The Relationship between Capital Investment Choice and Capital Productivity: A Test of Firm Life Cycle Theory
(A Comparative Investigation of Cyclical and Non-Cyclical Companies)

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ABSTRACT

In the current study, the relationship between the stages of firm life cycle and capital productivity and mediation effect of the capital investment choice in the two groups of companies have been examined and compared. The results of examine of 118 companies accepted in Tehran Stock Exchange in 7 years showed that there is a positive relationship between introduction, growth and maturity stages with capital productivity in the cyclical and non-cyclical companies. Regarding the cyclical companies, a positive relationship was witnessed between the decline stage and capital productivity. Such a relation, however, was not found between the two variables in non-cyclical companies as well as, no significant relationship was observed among the stages of introduction, growth, maturity and the capital investment choice in both groups of companies. In non-cyclical companies, the relationship between the decline stage and the capital investment choice was positive. Also, the results of the Sobel test did not approve the mediation role of the capital investment choice between the stages of the life cycle and capital productivity. Therefore, it seems that in the introduction, growth and maturity stages of both groups of companies, capital productivity has occurred through the optimal use of existing assets.

1 Introduction

Understanding the company's lifecycle heavily relies on the ability of company officials and managers to recognize the lifecycle. Consequently, identifying the company's lifecycle and recognizing life cycle issues from one era to the next will empower managers in making informed decisions to avoid many future issues. Dickinson [11] defined the company's business life cycle as distinct and identifiable stages that is caused by changes in internal variables such as choice of strategy, financial resources, and management capabilities or external factors including competitive environment and macroeconomic factors.Corporate executives try to choose strategies to improve their capital productivity, regarding each step of the company's lifecycle. Tavasoli and saeidi [24] considered the determining rate of seizing assets and acquisition other companies by public sector companies. They estimate this rate at various stages of the life cycle of the company. Therefore, according to their size and age, the companies have been divided into small, large, young, and mature groups, the results showed that with increase in age and size, public sector companies are more likely to seize the fixed assets of other companies to restructure and achieve improved operations. However, in the case of assuming owner-

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ship of other companies done through buying the companies, most public sector companies do this in the middle of their lifetime and in the course of their growth. Badurdeen,Aydin [4] From the Fama–French three-factor model, the expected stock return is a negative function of market value of equity, and also positive of book-to-market ratio. The investigators develop a discrete-time asset pricing model under a framework of the partial equilibrium and analyze how the corporate lifecycle impacts on the relationship between them. The results show that as firms become mature, the negative impact of market value of equity, which reflects the relative importance of growth options, on expected stock returns will weaken. In contrast, the positive relationship between the book-to-market ratio and expected stock returns is not changing over time. The theoretical analysis is supported by the empirical results of A-share listed firms from 1998 to 2016 in China. Badurdeen, Aydin [4] considered the multi-lifecycle based methodology is proposed to solve multi-objective product configuration design problems considering conflicting economic and environmental objectives. The methodology addresses issues across all the lifecycle stages, from extracting raw materials to product Research on end-of-life (EoL), and the entire demand cycle. The multi-objective optimization problem can be solved by introducing a non-dominated sorting genetic algorithm II using which various product design solutions can be generated by considering the tradeoff between several objectives. The proposed methodology is implemented on an industrial case study for the configuration design of toner cartridges. The Pareto optimal solutions yield better economic and environmental performances compared to the performance of the base toner cartridge. Zhai and Wang [28] and Francis, Huang [13] stated that the index of resource efficiency was considered as the growth rate of a particular company in comparison with the resource efficiency index of the same industry, to determine whether in the national scope, Capital has been allocated to the most efficient industries.

Companies need to invest in growth and development. These opportunities may vary in different stages of the company's life cycle. Dickinson [11] defines the stages of the life cycle as an alternative to the company's economic characteristics. The company's life cycle is a very important and decisive factor in many corporate decisions. Thus, according to the life cycle theory, companies based on different stages of their life cycle have different behaviors in relation to the existing opportunities.

Currently, the capital and investment market is one of the chief bases of each country's economic growth. Given that capital as an economic resource is restricted, the capital market, together with other markets, is responsible for the optimal allocation of such limited resources. Consequently, capital as a limited economic resource is likely to be allocated, according to the company's life stages, to companies which have more investment prospects and as a result experience higher returns and higher capital productivity [26]. Hence, because of the lack of economic resources and the attempts made by managers to access higher capital productivity in various stages of the company's life cycle, in the current study, the link between the stages of the company's life cycle and capital productivity in general and in different industries has been evaluated, compared and contrasted. Understanding and detecting the firm life cycle depends on managers' ability to identify the lifecycle. Therefore, identifying the company's lifecycle and recognizing the transition in the life cycle from one stage to the next will enable managers to make informed decisions and avoid many future obstacles [26]. The firm lifecycle theory can be described through the generalization of the product life cycle theory, which is derived from the incorporation of marketing and microeconomics. From this perspective, companies like products or services, make progress through four stages of introduction, growth, maturity, and decline

[7,11,14,15]. States that companies that have growth in sales, high capital spending and low lifetimes are generally recognized as growing business units. On the other hand, commercial entities with high sales and low capital expenditures are identified as declining business units. Large business units lie between the two groups [7].

2 Research Background

2.1 Life Cycle Theory

According to the theory of the life cycle, companies, like organic organisms, continuously tend to grow and develop from birth to decline [19,23]. All living beings, including plants, animals and humans, all follow the life cycle. That is, living beings are born, grow, get old and eventually die. These living systems at each stage of their life cycle have specific behavioral patterns to overcome the issues and problems of that period, as well as problems related to transition from one period to another [1]. The company's life cycle theory is described through the elaboration of the product life cycle theory. From this perspective, companies like products or services progress in four stages of emergence, growth, maturity, and decline. V.Kousenidis [25] states that companies that have growth in sales, high capital expenditure growth and low lifetimes are commonly known as growing businesses. On the other hand, commercial entities with high sales and low capital expenditures are known as declining business units. Large business units are placed between the two groups.

One of the characteristics of dynamic economic units is their lifecycle [26]. In the theory of the life cycle, it is assumed that corporations and enterprises, like all living beings who are born, grow and die, have a life or life cycle curve. According to the theory of the life cycle, companies in different phases of the life cycle have financial and economic characteristics that have certain graphs and behaviors, which mean that the financial and economic characteristics of a company are influenced by the stage of the lifecycle in which the company is located [1]. Jaafar and Halim [16] stated that, although the theory of life cycle is an important tool in understanding the life of organizations, life cycle literature, has been more conceptually developed rather than experimentally. They also believed the comparison between life cycle models shows that these patterns suffer from the lack of compatibility and predictability of company growth and development. There is also a wide discrepancy in the number of stages in the company's life cycle and growth. Ckuang [7], Park and Chen [21] Anthony [3] used four variables to determine the life cycle of the company using four variables: dividend profit, sales growth, capital expenditure ratio, and company age. While Hasan [14], Hasan, Hossain [15] and Dickinson [11] and DeAngelo [10] used companies' cash flow data. They argued that cash flows could provide different and useful information about the profitability, growth, and risk of companies, which could be the result of the performance and optimal allocation of company resources for more productivity.

2.2 Capital Productivity

Productivity is one of the criteria for assessing the performance of organizations and institutions. In other words, productivity is an indicator that determines the extent to which organizations are successful in achieving the desired goals with respect to the resources they consume. Boel [5] has defined productivity as the degree of effective use of each of the factors of production. So, today, optimal use of resources and improved productivity are essential.

Kato and Morishima [17] aims to improve productivity by maximizing the optimal use of all resources in a scientific way, by reducing production costs, expanding markets, increasing employment and raising real wages, and improving living standards, in the interest of Employees, managers and consumers. Companies usually seek to increase and improve the productivity of their operating processes. Therefore, they prefer to use the limited resources available to them as much as possible. In other words, the main goal of productivity in companies is the optimum use of available resources for company development wealth generation and greater profit for shareholders, thereby increasing the competitive advantage of the company in the market.Increasing productivity not only means optimal use of resources, but also helps to create a better balance between economic, social and political structures in society [6,9]. Accordingly, productivity means the optimal use of all resources in the organization, including labor, capital, material and human capacities, to achieve higher efficiency and effectiveness. Capital factor is one of the most important elements in the production of goods and services. Capital efficiency emphasizes the use of capital and physical assets. So , the higher the productivity of capital, the faster economic growth. Accordingly, capital productivity can play a significant role in the growth and development of companies and it is expected that stocks of high-productivity companies also have a higher performance [6].

Capital efficiency measures the ability to manage in an optimal use of capital as a significant and limited source of business, which is expected to improve corporate performance [9]. Economically, productivity is important in developing company activities. Full development without the optimal use of any of the factors of production is not possible. One of the factors of production is capital and managers can make it more efficient by the aid of growth and investment opportunities and increase the value of the company. Over the past years, in many countries around the world, the development of business units and productivity has created a lot of benefits for them [6]. Capital productivity measures the capability to manage in an optimum use of capital as a noteworthy and limited source of business, which is likely to advance the company's economic performance. The wide spread development is not feasible without employing all major factors involved in the production. One of these factors is capital. Managers can use development opportunities and investment possibilities to bring about capital productivity and add to the company's value [9].

2.3 Capital Investment Choice

The term investment consists of a wide range of activities that are carried out in order to generate future profits. Accordingly, an investment may be made in operational or non-operational assets. The choice of an investment method essentially refers to whether capital controlled by the company has been used in its core business [28]. Mardani and Sarlak [18] founded that the current and long-term investments have impact on financing methods through the sale of stocks and debt; the study assessed "the impact of investments on financing of companies listed on the Tehran Stock Exchange". The statistical sample is consisted of companies listed on the Tehran Stock Exchange during a five-year period (2010-2014). The results of this study and other similar internal investigations consider theoretical position and characteristics of investment in long-term financing, according to the company, for the country financial managers can add their financing through the sale of stock by changing the current investments participants in the capital market, while respecting the importance of long-term investments, consider the findings about financing through debt well. All business units have different

stages of their life cycle since they were born. Therefore, business units choose the right economic decisions with their place in the life cycle. Increasing investment in the company's operational activities reflects the growth prospects for the company [28]. This perspective is achieved if the resources invested in the company are used in a productive way, so that the returns generated per unit of the invested capital are more than average cost of providing the necessary capital. Zhai and Wang [28], Francis and huang [13] stated that if a company's capital is allocated to its core business, there should be a correlation between the growth rate of operating profit and the growth rate of operating profit in a particular industry. Therefore, the choice of investment method can be defined as investing in a real asset which used in the production of certain products in the future.

2.4 Life Cycle and Capital Productivity

Anthony [3] argued that companies in the early stages of their life cycle are mostly experiencing higher sales growth. Higher growth coupled with lower dividends in these companies may create more opportunities for projects with positive net present value. In addition, growing companies are more likely to invest in fixed assets. Brown and Rowe [6] state that the concept of capital productivity means measuring the power of management in optimal use of capital as one of the company's most important and limited resources. Hence, companies with high capital productivity are expected to have a higher performance. Capital investment is one of the most important inputs in the production of goods and services. Thus, the factor of capital productivity can play a significant role in the growth of companies. According to the theory of the life cycle, opportunities for investment in the stages of growth and maturity for companies reach their maximum and in the phase of decline, these opportunities fall. Therefore, companies need to increase their productivity levels and optimize their existing opportunities to stay in a competitive environment [8]. In companies with relative productivity above the industry average, the productivity generated results in a higher margin of profit. In contrast, companies whose productivity is lower than average productivity. In other words, their productivity is lower than competing companies, which ultimately leads to a decline in the business unit's bankruptcy [22]. Therefore, considering the lack of economic resources and the efforts of managers to access higher capital productivity, the first question is whether: Is there a relationship between the company's life cycle and capital productivity?

Accordingly, the research hypotheses are presented as follows:

H_1: there is a positive and significant relationship between the emergence stage and the capital productivity,

H_2: There is a positive and significant relationship between growth stage and capital productivity.

H_3: There is a positive and significant relationship between the maturity stage and the capital productivity.

H_4: There is a negative and significant relationship between capital depreciation and capital productivity.

2.5 Life Cycle and Capital Investment Choice

The value of each company depends on its financial decisions and investments. The market reacts differently to companies with more investment opportunities. In fact, the life of companies and their current status in their life cycle affect the set of investment opportunities facing those [8]. Based on

the theory of the life cycle, companies show different behaviors in relation to investment opportunities based on how they are at the stage of the life cycle. Companies that are more flexible to take advantage of these opportunities can be imagined for a brighter future of the future [4]. Companies that are in the growth stage tend to expand themselves and spend their cash on purchasing capital assets and investing in circulating capital [8]. Investment opportunities are one of the factors affecting the good growth of corporate profits. On the other hand, the vast majority of dissolved companies are being dissolved due to financial weakness and lack of profitability. The profit or loss statement, along with the information contained in other financial statements, is an information transfer tool for assessing the company's performance and financial performance results [22]. Investment opportunities do not spontaneously occur, but they must be identified or created. Phung and Mishra [22] showed that the main reason for the liquidation of most declining companies that were liquidated was financial weakness and lack of profitability. Therefore , the most important factors in the growth of companies, the existence of investment opportunities, the existence of liquidity and the correct use of economic resources under control.

Accordingly, the second question of the research is whether: Is there a relationship between the stages of the company's life cycle and the Capital investment choice? Based on the above question, the fifth to eighth hypotheses are presented as follows :

H$_5$: There is no positive and significant relationship between the introduction stage and the Capital investment choice.

H$_6$: There is a positive and significant relationship between the growth stage and the Capital investment choice.

H$_7$: There is a positive and significant relationship between the maturity stage and the Capital investment choice.

H$_8$: There is no meaningful relationship between the stage of decline and the Capital investment choice*.*

2.6 Mediation Role of the Capital Investment Choice

Investors in the market face a wide range of investment opportunities and investment opportunities. These investments can be in operational or non-operational assets. According to Collins and Hriber [8], the general concept of choosing an investment method means investing in assets that can generate additional income in the future. Capital investment can play a crucial role in corporate success. Make. The main purpose of investment decisions is to choose the appropriate investment method so that the value of the company increases. Agah and Malekpoor [2] founded that the financial risk assessment indexes, the transaction information was collected companies selected by sampling method based on Cochran formula in which totally obtained 640 year-firm data they have found that financial constraints are effective on investment performance based on the indicators (kz) and (ww), as well as the various levels of agency costs, including high and low agency costs effect on investment efficiency.

Zhai and Wang [28], Francis and huang [13] stated that the index of resource efficiency as a growth rate of a particular company compared to the productivity index of allocating resources in the same industry, to determine whether the national, Capital is assigned to the most efficient industry? Used. They argued that if a company's capital is allocated to its core business, there should be a correlation between the growth rate of operating profit and the operating profit growth rate in the particular in-

dustry. According to Phung and Mishra [22], the main objective of business units when deciding on investing in a capital project is to maximize shareholder wealth by acquiring assets and ultimately profit. In the meantime, there are a lot of factors, such as management prospects, opportunities created by technological change, competing companies' strategies, financial incentives, market forecasts, and noneconomic factors, which are factors that influence the choice of investment method. These factors create incentives for the willingness of business units to invest in capital investments. The most important of these motivations are as follows:

- Expansion of the company's operational activities

Capital investment decisions are aimed at expanding operational levels Collins and Hriber [8]. This is accomplished through the acquisition of fixed assets by purchasing equipment for the factory and by capital repairs or major repairs by rebuilding, completing or modifying an existing asset or changing the product line. Capital investment spurs business expansion, such as increasing production, creating new products, and thus increasing the value of the company. Increasing investment in the company's operational activities reflects the growth prospects for the company [8]. This vision will be achieved if the resources invested in the company are used efficiently and effectively, so that the returns generated are higher than the average cost of financing the invested capital [13,28].

- Transition between life cycle stages

When growth of a company decreases and becomes mature, machines, vehicles, equipment and other assets may or may not be technologically obsolete, which should be replaced by the new one [8]. In this case, business units are trying to increase their productivity and reduce their costs by using new and advanced technology in machinery and equipment. In other words, business units are trying to return to production and Advantages of the course. In this regard, Anthony [3] argued that growing companies are more likely to invest in fixed assets.

Therefore, the third question of the research is whether the company's life cycle through the choice of investment method affects capital productivity or not? Accordingly, the ninth hypothesis of the research is as follows:

H9: The Company's life cycle affects the capital productivity through the capital investment choice.

2.7 Cyclical and non-Cyclical Companies

Commercial units have certain operational characteristics that show different behaviors in different economic cycles. One of these features is the cyclical or non-cyclicality of the business unit. Cycle companies are often faced with varying demand for their products in periods of boom and recession. For example, in a recession, the demand for automotive products is expected to be relatively low, as people try to protect their funds for more essential uses such as food and medicine. As a result, the pharmaceutical and food industries are non-cyclical industries, because even in bad economic conditions people continue to buy medicines and food. Therefore, due to the relative stability of demand for products and services of non-cohabitant firms, investment and profitability in these industries are less influenced by the economic conditions. Fama and French [12] classified food industries, pharmaceutical industries, financial services, public service companies (water, electricity, telephone and gas companies) as non-cyclical industries and other industries as wheel industries. In this research, the classification of Fama and French has been used to determine cyclical and non-cyclical industries.

Based on the above mentioned theoretical and research background, the conceptual model of the research is presented as follows in Fig. 1
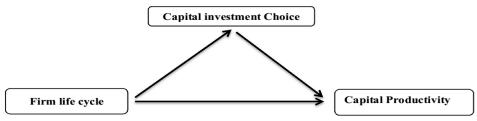

Fig. 1: The research Conceptual Model (developed by the researchers)

3 Research Methodology and Variables

In this research, the relationship between the stages of the company's life cycle with capital productivity, the relationship between the stages of the company's life cycle with the choice of the investment method and the mediation of the choice of the investment method on the relationship between the stages of the company's life cycle with interest Capitalization of listed companies in Tehran Stock Exchange. Hence, this research is a type of applied research. Its methodology is post-hoc type. Eviews software has been used to measure the variables of research and analysis of data.

The statistical population in this research is the companies accepted in Tehran Stock Exchange. From this society, 180 companies were first selected as the volume of statistical society by systematic elimination. Then, according to Morgan's Table, 118 companies were selected as sample size. Subsequently, the selected sample is divided into two parts of cyclical and non-cyclical companies based on the Fama and French [12] model. The study period is 7 years (2010-2016).

The above hypotheses will be analyzed by the following two models:

$$Capital\ pro_{it} = \beta_0 + \sum_{i=1}^{2} \beta_1 Life\ Cyc\_DUM + \beta_2\ Capital\ Investment\ choices_{it} + \beta_3\ Size_{it} + \beta_4\ ROA_{it} + \beta_5 Lev_{it} + \varepsilon$$

$$Capital\ Investment\ choices_{it} = \beta_0 + \sum_{i=1}^{2} \beta_1 Life\ Cyc\_DUM + \beta_2\ Size_{it} + \beta_3\ ROA_{it} + \beta_4\ Lev_{it} + \varepsilon$$

In this research, capital productivityis the dependent variable and is calculated using the Brown and Rowe [6] model through the following formula:

Capital productivity = operating profit / (debt + equity) - (cash + Short term investment)

Company Life Cycle is the independent variable.

In this research, the model used by Hasan [14], Hasan, Hossain [15] and Dickinson [11] from cash flows of operational activities (CFO), and Cash flow by investment (CFI) and cash flow by financing (CFF) were used to determine the life cycle stages, such as the introduction, Growth, maturity, Shake out and decline. It was decided on according to the following conditions:

Introduction: if CFO <0, CFI <0, and CFF> 0.

Growth: if CFO> 0, CFI <0 and CFF> 0.

Maturity: if CFO> 0, CFI <0 and CFF <0.

Decline: if CFO <0, CFI> 0 and 0 ≤CFF≤ 0.

Shake-out: the remaining firm years will be classified under the shake-out stage.

Capital investment choice is considered as the mediating variable.

In this research, the choice of investment method using Zhai and Wang [28] method, which shows the correlation between the growth of operating profit of the company and the growth of industry operating profit this year, is calculated. For this purpose, the growth rate of operating profit for each industry is calculated as follows:

Operating profit growth rate = (operating profit of the current year - operating profit of the previous year) / Operating profit for the previous year

Tere are three Control Variables that are described as follows:

• Size

It is equal to the natural logarithm of assets

• ROA

 This ratio will be calculated by dividing net profit into total assets.

• Lev

The leverage ratio is calculated by dividing the total debt into total assets.

4 Research Findings

4.1 Descriptive Statistics

In order to study the general characteristics of the variables, as well as estimating the model and their exact analysis, familiarity with the descriptive statistics of the variables is required.

Table 1: Descriptive statistics of research variables

Variables	Sample	std. error	Min	Max	Mean	Aver	Skewness	Kurtosis
CAPITAL PRODUCTIVITY	826	0.1601	-0.7593	1.3088	0.1179	0.1451	1.034	2.044
INVESTMENT CHOICES	826	0.4318	-0.9402	0.9915	0.2000	0.1495	-0.357	-0.604
INTRO	826	0.2557	0.0000	1.0000	0.0000	0.0702	-	-
GROW	826	0.4612	0.0000	1.0000	1.0000	0.6937	-	-
MATU	826	0.2959	0.0000	1.0000	0.0000	0.0969	-	-
DECL	826	0.3501	0.0000	1.0000	0.0000	0.1429	-	-
SIZE	826	1.6710	9.9497	19.1062	13.7177	13.9990	0.739	0.552
ROA	826	0.1329	-0.7896	0.5478	0.0863	0.1007	-0.006	1.201
LEV	826	0.2158	0.0658	1.5656	0.6380	0.6291	.0138	0.515

Source: compiled by the authors

Descriptive statistics are used to compute community parameters and include central indicators and community dispersion. In Table 1, the descriptive statistics of the variables including median, mean, maximum, minimum and standard deviation for 118 companies were presented during 7 periods (2010 to 2016).

Table 2: Descriptive statistics of research variables

		CAPITAL PRO	INVESTMENT CHOICES	INTRO	GROW	MATU	DECL	SIZE	ROA	LEV
CAPITAL PRO	Pearson Correlation	1								
	Sig. (2-tailed)									
	N	826								
INVESTMENT CHOICES	Pearson Correlation	-.059	1							
	Sig. (2-tailed)	.089								
	N	826	826							
INTRO	Pearson Correlation	.098**	-.033	1						
	Sig. (2-tailed)	.005	.343							
	N	826	826	826						
GROW	Pearson Correlation	.262**	.123**	-.414**	1					
	Sig. (2-tailed)	.000	.000	.000						
	N	826	826	826	826					
MATU	Pearson Correlation	.069*	.158**	-.090**	-.393**	1				
	Sig. (2-tailed)	.048	.000	.010	.000					
	N	826	826	826	826	826				
DECL	Pearson Correlation	-.202**	.153**	-.112**	-.399**	-.122**	1			
	Sig. (2-tailed)	.000	.000	.001	.000	.000				
	N	826	826	826	826	826	826			
SIZE	Pearson Correlation	.065	.049	-.082*	.048	.065	-.058	1		
	Sig. (2-tailed)	.063	.160	.018	.172	.063	.094			
	N	826	826	826	826	826	826	826		
ROA	Pearson Correlation	.864**	-.077*	-.095**	.214**	-.090**	-.125**	.059	1	
	Sig. (2-tailed)	.000	.027	.007	.000	.009	.000	.092		
	N	826	826	826	826	826	826	826	826	
LEV	Pearson Correlation	-.465**	.078*	.154**	-.174**	.096**	.030	.058	-.436**	1
	Sig. (2-tailed)	.000	.025	.000	.000	.006	.387	.098	.000	
	N	826	826	826	826	826	826	826	826	826
**. Correlation is significant at the 0.01 level (2-tailed).										
*. Correlation is significant at the 0.05 level (2-tailed).										

Source: compiled by the authors

Table No1 explain about descriptive statistics and nine different variable has been explained capital productivity with min level of -0.7593 and max level of 1.3088, investment choices with min level of -0.9402 and max level of 0.9915, intro measured by dummy variable where 0 stands for nill and 1 stands for intro stage, grow measured by dummy variable where 0 stands for nill and 1 stands for

growth stage(GROW), maturity (MATU) measured by dummy variable where 0 stands for nill and 1 stands for maturity stage, decline (DECL) measured by dummy variable where 0 stands for nill and 1 stands for decline stage, size with min level of 9.9497 and max level of 19.1062 , ROA with min level of -0.7896 and max level of 0.5478, LEV with min level of 0.0658 and max level of 1.5656. The most important Measures of Central Tendency is the mean. It represents the centrality of data.

For example, the mean of main variables of the research including capital productivity, choice of investment method, introduction, growth, maturity and decline were 0.1451, 0.1495, 0.0702, 0.6937, 0.0969 and 0.1429 respectively which shows that most data are centered on these points. Another major measure of variability is standard deviation. The larger the standard deviations, data set are farther away from the mean. Among the research variables, the size of the company with the 1.6710 has the highest level of variability and the return of the assets with the value of 0.1329 has the lowest variability.Skewness indicates the possible level of asymmetry of a frequency distribution. The amount of skewness varies between -3 and +3. If the skewness is zero, the population is symmetric. If the skewness coefficient is greater than zero, then it is skewed to the right, and if it is less than zero, then it is skewed to left. For example, in Table 1, capital productivity with the value of 1.340 is skewed to the right and the capital investment choice with the value of 0.357 is skewed to the left.The kurtosis is an index that shows the amount of concentration, dispersion, and kurtosis of the data of a frequency distribution. When the coefficient of kurtosis is zero, the curve is normal. When it is greater than zero, the curve is thin and tall and when less than zero, the curve will be shorter and flatter than the normal curve. For example, in Table 1, capital productivity with the value of 2.044 has positive kurtosis and the capital investment choice with the value of -0.604 has negative kurtosis.The results of Descriptive statistics of research variables are presented in Table 2.

Table 3: The result of F-Limer test, Hausman test and OLS test

Test	Model	Statistic	d.f	p-value	Result
	first model	4.1268	117.0	0.00	H0 rejected (pooling method selected)
F-Limer test					
	Second model	8.1846	117.0	0.00	H0 rejected (Pooling method selected)
	first model	36.224	8.00	0.00	H0 rejected (The random effects method selected)
Hausman test					
	Second model	16.0067	7.00	0.02	H0 rejected (The random effects method selected)
	first model	398.41	*	0.00	H0 rejected (There is a heteroscedasticity)
OLS test					
(Breusch-Pagan / Cook-Weisberg test)					
	Second model	1.1700	*	0.27	H0 Accepted (There is no heteroscedasticity)

Source: compiled by the authors

The correlation between research variables at the level (sig≤0.01) and (sig≤0.05) showed that the correlation coefficient between the variables of research at the determined level is significant. The F (Limer) test statistic has been used to decide on the choice of pooling or panel method. Based on the results of this test (Table 3), it is decided to reject or accept the equivalence hypothesis of certain fixed effects of the companies and finally to decide on the choice of the classical method or panel data method. The results of the Chow test (F statistics), which are given in below, It has been shown that at 95% confidence the null hypothesis is rejected, so the panel data method should be used.

Hausman test was used to select between fixed and random effects models. The results of the Hausman test is presented in Table 3 show that the constant effects method should be used to investigate the research model.

Subsequently, were used to investigate the Heteroscedasticity. The results of this test, presented in Table 3, showed that there is no problem of heterogeneity of variance in the research model (since the probability or calculated P-value is greater than 0.05). Therefore, the final estimation of the second model is made using the OLS test.

4.2 Results of the Research Model Test

The results of estimating the first model of research for cyclical and non-cyclical companies are presented in the Tables 4 and 5:

Table 4: The result of applying the first research model for cyclical companies

Variable	P-VALUE	t-statistics	SD	Coefficients
$\beta 0$	0.0107	2.561260	0.047890	0.122659
INTRO	0.0000	6.850730	0.008100	0.055488
GROW	0.0000	13.46919	0.004755	0.064053
MATU	0.0000	10.25643	0.005433	0.055720
DECL	0.0000	4.860097	0.005789	0.028136
CAPITAL INVESTMENT CHOICES	0.4610	-0.737780	0.004360	-0.003217
SIZE	0.0002	-3.697261	0.002802	-0.010358
ROA	0.0000	121.8992	0.008366	1.019860
LEV	0.6497	0.454479	0.014919	0.006780

Capital proit = β0 + $\sum_{i=1}^{2} \beta_1 Life\ Cyc\_DUM$ + β2 Capital Investment choicesit + β3 Sizeit + β4 ROAit + β5Levit + ε
Source: compiled by the authors

Table 5: The result of applying the first research model for non-cyclical companies

Variable	P-VALUE	t-statistics	SD	Coefficients
$\beta 0$	0.0130	-2.503974	0.069046	-0.172889
INTRO	0.0199	2.346190	0.020137	0.047245
GROW	0.0105	2.580732	0.022789	0.058813
MATU	0.0019	3.147670	0.020845	0.065615
DECL	0.7794	0.280443	0.009586	0.002688
CAPITAL INVESTMENT CHOICES	0.7876	0.269766	0.010937	0.002950
SIZE	0.0134	2.492682	0.005235	0.013050
ROA	0.0000	9.191090	0.111693	1.026577
LEV	0.9397	0.075674	0.024278	0.001837

Capital proit = β0 + $\sum_{i=1}^{2} \beta_1 Life\ Cyc\_DUM$ + β2 Capital Investment choicesit + β3 Sizeit + β4 ROAit + β5Levit + ε
Source: compiled by the author

According to Tables 4 and 5, the first, second and third hypotheses of research are approved in cyclical and non-cyclical companies because the calculated p-value for the independent variable of research in the stages of introduction, growth and maturity, for cyclical and non-cyclical companies are less than 0.05. Thus, it can be said that there is a positive and significant relationship between the stages of introduction, growth and maturity with capital productivity at the 95% confidence level. However, t statistic for cyclical companies in all three stages is more than non-cyclical companies which indicate a more meaningful relationship with cyclical companies than non-cyclical companies.

Also, based on the results of Tables 4 and 5, the fourth hypothesis has been rejected in cyclical and non-cyclical companies. Since there is a positive and significant relationship between decline phase and capital productivity, as opposed to the defined hypothesis (negative and meaningful), but in non-cyclical corporations the coefficient of this independent variable is more than 0.05. Therefore, there is no relationship between the decline stage and the capital productivity at the 95% confidence level.

The results of estimating the second model of research for cyclical and non-cyclical companies are described in the Tables 6 and 7.

Table 6: The result of applying the second research model for cyclical companies

Variable	P-VALUE	t-statistics	SD	Coefficients
β_0	0.0232	-2.276354	0.655411	-1.491947
INTRO	0.7525	-0.315572	0.154032	-0.048608
GROW	0.8407	-0.201108	0.145401	-0.029241
MATU	0.7516	0.316718	0.169953	0.053827
DECL	0.8107	0.239680	0.150642	0.036106
SIZE	0.0094	2.607095	0.044189	0.115205
ROA	0.8427	-0.198587	0.169611	-0.033683
LEV	0.5491	0.599524	0.164660	0.098718

Capital Investment choices$_{it}$ = β_0 + $\sum_{i=1}^{2} \beta_1 Life\ Cyc\_DUM$ + $\beta_2\ Size_{it}$ + $\beta_3\ ROA_{it}$ + $\beta_4\ Lev_{it}$ + ε
Source: compiled by the authors

Table 7: The result of applying the second research model for non-cyclical companies

Variable	P-VALUE	t-statistics	SD	Coefficients
β_0	0.7735	-0.288224	1.324419	-0.381729
INTRO	0.5561	0.589665	0.123267	0.072686
GROW	0.2031	1.277184	0.113368	0.144791
MATU	0.1062	1.623299	0.122605	0.199025
DECL	0.0003	3.695211	0.031666	0.117013
SIZE	0.8052	0.246969	0.085749	0.021177
ROA	0.9143	-0.107785	0.715446	-0.077114
LEV	0.9858	0.017813	0.470755	0.008386

Capital Investment choicesit = $\beta0$ + $\sum_{i=1}^{2} \beta_1 Life\ Cyc\_DUM$ + $\beta2\ Sizeit$ + $\beta3\ ROAit$ + $\beta4\ Levit$ + ε
Source: compiled by the authors

Based on the results of Tables 6 and 7, the fifth hypothesis of the research is confirmed in cyclical and non-cyclical companies because the calculated p-value for the independent variable of research in the introduction stage for cyclical and non-cyclical companies is greater than 0.05.

Therefore, it can be said that in cyclical and non-cyclical companies between introduction stage and Capital investment choice at 95% confidence level there is no positive and significant relationship. However, t statistics for cyclical companies is significant and negative. This value is significant and positive in non-cyclical companies.The sixth and seventh hypothesis of research in cyclical and non-cyclical companies has been rejected because the calculated p-value for the independent variable of research in the growth and maturity stages for cyclical and non-cyclical companies is greater than 0.05. Therefore, there can be no positive and significant relationship between growth and maturity stages with Capital investment choice in cyclical and non-cyclical companies at 95% confidence level.Based on the results of Table 6, the eighth hypothesis is confirmed in cyclical companies. because the calculated p-value for the independent variable of the research in the phase of decline for cyclical companies is more than 0.05. Therefore, it can be said that there is no positive and significant relationship between the declining stage and Capital investment choice in cyclical firms at the 95% confidence level. This hypothesis has been rejected in non-cyclical companies. because the calculated p-value for the independent variable in the study of cyclical companies is less than 0.05. Therefore, it can be said that there is a positive and significant relationship between the decline stages with Capital investment choice at the 95% confidence level. Investigation of the mediation role of the choice of investment method since in this research, the capital investment choice has been selected as a mediating variable. Therefore, it is necessary to examine whether this variable has a mediator role in the relationship between the independent variable and the dependent variable.

Table 8: The results of the Sobel test

Industry	Life cycle	A	Sa	B	Sb	Z-Value	Results
Cyclical companies	Introduction	0.07268	0.123	0.00295	0.01093	0.13344	There is no mediating relation
	Grow	0.14479	0.113	0.00295	0.01093	0.20949	There is no mediating relation
	Maturity	0.19902	0.122	0.00295	0.01093	0.22738	There is no mediating relation
	Decline	0.11701	0.031	0.00295	0.01093	0.25971	There is no mediating relation
Non-cyclical companies	Introduction	0.05548	0.008	0.03610	0.26976	0.13241	There is no mediating relation
	Grow	0.06405	0.004	0.03610	0.26976	0.13346	There is no mediating relation
	Maturity	0.05572	0.005	0.03610	0.26976	0.13319	There is no mediating relation
	Decline	0.028136	0.0058	0.036106	0.26976	0.13104	There is no mediating relation

Source: compiled by the authors

In this research, Sobel test was used to examine the significance of the mediating effect. This test was performed using non-standard path coefficient and standard error using the following formula:

$$Z - Value = \frac{a * b}{\sqrt{(b^2 * s_a^2) + (a^2 * s_b^2) + (s_a^2 * s_b^2)}}$$

If the absolute value of Z-value is greater than 1.96, the mediation relation will be accepted. Otherwise, the relationship will be rejected. The structural flow of research for this test has been as follows:

Stages of Life-cycle ➜ *Capital Investment choice* ➜ *Capital productivity*

The results of the Sobel test for examining the mediation role of the choice of investment method for cyclical and non-cyclical companies is described in Table 8.

Based on Tables 4 and 5, in cyclical and non-cyclical companies, the calculated p-value for the Capital Investment choice is greater than 0.05. Thus, it can be said that there is no relationship between the Capital Investment choice and capital productivity at 95% confidence level. On the other hand, the Z-value calculated in Table (8) for stages of introduction, growth, maturity and decline is less than 1. 96. Therefore, at 95% confidence level, it can be stated that in cyclical and non-cyclical companies, the company's life cycle in the stages of introduction, growth, maturity and decline through the Capital Investment choice is not affected by capital productivity.

5 Conclusion

According to the theory of the life cycle, companies are very small at the stage of emergence and their assets are negligible. Based on the results obtained from the research model in cyclical and non-cyclical companies, a positive and significant relationship was found between the emergence stage and capital productivity. On the other hand, there is no relationship between the emergence and choice of the investment method in cyclical and non-cyclical companies. Based on life-cycle theory, at the stage of the emergence, due to the emergence of companies, financial flexibility and operating cash flow are very low. Thus, emerging companies are trying to make optimal use their existing operating assets in order to gain more market share and thus experience higher capital gain. The result of t statistics shows that this relationship is more meaningful in cyclical companies than non-cyclical companies.

The results of the research showed that there is a positive and significant relationship between growth stage and capital productivity in cyclical and non-cyclical companies. Based on the theory of the life cycles in the growth phase, the profit from the sale of the products will be higher than that of the emergence. As a result, the company's financial flexibility increases. On the other hand, more investment in assets, given the growing investment opportunities and the optimum use of assets is caused. In most cases, the return on investment will be more than the cost of financing the cost. The research results indicate that there is no relationship between the growth stage and the choice of investment method in any of the companies (both cyclical and non-cyclical), that is, companies did not tend to invest in operating assets. It seems that according to the economic conditions prevailing on companies and the recession in production, companies (cyclical and non-cyclical) have tried to increase their productivity by using their existing assets. The results of t statistics show that this relationship is more meaningful in cyclical companies than non-cyclical companies. The results of the research showed that there is a positive and significant relationship between cyclical and non-cyclical companies between maturity stage and capital productivity. The results of t statistics show that this relationship is

more meaningful in cyclical companies than non-cyclical companies. According to the theory of life cycle, companies experience sTable and balanced sales at maturity. Therefore, the financial flexibility of the company is very high, and as a result, the company's liquidity needs are mainly provided by domestic sources. At this stage, the size of the company and the size of the company's assets are larger than the growth stage, and the rate of return on investment is in most cases equivalent to or more than the rational cost of financing. On the other hand, there is no relationship between the maturity stage with the choice of investment method in any of the companies (cyclical and non-cyclical). Therefore, it seems that the optimal use of assets and significant stability in sales revenue have led to an increase in capital productivity in cyclical and non-cyclical companies. The results of t statistics show that this relationship is more meaningful in cyclical companies than non-cyclical companies.The research findings show that there is a positive and significant relationship between the decline rate and capital productivity in cyclical companies. But in non-cyclical companies between these two variables, no relationship was found. According to the Life Cycle Theory, at this stage, the opportunities for growth and investment are very low and the company is in a very competitive situation. As a result, the decline in sales and possibly the disappearance of assets, due to technological reasons, reduce the liquidity and profitability indicators of the company. Therefore, companies are getting closer to the declining stage, reducing their capital productivity. However, there is a relationship between the two variables in non-cyclical companies. That is, the companies chose investment in operational assets in the phase of decline, and started a new phase of growth.

The results of the research showed that there is no relationship between the choice of investment method and capital productivity in cyclic and non-cyclical companies. The Sobel test did not approve the mediation role of the choice of investment method between the stages of the life cycle and capital productivity. Therefore, it seems that in the introduction, growth and maturity stages of both groups of companies, capital productivity has occurred through the optimal use of existing assets.

According to results of the research, there is a negative and significant relationship between firm size and capital productivity in cyclical companies, while this relationship is positive and significant in non-cyclical companies as well as there was a positive and significant relationship between asset return ratio and capital productivity in both groups of companies, but this relation is more meaningful in cyclical companies because "t" statistics is higher in cyclical companies. Also, no relationship was found between financial leverage and capital productivity in both groups of companies.

The research findings show that, there is a positive and significant relationship between the size of company and the choice of investment method in cyclical companies, but such a connection was not found in non-cyclical companies. Also, there was no relationship between variables of return on assets and financial leverage in both groups of companies and the choice of investment method.

References

[1] Adizes, I., *Corporate Life cycles: How and Why Corporations Grow and Die and What to Do about it*. Prentice Hall, Englewood Cliffs, 1989, P. 5-136. https://doi.org/10.1016/0024-6301(92)90356-7

[2] Agah, M., Malekpoorb, H., *Investigating the Effect of Financial Constraints and Different Levels of Agency Cost on Investment Efficiency*, Advances in Mathematical Finance and Applications, 2017, 2(4), P. 31-47. (In Persian) DOI: 10.22034/amfa.2017.536264

[3] Anthony, J., Ramesh, K., *Association between Accounting, Performance Measures and Stock Prices: A Test of the Life Cycle Hypothesis*. Journal of Accounting & Economics. 1992, 15, P. 203-227. https://doi.org/10.1016/0165-4101(92)90018-W

[4] Badurdeen, F., Aydin, R., *A multiple lifecycle-based approach to sustainable product configuration design*. Journal of Cleaner Production, 2018, 200,P. 756-769. https://doi.org/10.1016/j.jclepro.2018.07.317

[5] Boel, B. *The European Productivity Agency and Transatlantic Relations 1953-1961*. Museum Tusculanum Press. 2003 , 4. DOI. 10.26530/OAPEN_342371

[6] Brown, D., Rowe, B., *The productivity premium in equity returns*. University of   Wisconsin US. 2007. http://dx.doi.org/10.2139/ssrn.993467

[7] Chuang, K.S., *Corporate life cycle, investment banks and shareholder wealth in M&As*. The Quarterly Review of Economics and Finance, 2017, 63, P. 122-134. https://doi.org/10.1016/j.qref.2016.02.008

[8] Collins, D. W., Hribar, P., *Cross sectional variation in cash flow asymmetric timeliness and its effect on the earnings-based measure of conditional conservatism*. University of Iowa. 2012. http://dx.doi.org/10.2139/ssrn.2120677

[9] Davis, E. P., Madsen ,J. B., *Productivity and equity market fundamentals: 80 years of evidence for 11 OECD countries*. Journal of International Money and Finance2008, 27(8), P. 1261-1283. https://doi.org/10.1016/j.jimonfin.2008.05.008

[10] DeAngelo, H., DeAngelo, L., *Dividend policy and the earned/contributed capital mix: a test of the life-cycle theory*. Journal of Financial economics 2006, 81(2), P. 227-254. https://doi.org/10.1016/j.jfineco.2005.07.005

[11] Dickinson, V., *Cash flow patterns as a proxy for firm life cycle*. The Accounting Review .2011,86(6), P.1969-1994. https://doi.org/10.2308/accr-10130

[12] Fama, E. F., French. K. R., *Business conditions and expected returns on stocks and bonds*. Journal of Financial economics, 1989, 25(1), P. 23-49. https://doi.org/10.1016/0304-405X(89)90095-0

[13] Francis, J. R., Huang, S., *Does corporate transparency contribute to efficient resource allocation?* Journal of Accounting Research .2009, 47(4), P. 943-989. https://doi.org/10.1111/j.1475-679X.2009.00340.x

[14] Hasan, M. M., *Organization capital and firm life cycle*. Journal of Corporate Finance .2018, 48, P. 556-578. https://doi.org/10.1016/j.jcorpfin.2017.12.003

[15] Hasan, M. M., Hossain, M., *Corporate life cycle and cost of equity capital*. Journal of Contemporary Accounting & Economics, 2015. 11(1), P. 46-60. https://doi.org/10.1016/j.jcae.2014.12.002

[16] Jaafar, H., Halim H. A., *Refining the firm life cycle classification method: A firm value perspective*. Journal of Economics, Business, and Management, 2016, 4(2). https://doi.org/10.7763/joebm.2016.v4.376

[17] Kato, T., Morishima. M., *The productivity effects of participatory employment practices: Evidence from new Japanese panel data*, Industrial Relations: A Journal of Economy and Society, 2002,41(4), P. 487-520. https://doi.org/10.1111/1468-232X.00262

[18] Mardani, M., Sarlak, A., *The Effect of Investment on the Financing of Listed Companies in Tehran Stock Exchange*, Advances in Mathematical Finance and Applications, 2018, 3(1), P.79-89. (In Persian) DOI:10.22034/amfa.2018.539136

[19] Miller, D., Friesen, P. H., *A longitudinal study of the corporate life cycle*. Management science ,1984,30(10), P.1161-1183. https://doi.org/10.1287/mnsc.30.10.1161

[20] Novotný. F, Podpiera. F., *The profitability life-cycle of direct investment: An international panel study.* Economic Change and Restructuring ,2008, 41(2), P. 143–153. https://doi.org/10.1007/s10644-008-9045-5

[21] Park, Y., Chen. K. H., *The effect of accounting conservatism and life-cycle stages on firm valuation*. Journal of Applied Business Research, 2006, 22(3), P.75-92. https://doi.org/10.19030/jabr.v22i3.1428

[22] Phung, D. N., Mishra. A. V., *Ownership structure and firm performance: Evidence from Vietnamese listed firms*. Australian Economic Papers 2016,55(1), P.63-98. https://doi.org/10.1111/1467-8454.12056.

[23] Quinn, R. E., Cameron. K., *Organizational life cycles and shifting criteria of effectiveness: Some preliminary evidence*. Management science 1983,29(1), P.33-51. https://doi.org/10.1287/mnsc.29.1.33

[24] Tavasoli, A., Saeidi, P., *According to Agency Theory and Neoclassical Theory; New Ownership and Diversity of Public Sector Companies in Corporate Life Cycle*. Advances in Mathematical Finance and Applications, 2018,3(1), P.1-16. (In Persian) DOI: 10.22034/amfa.2018.539131

[25] V. Kousenidis, D., *Earnings–returns relation in Greece: some evidence on the size effect and on the life-cycle hypothesis*. Managerial Finance. Technological Educational Institution of Thessa loniki. 2005,31(2), P. 24-54. https://doi.org/10.1108/03074350510769488

[26] Xu, B., *Life cycle effect on the value relevance of common risk factors*. Review of Accounting and Finance 2007,6(2), P. 162-175. https://doi.org/10.1108/14757700710750838

[27] Yilmazkuday, H., *Productivity Cycles in Public and Private Manufacturing Sectors: Evidence from Turkey*.International Journal of Applied Economics, 2009, 6(2), P. 21-40 http://dx.doi.org/10.2139/ssrn.1020061

[28] Zhai, J., Wang Y., *Accounting information quality, governance efficiency and capital investment choice*. China Journal of Accounting Research .2016,9(4), P. 251-266. https://doi.org/10.1016/j.cjar.2016.08.001