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DCA STRATEJİSİNİN BORSA İSTANBUL'DA UYGULANMASI

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ABBREVIATION LIST

BH	:	Buy-and-Hold
BIST	:	Istanbul Stock Exchange
CD	:	Certificate of Deposit
DA	:	Dollar Averaging
DCA	:	Dollar Cost Averaging
EMH	:	Efficient Market Hypothesis
FTSE	:	Financial Times Stock Exchange
GBM	:	Geometric Brownian Motion
IRR	:	Internal Rate Return
LS	:	Lump Sum
OPAC	:	Online Public Access Catalog
OR	:	Optimal Rebalancing
RI	:	Random Investment
VA	:	Value Averaging

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ABSTRACT

The aim of this study is to compare and contrast DCA, namely Dollar Cost Averaging, and LS, namely Lump Sum, strategies. In line with this aim, the study is divided into five main sections.

In the first section, the problem is introduced and the two strategies, DCA and LS are explained. The second section is the literature review part of the study, where the advantages and disadvantages of these two approaches are compared in terms of flexibility and timing of investment, expected yield and risk reduction and psychological aspects. In the third section research methodology is explained and then in the fourth section findings of the research is given. Finally the fifth section is conclusion, where the summary of the current study is given.

The literature review of this study, which contains in depth studies of scholars and practitioners, is a thorough study of the performance comparison of DCA and LS. Basically, DCA is based on purchasing stocks in equal installments and the remainder of the investment amount is put out at interest during the investment period. On the other hand LS strategy is based on purchasing stocks at a time during the investment period. In this context, DCA represents a common and helpful regular investment strategy for directors of mutual funds, personal investors, economic analysts, and pension planners. Academics and practitioners discuss the problem of DCA's performance efficiency. The DCA is defined as a plan for decreasing risk as a most frequently suggested investment strategy. The benefit was nevertheless stated as the cost of producing higher yields.

In this regard, in the research part of the study, 46 different stocks from BIST50 are analyzed for 234 variations of 5-year investment periods (from January 1995 to June 2019) in order to determine whether DCA or LS is a superior strategy. The evaluated outcomes are verified by using the Monte Carlo simulation.

In brief, a great majority of the analysis reveal that DCA is superior to LS for the defined investment period. However the differences are not significant. Furthermore, scientific trials demonstrate that the DCA approach precedes the risk reduction, but in terms of efficiency, it is inferior to the LS approach to obtain yield. Although the better results are provided through investments in less volatile assets, it is more appropriate to apply in contrast with LS to more risky investments. Ultimately, it can be said that neither DCA nor LS is superior to each other in terms of BIST50 stocks for the specified investment periods.

Keywords: Dollar Cost Averaging, Lump Sum, DCA, LS, BIST50

ÖZET

Bu çalışmanın amacı, Ortalama Dolar Maliyeti (DCA) ve Lump Sum (LS) stratejilerini karşılaştırmaktır. Bu amaç doğrultusunda çalışma beş ana bölüme ayrılmıştır.

Birinci bölümde, problem tanıtılmış ve söz konusu iki strateji, DCA ve LS, açıklanmıştır. Çalışmanın ikinci bölümü, bu iki yaklaşımın avantajlarının ve dezavantajlarının yatırımın esnekliği ve zamanlaması, beklenen verim, risk azaltma ve psikolojik yönler bakımından karşılaştırıldığı literatür taramasıdır. Üçüncü bölümde araştırma metodolojisi açıklanmış ve dördüncü bölümde araştırmanın bulguları ortaya koyulmuştur. Son olarak, beşinci bölüm, bu çalışmanın özetinin ortaya konulduğu sonuç bölümüdür.

Bilim insanlarının ve uygulayıcıların derinlemesine çalışmalarını içeren literatür taraması, DCA ve LS'nin performanslarının karşılaştırılmasına dair kapsamlı bir çalışmadır. Temel olarak, DCA eşit taksitler halinde hisse senedi alımına dayanmaktadır ve yatırım tutarının geri kalanı yatırım dönemi boyunca faize yatırılmaktadır. Öte yandan, LS stratejisi yatırım dönemi boyunca tek seferde hisse senedi alımına dayanmaktadır. Bu bağlamda, DCA yatırım fonu yöneticileri, kişisel yatırımcılar, analistler ve emeklilik planlamacıları için ortak ve faydalı bir düzenli yatırım stratejisini temsil etmektedir. Akademisyenler ve uygulayıcılar, DCA'nın performans verimliliği sorununu tartışmaktadır. DCA, en sık önerilen yatırım stratejisi olarak riski azaltmaya yönelik bir plan olarak tanımlanmaktadır. Bununla birlikte, faydası daha yüksek verim elde etmenin maliyeti olarak ifade edilmektedir.

Bu bağlamda, çalışmanın araştırma bölümünde, DCA ya da LS'den hangisinin diğerinden üstün bir strateji olduğunu belirlemek için BIST50'den 46 farklı hisse senedi, 5 yıllık yatırım dönemlerinin 234 farklı varyasyonu (Ocak 1995 - Haziran 2019) kullanılarak analiz edilmiştir. Elde edilen değerlendirme sonuçları Monte Carlo simülasyonu kullanılarak doğrulanmıştır.

Kısacası, analizin büyük bir çoğunluğu tanımlı yatırım dönemi için DCA'nın LS'den daha üstün olduğunu ortaya koymaktadır. Ancak, aralarındaki farklar anlamlı değildir. Ayrıca, bilimsel denemeler göstermektedir ki, DCA yaklaşımı risk azaltımından önce gelmektedir, ancak verim açısından ele alındığında kazanç elde etmek bakımından DCA yaklaşımı, LS yaklaşımından daha kötü performans göstermektedir. Daha az istikrarsız varlıklara yapılan yatırımlar ile daha iyi sonuçlar elde edilse de, LS ile karşılaştırıldığında DCA'ya daha riskli yatırımlar için başvurmak daha uygundur. Sonuç olarak, belirtilen yatırım süreleri için ne DCA'nın ne de LS'nin BIST50 hisse senetleri için üstün bir strateji olduğu söylenebilir.

Anahtar Kelimeler: Ortalama Dolar Maliyeti, Götürü, DCA, LS, BIST50

CHAPTER ONE
INTRODUCTION

1.1. OVERVIEW

Malkiel (1996) describes investment as a way of purchasing assets to earn profits with respect to reasonable, predictable income and recognition in the long run. Investment is based on the ability to predict the future for success as a gamble. (Malkiel, 1996:28) However, it is hard to determine the right time to invest according to the Special Report of ING (2005:1) "Timing the market does not work." According to numerous studies of previous thinkers, historical performance is unlikely to be repeated, and the financial market cannot be assumed. The market is more efficient and less predictable (Malkiel, 2003). The general answer, "buy low and sell high" is too essential to obey in the fluctuated markets. While investment diversification helps investors to eliminate unsystematic risk, they are unable to take market risks away. Investment consultants often have to define investment policies that recommend their customers the best asset distribution based on timing, capital size, and investors' different risk aversions.

Dollar Cost Averaging (referred to as DCA hereafter) represents a common and helpful regular investment strategy for directors of mutual funds and hedge funds, personal investors, economic analysts and pension planners in the long run. According to DCA, investors are allowed to invest regularly in shares in a set quantity of capital in order to avoid placing in large amounts of cash with upward-loaded shareholdings or selling them with sudden and even extended price panics shifts in the market inevitably. DCA is a conservative investment strategy regardless of market circumstances. The common notion is DCA is used for increasing yield and avoiding risk. If an investor invests 100$ every month for 5 years, he invests 6,000$ for that share. Instead, the entire sum of 6,000 USD can immediately be dipped in, the investment is left in place, and the yield on that investment can be calculated over 5

years. This approach is referred to as a Lump Sum (referred to as LS hereafter). Its benefit is that an individual can determine an optimum distribution of assets. However, market timing is essential for this strategy for choosing the right time because investors believe in buying at the lowest price and selling at the highest price. Thus, if an investor makes a mistiming the market that happens to buy at the high price and experience market drop right after the upfront investment (Chen, 2007). It might be the wrong time to invest (Leggio and Lien, 2001).

The investment for DCA has separated capital into smaller amounts that the investors periodically invest these fixed smaller amounts into shares at regular intervals. Therefore, the risk is eliminated since the prices are averaged out over time rather than fixed at a single price. (Weston, 1949) The yield is less affected by the fluctuations in prices, and investors do not need to wait the right time in order to buy low and sell high. The risk of a decrease in the market could be avoided following a LS investment. As a result of this, it is an effective strategy in hedging against regrets resulting from investing LS when the markets are high, and this is most preferred by risk-averse investors (Pye, 1971, Statman, 1995, Dubil, 2004, 2005)

Basically, from the point of view of a general risk-averse investor, the performance evaluation in the investment strategy is based on standard assumptions. It is hard to determine the timing of investment. It must, therefore, also be seen as one of the essential choices an investor makes (Abeysekera, Rosenbloom, 2000). It does not need to consider timing investment with a market performance for the investor using DCA as periodic investments are made in the same quantity of capital. If an investor decides to invest a significant amount of cash into the stock market, it is hard to determine which strategy need to be used; LS or DCA. Hence, it is crucial to understand the principles of DCA strategy by comparing it with LS.

1.2. HOW DOES DCA WORK?

DCA Strategy is a strategy recommended by professional advisors to procure equity securities. The strategy is based on regular investments of a fixed sum of capital to a share, bond, or mutual fund (Brennan, Li, Torous, 2005). Although DCA reduces the risk against price fluctuations, it requires discipline in the market. DCA enables investors to purchase a share at a price below the average price at the purchase date since the fixed dollar investments buy more shares at lower prices.

Basically, investors purchase a constant amount of a share, for instance, 500 USD every month. These investments may be at elevated rates, some at average rates and some at low rates. When buying at high rates, few shares will be earned, and many shares will be acquired for constant dollar value when purchasing at low rates. As a consequence, the bulk of shares bought at reduced rates were not bought at average prices but in weighted average rates.

Malkiel [4, p. 242) rightly states that the popular concept that a DCA can contribute to minimizing the danger of investing all assets in the market at an unsuitable moment. Accordingly, Latane states that DCA is a method used to benefit from ups and downs in shares. DCA avoids the danger of placing all your investment at the incorrect moment on the stock market. However, it is stated that it is crucial to stick with the plan. One of the keys to success is to purchase when the market is in depression. On the other hand, people try to sell when the market is down if people have the self-control, DCA helps them.

In order to understand DCA clearly, assume that there is a portfolio that 300 USD is committed for the beginning. In this instance, the prices of shares vary from 10 USD to 30 USD per share. In order to give a system a good test, let's begin with the average share price.

The 300 USD scheduled will purchase 15 shares for 20 USD per share during the first period. After that market began to rise to a cost per share of 25 USD at the end of the period, providing a value of 375 USD to 15 shares of the portfolio. According to

plan, another 300 USD will be invested in 12 shares of the share at 25 USD per share. The market continues to rise, and at the end of the period, 27 shares valued at 810 USD. We will buy 300 USD more for a 30 USD share and receive just 10 shares in return for our capital. Market turns from its peak at that point. Our 37 shares are worth 925 USD at the end of the third period, and our profit is just $25, even the market has reached its peak. However, the average dollar demand for its devotees remains unwavering, and therefore another 600 USD is being invested on the market at 25 USD per share, which adds 12 shares to the portfolio. Following that, prices continue to decline even further, reaching low 10 USD per share in the early seventh stage, with a massive loss of almost 1000 USD in the 1800 USD invested over the six running periods.

The crucial point is here. Suppose that, despite the decline, the investor still has another 600 USD and will receive 30 shares for his investment according to his plan. The market begins, first reaching 15 USD and then 20 USD per share and the price reaches its beginning price where the plan started. In eight periods, the investor set out a total of 2400 USD for 134 shares, for 20 USD per share of 2680 USD. At the end of the program, the average price reaches to 8.95 USD.

DCA is also regarded as a harmonic average of the share price. Below, the formula is given;

$$\text{DCA} = \frac{ns}{\frac{s}{p0}+\frac{s}{p1}+\frac{s}{p2}+\cdots+\frac{s}{pn}}$$ Where s is the dollar sum that is periodically invested.

1.3. THE PROBLEM OF DCA

Based on the various advantages, the DCA approach is one of the most common methods. It is also compared with LS strategy in many studies. However, there are a lot of disagreements about choosing DCA or LS. A lot of studies have been made about

the DCA based on comparison with LS. Due to the different and same conditions, a lot of academics have different opinions about the desirability of DCA. Furthermore, there is an increase in studies that criticize the strategy and defend it can be dominated by other investment strategies such as LS. Therefore, DCA Strategy needs to be investigated from the point of analytical summation by incorporating methodological problems, techniques of research, and theories extensively. In order to assist investors in making better investment choices, thorough research is needed to undertake a significant investigation into the DCA topic.

1.4. OUTLINE OF THE DISSERTATION

This study is prepared to ascertain the effectiveness of DCA in terms of two different perspectives. The nature, application, and performance of DCA must be obviously and thoroughly understood and crucial views summarized in the field. Furthermore, in this paper, DCA and LS will be tested in order to figure out which one is better.

Here are the questions to be discussed;

1) What are the views of scholars who support that DCA is better than LS, worse than LS or with mixed views?

2) Which studies are conducted theoretically or empirically in this field?

3) What are the opinions and outcomes against or in support of DCA?

4) How can the yield and risk of DCA be measured?

5) What are the best terms for investors to use DCA to allocate their assets between risky assets and risk-free assets best?

6) The effect of psychological protection, from the point of view of behavior finance?

7) What are the advantages and disadvantages of DCA when it is compared with LS?

8) How effective is DCA as a simple and most common investment strategy?

CHAPTER TWO
DCA AND LS

2.1. INTRODUCTION

Many studies have been carried out to examine DCA's efficiency by comparing alternative approaches such as LS, Value Averaging (referred to as VA hereafter), and a Buy-and-Hold (referred to as BH hereafter) investment strategies. However, there is a great deal of difference in this regard. Mainly there are different opinions about the desirability of DCA and LS. This chapter states the advantages and pitfalls about DCA which have been written before. The policy must then criticize the common literature on the ground to clarify the more profound assessment.

2.1.1. DCA as a sub-optimal investment strategy

The scholarly literature has declared that DCA is ineffective (Milevsky and Posner, 1999). Although the capacity of DCA to decrease investment risk is acknowledged, DCA has still been discussed in two proposals as an investment strategy that is sub-optimal (Constantinides, 1979). On the other hand, the annual yields of various DCA strategies have compared with LS. Hence, LS produced superior yields when it is compared to DCA for all time periods (Williams and Bacon, 1993). LS allows the funds invested in receiving more independent yields and gives more confidence to get the expected yield in the time horizon with lower variances, that's why LS is better than DCA (Rozeff, 1994).

2.1.2. DCA as an investment strategy with mixed opinions

In addition, the question of DCA performance has some mixed views. For instance, in contrast to domestic equity investments, DCA is tested by Atra and Mann (2001) on several international indices, suggesting that DCA may be a top strategy to

decide on when it is implemented. Accordingly, LS may be a superior approach to determine when applied.

2.1.3. DCA as an optimal strategy

DCA has an ability to reduce the risk as a benefit over LS and "The level of risk reduction depends on the length of the averaging relative to the total saving horizon" (Dubil, 2005). In addition, DCA might not be the same as a standard financial theory but should instead avoid "regrets" to investors (Statman, 1995). It undertones investors might use DCA to prevent the bad yield of all of their LS. Investors do choose not only the DCA strategy for behavioral rationality but also select a DCA strategy for retirement plans (Atra and Mann, 2001). Investors that retire as an alternative to benefit from ups and downs of the market while at the same moment lowering the danger of loss are also proposed to adopt the DCA policy.

2.2. THE ACADEMIC VIEWPOINT ON LS AND DCA

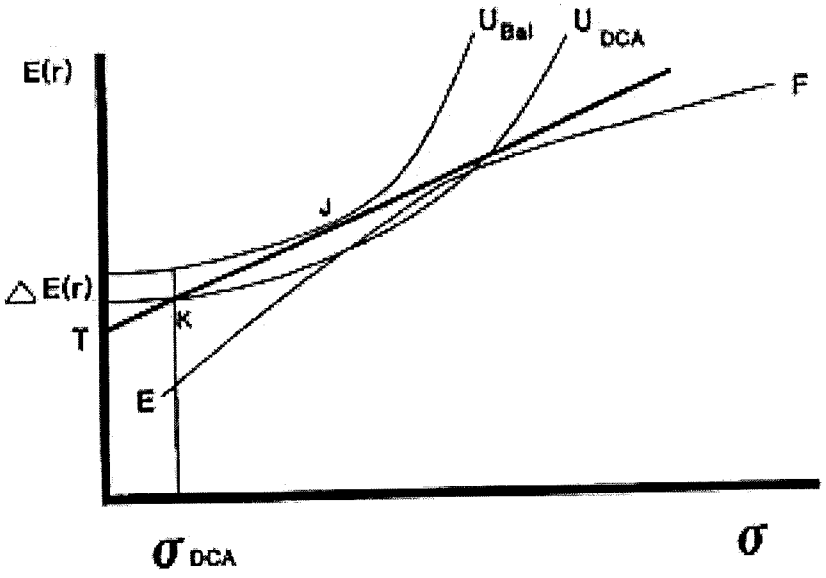
2.2.1. Literature asserting that LS precedes DCA

There are two qualifications with directly associated with DCA (Constantinides, 1976). In comparison to a sequential investment strategy that could be disrupted by a drastic decrease and investor psychological variables, Constantinides expresses his worries about the characteristics of DCA with time horizon as a non-sequential investment strategy. Constantinides defines DCA based on the composition of the wealth of investors. He demonstrates why DCA moves the central gamble into a series of smaller gambles to scatter risk. His assumptions are based on the underlying resources invested to an ideal regular market; investors are pricers, and there is no personal tax, and no transaction costs and maximizes their anticipated usefulness to avoid unnecessary DCA problems. Constantinides split DCA into two proposals to criticize the lower standard of investment policy with the use of the anticipated utility

function. First, he says that a sequential investment policy dominates DCA. It is irrespective of prospective information that "will not coincide with the optimal sequential policy at all future times" (1976). According to Constantinides, "an optimal inconsequential policy is invariant to the composition" (1976). In other respects, DCA is identified as a mixture of wealth. As a result, DCA is different than a set of policies, which is called "gradual policies." If an investment policy is defined as "gradual," the transition from one portfolio to another is accomplished is more than one stage. Pye proved that the optimal inconsequential policy is not gradual; the investor just adjusts his portfolio composition only at the beginning and end of the period. It is similar to DCA, but the primary reason for the confusion is that DCA policies are usually but not necessarily progressive policies.

The DCA investment approach is contrasted with the Optimal Rebalancing (OR) and Buy-and-Hold (BH) strategies (Knight and Mandell, 1993). This document was intended to declare that DCA's best-known advantages are rejected; increase yields by purchased shares with reduced prices and prevent an uneventful timing of the LS investment. They supposed that shareholders have an original volume of wealth invested into the underlying riskless investments and understand the equilibrium for optimized utilities between hazardous and riskless investments, fifty-fifty. First of all, it has been found that DCA's policy is experiencing losses in utility compared to the OR strategy, exemplified by the visual assessment that ignores the risk aversion of investors.

Figure 2.1. Knight and Mandell (1993)



Second, by using the Monte Carlo simulation, Knight and Mandell compare the equivalent wealth differentiation and the equal yield on certainties between the three strategies. The Wiener process is also established in terms of both risky and risk-free assets as a utility function pattern based on Merton theory (1969)(Knight and Mandell, 1993). Afterward, the expected utility of wealth is evaluated by 500 drawings of the New York Stock Exchange information, for investors with different degrees of risk-aversion. Knight and Mandell, therefore, argued that among the three strategies, the DCA results are "consistently and significantly" less the other two (Knight and Mandell,1993: 57). The performance of the approach will also be measured with high, moderate, and low-risk aversion levels of the monthly yields from 1962 to 1992 of S&P 500 and Treasury Bills. As a result of this researched, it is stated that "yielded the smallest annualized yield and mean utility" (Knight and Mandell, 1993:59). Furthermore, the cost of the transaction is presumed to be reduced by more investment and to be boosted by the increase in investment frequency. It is therefore assumed that

more expenses are added to DCA relative to other investment approaches, thereby exacerbating DCA's efficiency. Knight and Mandell (1993) concluded that DCA is a strongly underserved investment strategy, in comparison with OR and BH policies, based on their theoretical statements and numerical assessment.

As expressly stated, the idea of "Those who hesitate, lose," claims that the dollar average is dominated by the investment policy of the LS or spreads risky investment in time (Rozeff, 1994). There are some objections to particular literature on investment, which states that the dollar average reduces the variance without compromising on yields (Smith, Proffitt and Stephens 1992, Black and Scholes 1974). The stock market is seen as having a favorable anticipated risk premium, meaning that the market has been steadily rising. Rozeff compares two investment strategies to approve these arguments against DCA. Rozeff used a generalized example of two phases and other T periods, supposing that the yields of two approaches follow a random pattern of walking and usually are multivariate in this study. Hence, he provided hypothetical illustrations with regards to variance and mean yields (expected terminal yields) by using the classic mean-variance approach of Markovitz (1959). First of all, equivalent investment in DCA and LS produces uneven yields that as an assumption, DCA has less expected terminal wealth than LS, but less risky (namely, lower standard deviation). Secondly, proper risk adaptation leads to a "clear and fair comparison" by reducing the level of risky assets invested in the LS approach. The LS and DCA adjustments result in a higher standard deviation of the Dollar Averaging (referred to as DA hereafter) strategy by equalizing the yields. Similarly, LS strategy provides greater expected terminal wealth if standard deviation adjusted. Furthermore, Rozeff applied real data of monthly S&P 500 Index and the portfolio of a small firm from 1926 to 1990 in order to test his results by computational simulation. For comparison, DCA and LS yields, and standard deviations over intervals, ratios between them and Z statistics have been calculated that indicate LS's risk-adjustment policy outperforms the DCA policy. According to these outcomes, DCA is not as good as LS when compared with the inefficient mean-variance, which reduces the yields of investments

on risky assets by the weaker reassurance that the expected yield will be achieved with the lower variance.

The efficacy of DCA was also examined by Thorley (1994). The conventional wisdom that investors may benefit from the DCA strategy is questioned, provided that the risk of investment is decreased in an unexpected way and the yields are increased by lower share average costs in contrast with the average prices. First and foremost, a concise mathematical instance shows the misconception of the second point. It is probable but not certain that there is a lower average cost, and "DCA performs well under a seemingly plausible but irrelevant criterion" (Thorley, 1994: 139). The most critical value for investors is the final yield rather than a contingent calculation for investors who can simply clear their accounts at present rates based on the average historical costs for their shares. Secondly, Thorley's study of the average dollar includes both the DCA and VA with less anticipated yields and greater risk compared to the BH strategy for the benchmark. According to his assertion, a completely random or effective market is examined in order to calculate the yield from the investment capital by IRR (Internal Rate Return) and to ignore the yield on non-invested capital using the initial figures from S&P 500 Index and Treasury bill for the era 1926-1991 and from the 1992 yearbook of the Ibbotson Associates. Furthermore, the scenario of periodic price adjustments such as share prices with average reversal and price change dynamics on brief horizons is regarded based on the preceding proof. As a result, the averaging policy is still not as good as the benchmark. Moreover, Thorley has assessed steady yield rates, unbiased estimation of future yields, risk, adapted portfolio risks, and strategic beta on age, arithmetic mean, standard deviation, beta, Sharpe Measure, and Treynor Measurement on the basis of 66 historical evidence of DCA yields. The research is concluded as "DCA has no value and may actually be harmful as an investment strategy" (Thorley, 1994: 142).

The investment performances are also examined by Marshall (2000) according to three different investment strategies: VA (Value Averaging), DCA (Dollar Cost Averaging) and RI (Random Investment), by using IRR (Internal Rate of Return). They

also pointed out that EMH (Efficient Market Hypothesis) is not possible to use with DCA and other purely mechanical methods because investors could initiate investment techniques at various inventory price concentrations and the advantages of the technologies should disappear as more and more investors are using the appropriate technical method. First of all, with presumed increasing, decreasing and fluctuating inventory price patterns in time, Marshall given statistical comparisons of averaging rates, average expenses and IRRs between DCA and VA. In spite of VA having a reduced average share price and greater IRR than DCA, Marshall stated that it was inadequate to demonstrate advantageous performance over DCA due to greater terminal yield on investment and related risk. In the second place, he continued the tripartite comparison among the approaches, using 500 investment results simulations over time to analyze the average yield and normal IRR and F-Test deviation, in order to check variation between IRRs, assuming that transaction and taxes were overlooked. For the time frame from 1 January 1966 to the 31 March 1989, randomly chosen information were used for the S&P 500 index variation with a five (20 quarter) investment time period. Therefore, he investigated that the VA's performance predominated in DCA and RI, all thirteen tests, with 73,5% of all simulations without "statistically significant risk difference" (2000,97) among the three techniques. In addition, DCA works similarly with RI in relation to prior studies carried out by Marshall and Baldwin in 1994. Finally, he did a final test on the basis of past evidence rather than on theoretical analyses, and found VA produced higher IRRs compared with DCA and RI for the entire period, ignored temporary investment yields and the inherent decrease in the risk of a currency market fund. Therefore, Marshall concluded that VA exceeds DCA and RI, without further risk and in higher anticipated yields.

Heretofore, many studies examined the effectiveness of DCA in the stock market. There is not any study that focuses on the performance of DCA in the bond market. However, Bacon (1997) examined the performance of DCA in the bond market by applying DCA to both Treasury bonds and corporate bonds for the period 1926-1995 and concludes that DCA is unlikely to perform better than LS for all averaging

periods. The conclusion follows the assumption that the funds for DCA investment are initially invested in T-bills and shifted to bonds gradually in a fixed amount. According to the annual holding period return (AHPR), LS strategy is found to be better than DCA strategy for all averaging periods of 12, 6, and 3 months (table 2.28). This may due to the high opportunity cost related to those un-invested funds in T-bills. It is also stated that the shorter the averaging period, namely the less the number of the installments, the higher is the annualized yield. That means, "The sooner the investor is fully invested in long-term bonds, the higher is the annual yield" (p.80). Bacon et al. (1997) also point out that although DCA can reduce risk, it is still not efficient since it has lower Sharpe Index compared to LS, which indicates its inferior risk-adjusted performance. Thus, DCA is still inferior to LS even after adjusting for risk. They further compare DCA strategy with 50:50 BH strategy in terms of annualized yield, standard deviation, and Sharpe index (table 2.29). The results show that the BH strategy has a higher Sharpe Index and lower risk than DCA. The BH approach, therefore, can be considered an alternative to DCA for investors who find LS approach unpleasant. In the end, while DCA is agreed to decrease risk and anxiety among investors, small to medium risk-averse investors are generalized to invest at the earliest possible moment.

By comparing VA, Chen and Estes (2007) also examined the efficiency of DCA. First, the changes in normal yield variation are observed to be different from the standard deviation in terminal values with regard to the modifications in time horizon. Instead of infeasible returns, dollar returns were implemented. Secondly, in their research, Monte Carlo simulations are used for evaluating DCA efficiency on the basis of monthly historical data consisting of treasury bills and the S&P 500 Index over a period of 70 years. Moreover, the years 1950-80 were involved to cover the wars in Korea and Vietnam and the global oil shocks. As a consequence, DCA has overtaken the VA approach by lowering its growth target rates by 8 percent. Besides, their data have revealed that VA is better than DCA, even without capital reserves, investing a greater terminal value. Following, they maintained the effectiveness in regard to aggregate levels of risk and claimed that "at an annual growth target of 12 percent the

total risk from the VA strategy is still lower than that from the DCA strategy". Chen and Estes also indicate that the DCA approach is underperforming than the LS approach based on studies through pension plans for shareholders with annual growth rates exceeding 8% and below 12%.

2.2.2. Literature that has mixed opinions about DCA and LS

The dollar averaging for mini-max strategies are addressed. According to Pye, one important impact of the dollar averaging is to address the uncertainty. Theoretically, by examining sequential strategies and sequential policies using comparative formulations, he evaluated the dollar averaging investment approach. The assumption was that there was some capital to be invested in shares at certain intervals and the share prices would follow an arithmetical random path. Pye says hedging from great regret or loss of opportunity. He maintained dollar averaging's psychological advantages with regard to the effects of a regret criterion on the decision-making process for private investments, but he stressed that the approach lacked a "hedging against negative results". Using a variety of formulations, Pye shows that "Dollar averages are non-sequential mini-max policies", which are independent of share prices if there are the same opportunities for the most significant price fluctuations, both negative and positive. Indeed, Pye dissatisfies the dollar averaging's capacity to maximize the anticipated utility of "a purely concave utility function" as a non-sequential investment approach, based on the arithmetic random walk assumption.

The Monte Carlo Model for simulation was used by Abeysekera and Rosenbloom (2000) as an advanced investment strategy between LS and DCA approaches for the investor to find the exceptional one. This study aimed very clearly at proving that the choice of DCA-LS strategies should be based on the distributional properties of the investor's expected outcome at the initial investment moment. First, share price movements and riskless interest rates are modeled on a lognormal distribution. Data from the S&P 500 Index monthly returns from 1926 to 1997 and

from the Treasury bill rate from 1934 to 1998 were used for the simulation as proxies. They presumed that an original amount of capital was needed to be invested. T-bill rates pursued random increases over a period of one year ; monthly stock market returns were independent; lognormal distribution was continuous with parameters that were consistent, and share yields anticipated surpassing the risk-free rate. A 1000-fold simulation was conducted to estimate the terminal value distributions and the differences between LS and DCA strategies. In order to determine the relative frequency of LS outperforming DCA and the difference in percent between LS and DCA strategies in the model of simulation, they paid regard to various scenarios, taking account of different initial risk-free rates and distinct expected security yields. Therefore, they found that in most of the strategy, especially the low volatility assets, DCA would have underperformed LS. They argued that the opportunities for the LS strategy to outperform the DCA strategy decreased with increased volatility. They also say that, compared to the DCA approach, there is greater risk with the LS investment approach, even though the average yield is higher. With regard to their empirical illustration and evaluation of simulation, they found it difficult to say that one approach is preferable to the other. Both strategies have virtues and drawbacks. The choice between the two approaches must therefore be based on reward/risk tradeoffs from the investor's own views, although with less risk LS produces greater yields.

To provide further understanding, Atra and Mann have studied the controversy between the DCA and LS strategies from a performance measurement point of view for distinct time periods. It is observed that the returns on investment policies are hard to compare based on the different timing of the invested funds. In response to this issue and in accordance with the idea of Sharpe (1994), they therefore implemented a portfolio that consists of capital borrowed at risk-free and invested in risky securities and which makes possible the comparison of strategies based on reward and risk. They assumed that the remaining DCA money was temporarily invested in risk-free asset and assumed that the DCA and LS strategies were financed fully from borrowed funds in terms of self-financing portfolios, notwithstanding transaction costs or fiscal taxes.

The investigation was based on historical statistical data from Morgan Stanley Capital International's total monthly yield for a range of global indexes 1970 through 1988, and on risk-free rates estimated with U.S. 90-day Treasury bill rates. First of all, it is observed that DCA yields slightly higher than LS, although not essential in respect of the results of the full sample. Second, they reaffirm the existential "good season" and "poor season" for distinct investment strategies by replicating their 29 times monthly yield outcomes. They stated that the best period for LS is in October to January, and that November and December represent an important time frame for original investments by LS, while February to September represent the best time for DCA and May and June is the most successful time frame for DCA. In addition, Atra and Mann (2006) introduced a risk-adjusted Sharpe ratio for identification of the more desirable approach. Barely, they have discovered that DCA generates greater yields and greater risks as not conforming to the traditional wisdom. Furthermore, all international indices show a similar tendency with the concept of seasonality, and the US market is least susceptible to using an alternative strategy. Using all of the empirical illustrations and analyzes, they deduced that DCA investing does not present benefits in terms of rewards / risks and that the preferences between LS and DCA strategies should include seasonal stock market timing patterns.

LegGio and Lien (2001) have examined the relationship between DCA strategy and investor aversion preferences from the point of view of the Statman (1995) behavioral rationale by comparing them to the following alternative investment strategies: LS (Lump Sum), BH (Buy-and-Hold), and VA (Value Averaging). Data from the monthly yields for the period 1970–1999 were derived for empirical research from Ibbotson and Sinquefeld (2000) including: large company shares (S&P 500 Composite) and small business shares of Ibbotson and risk-free assets: US T-Bills for DCA funds that have not been invested. As an alternative to the theory of expected utility that assessed the decision-making from the perspective of a risk-aversion to the overall investment wealth, Markowitz (1952) suggested that the decision-making process should be evaluated in terms of the prospective losses and profits by using S-

shaped value-functions (curve is convex for losses and concave for profits). Leggio and Lien presumed the same relative risk aversion for investors as Markowitz, and the funds available for investment had been determined to be available within an investment period of one year. Their results from 30 observations showed that, regardless of the underlying asset, the average surplus yield for DCA is always under the mean surplus yield for LS investing. In addition, the mean-variance inefficiency of DCA was indicated. Results from their studies have shown that higher average portfolio yields and lower standard deviation of BH than DCA contradict the property of the expected utility function, which is that the higher the yields, the riskier the investment. In the same way, by using the S-shaped utility function, LS and BH generated greater value functions than DCA for the shares of both big and small firms. DCAs were analyzed as being sub-optimal to LS, particularly for shares of smaller firms with greater volatility, in terms of the p-value and Sharpe ratio. In the final analyses, the investor's utility for assets that are volatile relatively, such as the small capitalization share, was the minimum for a DCA investment strategy and was lower than all investment strategies, except value averaging of large capitalization shares.

The objective is to evaluate DCA strategy efficiency against alternative investment strategies such as LS and the VA in Leggio and Lien (2003). In the study, the criterion is that the more the ratio, the greater the investment outcome for carrying risk. As the only investment risk actions were not satisfied with the Sharpe ratio, the risk-adjusted rules were taken into consideration: the Sortino ratio and the Upside Potential Ratio (UPR) as alternative instruments. The point is that Sharpe was an inappropriate measure, since the normal yield curve shows not only positive but also negative variations from the mean, which is the surplus yield for the standard deviation per unit. They argued that the real risk for investors is that the deviations from the negative average not the deviations from the positive average. Therefore, the Sortino ratio was utilized which relates to the "downside risk" irrespective of the upside potential risk by positive surplus yield measures, by excessive yield measures. Investors are expected to have a fixed amount of capital at their disposal, originally

within a one-year period. DCA's remaining capital has to be invested in the United States T-bills and its investment portfolios have consolidated risky capital assets and risk-free assets: big firm shares (S&P shares combined), small firm shares of Ibbotson, long term bonds of government and corporates. Their study on DCA was focused on the empirical test based on historical data and the alternative approaches. They used the monthly return information from the Ibbotson Associates Valuation Edition 2000 Yearbook for the two periods 1926-1999 and 1970-1999 respectively. The statistical analysis showed that the Sharpe ratio ranking findings contradict the Sortino ratio and UPR. With this results, they decided that DCA is not optimal with the Sharpe ratio and DCA is even lower with more precision performance measures: the UPR and the Sortino ratio.

The article of Milevsky and Posner (2001) aimed to model the distribution of investment funds among risk-free and risky assets on the basis of the Geometric Brownian Motion (GBM), and to shape the ongoing financial response to Statman's (1995) comprehensive behavioral theory and DCA performance analysis as opposed to the LS strategy. Their primary concern was not to compare two investment strategies but to explain that using a DCA policy is like purchasing an Asia-based arithmetic option with zero strike that act as a popular derivative to the core security. The beginning of the illustration was to establish the GBM design, which contributed to the stochastic value of DCA portfolios and permitted the use of stochastic computing techniques. They suppose an original quantity of capital assets and interest gained from each section of assets that have not been invested (that can also be zero), which will reinvest with a time adjustment in the underlying share. In summary, the stochastic dollar-cost average payoff end-of-period was similar to the stochastic payoff for a zero strike Asian arithmetic calling option. They reiterated that this identity implies a sound person would not be able to distinguish between the average cost of dollars and the purchase of the zero-strike arithmetic Asian call option. In addition, the expected conditional outcome of DCA against LS was analyzed, assuming that the ultimate fixed value of the underlying security was known, which is still strongly dependent on the

track and in the stochastic process. Unlike GBM the instrument is used to examine the conditional anticipated pay-off from DCA by means of a conventional Brownian bridge that is steady at both ends. In fact, in terms of anticipated value and standard deviation as opposed to the BH portfolio, DCA strategy's mean variances are examined through continuous financing through the use of numerical examples and Sharpe ratio risk-adjusted analyses. Their research has summed up the fact that the DCA with certain volatilities has higher conditional anticipated value than the LS which benefits from higher volatility levels, maintaining its stochastically dominated position within the mean-variable framework of the DCA approach. In addition, the authors put an emphasis on the consistency between the conditional expectations and behavioral explanation.

2.2.3. Literature that states DCA precedes LS

The study of Wilson (1961) on the accelerated dollar average is based on the work of William T. Morris (1959) to purchase a policy to expand his abbreviated treatment so that it fits the nature of a dynamic programming problem more closely. In his article Wilson formulates an average dollar feature, provided that particular units of shares are needed within a certain price range during a limited period of the investment period. The study is that the DA is considered to be a kind of price which prevails at the time and the purchasing is also assumed to operate until the cost of purchasing is lower than in a purchasing unit strategy per period (overall units / time periods). In this regard, Wilson says that the simple DA is ideal for the latter as they make real purchase prices more sensitive for any period. Thus Wilson had assumed that the accelerated DA would make purchases more price-sensitive than the simple DA at any given interval, simplifying the reduction of the average investment cost. It is evaluated that the accelerated DA precedes the simple alternative DA and a strategy of purchasing fixed units. He finalized that a puzzle had been suggested about the date on which the anticipated cost could be low. Based on the outcomes of the features, the

study of accelerated DA is more in line with the attributes of a dynamic programming problem.

Statman sees the psychological advantages of the DCA approach from an irrational investor perspective, based on several prior studies by scholars and professionals, through a comparison of its investment strategy with LS. Statman (1995) builds two frameworks for investment in normal standard financing and behavioral finance. The previous context, which includes the expected returns theory, is identified as positive theory and is influenced by the interactions of financial markets and individual investors. The latter, which has to do with the DCA approach, is the predominant topic of the research regarding the inconsistency between the implementation of DCA and the financial market predictions. Statman analysis can be handled on four dimensions; theory of prospects, aversion to regret, cognitive mistakes and self-control from both conventional and behavioral investors' viewpoint. First, they show DCA's performance numerically, by means of the standard utility and prospect function theory proposed by Markowitz (1952) and Kahneman and Tversky (1979). In view of its impact on investment decision-making, they mention that DCA's investment framework is important and advantageous over LS, though they have been recognized by Constantinides (1979) as "confusing". Secondly, with regard to the potential for priding and regretting investments, Constantinides emphasizes that DCA policy has the capacity to reduce investment responsibility. Based on the divergence with Constantinides (1979), which overlooked new information for investments in DCA strategy's sub-optimality, he argued that DCA had advantages in combating gaps in self-control as cognitive mistakes, and that influence investors to stop investing. Statman emphasized the consistency between DCA and behavioral financials according to every assessment and argument, and confirmed his persistence in the DCA approach, although he acknowledges its inferiority for a fully rational investor in standard financial environment.

Despite the fact that many studies have evaluated the performance of DCA at the end of its investment horizon, the exposure to loss of DCA during the investment

horizon has never been investigated. Trainor (2005) examines the within horizon exposure to loss of both DCA and LS by using the statistic known as "first-passage-time probability." He develops that if the averaging period of DCA is more than three years, DCA can "significantly reduce the probability, magnitude, and duration of enduring a large loss anytime within the investment horizon" (p.320). Trainor argues that within-horizon risk is exceptionally relevant for the decision-making and significant especially to the investors with minimum loss thresholds, possible needs for interim withdrawal, changes in asset allocations, and/or a possible change in retirement date or investment time horizon. It can also be pointed out that the within-horizon risk is at least as considerable as the end-of-horizon risk. Furthermore, it increases when the time horizon increases, which is opposite to the end-of-horizon risk that decreases when the time increases. Firstly, the end-of-horizon and within-horizon probability of losses of DCA and LS are calculated by simulating 100% share, 50/50 share/bond and 100% bond portfolios in the US market with 1-year investment horizon. The results show that the within-horizon risk is significantly more considerable than the end-of-horizon risk for both policies, and DCA has lower risks for both types of risk. Moreover, since the portfolio with a high proportion of shares has little risk of significant loss, DCA is not recommended for the investors investing in more than 50% in bonds for the purpose of risk reduction but remains a good strategy for portfolios with a high proportion in bonds. In addition, the investment horizons are extended to 5, 10, and 20 years, and LS strategy is compared with DCA strategy with 1, 3, and 5-year average period. The results are proof that DCA still faces a lower probability of losses for both within- and end-of-horizons than LS. It is also interesting to find that the longer the averaging, the lower the within-horizon probability of losses. Furthermore, Trainor compares DCA and LS strategy for a $100,000 investment in risky asset conditional on 10% expected yield and 20% standard deviation (Table 2.3). As a result, the DCA strategy would sacrifice anticipated yield, and the amount of the sacrifice increases with the averaging period. However, as findings of Dubil (2004), DCA does offer advantages in risk reduction since the conditional expected shortfall

("the mean shortfall conditional on the occurrence of the shortfall" p. 328) of DCA is smaller relative to LS, though this advantage reduces with longer investment horizons. The expected time of enduring a shortfall is also found to be vitally important reduced by using DCA. For a 10-year horizon, a 5-year DCA strategy can decrease the within-horizon probability of shortfall by more than 30%; the conditional mean expected deficiency by 45% and the scheduled time of enduring a loss by around 50%.

Dubil (2005) studied the substantial risk decrease of the investment strategy DCA, which spreads the assets over time automatically by comparing the LS policy, which puts some funds at the forefront. It will investigate the better long-term distribution of assets, such as the underlying shares, bonds, mutual funds or CDs (Certificates of Deposits). With regard to individuals who may fail to fulfill their investment objectives, Dubil not only examines the average and standard variations in yields, but also the probability of deficit and the conditional expectation of the deficit. First, the yield criteria for DCA are approached by Dubil in the light of just one share, which shows that the only way to calculate the expected yield and volatility probabilistic is, because share price predictions cannot be implemented. He highlights the psychological benefits of DCA policies that prevent investors from behavioral bias. Dubil's arguments are based on the research of Kahnemann and Tversky (1979) regarding shareholders, which asserts that their investment performance standards are unstable and they are both unreasonable and loss averse. In instances with low risk, he prefers 'buy all up front' and promotes DCA, as the rational optimal strategies for high risk instances. The absolute value of the standard deviation of the terminal amount is the relative certainty regarding the yields in consideration of the risk metrics of him. The smaller the ratio, the reduced the danger, and the vice versa. Second, in observing Asian options, Dubil demonstrates DCA's damping effect on option values by means of derived formulas for volatility and compares volatility between mean and underlying proportions for various average times and maturity periods. In his paper Dubil uses the Monte-Carlo stimulation to compare DCA strategy with a one-time plan for both shorter- and longer-term horizons, different yields, and various yearly volatility

scenarios. Consequently, this enables the DCA to reduce risk in risky investments more effectively. The leveraged upfront strategy yields higher than the DCA, but the increased risk are not worth that. In short, according to him, LS promotes low-risk capital for long-term investors, and DCA offers substantial benefits for lowering the risk of underlying high-risk assets.

There are literature and economic businesses supporting DCA and this is considered primarily a strategy for long-term development, for example, for pension plans, which is efficient, easy and simple. DCA is often recommended as a pension investment routine for many experts. The DCA strategy is regarded one of the strategy to accumulate and encouraged investors to use it in conjunction with the Tachino and Woerheide (2005)'s BH approach for equities investment. DCA is said to be advantageous for not be affected by market timing efforts as one in ten suggested pension investment approaches. In addition, in Flex-funds (2007), it was described as a better approach to build wealth by providing frequent donations, as compared with LS annual contributions, such as purchasing at rates greater than average, obtained at the incorrect moment. Annuity Advantage (2003) recommended that DCA recommend pensioners to manage pension plan for a long term proposal because of the

atmosphere of uncertainty on the financial market. As it has been mentioned, DCA offers automatic services irrespective of the fluctuation in share price, although not guaranteeing a favorable yield or risk reduction. Moreover, in comparison to DCA, it is suggested that LS is more suited for conservative investment to safeguard saving while enabling it to grow in increasing and falling stock markets, whereas, it was stated that LS is more appropriate for conservative investment (Sun Life Financial, 2005).

2.3. CONSIDERABLE CRITICISM IN THIS FIELD

Over such a long time, academic researchers and financial experts have investigated and discussed DCA. All criticisms of the DCA strategy literature seemingly cannot be included here. It is therefore decided to restrict the decision to use

analytical methodologies to choose critical points from those articles as the main element of this article. Many studies have been analyzed in view of historical market performance, empirical and theoretical models. There are three different points of view in the literature: LS precedes DCA, DCA precedes LS and mixed options about LS and DCA. Once the items have been categorized according to their criticisms, research is carried out on a view-by-view basis.

2.2.3. Literature that states LS precedes DCA

2.3.1.1. Expected Yield and Risk Reduction

Results from the Knight and Mandell (1993) research show that, as compared to the other approaches, the higher is the degree of risk aversion, the comparatively reduced the DCA yields. This implies that the DCA promotes more riskless assets. Their study offers logical and explicit reasons for DCA's underperformance of the Buys and Hold's (BH) approach and Optimal Rebalancing (OR) approach including graphical testing, numerical simulation and empirical real-world data testing. Their research takes investors with different levels of risk aversion into consideration. However, the article also contains a few shortcomings. First of all the sub-optimality of DCA from yields and risk prevention is maintained in two ways, but their conversations focus only on anticipated yields and averaging mean annualized returns, leaving aside the standard deviation. On the other hand, the benefit of our strategy is fully on the premise that investors can optimize their utility by knowing the best allocations for assets. In the practical world, it is certainly not reliable.

Scherer and Ebertz (2003) rejected the argument that cost averaging is beneficial in the very fluctuating industry. They present us with mathematically theoretical price averaging statements without comparing them with other investment approaches. They provide extra insights into the performance assessment from the perspective of Asset Prize Theory as one of the scientists who identified the suboptimal value for cost averaging. Nevertheless, they refute most common research on cost

averaging measurement in statistical risk measures and utility functions, which do not have adequate argument to persuade them. The strategy also applies to demonstrate and evaluate the inferiority of the cost averaging. As a consequence, they draw their findings on raw, statistically unsatisfactory statements.

According to a comparison, the relationship between frequency of DCA policy and its outputs is found by William and Bacon (1994), which is that the DCA's average annualized outputs is unreasonable in relation to the number of DCA payments, and the sooner to invest, the higher the yield realized. Faced with the issue of selecting a more significant investment strategy by economic players, their research statistically examines the efficacy and specific evaluation of the multiple DCA and LS investment approaches. For example, throughout the multiple investment interval, they compare three distinct DCA approaches with LS. However, the shortest time interval is 1970-91, that is 22 years. The findings are based solely on a prolonged period, which does not concentrate their performance on a shorter period for 1-5 years. In addition, their performance is based on the bull market in the 1980s for a monthly yield comparison of one year. It only implies, therefore, that LS can be superior to DCA in the upstream market rather than in the downstream market.

Chen and Estes (2007) say that, without any concern about the LS strategy, DCA is better for investors with a low annual growth target rate, than below 8%, or a high annual level that exceeds 12%. They provide empirical performance comparisons for DCA and VA focusing on averaging investment strategies. Furthermore, the importance of terminal yields as a precise metric has also been expressed in terms of risk-reward trade-off comparison. They claim that DCA falls below the VA approach in the eye of investors in the context of pension plans.

2.3.1.2. Flexibility and Timing of Investment

By assuming the stock market as whole, Constantinides (1976) criticizes DCA, as DCA is unable to add new market information to decision-making, is dominated by

a sequential, optimally and non-sequentially-optimized investment policy by using the utility function model. In the field of research cited by countless academics, his strict statements on the sub-optimality of DCA investment strategy are prevailing in proving the low efficiency of DCA. Initially, Constantinides clarified the nature of DCA as an investment policy related to the planning horizon and contrasted it against both investment strategies, which are frequently and constantly re-equalized. He concludes by getting one step ahead of Pye's (1971) study of the optimal development of progressive strategies, which states the relationship that DCA has with progressive strategies and does not underline any progressive policy as suboptimal as DCA.

As Rozeff (1994) claims to invest immediately, LS policy precedes DCA . If not, the spread of investment would suffer a performance penalty compared to the immediate risky investment in assets. The research evaluates the efficacy of DA and LS at various time periods, in particular with the right adaptation of risk between the two approaches. However, it is only partially convincing because, as presumed, it concentrates solely on the booming market but not on both downward and upward market trends. He mentions DCA's advantage in preventing all dollars from being invested inappropriately. Rozeff does not, however, accept that DCA in this scenario is not inferior to LS.

2.3.1.3. Misconception about the Advantages of DCA

From the viewpoint of Thorley (1994), the overarching concept that DCA yields greater investment return than LS is misleading entirely. First of all, Thorley maintains, on the grounds of historical proof from 1926 to 1991, that DCA does not have a value that is exclusively based on a 66-year long-term observation and assuming that there is no yield on the non-invested resources of DCA. However, in real world actually, the waiting investment funds are always invested to accumulate interest through T-bills. Second, not only the present share price, but also the all shares owned value is a determining factor for the final value of the investment. Thorley emphasizes the

historically significant role of average costs and ignores the impact of reduced average costs, which increases the amount of shares acquired. His opinion is therefore partial. He also mentioned that the DCA policy is cheating salary earners and disrupting their monthly saving plan in his conclusion. The argument is subjective and untrustworthy. However, according to Thorley, the study conducted by the author shows the slightly worse performance of DCA, which also considers the scenario of both efficient and inefficient market.

Marshall (2000) remarks that a lower average cost investment technique is less essential than another because the expected yields and the associated risk avoided are not so significant that this is contrary to Greenhut's (2006) study on lower-cost numerical illusion of DCA. It offers statistical analysis between Value Averaging (VA), Dollar-cost Averaging (DCA), and Random Investment (RI) without direct comparison between DCA and LS. Though DCA is shown to be worse than VA in yield expectations using IRR, it has indiscriminately been stated that there is no statistical distinction in anticipated yield or risk avoidance between DCA and random investment methods.

2.3.2. Literature that has mixed opinions about DCA and LS

2.3.2.1. Expected Yield and Risk Reduction

Assuming that the anticipated yield rate exceeds the risk-free rate, Abeysekera and Rosenbloom (2000), insist on DCA's sub-optimality of reduced share returns in the upside stock market; but, they highlight DCA's reduced standard deviation in risk reduction impact. They also argue that the outcome of comparisons between investment strategies depends on the opinions of investors. Their main research methodology is the simulation model of Monte Carlo. They also address the characteristics of a simulation that is flexible and can be readily adapted to be applied and can provide a "full image" of investment results in several replications. The results of the LS strategy and DCA strategy are measured on the basis of historical evidence taking the distributional properties into account. It's no surprise that Leggio and Lien

(2001, in Spanish) defend LS a superior investment strategy for DCA and are one of the promoters that acknowledge the sub-optimality of DCA as an investment policy. Moreover, the view that LS produces greater average surplus yields is equivalent to that of Rozeff (1994), who claims to be misinterpreted with the DCA investment using Markowitz's classical mean variance strategy (1959). They provide an explicit empirical examination, based on Statman's behavior and historical proof, except for the easy illustrations of the four asset choice: Dollar Cost Averaging (DCA), Lump-Sum (LS), Buy-and-Hold (BH) and Value Averaging (VA). They take into account investment measurements concerning the aversion of shareholders by comparing the expected utility function to the concept of value function of the Prospect Theory. They call for trials with greater and lower volatility from the perspective of the used data, covering the fundamental assets. They also take "anomalous situations" into account, such as the January effect.

Moreover, since many surveys analyze DCA investment policy efficiency from expected return and standard deviation, academics also carried out studies perform through a number of risk-adjusted yield measurements, as was the case in Leggio and Lien (2003). They indicate that the popular Sharpe ratio provides the result of the reserve ranking compared to the more accurate Sortino ratio and the UPR (Upside Potential Ratio). The results of the experiment reveal that DCA is the most popular risk-free asset approach compared to LS and VA. However, it was found that LS preceded DCA for both corporate and government bonds by the Sortino ratio and UPR. In view of data used, both the longer period of 74 years and the shorter period of 30 years are taken into consideration and the important difference between the reports has not been identified. Furthermore, the two portfolios on the diversification strategy analyze the annualized surplus yields and risk measures in detail.

Empirically, Dubil (2005) shows the benefit of reducing risks of DCA through computed statistics using the formulas and further explicit Monte Carlo simulation to compare up-front investments with the average investments. He utilizes the behavior theory because of the emotional biases of investors as many scholars to support his

arguments for the DCAs. For elderly persons and younger investors, Dubil considers generous scenarios, for short-term and long-term, differing share returns, and varied annual volatility. His investigations are, however, only focused on long-term investment and ignore the most important investment objective that is to maximize the expected utility.

2.3.2.2. Flexibility and Timing of Investment

Atra and Mann (2006) evaluate seasonality approaches and evaluate in detail their efficiency over time periods to discover the best moment for the start of a specific approach. They consider both the benchmark US stock market indices and the common indices across the world. In order to guarantee a comparison of the objectives between the objectives, LS and DCA are compared in terms of their distinct timing for invested money flows by using a self-financing portfolio. Similar findings have been found with Rozeff (1994) on the worse performance of DCA on reducing risk. On the other hand, their arguments are based merely on present month's average return instead of the comparison of investment strategy terminal value.

2.3.2.3. Psychological Considerations

Although Pye (1971) agreed to the advantage of psychological assessments on DA, such as the impact on regrets, rather that output on anticipated returns or the end values attained, despite the inadequacy of DA to maximize anticipated utility. He conducts studies on the roles of DA in mini-max and non-sequential investment policies for investors. He utilizes theoretical arguments and mathematical formulations in order to investigate the performance of a dollar in comparison to sequential processes for digital illustration or assessment. His research of DCA's sub-optimality as one of the progressive approaches contributed mainly to Constantinides' (1976) convincing arguments about the sub-optimal nature of DCA approach.

A number of scholarly writers and professionals investigated the performance of DCA in relation to LS, both in theoretical and in empirical terms. On the other side, most of these concentrate on considering strategies in terms of anticipated returns and standard deviations and agreeing on the rationality of the DCA's main explanatory benefits. In view of the behavior of share, Greenhut (2006) provides a further understanding of the DCA investigation from the mathematical exposure perspective. Besides, they concluded that the DCA approach is fair in terms of the plan for the LS only, regardless of other things, such as potential psychological advantages, to achieve average share rates.

2.2.3. Literature that states DCA precedes LS

2.3.3.1. Expected Yield and Risk Reduction

Israelsen (1999), a proponent of the DCA approach, indicated that the DCA strategy benefitted from lower volatile investment by offering numerical reviews of DCA's performance in relation to LS investment based on historical proof. However, given the identical returns of LS investment using the equity mutual fund information of 30 September 1998, its findings are limited and cannot be generalized for a scenario of total investment.

Milevsky and Posner (2001) start studying a bit differently from most of the authors who have shunned the benefits of the DCA approach in contrast to the LS approach. While they claim irrationality and inefficiency of the mean variation of DCA, they examine that the expected conditional payoff of DCA is higher than the expected level of volatility, depending on the pre-determined final value of the underlying security. They also highlight the consistency in the complement of Statman's behavioral thesis (1995) between conditional set value and the behavioral expectation of individual investors. Their conclusion, however, is based on the assumption that investors have clear target returns or that investors can pre-determine the final value of

high volatility investment instruments, which are, in reality, substantially unsafe and unreliable. The basis of conjecture is thus virtually volatile.

2.3.3.2. Psychological Considerations

Statman (1995) offers further developments and strong exploration on social funding coherent with DCA as opposed to standard economics, based on studies on Markowitz (1952) and Kahneman & Tversky (1979) on Prospect Hypothesis. He made theoretical and clear argument about the benefits of the DCA rather than assessing the efficiency of the DCA in terms of its anticipated yield or standard deviation, based on the view of personal investors' psychological considerations. However, he persists with the premise of rational buyers in the sub optimal nature of the DCA approach. Contrarily, Samuelson (1994) statement "sleeping well for irrational reasons, is as good as sleeping well for rational reasons," reduced the virtue of DCA over LS investing approach as Statman (1995) remarked.

2.3.3.3. Summary of Criticism

In summary, the views of the effectiveness of DCA investment policy between academics have been highly polemical for an extended period. As a consequence, in comparison to DCA's popularity among professional finance consultants, the bulk of academics favor LS as opposed to DCA. Furthermore, the misconception of DCA's cost advantage in its efficiency assessments must be highlighted. In terms of its risk results, more reports noted DCA optimality in reducing risk.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1. OUTLINE

The methodology to be used in this article focused principally on an extensive study of the DCA investment policy in academic journals. It is an important job because of the long term debate over the DCA's effectiveness in comparison to LS as an investment strategy. The study combines descriptions of views, statements or conclusions of prior investigations, more in-depth conceptual debate and literature review and a holistic graphic overview with a numerical assessment. Furthermore, the Monte Carlo simulation methodology for testing and verifying DCA policy and LS investing numerically, with regard to the summed results of the literature assessments, shall be used to identify which has the best performance.

3.2. DATA SOURCES AND TYPES

The secondary data on DCA literature is generally collected from the Bahcesehir Library internet newspapers and databases, with an attendant from a choice of the tertiary information sources including the OPAC library, commercial bibliographic databases, Internet directories and search engines. In the Literature Review chapter, sources collected and recuperated have been critically structured and evaluated.

The S&P 500 Index is common throughout all types of research, accounting for 37% of everything and is even higher than any other dataset. We assume that the equity investment is a common fund to draw on the S&P 500 index and initially sell for £ 100 per unit comparable to the one used in both Abeysekera and Rosenbollm (2000) and Marshall (2000), to lay the database for efficiency measurements of the DCA and LS strategy. In fact, two the most common UK indexes, FTSE 100 and FTSE All-Share

Index, which have been used as the dividend paid by the firms within the index, are included, in addition to DCA trials on the most common S&P 500 index.

The rates of closer indexes are used as the grounds from the YAHOU FINANCE Web site, in line with Greenhut (2006) in order to obtain more accurate simulation outcomes. Sample standard deviations of the monthly yields of the S&P 500 Index between 3rd January 1950 and 1st December 2006, FTSE 100 Index between 2nd January 1985 and 1st December 2006, FTSE All-Share Index between 4th January 2000 and 1st December 2006 are utilized for the forecasts of the standard deviation of the annual yields. For all of the assumptions used in the simulation, the outcomes of yearly standard deviations are 14.20% (S&P 500), 16.04% (FTSE 100) and 13.92% (FTSE All) and annual average yields on the share of 7.77% (S&P 500), 7.21% (FTSE 100) and 1.15% (FTSE All). Using historical data or a subjective assessment, μ can usually be calculated according to present equity opportunities (Abeysekera and Rosenbollm, 2000). In order to ensure reliability of the results, the historical data from the real world is used, the same as the standard deviation of yield.

3.3. METHODOLOGY

Qualitative and quantitative techniques were employed to examine the performance of DCA approach in relation to LS approach for investment. The use of intensive literature reviews has been an intensive qualitative approach, which simplifies the understanding of the DCA policy, summarizes different views from several earlier studies. Its overall conclusion is useful to presuppose the subsequent empirical tests to check the theoretical findings observed. The simulation is the most common practical technique used by scholars based on the contrast of methods applied in the research, which accounts for about one-third of the total. The simulation model is therefore presumed to be a helpful method for measurement of performances of both DCA and LS approaches. Thus, by using the methodology of simulation in Monte Carlo, the quantitative performance test for DCA and LS approaches will include

comparison of anticipated yields, standard deviation of anticipated yields and simple risk adjusted yield ratios. The technique is used in reliance on the random-walk hypotheses on share prices. For calculating the first approximation data for DCA and LS investment techniques over a 12-month time horizon, a thousand investments results simulations are used over time. Lastly, to prove literature results, the average yield and standard deviation results and the mean yield / standard deviation ratio are separately compared.

3.2.1. Monte Carlo Simulation

Chance (2004) stated that Monte-Carlo simulation is considered to be a lawful method used in many elements of business operations to address uncertainty. Monte Carlo simulation is a widespread category of computing algorithms and relates to the technique of analyzing the conduct in real life share prices, interest rates and exchange rates. It produces random and continuous values for simulating a system and providing a numerical answer, particularly for mathematical issues that are too complicated, which summarizes outcomes in terms of the linear estimates of the feasible yield ranges and distributions (Decisioneering, 2005). The simulation can use pools of random numbers that have been constructed in relation to share price behavior. Since Davenport (1992) states that real random numbers for method application are not essential, deterministic, pseudo-random factors are common and simple to evaluate and rerun experiments.

The simulation used in this article assesses multiple DCA and LS investment model scenarios through the sample of the value of share prices from probability distributions over and over for uncertain variables of anticipated annual yield on the share and standard deviation of the share's annual yields. For this purpose, the equations are necessary for the distribution of probability that can define the uncertain variables. The simulation includes a GBM method as a manner of determining the essence of the share price. DCA's performance test simulation comprises 1000 lognormal stock price

paths calculated by the spreadsheet. The DCA approach consists of ongoing, regular investment in equal installments totaling equal to LS, which includes a single initial investment. In order to identify the expected quantitative outcomes equivalent to the critical sum, findings relating to the DCA investment strategies relating to these random share rates will be evaluated. For explicit reasons, by using spreadsheet we produce monthly results and compare DCA and LS terminal values.

3.4. PERFORMANCE MEASUREMENTS FOR EVALUATION

First of all, the terminal values of DCA and LS investments strategies, which refer to the value of an investment at the end of a period taking into consideration the rate of interest, will be used in order to compare their cash flow performance.

$$T_v = P_v \times (1 + r)^t$$

$T_v = Terminal\ Value\ of\ shares$

$P_v = Present\ value\ of\ share$

$r = rate\ of\ interest$

$t = Period\ of\ time$

Furthermore, the lognormal property of share prices could be used to inform the allocation probability of a continually compounded yield rate between moment 0 and T (Hull, 2006:305). The monthly yield rate is determined using the existing and the previous index price.

$$x = \frac{1}{T} ln \frac{S_T}{S_0}$$

$x = Annualy\ continously\ compunded\ rate\ of\ return\ realized\ between\ times\ 0\ and\ T$

$S_T = price\ of\ the\ stock\ at\ time\ T.$

$S_0 = price\ of\ the\ stock\ at\ time\ 0.$

In addition, Hatton (2005:28) observed that standard deviation gauges the variety of feasible results mathematically, which represent the risk or uncertainty of

asset or security classes. This standard deviation measurements is used to calculate the risk of share investment in DCA and LS approaches by dispersing the difference between the monthly returns and their complete average yields over time.

$$\sigma = \sqrt{[\frac{\sum(S - \bar{S})^2}{n}]} = \sqrt{V} = \sqrt{\sigma^2}$$

Where;

$\sigma = Standard\ deviation\ of\ expected\ returns$

$V = Variance$

$S = current\ return\ of\ a\ time\ horizon$

$\bar{S} = average\ of\ returns\ over\ a\ given\ period$

$n = units\ of\ periods$

In addition the reward-risk ratio was chosen with a mean-variance criterion in order to give a more price performance measurement of the selected investment strategy. An investor's award for trade in volatility demonstrates a wider assessment of both yields and risk. This article merely uses the proportion between the anticipated yield during the sample period and the normal standard deviation, since the examinations of different risk-adjusted levels have not received much attention.

$$Reward/Risk\ ratio = \frac{\mu}{\sigma}$$

Where;

$\mu = continously\ compunded\ annual\ return\ on\ the\ stock$

$\sigma = standart\ deviation\ of\ the\ annual\ return\ on\ the\ stock$

3.5. GRAPHICAL ANALYSIS

In relation to the numerical measures of the results of DCA and LS approaches, the examination included graphical analysis to illustrate a general results assessment of their theoretical statements as well as scientific assessments such as the proportions of opinions that support the optimal DCA and an overall comparison between yield

rates obtained by the simulation. The most common formats of graphs, pie charts and histograms are used in this article to represent the values of a series of variables to help classifying the underlying datasets into groups to achieve the results with differentiated patterns.

3.6. HYPOTHESES AND ASSUMPTIONS

It is assumed that the transaction cost, tax and dividend issues are ignored and behavioral financing issues avoided in order to avoid irrelevant complexities and to highlight the primary opinions on DCA about yields and risks discussed. (Taking the dividends of all FTSE All Share and FTSE 100 companies into account would be very tedious and inaccurate. Dividends are ignored by most of the past studies which used indices for calculating yields.) However, this model can be changed easily as factors can then be incorporated. The risk-free rate is fixed at zero. Hence, the expected yield for each period is the excess share yield over the risk-free rate. The scenario assumes that investor P has £ 24,000 that is prepared to invest immediately in equities, while investor Q is available for investing a total of £ 2,000 to one installment over the given investment period based on the DCA strategy. Therefore, the premise simplifies the performance assessment by taking a zero risk-free rate into account. In order to stimulate the LS and DCA approaches, we adopt Hull's share pricing model (2006:434). Similarly, we test a random path with a lognormal distribution to model the share price at the moment t.

$$S_\tau \sim S_0 \exp\left(\left[\mu - \frac{1}{2}\sigma^2\right]\tau + \sigma\sqrt{\tau N_{0,1}}\right.$$

Where;

$S_\tau = price\ of\ the\ stock\ at\ time\ t$

$S_0 = price of\ the\ stock\ at\ time\ 0$

$\tau = units\ of\ years, 1/12(monthly)$

$\mu = continously\ compounded\ annual\ return\ on\ the\ stock$

$\sigma = standard\ deviation\ of\ the\ annual\ return\ on\ the\ stock$

$N_{0,1} =$
$random\ sample\ from\ a\ normal\ distribution\ with\ mean\ 0\ and\ standard\ deviatio$

The parameters of the lognormal distribution, μ and s, are considered as constants in the spreadsheet simulation model. We compute an annual standard deviation s=14.20% and an annual return on the share μ=7.77% as assumptions in the simulation, based on a data set of S&P 500 for the period between dates 3rd January 1950 and 1st December 2006.

CHAPTER FOUR
FINDINGS

4.1. FINDINGS

In the statistical research, BIST50 shares have been examined. Yields of 46 shares are compared, within 234 time periods of 5 years starting from 1995 to 2019 in LS and DCA strategies. 4 of the recent stocks are not in the BIST50 by 1995 thus there are 46 stocks in all analyses.

When we compare DCA with LS yields by shares, we have these results for a total of 5 years.

DCA strategy is superior on 39 shares out of 46 stocks in 234 investment term variations.

LS strategy is only superior on 5 shares out of 46 stocks in 234 investment term variations.

On Arcelik and Eregli stocks, there is equality; 117 terms DCA is superior and 117 terms LS is superior.

When a share is examined in different time periods (the share base yields) of 5 years on DCA strategy is mostly positive, negative yield terms are negligible. Out of 46 stocks and 234 investment terms, on DCA strategy negative yield terms are only 8,41% of all investment periods but ratio is higher on LS strategy with 18,28%. Compared to average positive yields of both strategies negative yields are minor for example average of positive yields vs negative yields of 46 stocks and 234 investment terms is 443,16% vs 16. 55% for DCA and 457,43% vs 25,38% for LS.

On 5 years periods; when the yield of each share is examined;

DCA has positive yields, 91.59% of all 5 years' time period.

LS has positive yields, 81.72% of all 5 years' time period.

On 5 years period, DCA precedes LS for positive yields. Negative return periods are very rare on DCA, even in economic crisis yields are positive due to 5 years

investment period. If we are looking to the 2008, which is investment term 156 to 192, there is a bear market. When we look for the price action on BIST, bull markets last longer and bear markets are shorter. That is the one reason on 5 years investment period, even if there is a bear market prices recover in 5 years period.

This analysis has examined a vital question for investors whether to invest cash immediately to share or shares or to use a DCA method into BIST.

Yields are examined by shares, by time periods and the positive yield percentages. On 3 cases, DCA precedes LS.

To sum up, DCA precedes LS for BIST50 shares, but these differences are not significant. Also, there are some constraints for the analysis. BIST started in 1986; it could not be examined as S&P 500. Thus, the time range was limited to 33 years and most of the stocks' IPO was in 1995 January. Hence total data is limited to 24 years.

On the other hand, when the DCA strategy is examined, the strategy lowers the share cost.

Out of 46 stocks, to prove whether DCA or LS strategy is better significantly, results for t test is in the table below.

Table 4.1. DCA-LS T test

Yield	Strategy	N	$\overline{X}$	S	Sd	t	p
Strategy Yield Averages	**LS**	234	3,53	6,16	233	-1,229	,220
	DCA	234	3,70	5,80			

As it seems from table, out of 46 stocks, there is no significant difference between two strategies statistically. ($t_{(233)}$=-1, 229, p>.05). LS strategy ($\overline{X}$ = 3,53),

DCA strategy($\overline{X}$ = 3,70) are very close to each other. To sum up, within 46 stocks' return there is no significant return difference.

Table 4.2. Interest Rates and DCA Regression Analysis

Variable	B	Standard Error	β	F	R^2	t	p	r
Fixed	.016	.002				9,507	.000	
Interest	.005	.000	.599	125,161	.358	11,188	.000	.599

As it thought to be relevant with the return of DCA strategy, interest rate regression analysis has been examined. As a result, there is a significant relation (R = .599, R^2 = .358) examined. ($F_{(1\text{-}224)}$ = 125,161, p< .01). As interest rates are independent variables, they explain %35.8 of DCA returns.

It is studied that whether DCA or LS is superior on high interest environment out of 46 stocks. T test results are below on the table.

Table 4.3. Returns on DCA and LS for high interest period (5 years of investment term January 1995 to June 1997)

Yield	Strategy	N	$\overline{X}$	S	sd	t	p
Average of	**LS**	30	15,49	11			
					29	1,523	,139
yields	**DCA**	30	14,18	10,73			

($t_{(29)}$=1,523, p>.05). LS strategy yields ($\overline{X}$ = 15,49) and DCA strategy s yields($\overline{X}$ = 14,18) are close. Thus, as table shows, there is no significant difference for the yield of 46 stocks on this high interest period between two strategies.

It is studied that whether DCA or LS is superior on crisis period out of 46 stocks. . T test results are below on the table.

Table 4.4. Returns on DCA and LS for crisis period (5 years of investment term starting December 2017 to December 2010)

Yield	Investment Strategy	N	$\overline{X}$	S	sd	t	p
Average of	**LS**	37	1,57	.85			
					36	3,049	,004
yields	**DCA**	37	1,12	.49			

($t_{(36)}$=3,049, p<.05). LS strategy yields are superior than ($\overline{X}$ = 1,57), DCA strategy yields ($\overline{X}$ = 1,12). As table shows, LS yields are superior to DCA on crisis period (starting from 2008) significantly out of 46 stocks.

As a result with all T tests and returns, there is no significant difference between two strategies (DCA and LS) out of 46 stocks on BIST in 234, 5 years investment variations starting from 1995 January to 2019 June. It is proven that LS is a better strategy on crisis period on BIST and also LS precedes DCA two-third of the time on S&P 50, is the reason that markets have uptrend over the long-term.

CONCLUSION

DCA is a common investment strategy advocated by experts and academics in response to the uncertainty of the stock market. It includes diverse points of perspective in a variety of modes, including simple numerical descriptions, evaluations of past performances, scenario simulations and theoretical model debates. However, the analytical summation studies about the DCA approach are insufficient. The main objective of the article is to study the DCA investment strategy intensively, which prior thinking scientists with significantly contentious scholarly opinions have already examined extensively for a long time.

In addition, 27 of the 40 articles, which have become most important to the field of studies, focused on current understanding of the subject including methodological questions, study methods and abstract concepts. In the literature, it is found that 11 articles belonged to the category that LS precedes DCA, 10 articles belonged to the category that provide mixed opinions on the DCA performance and 6 were considered to promote the superiority of DCA. Academically, it has been discovered that, as opposed to the DCA popularity among experienced financial consultants, there are a minority of scientists in favor of DCA compared with LS. Furthermore, this research is conducted to appraise the literature in consideration of the advantages of LS over DCA from the point of providing greater expected yields and reduced risks, immediate investment timing and more flexibility and the misconception of the advantages over DCA, a combination of mixed assertions focusing on the points of expected yields and reduced risks, investment timing and flexibility and psychological considerations and the prominent benefits of DCA over LS in the dimensions of increased yields and reduced risks, more flexible investment opportunity and other psychological considerations. However, in reference to Greenhut (2006), Wilson (1961) and Marshall (2000) considering the cost advantage of DCA in view of its performance

measurements, there is misunderstanding since the lower average cost does not suffice to ensure optimal performance in one strategy than the other.

With regard to the literature reviewed, most scientists indicated that the DCA yields are less than the LS approach and more publications have noted the optimality of DCA in terms of reducing risk. Particularly, Bacon et al. (1997), William and Bacon (2004) and Johnson (2004) put forward that the less DCA installments, the greater the yield created to explain DCA's yield inferiority. Furthermore, there are distinct opinions on DCA's market circumstances. While Rozeff (1994) stated the upward market performs better for DCA, Brennan et al. (2005) recommended DCA in bear market. Furthermore, the conflicts over the connection between DCA performance and financial market volatility are intense: Dubil (2005) showed that DCA operates better with greater risky investments, contrary to Scherer and Ebertz (2003) Leggio and Lien (2001) and Leggio and Lien (2003) who are claiming that cost averaging is less important in the volatile market with frequent upward and downward price changes.

In the research part of the study, T-tests were applied on 46 stocks of BIST50 for 234 distinct 5-year investment terms to decide between DCA and LS. As a result average of positive yields and negative yields of 46 stocks of 234 investment terms are 443,16% and 16. 55% for DCA and 457,43% and 25,38% for LS respectively. It indicates that DCA has higher positive and lower negative yields against LS. Additionally, the ratio of negative yield terms is lower on DCA strategy compared to LS, 8,41% and 18,28% respectively.

The conclusion will be summarized briefly as follows, in accordance with all the outcomes obtained and the assumption of a favorable excess return for the investment. In the light of the approach of this study, here are the fundamental points that must be taken into consideration:

- The misconception of DCA's cost advantage in its efficiency assessments must be highlighted.
- DCA is a risk reducing approach. However, the efficacy of yield generation of DCA is not better than the LS approach.

- In general, by investing in less volatile assets, DCA approaches have better efficiency. In comparison with LS, because of its important capacity to safeguard the risk, DCA may be used for investments with the riskier underlying assets.
- It is unwise to assert the superiority and inferiority of DCA approaches and to differentiate DCA from optimal or sub-optimal investment approaches. Implementation of the DCA strategy in the real world depends definitely on investor risk aversion levels.

It is important to note that the studied period covers crisis terms (5-year time periods starting from December 2007 or December 2010) and high interest rate terms (5-year time periods starting from January 1995 or June 1997) in Turkey. In this sense, while there was no significant difference between DCA and LS strategies during high interest rate terms, DCA strategy was superior to LS strategy during the crisis period.

To conclude, contrary to the existing literature, DCA is superior in terms of risk/reward ratio in BIST50 stocks for 5-year investment terms between January 1995 and June 2019. However the findings demonstrate that these differences are not significant and neither DCA nor LS superior with regard to BIST50 stocks of the given investment terms as well. Consequently, as it was emphasized in the literature review, timing and seasonality of the investment is critical to determine the efficiency of the selected strategy. In brief, when you buy the stocks is vital, whether at the beginning of bull market, bear market or in the middle of one of these. Future studies should examine the expectation effects such as earning dates and news. This would be beneficial to determine the correct timing of purchasing stocks.

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