing effect of both sales growth and profitability on working capital investments in the Basic Metal industry firms results in a negative impact on fixed asset investments. The findings indicate a striking resemblance between the Non-Metal and Metal Products sectors concerning fixed asset financing. In both sectors, short-term borrowings and shareholders' equity financing are observed to decrease the fixed asset investment rate, evidently supporting current assets with the aim of achieving high profitability in the short run.

The findings of the study suggest that firm managers and financial planners need to carefully account for sector-specific traits when making long-term investment decisions. By recognizing and integrating sectoral nuances into their financial strategies, managers can enhance the effectiveness and sustainability of their long-term investment planning initiatives within the manufacturing domain.

6. Conclusions and Policy Implications

This study aims to discern the differences in fixed asset financing across manufacturing sub-sectors using annual data for the period spanning from 2010 to 2022 for manufacturing firms in Turkey. The study encompasses manufacturing companies operating in BIST manufacturing sub-sectors of Food, Beverages and Tobacco; Textiles, Wearing Apparel and Leather; Chemicals, Petroleum Rubber and Plastic Products; Non-Metallic Mineral Products; Basic Metal; Fabricated Metal Products Machinery Electrical Equipment and Transportation Vehicles, and regularly traded on BIST for the period 2010-2022. The datasets, which are built separately for each manufacturing sub-sector and contain a time dimension of 13 years, are analyzed by following a five-stage panel data methodology. Pre-estimation evaluations, including tests for multi-collinearity, cross-sectional dependence, slope homogeneity, stationarity, autocorrelation, and heteroskedasticity, are conducted using various econometric tests before estimating the panel regression models. The presence of time and/or group fixed effects are investigated using the *F* test to determine the most appropriate estimator. The robust estimators proposed by Beck and Katz (1995) are used to overcome the autocorrelation and heteroskedasticity identified in the models.

The panel regression models constructed for all manufacturing sub-sectors analyzed in the study are found to be statistically significant. Consequently, it has been determined that financing policies, financial performance and sales growth have significant effects on fixed asset investments in manufacturing sub-sectors. This finding reveals the decisive effect of financing strategies on long-term investments. The results of the regression analysis indicate that the impact of short-term financing decisions on fixed asset investments is uniform across all manufacturing sub-sectors. Specifically, short-term borrowings are found to diminish fixed asset investments across all sub-sectors, with the most pronounced effect observed within the Chemicals sector companies. These findings align with previous studies by Easton et al. (1993), Hamidi (2015), Abdioğlu and Aytekin (2016), Abedin et al. (2017), Nguyen and Nguyen (2019), Akron et al. (2020), Açıkgöz and Alp (2022), and Kalusová and Badura (2022) which also reported a decreasing effect of financial leverage on long-term investments. However, this finding contradicts with the findings obtained by Nunes et al. (2017) and Köroğlu et al. (2023) Conversely, the impacts of long-term financing options and financial performance on fixed asset investments vary significantly across manufacturing sub-sectors. Specifically, long-term borrowing decisions are observed to reduce fixed asset investments in the Food and Basic Metals sectors. In the Textiles sector, on the other hand, long-term borrowing decisions are found to lead to an increase in fixed asset investments, aligning with findings obtained by Milojević et al. (2021) and Çam and Özer (2022). Similarly, financing with shareholders' equity is found to increase fixed asset investments in Food sector, aligning with the findings of Can et al. (2021). However, in the Non-Metal and Metal Products sectors, financing with shareholders' equity is observed to decrease fixed asset investments. Another notable finding is that the auto financing option significantly decreases fixed asset investments in the Food and Textiles sectors, which contradicts the findings of Can et al. (2021) and Hamidi (2015). The findings reveal that high profitability leads to a decrease in fixed asset investments in the Textiles, Basic Metal, and Metal Products sectors. This result contradicts the findings of Welch and Wessels (2000), Jiang et al. (2006), Olatunji and Adegbite (2014), Jiang and Dalbor (2017), and Akron et al. (2020), but aligns with the results of Can et al. (2021) and Açıkgöz and Alp (2022), which focused on Turkish companies. Another significant determinant of fixed asset investments is the rate of growth in sales. Contrary to the findings of Dalbor and Jiang (2013), growth in sales is found to significantly decrease fixed asset investments in all manufacturing sub-sectors.

The findings suggest that short-term borrowing stands out as a significant financing option in manufacturing sub-sectors characterized by high working capital and long operating cycles. Short-term borrowing is observed to decrease fixed asset investments across all manufacturing sub-sectors. Conversely, financing with shareholders' equity is found to increase fixed asset investments in the Food sector, aligning with the principle of maturity matching in financing. Similarly, long-term borrowing decisions in the Textiles sector exhibit a similar increasing effect on fixed asset investments. However, the impact of long-term financing options on fixed asset investments is not significant across all sub-sectors. The effects of financing with shareholders' equity in the Textiles sector, long-term borrowing, and auto financing in Non-Metal and Metal Products sectors, as well as all equity financing options in the Basic Metal sector, and all long-term financing options in the Chemicals sector are found to be insignificant on fixed asset investments. The insignificance of long-term financing options, typically considered the primary source of financing for fixed asset investments, may be attributed to high working capital ratios and long operating cycles in manufacturing sectors. This finding is consistent with the findings of Çelik and Boyacıoğlu (2013). Moreover, the fact that a significant majority of the companies in the analyzed sectors are companies that prefer short-term debt financing policy at a high rate supports this assessment. Similar to the findings on financing options, in manufacturing sub-sectors, higher turnover rates and operating cycles together with profitability and sales growth increase the working capital investments and decrease the fixed asset investment.

The empirical findings derived from the analyses are believed to be instructive for firms' long-term investment plannings and financing strategies. Additionally, they contribute significantly to the academic literature by unveiling the effects of various financing options on fixed asset investments separately and by determining the sectoral distinctions in fixed asset financing. The obtained results hold potential benefits for a wide range of stakeholders including company managers, investors, policy makers and researchers. The effects of short- and long-term borrowings and equity financing on long term investments provide important information to firm managers in the process of developing long term investment and financing policies. By anticipating the long-term implications of financing options, firm managers can proactively mitigate potential losses and capitalize on opportunities by adjusting their long-term investment strategies. This proactive approach enables managers to navigate market dynamics more effectively and enhance the overall resilience and sustainability of their organizations.

Investors, on the other hand, can glean valuable insights into firms' long-term investment policies and guide their investment decisions by scrutinizing the financing structures of companies. Understanding how firms allocate their resources and finance their long-term investments can help investors assess the stability, growth potential, and risk profile of these companies. By analyzing the financing strategies adopted by firms, investors can make more informed investment choices aligned with their financial objectives and risk tolerance levels. This knowledge empowers investors to make sound investment decisions that align with their long-term investment goals and maximize potential returns while managing risk effectively.

The significant differences determined across manufacturing sub-sectors regarding the impacts of financing policies on long-term investments could offer valuable insights to financial policymakers, especially within the banking sector. Understanding these differences enables policymakers to tailor financial products and services to meet the specific needs and preferences of various manufacturing sub-sectors. By recognizing the unique financing requirements and risk profiles of different sectors, financial institutions can develop customized lending solutions, investment products, and financial services that better address the distinct needs of manufacturers. This targeted approach enhances the efficiency and effectiveness of financial intermediation, fosters greater access to capital for businesses, and promotes economic growth and development across diverse manufacturing industries. Ultimately, aligning financial products with the specific characteristics and dynamics of manufacturing sectors contributes to the overall resilience and competitiveness of the economy.

It is crucial to approach the findings of this study with consideration for its limitations regarding cross-sectional and time dimensions. As the study focuses solely on publicly traded manufacturing firms, generalizing the findings to firms in other sectors may lead to inaccuracies. Additionally, the exclusion of factors beyond financing options, financial performance, and sales growth, which could also impact fixed asset investment policies, represents another important limitation. Future research should aim to address these limitations by expanding the scope of analysis to include a more diverse range of firms across various sectors. This paper provides important sources for researchers investigating financing policies within manufacturing sector, both in terms of its methodology and findings. By elucidating the relationships between financing decisions and long-term investment strategies, this study lays the groundwork for further research in the field. Researchers can uncover deeper insights into the complex dynamics shaping financing decisions and investment behaviors within manufacturing sectors by expanding the scope of inquiry. In future studies, exploring the effects of additional factors such as working capital policies, market performance, institutionalization, and macroeconomic variables will help gain a more comprehensive understanding of the characteristics of long-term investments.

References

Abedin, M. T., Sen, K. K., & Akter, M. (2017), "Determinants of Net Capital Expenditure Cash Outflows: Evidence from The Pharmaceutical Sector of Bangladesh, Asian", Journal of Accounting Perspectives, Vol. 10, No. 1: 73-98.

Abdioğlu, N., & Aytekin, S. (2016), "Finansal Esneklik ve Sermaye Yatırımları Arasındaki İlişkinin İncelenmesi", Aksaray Üniversitesi İktisadi ve İdari Bilimler Fakültesi, Vol. 8, No. 1: 11-19.

Açıkgöz E., Uygurtürk, H. & Korkmaz, T. (2015), "Analysis of Factors Affecting Growth of Pension Mutual Funds in Turkey", International Journal of Economics and Financial Issues, Vol. 5, No. 2: 427-433.

Açıkgöz, T., & Alp, Ö. S. (2022), "Firm-Specific and Macroeconomic Determinants of Fixed Asset Investment Decisions in Türkiye", Journal of Accounting & Finance, Vol. 96: 117-134.

Akgüç, Ö. (2010), Finansal Yönetim, 8th Edition, Istanbul: Avcıol Basım Yayın.

Akron, S., Demir, E., Díez-Esteban, J. M., & García-Gómez, C. D. (2020), "Economic Policy Uncertainty and Corporate Investment: Evidence from the US Hospitality Industry", Tourism Management, Vol. 77: 104019.

Alkaraan, F., & Northcott, D. (2007), "Strategic Investment Decision Making: The Influence of Predecision Control Mechanisms", Qualitative Research in Accounting & Management, Vol. 4, No. 2: 133-150.

Asteriou, D., & Hall, S. G. (2007), Applied Econometrics: A Modern Approach Using EViews and Microfit, Revised Edition, New York: Palgrave Macmillan.

Azmı, A. F., & Alı, S. (2019), "Fixed Assets Revaluation and Future Firm Performance: Empirical Evidence from Indonesia", The Indonesian Journal of Accounting Research, Vol. 22, No. 3: 419-148.

Baltagi, B. H. (2014), Econometric Analysis of Panel Data, 5th Edition, Chichester: Jhon Wiley & Sons Ltd.

Baltagi, B., & Li, Q. (1991), "A Joint Test for Serial Correlation and Random İndividual Effects", Statistics and Probability Letters, Vol. 11: 277-280.

Beck, N., & Katz, J. N. (1995), "What to do (and not to do) with Time-Series Cross-Section Data", American Political Science Review, Vol. 89, No. 3: 634-647.

Born, B., & Breitung, J. (2016), "Testing for Serial Correlation in Fixed-Effects Panel Data Models", Econometric Reviews, Vol. 35, No. 7: 1290-1316.

Breusch, T. S., & Pagan, A. R. (1979), "A Simple Test for Heteroskedasticity and Random Coefficient Variation", Econometrica, Vol. 47, No. 5: 1287-1294.

Breusch, T. S., & Pagan, A. R. (1980), "The Lagrange Multiplier Test and Its Applications to Model Specification in Econometrics", Review of Economic Studies, Vol. 47, No. 1: 239-253.

Can, G., Günay, S., & Ocak, M. (2021), "How Does Size Affect Capital Expenditures? Evidence from Borsa Istanbul", SN Business & Economics, Vol. 1, No. 1: 1-28.

Chistik, O., Ovchinnikov, O., Volgin, A., Tumanov, A., & Danilova, L. (2023), "Investments in Fixed Assets in Russia: Analysis and Forecast", E3S Web of Conferences, Vol. 389: 1-8.

Çam, İ., & Özer, G. (2022), "An Analysis of the Effects of Firm-Specific Factors on Businesses' Investment Financing Decisions", The Journal of Social Economic Research, Vol. 22, No. 2: 102-117.

Çelik, I., & Boyacıoğlu, N. (2013), "The Impact of Fixed Assets Expenditures on Working Capital Management: An Application on Manufacturing Enterprises in Istanbul Stock Exchange", Journal of Suleyman Demirel University Institute of Social Sciences, Vol. 17, No. 1: 81-99.

Çil, N. (2018), Finansal Ekonometri: Istanbul: Der Yayınevi.

Dalbor, M., & Jiang, L. (2013), "Determinants of Capital Expenditures in the US Restaurant Industry" The Journal of Hospitality Financial Management, Vol. 21, No. 2: 77-86.

De Hoyos, E. R., & Sarafidis, V. (2006), "The Testing for Cross-Sectional Dependence in Panel Data Model", The Stata Journal, Vol. 6, No. 4: 482-496.

Demir, Y., & Görür, Ç. (2020), "Investigation of the Relationship between Various Energy Consumption and Economic Growth Belonging to OECD Countries by Panel Cointegration Analysis", Ekoist: Journal of Econometrics and Statistics, Vol. 32: 15-33.

Easton, P. D., Eddey, P. H., & Harris, T. S. (1993), "An Investigation of Revaluations of Tangible Long-Lived Assets", Journal of Accounting Research, Vol. 31: 1-38.

Frezatti, F., de Souza Bido, D., Da Cruz, A. P. C., Barroso, M. F. G., & de Camargo Machado, M. J. (2013), "Investment Decisions on Long-Term Assets: Integrating Strategic and Financial Perspectives", European Accounting Review, Vol. 22, No. 2: 297-336.

Gujarati, D. N. (2004). Basic Econometrics, 4th Edition, New York: McGraw-Hill.

Güriş, S., Çağlayan, E., & Güriş, B. (2013), EViews ile Temel Ekonometri. Istanbul: Der Yayınevi.

Harc, M. (2015), "The Relationship between Tangible Assets and Capital Structure of Small and Medium-Sized Companies in Croatia", Ekonomski Vjesnik/Econviews: Review of Contemporary Business, Entrepreneurship and Economic Issues, Vol. 28, No. 1: 213-224.

Hamidi, M. (2015), "Determinants of Capital Expenditures Decision in Malaysian Companies", In the Australian Conference on Business and Social Science. Sydney, Australia.

Hisham, A. A. M., Karim, Z. A., & Khalid, N. (2019), "Determinants of Capital Expenditure Spending in Malaysian Palm Oil Industries: A Dynamic Panel Data Analysis", Economic Journal of Emerging Markets", Vol. 11, No: 2: 223-233.

Honda, Y. (1985), Testing the Error Components Model with Non-Normal Disturbances", Review of Economic Studies, Vol. 52: 681-690.

Im, K., Pesaran, H., & Shin, Y. (2003), "Testing for Unit Roots in Heterogeneous Panels", Journal of Econometrics, Vol. 115, No. 1: 53-74.

Jiang, C. H., Chen, H. L., & Huang, Y. S. (2006), "Capital Expenditures and Corporate Earnings: Evidence from the Taiwan Stock Exchange", Managerial Finance, Vol. 32: 853–861.

Jiang, L., & Dalbor, M. (2017), "Factors Impacting Capital Expenditures in the Quick Service Restaurant Industry", The Journal of Hospitality Financial Management, Vol. 25, No. 2: 90-100.

Kaya, M. (2021), Finansal Zaman Serilerinin Temel Özellikleri. In İ. Çelik, & S. Bozkuş Kahyaoğu (Eds.) Finansal Zaman Serisi Analizleri: Temel Yaklaşımlar. (pp. 5-40). Ankara: Gazi Kitabevi.

Kalusová, L., & Badura, P. (2022), "Factors Affecting the Capital Allocation into Fixed Assets of Slovak Enterprises?", Montenegrin Journal of Economics, Vol. 18, No. 1: 169-182.

Köroğlu, A., Zaif, F., & Karapınar, A. (2023), "Motives for Property, Plant, and Equipment Revaluation: An Empirical Analysis of Listed Manufacturing Firms", The World of Accounting Science, Vol. 25, No. 2: 274-295.

Levin, A., Lin, C. F. & Chu, C. S. J. (2002), "Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties", Journal of Econometrics, Vol. 108: 1-24.

Milojević, S., Milašinović, M., Mitrović, A., & Knežević, S. (2021), "Solvency and Financing of Fixed Assets: The Case of Agricultural Enterprises in Serbia", International Academic Journal, Vol. 2, No. 2: 26-34.

Modigliani, F., & Miller, M. H. (1958), "The Cost of Capital, Corporation Finance and the Theory of Investment", The American Economic Review, Vol. 48, No. 3: 261-297.

Nguyen, H., & Nguyen, T. (2020), "Determinants of Firm's Capital Expenditure: Empirical Evidence from Vietnam", Management Science Letters, Vol. 10, No. 5: 943-952.

Nunes, P. M., Serrasqueiro, Z., & Matos, A. F. (2017), "Determinants of Investment in Fixed Assets and in Intangible Assets for High-Tech Firms", Journal of International Studies, Vol. 10, No. 1: 173-179.

Öndeş, T., & Barakalı, O. C. (Mayıs, 2023), “Makroekonomik Göstergelerin İşletmelerin Duran Varlık Yatırımına Etkisi: BIST sanayi işletmeleri üzerine bir araştırma”, Uluslararası Ekonomi Finans ve İşletme Kongresi (EFI2023), Sivas, Türkiye.

O’Brien, R. M. (2007), “A Caution Regarding Rules of Thumb for Variance Inflation Factors”, Quality and Quantity, Vol. 41, No. 5: 673-690.

Olatunji, T. E., & Adegbite, T. A. (2014), “Investment in Fixed Assets and Firm Profitability: Empirical Evidence from the Nigerian Banking Sector”, Asian Journal of Social Sciences and Management Studies, Vol. 1, No. 3: 78-82.

Papadakis, V. M. (1995), “The Contribution of Formal Planning Systems to Strategic Investment Decisions”, British Journal of Management, Vol. 6, No. 1: 15-28.

Pesaran, M. H. (2004), “General Diagnostic Tests for Cross Section Dependence in Panels. Cambridge Working Papers in Economics.

Pesaran, M. H. (2007), A Simple Panel Unit Root Test in the Presence of Cross Section Dependence”, Journal of Applied Econometrics, Vol. 22: 265–312.

Pesaran, M. H., & Yamagata, T. (2008), “Testing Slope Homogeneity in Large Panels”, Journal of Econometrics, Vol. 142: 50-93.

Santoso, H., Lako, A., & Rustam, M. (2020), “Relationship of Asset Structure, Capital Structure, Asset Productivity, Operating Activities and Their Impact on the Value of Manufacturing Companies Listed on the Indonesia Stock Exchange”, International Journal of Multicultural and Multireligious Understanding, Vol. 7, No. 8: 358-370.

Seng, D., & Su, J. (2010), Managerial Incentives Behind Fixed Asset Revaluations: Evidence from New Zealand Firms. Working Paper, Department of Accountancy and Business Law, University of Otaga.

Smith, C. W. (1993), “A Perspective on Accounting-Based Debt Covenant Violations", The Accounting Review, Vol. 88, No. 2: 289-303.

Soylu, N., Uygurtürk, H., & Korkmaz, T. (2018), “The Effect of Fixed Assets Purchase Announcements on Stock Returns: A Research on Textile, Wearing Apparel and Leather Industry”, The Journal of Accounting and Finance, Vol. 79: 67-80.

Swamy, P.A., (1970), “Efficient Inference in a Random Coefficient Regression Model”, Econometrica, Vol. 38, No. 2: 311–323.

Tatoğlu, F. Y. (2013), Panel Veri Ekonometrisi: Stata Uygulamalı, 2nd Edition, Istanbul: Beta Basım.

Temiz, H., & İpci, M. Ö. (2018), “Investigation of the Relationship between Earnings Management and Firms Investment: BIST Manufacturing Sector Case”, Ege Academic Review, Vol. 18, No. 3: 409-421.

Welch, I., & Wessels, D. (2000), “The Cross-Sectional Determinants of Corporate Capital Expenditures: A Multinational Comparison”, Schmalenbach Business Review, Vol. 52, No. 2: 103-136.

Whittred, G., & Chan, Y. K. (1992), “Asset Revaluation and The Mitigation of Underinvestment", Abacus, Vol. 28, No. 1: 58-73.

Appendix: Abbreviations/Nomenclature

Food	Food, beverages and tobacco sub-sector
Textiles	Textiles, wearing apparel and leather sub-sector
Chemicals	Chemicals, petroleum rubber and plastic products sub-sector
Non-Metal	Non-metallic mineral products sub-sector
Basic Metal	Basic metal sub-sector
Metal Products	Fabricated metal products machinery electrical sub-sector
BIST	Borsa Istanbul
UK	United Kingdom
US	United States
GDP	Gross domestic product
KAP	Kamuyu Aydınlatma Platformu- Public Disclosure Platform
FAI	Fixed asset investments ratio
SHORT	Short-term financing ratio
LONG	Long-term financing ratio
EQUITY	Shareholder's equity ratio
AUTO	Autofinancing ratio
ROA	Profitability-Return on assets ratio
SALES	Growth in sales
FAIt-1	1-period lagged value of FAI
TANG	Tangible fixed assets ratio
FINNET	Financial Information News Network data base
VIF	Variance inflation factor
CD	Pesaran (2004) cross-sectional dependence test
PCSE	Period corrected standard errors
SSCP	Sums-of-squared cross-products
LLC	Levin, Lin, and Chu (2002) panel unit root test
IPS	Im, Pesaran and Shin (2003) panel unit root test
CIPS	Cross-sectionally augmented IPS tes by Pesaran (2007)
CADF	Cross-sectionally Augmented Dickey-Fuller test by Pesaran (2007)
J-B	Jarque-Bera normality test
D-W Stat.	Durbin-Watson statistic