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Value-Weighting on the Swedish Stock Exchange

A Stochastic Movement towards Mean-Variance Optimization

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Abstract

In this thesis, we use Bloomberg data to compute a metric developed by Bhattacharya & Galpin (2011) to examine the popularity of value-weighting on the Swedish stock exchange. After analyzing our data, we reach three conclusions in documenting that: (1) Value-weighting is becoming more popular over time. (2) Value-weighting is more popular on the OMXS30 than on the market as a whole (the OMXS All Share Index). (3) The popularity of value-weighting is decreasing in times on financial turmoil. The thesis is concluded with a discussion concerning possible explanations for our findings.

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1 Introduction

Window washers in New York skyscrapers take on a lot of risks when going to work, and they are compensated for it. With limited or no education salaries can be as high as $35 per hours (NBC News, 2014). The risk they take going to work is reflected in the compensation they get for working on a tiny catwalk hundreds of meters up in the sky. This is a risk window washers need to take, one they cannot get rid of. However, the job would be even riskier for a window washer with an inclination towards exercising the Irish Jig while window washing. This begs the question: will the window washer with this peculiar tendency be rewarded with a higher paycheck? Unless the window washer can wash window more efficiently while doing the Irish Jig the answer is likely to be no. Why? Because this window washer is taking on unnecessary risk, a risk that he - or she - does not need to carry to get the job done. When investing, and as the previous analogy suggests, to some extent in life, one is rewarded for the risk one takes; with the reservation that there is no reward for unnecessary risk taking.

The above is an attempt at an analogy relating to the diversification of an investor's portfolio through mean-variance optimization, which according to portfolio theory formulated by Markowitz (1952), Tobin (1958) and Sharpe (1964) is the only rational option when markets are efficient. When investing in the market, all idiosyncratic risk is diversified away. One only holds the risk necessary to obtain the desired return, and one is not - as the previous analogy would put it - exercising the Irish Jig while window washing. The philosophical opposite of investing based on a value-weighted strategy, is investing in individual stocks; or stock picking. Successful stock pickers like Warren Buffett and others are instead of mean-variance optimization influenced by theories first formulated by Graham & Dodd (1934) who in “Security Analysis: Principles & Technique” present techniques of figuring out whether a stock is a buy or a sell. That is, figuring out how markets are not efficient in mispricing securities. Much like exercising the Irish Jig while window washing, stock picking might seem intriguing; possibly even fun. That is until the unnecessary risk one has exposed oneself to presents itself. The concept of diversification and value-weighting is of importance for all investment decisions. But are investors on the Swedish stock exchange aware of this? Which is the investment philosophy prevailing over time? And are there circumstances or occurrences that should promote one over the other?

Bhattacharya & Galpin (2011) develop a theory based metric that evaluates the popularity of value-weighted portfolios on any given market. Using their metric, the purpose of this thesis is to investigate the popularity of value-weighting on the Swedish stock exchange over time and to examine whether individual segments or periods in time affect the popularity of value-weighting. This thesis focuses on the fact that as the market is value-weighted, all portfolio holdings are also value-weighted if investors only invest in the market. Bhattacharya & Galpin (2011) investigate the popularity of value-weighting over time in 46 countries, where Sweden is one of the investigated countries. Sweden is in their article only stated as an observation in a table, making it hard to see e.g. if the popularity fluctuates over time or if the investment practices permeated by Sharpe (1964) are affected by financial turmoil or differ over market sub-segments on the Swedish stock exchange. To the best of our knowledge no previous study has (1) investigated the popularity of value-weighting on the Swedish stock market over time during a recent[1] period of time. Nor have any study (2) investigated sub-segments of the Swedish stock market or (3) examined if the popularity of value-weighted portfolio is affected in times of financial turmoil. The investigated period spans over the years 2000 through 2016, thus including two intense periods of the Swedish stock exchange; the IT-bubble and the more recent global financial crisis of 2007 through 2008. Computations of the metric are aimed at detecting deviations from value-weighting and are conducted monthly over the investigated period, resulting in three significant findings.

The first finding is that the popularity of value-weighting is increasing over the investigated period. Although this thesis is the first to formally document that the popularity of value-weighting portfolios is increasing on the Swedish stock exchange, indications pointing in this direction have been published previously. Despite the fact that Bhattacharya & Galpin (2011) find that the popularity of value-weighting on the Swedish stock exchange is becoming less popular its popularity is increasing amongst developed countries and for the world as a whole. Barnes & Scott (2007) [2] investigate the popularity of value-weighting portfolio on the UK stock market using the metric first presented by Bhattacharya & Galpin (2011). They find that stock picking is becoming less popular on the UK equity market vis-a-vis value-weighting on all market segments. According to Bhattacharya & Galpin (2011) the increasing popularity of

[1] Bhattacharya & Galpin (2011) conducts a worldwide study over a period covering the years 1995 through 2007. Their study focuses on the U.S. exchanges and 46 exchanges across the world, where Sweden is one of the investigated exchanges.
[2] The first edition of Bhattacharya & Galpin's "The Rise of the Value–Weighted Portfolio" was published in 2005.

value-weighting is possibly due to the explosive growth of mutual funds and exchange-traded funds (ETFs). Khorana, Servaes & Tufano (2005) who in their article "Explaining the Size of the Mutual Fund Industry around the World" find that the fund industry is larger in countries in which laws, regulations, and institutions are functioning well. As value-weighting is more popular in these countries it suggests that information disclosure environment is central for the incentives to value-weight.

The second significant finding is that value-weighting is more popular on the OMXS30 than on the market as a whole (the OMXS All Share Index). This finding aligns with those reached on the U.S. stock exchanges by Bhattacharya & Galpin (2011). Barnes & Scott (2007) also conclude that there is significantly less stock picking on large capitalization stock in relation to smaller stocks. This empirical finding is well aligned with theory regarding market efficiency and information disclosure.

Our third finding cast a new light not only on the Swedish stock exchange but the field of portfolio theory as a whole. We find that the popularity of value-weighting is decreasing in times of financial turmoil. Theory suggests that financial turmoil drive markets away from efficiency. If all available information is no longer reflected in the price of a certain stock, rational investors might not choose to value-weight by purchasing the market portfolio. Instead, exercising an Irish Jig on the Swedish stock exchange; one that under these new circumstances could be classified as rational risk taking. Or even, in the presence of arbitrage opportunities, not at all as risk taking.

The remainder of the thesis is organized as follows. Chapter 2 presents portfolio theory as formulated by Markowitz (1952), Tobin (1958) and Sharpe (1964). A metric based on the theory, designed to act as a proxy to assess the popularity of value-weighting is presented together with a literature review. Chapter 3 outlines our results. The thesis is concluded in Chapter 4, where our results are summarized followed by a discussion around suggestions for further research.

2 Theory

This chapter opens with a review of portfolio theory - as formulated by Markowitz (1952), Tobin (1958) and Sharpe (1964) - after which we present the metric used as a proxy for investigating the popularity of value-weighting on the Swedish stock exchange. As the metric is affected by market efficiency, the chapter continues in summarizing theory regarding market efficiency.

Finally, the metric itself and market efficiency are - as concluded by Bhattacharya & Galpin (2011) and Kadapakkam, Krause & Tse (2014) - affected by the occurrence of ETFs on the stock exchange the chapter concludes in presenting theory regarding ETFs.

2.1 Optimal Portfolios

Harry Markowitz was the first to in "Portfolio Selection" (1952) define an optimal portfolio[3] which he concluded one constructs through mean-variance optimization. In an optimal portfolio, investors can't get a higher expected return per unit risk. Tobin (1958) suggested that the conclusion reached by Markowitz implied that an investor, under certain conditions, decides upon portfolio weights of two assets; an optimal portfolio of risky assets and a risk-free asset. Sharpe (1964) concluded that the optimal portfolio of risky assets is the market portfolio. Sharpe derived a market equilibrium theorem[4] that applies to asset prices under risky conditions. Sharpe concludes that all investors, independent of the portfolio holdings being efficient or not, are only rewarded - in terms of expected return - for the risk associated with the market. The reason for this being that idiosyncratic - or firm specific - risk is diversifiable, meaning that investors do not need to expose their portfolio to that (unnecessary) risk. Standard paradigms of finance and market efficiency have, through the underlying assumptions of the Capital Asset Pricing Model (CAPM), broad implications on asset combination and diversification strategies. In an efficient and well-functioning market the accrued aggregated knowledge of the market incorporates all available information in the prices of securities. That being the case, investors should not be able to beat the market other than by chance. One need not be holding idiosyncratic risk, nor performing the Irish Jig while washing windows in New York City; as long as the world functions as Sharpe (1964) and

[3] Markowitz (1952) came to this conclusion with the assumption that investors care only about the risk-return relationship of their portfolios and that markets are unforecastable.
[4] The Capital Asset Pricing Model or the CAPM (Sharpe, 1964).

others model it. As mentioned earlier, any rational investor only chooses weights in a risk-free asset and the market portfolio to get the highest possible expected return. With the assumption of all investors maximizing their expected returns and minimize their risk - as measured by standard deviation - all rational investors buy the optimal market portfolio (Markowitz, 1952; Sharpe, 1964). That is: choosing between a value-weighted portfolio and a risk-free asset at any given time *t*.

Underlying the conclusions reached by Markowitz, Tobin, and Sharpe are several reasonable assumptions. These are first and foremost that markets are efficient; therefore one cannot beat the market other than by chance. The theory also assumes that all investors care only about the mean-variance relationship of their portfolio. That is investors like returns and dislike risk. Far from everyone agree with the theoretical foundations such as market efficiency and rationality on which the theory originates. Critiques against the assumptions have been put forth amongst others by Roll (1977). In Roll's article "A Critique of the Asset Pricing Theory's Tests: Part I: On Past and Potential Testability of the Theory," he states that the CAPM model is impossible to either prove or reject. The critique originates from the fact that it is more or less impossible to collect information on the all market securities, which is what Sharpe (1964) define as the true market portfolio. What Lo & Wang (2000) found was that if the assumption of two-fund separation[5] holds, all subsets of the market also are value weighted. Hence, the metric developed by Bhattacharya & Galpin (2011) along with its assumptions are feasible to work for the purpose of analyzing a proxy examining the popularity of value-weighting on any given market or subset of that market.

2.2 Bhattacharya & Galpin's Value-weighting Metric

The metric presented in "The Global Rise of the Value-Weighted Portfolio" by Bhattacharya & Galpin (2011) relies heavily upon the conclusion reached by Lo & Wang (2000). In their article "Trading Volume: Definitions, Data Analysis, and Implications of Portfolio Theory," they find that since the market is value-weighted, all investors portfolio holdings are also value-weighted; if they invest in the market. The two-fund separation theorem, that of a risk-free asset and the market portfolio suggests that any rational investor *j* choose weights in these two assets to optimize the mean-variance relationship of their respective portfolio. If

[5] See *Section 2.2*.

this relationship holds Lo & Wang (2000) conclude that the dollar turnover[6] of any stock, *i*, are identical for all stocks on any given market. The market is value-weighted, and with any given investor *j* only choosing portfolio weights in a risk-free asset and the value-weighted market, all portfolio holdings must be value-weighted.

The idea behind the metric developed by Bhattacharya & Galpin (2011) is very intuitive. If all investors on a market are value-weighting, the share volume in dollars of stock *i* is entirely explained by the weight of stock *i*. The metric measures deviations from constant dollar turnover. The weight of stock *i* is the market capitalization of stock *i*, which per definition is proportional to the weight of stock *i* in a value-weighted portfolio. The metric defines turnover of stock *i* at time *t* as the ratio of volume to market capitalization. Therefore; the cross-sectional variance of log turnover is greater than 0 for all stocks in a non-value-weighted portfolio and equal to 0 in a portfolio that is value-weighted (Bhattacharya & Galpin, 2011). The deviations from constant dollar turnover - that is turnover explained by the weight of company *i* at time *t* - is measured through the value-weighted cross-sectional variance of log turnover at time *t*, where:

$$\text{Value} - \text{weighted cross} - \text{sectional variance of } \ln(turnover)_t =$$

$$\sum_{i=1}^{n} w_{it} * \left(\ln(turnover)_{it} - \sum_{i=1}^{n} w_{it} * \ln (turnover)_{it} \right)^2$$

$$\text{where } w_{it} = \frac{\text{Market Capitalization of stock i at time t}}{\text{Market Capitalization of market at time t}}$$

$$\text{and } (turnover)_{it} = \frac{\text{Share volume of stock i at time t}}{\text{Shares outstanding of stock i at time t}}$$

Equation 2.1

As mentioned previously Lo & Wang (2000) concluded that if all investors choose from a risk-free asset and a value-weighted portfolio the dollar turnover - or in our case SEK turnover - is identical for every stock *i*. The metric developed by Bhattacharya & Galpin measures the deviations from constant SEK turnover in calculating the value weighted cross-

[6] Lo & Wang (2000) define dollar turnover as share volume value in dollars over market capitalization in dollars.

sectional variance of log turnover. When the metric does not equal 0 the dollar turnover is not identical for all stocks, signaling a deviation from the assumption that investors choose weights in a risk-free asset and the market portfolio. In the real world, one should be aware that the value of the metric developed by Bhattacharya & Galpin (2011) will not equal 0. The metric will instead be positive. This implies that the assumption of two-fund separation does not hold. Nonetheless, the metric is for the purpose of this thesis not to investigate whether all investors in any given market or subset of that market are all value-weighting or if the assumption of two-fund separation theorem holds. It is rather used as a proxy to investigate how value-weighting is affected over time, varies over sub-segments of the market and whether value-weighting is affected by the occurrence of financial turmoil. All for which this metric is feasible for.

Bhattacharya & Galpin (2011) use log transformation of turnover since turnover always is positive; therefore it is highly positively skewed. Further, when scaled by equivalent numbers, the variance of turnover is altered, but the variance of log turnover is unaltered (Bhattacharya & Galpin, 2011). Value-weights are used rather than equal weights and value-weighting metrics results in larger stocks yielding in higher deviations than those of a smaller stock with a variance of turnover secluded from 0 (Bhattacharya & Galpin, 2011). For further implications of value-weights rather than equal weights see *Section 4.2.1.*

As mentioned previously the assumption of investors maximizing expected returns and minimizing risk as measured by standard deviation (Markowitz, 1952; Sharpe, 1964), implies that all investors in a market chose between a value-weighted portfolio and a risk-free asset at any time *t*. That being the case the cross-sectional variance of log turnover as measured by *Equation 2.1* is equal to 0. Deviations can occur by investors stock picking, or when investors choose portfolios that are not optimal (Markowitz, 1952; Sharpe, 1964; Bhattacharya & Galpin, 2011). Deviations from the metric equaling 0 might also occur due to the underlying assumptions - those of symmetric information, strong market efficiency and preferences only given by mean-variance optimization - not holding (Markowitz, 1952; Tobin, 1958; Sharpe, 1964). The metric not equaling 0 in the real world is, as mentioned briefly in the introduction, also shown in the study conducted by Bhattacharya & Galpin (2011). The metric acts as a proxy for the popularity of value-weighting, the greater the popularity of value-weighting, the lower the value of the value-weighted cross-sectional variance of log turnover.

In their article from 2011 Bhattacharya & Galpin stress that although their metric has its founding in CAPM and portfolio theory, it is only a proxy for the popularity of value-weighting and not a precise measure. The metric exhibits three empirical shortcomings. First, the metric does not account for relative liquidity changes between various sub-segments of the market. We mitigate this weakness by calculating the metric on a sub-segment of the market (OMXS30), in which all stocks are highly liquid. Second, the metric does not distinguish between a buy and hold strategy of value-weighting and market timing of a value-weighting portfolio (Bhattacharya & Galpin, 2011). Bhattacharya & Galpin (2011) mitigates this shortcoming by analyzing the nature of change in average turnover of a value-weighted portfolio. In this thesis we plot the changing nature of average turnover of the OMXS All Share Index and our sub-segment (OMXS30) as presented in *Section 3.2.3*. The final shortcoming is of technical nature in that the metric equaling 0 is a necessary but not sufficient in reinforcing a conclusion that all investors in a market are value-weighting (Bhattacharya & Galpin, 2011). The situation where further analysis beyond that of this value-weighting metric is required is tested by Bhattacharya & Galpin (2011). After testing for it, they conclude that such situations are highly unlikely[7]. So, in this thesis, such conditions are not investigated further.

Taking the shortcomings into account the metric developed by Bhattacharya & Galpin (2011) metric has six advantages, which is why it is used for the purpose of this thesis. First: as the metric computes the value-weighted cross-sectional variance of log turnover at any point in time *t* it is not affected by tiresome time series properties (Bhattacharya & Galpin, 2011; Dougherty, 2016). Second: the metric is based on well-established theory developed by highly regarded Nobel laureate scholars (Markowitz, 1952; Sharpe, 1964) and the development of the metric was accomplished with the input from these same scholars (Bhattacharya & Galpin, 2011). Third: it uses readily available data. Fourth: time trends can be easily detected. Fifth: although requiring vast amounts of data[8] the metric is relatively straightforward to estimate. The sixth and final advantage is that markets are easily defined in multiple ways

[7] Bhattacharya & Galpin (2011) presents a situation in which all investors are stock picking but the metric still equals 0. The example is the following: "Suppose agent 1 is a stock picker who only buys and sells small stocks in small volumes from agent 2, who is also a stock picker. Suppose agent 3 is a stock picker who only buys and sells large stocks in large volumes from agent 4, who is also a stock picker. Suppose transactions between agents 1 and 2 and between 3 and 4 occur at the same time. Thus, although all individual agents are stock pickers, in aggregate it would seem that agents are buying and selling a value–weighted portfolio" (Bhattacharya & Galpin, 2011 pp. 742–743).

[8] Underlying the computations of the value-weighted cross-sectional variance of log turnover for each period *t* (month) are all stocks listed on the OMXS All Share Index

(Bhattacharya & Galpin, 2011). The latter is of importance to this thesis since this trait enables investigations of sub-segments of the Swedish stock market. This draws on the conclusion made by Lo & Wang (2000) who find that if two-fund separation holds, all portfolio holdings on the subsets of must be value-weighted[9] (Lo & Wang, 2002; Bhattacharya & Galpin, 2011).

2.3 Market efficiency

Market efficiency, its relevance, and accuracy are often a subject of discussion (Lo, 2004; 2012). One definition of an efficient market is that in such all information is reflected in the price of assets (Fama, 1970; Bodie, Kane & Marcus, 2014). The conclusion is that the more efficient the market is, the more random are the price fluctuations in that market. Making it harder to make money in the market based on information-driven sell and buy decisions (Sharpe, 1964; Fama, 1970; Lo, 2004; DeMarzo & Berk, 2013), deviating from a value-weighting approach. As market efficiency is principally based on information disclosure, markets are more efficient in segments where information disclosure is better (Crawford, Roulstone & So, 2012; Morck, Yeung & Yu, 2000; 2013). Which our results when comparing the OMXS All Share Index to the OMXS30, where the constituents of the latter closely followed by a large number of analysts, indicate.

A driving principle and commonly used argument for market efficiency is the principle of no arbitrage, which entails that one can't make profits without taking any risk. The line of arguing is reasonable: when such an opportunity presents itself actors move quickly to exploit the arbitrage opportunity. A typical example is one where an economist and his - or hers - companion are out walking and find a $100 bill lying on the ground. The companion reaches down to pick it up but is reminded by the economist that if it were a real $100 bill, someone would have already picked it up. In the presence of arbitrage opportunities, a rational investor shouldn't hold a value-weighted portfolio. The theory has shown that the occurrences of arbitrage opportunities are more prevalent during times of financial turmoil, which should affect the metric used as a proxy for the popularity of value-weighting. See *Section 2.3.1* for a further discussion.

[9] Given the underlying CAPM assumptions of mean–variance optimization preferences and full market efficiency

No consensus has been reached on whether the Efficient Market Hypothesis (EMH) holds or not (Lo, 2004). Although most famously formulated by Fama (1970) the origin of the hypothesis traces, according to Lo (2004), to Paul Samuelson and his article "Proof that Properly Anticipated Prices Fluctuate Randomly" that was published in 1965. Samuelson (1965) concludes that in efficient markets the price changes of an asset must be unforecastable. If future prices are unforecastable, any individual investor cannot beat the market by other than by change. Therefore, as markets become more efficient, the incentive for a value-weighting strategy increases in vis-a-vis stock picking.

With technology improving over time, the information disclosure and thereby efficiency is increasing over time (Morck, Yeung & Yu, 2000; 2013; Lo, 2004; 2012). Consequently, the incentives to stock pick versus investing in the market - or value-weight - should decrease as efficiency improves and information asymmetry declines. Lo (2012) argues that although information disclosure improves over time the level of effectiveness in markets is not linear. It is subject to overall micro and macroeconomic occurrences which suggest resulting in deviations from the trend found by Morck, Yeung & Yu (2000). For this reason, the overall tendency to value-weight should not be linear over time, but subject to the same occurrences as market efficiency. These same occurrences are observed in *Section 3.2* of this thesis where the overall trend of an increasing popularity of value-weighting is heavily affected during certain time periods.

Andrew W. Lo formulated "the Adaptive Market Hypothesis" in 2004 and presented an alternative to the efficient market hypothesis that complements the EMF rather than rejecting it. Lo suggests that by incorporating ideas and theory of evolutionary biology - rather than just mathematical models from physics - agents reach a better understanding of the underlying fundamentals and behavior of the financial markets (Lo, 2004; 2012). Lo (2004) argues that the efficient market hypothesis is not wrong, but rather that it is incomplete. Although markets being well behaved over long periods they can break down for reasons that are understandable if one decide on including them the models (Lo, 2012).

The Adaptive Markets Hypothesis offers a takeaway that is of importance to this thesis. First: the trade-off between risk and reward is not constant over time. In times of market dislocation, fear rules the day, and investors tend to act less rational. Investors will reduce weightings in risky assets and increase weighting in less risky assets, resulting in a price

increase in the less risky asset and vice versa (Lo, 2012). This is the opposite of what rational finance would predict. One should be reminded that if investors hold only the market portfolio and a risk-free asset and choose only from these two portfolio weightings, this shouldn't affect the popularity of value-weighting (Bhattacharya & Galpin, 2011). The implications might, however, be affecting market efficiency during these periods, since securities are priced in patterns contradicting those of finance theory. The conclusion reached by Lo (2012) is one where the EMH seems to hold as a good approximation of reality, but one that only functions as such during times of financial stability. As the environment becomes more dynamic and stochastic, the EMH seems less plausible, and behavioral irregularities emerge amongst investors and the market as a whole (Lo, 2012). Possibly outlining an explanation for some of the inconsistencies found in this thesis.

2.3.1 Market Efficiency and Financial crisis

The metric developed by Bhattacharya & Galpin (2011) is per definition - via the assumptions of the CAPM - affected by market efficiency, and might, therefore, be affected in times of financial turmoil. One study, conducted by Lin, Brooks & Kim (2008) investigates the 1997 financial crisis in eight Asian stock markets and concludes that the markets became less efficient concerning first-order autocorrelation of stock returns. This suggests that the metric developed by Bhattacharya & Galpin (2011) might be affected in times of financial turmoil. When markets are not efficient there is a deviation from the assumption that the market cannot be beaten by anything other by chance (Fama, 1970; Lo; 2000; Morck, Yeung & Yu; 2000). Consequently, it might no longer be rational for rational investors to invest in the market. Possibly explaining why the value-weighted portfolio becomes less popular during these periods.

Choudhry & Jayasekera (2013) reaches a similar conclusion in finding that the market efficiency declines significantly during the time of the global financial crises of 2007 and 2008. They conclude that the market efficiency falls harshly during a recession, and arbitrage opportunities occur more frequently when market efficiency declines (Choudhry & Jayasekera, 2013). The authors conclude that it is when the economy slides into a recession that market efficiency is most profoundly affected (Lesmond, Schill & Zhou, 2004; Choudhry & Jayasekera, 2013). This suggests that there seems to be a period in which the market struggles to adapt to the new conditions. The occurrence of arbitrage opportunities due to

mispricing of securities heavily deviates from the conditions underlying the CAPM. During these circumstances, an investor does not optimize his - or hers - portfolio holdings by value-weighting.

Horta, Lagoa & Martins (2014) investigate the effects of the global financial crisis on eight stock markets. Their results are that all markets show signs of decreased efficiency and longer memory of the market, suggesting that prices during this period do not fluctuate randomly; making it possible to exploit mispricing through advanced trading techniques that deviate heavily from those proposed by the CAPM. All of which are possible explanations for a decline in the popularity of value-weighting during times of financial turmoil.

2.4 Exchange-Traded Funds

Exchange-traded funds or ETFs have gained popularity over the past years. Nowadays, they are easily used to track any underlying index without having to buy the underlying constituents (Hill, 2016; Bhattacharya, Loos, Meyer & Hackethal, 2017; Nasdaq, 2017a; Nasdaq, 2017b). As the name suggests they are traded on exchanges, just like ordinary stocks. Other than better-enabling investors to hold diversified portfolios and reduce the cost of doing so, there have been studies that suggest that markets become more efficient with the presence of exchange-traded funds. One such study conducted by Kadapakkam, Krause & Tse (2014) conclude that the use of ETFs reduces market noise attributed to bid-ask bounce, thus increasing market efficiency. Studies have also found that markets overall have become more efficient during the past ten years and attribute this partly to the rise of ETFs (Klapper, Sulla & Vittas, 2004; Kadapakkam, Krause, Tse, 2014; Bhattacharya et al. 2017).

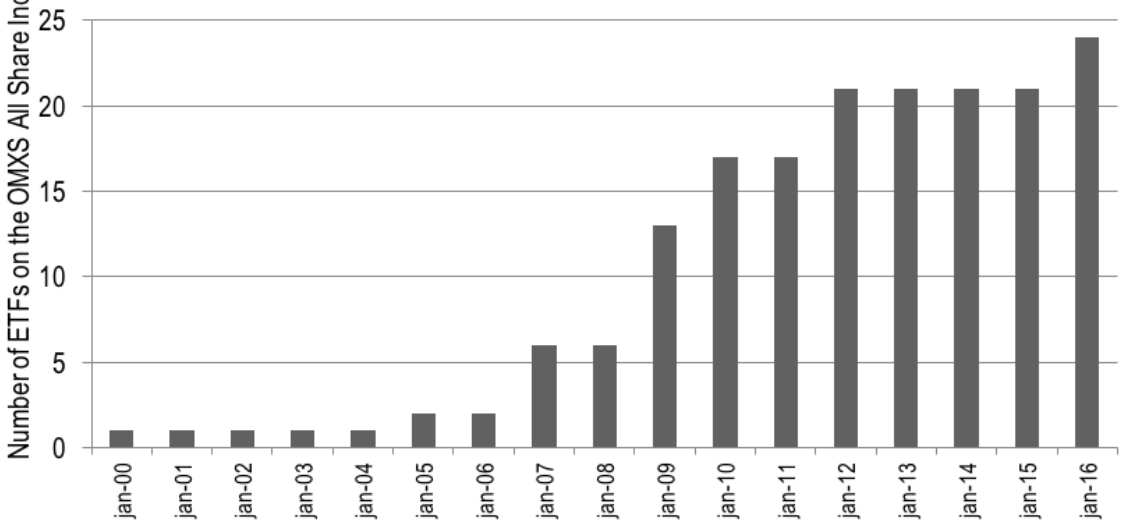
As the ETFs track a particular benchmark index it enables passive exposure to the index through a single tradable security. Buetow & Henderson (2012) conclude that ETFs constitute a significant opportunity to invest in passive investment instrument that allows investors to access asset classes that previously had not been available, lowering the costs of value-weighting. “The Evolution and Success of Index Strategies in ETFs” by Joanne M. Hill (2016) reach conclusions similar to those reached by Buetow & Henderson (2012). Hill finds that the reason for the dramatic increase in the number of ETFs listed on stock exchanges might attribute to the fact that they enable investors to pursue value-weighting strategies to a fraction of the previous cost or that of what mutual funds offered. For the purpose of this

thesis, the finding presented by Hill (2016) is highly relevant as the mean-variance optimizing strategy as suggested by modern portfolio theory relies on rational investors holding a combination of a risk-free asset and the market. ETFs have been a revolutionary invention; they are readily available, have implications on value-weighting and are, although their underlying constituents might not be, highly liquid investment vehicles. Further, ETFs enable large and small investors to hold them for the same low management fees (Hill, 2016). All of which should increase the incentives to value-weight for all market actors.

According to Davidov, Florestedt, Peltomäki & Schön (2017), the usage of ETFs and other exchange traded products have increased amongst all types of investors on the Swedish stock exchange. *Figure 2.1* present the number of ETFs listed on the OMXS All Share Index over the reviewed period.

Figure 2.1: ETFs on the OMXS All Share Index

The figure shows the number of ETFs on the OMXS All Share Index. The data is collected from Datastream and have been retrieved yearly per the 1st of January of each year.



As *Figure 2.1* depicts, the number of ETFs have increased during the investigated period; starting with one ETF in 2000 and 24 at the end of 2016. Hill (2016) suggest that the growth of ETFs might be viewed as a global quest by investors to move closer towards an index based value-weighted portfolio as proposed by Sharpe (1964), something that could explain the increased popularity of value-weighting the Swedish stock exchange.

3 Data and Empirical Findings

The three individual data items are collected and used to compute the metric used for the purpose of this thesis, as expanded upon in *Section 3.1*. We calculate the metric for the market (the OMXS All Share Index) and the OMXS30[10]. Considering individual stocks are listed and frequently delisted the sample size underlying the computation of the metric changes over time. To correct for variations in the sample size for the computations, we randomly select a fixed number of stocks[11]. As mentioned previously metric is expected to fluctuate as it is profoundly affected by individual stocks[12] that deviate from the overall trend. To visualize this, we also plot a version of the where the most extreme one percent are excluded.

The results are plotted for the different investigated samples and a trend for the entire investigated period is presented. The chapter is concluded with the investigation of the popularity of value-weighting over periods of financial turmoil.

3.1 Basic Variables & Collection of Data

The estimation of the popularity of value-weighting requires three data items: shares outstanding, share volume and share price. The data items are readily available and from well-known sources. For the purpose of this thesis, Bloomberg is the database used.

For all shares, we collect data items at the individual stock level. Shares outstanding is the number of shares of common equity, share volume is the number of shares traded in stocks within a given period *t* (month) and closing price is the price at the end of a specified period *t*. Although data for all stocks are collected daily for the entire investigated period the metric developed by Bhattacharya & Galpin (2011) is computed monthly. Share volume is summarized in every period *t* to get the monthly share volume per stock *i*. Closing price together with shares outstanding are collected on the final trading day of each period *t*. The market capitalization of a stock computed as the shares outstanding multiplied by its closing price at the end of each period *t*.

[10] The OMXS30 index has the stocks with highest traded value per six months as its constituents (Nasdaq Global Indexes, 2017).
[11] See *Section 3.2.1* for further details
[12] Referring to the discussion in *Section 2.2* and the implications of a value-weighted metric. In the revised sample, the one percent most extreme outliers have been removed.

As given by *Equation 2.1* in *Section 2.2* we compute the metric in every period *t.* For each period, the turnover of stock *i* is calculated as share volume over shares outstanding at the end of that month for stock *i*. After which, the value-weighted cross-sectional variance of log turnover is calculated in period *t* for the market and the subsections, where *t* extends from January 2000 to December 2016. The metric measures deviations from constant turnover, indicating that two-fund separation does not hold and that there is a deviation from all investors value-weighting.

As mentioned previously, data is collected daily[13] and summarized monthly to fit our period *t*. Before computing the metric, all observations are examined before included in the final sample. For a stock to be included in the final sample, Bloomberg must list the observation as an ordinary common share. In addition: the stock must have been traded during time period *t* and information regarding the number of shares outstanding must be obtainable through Bloomberg. Given these conditions 4 191 observations, or 5.36 %, out of 78 198 have been excluded from the final sample[14]. For the OMXS30 no alteration of the original sample obtained through Bloomberg has been made. Since the investigated period stretches from the year of 2000 through 2016, 204 value-weighted cross-sectional variances of log turnover are computed for the OMXS All Share Index and 198 for the OMXS30[15].

3.2 Empirical Findings

After analyzing our data, we reach three significant findings. The first (1) is that the popularity of value-weighting one's portfolio is increasing for all investigated data samples during the observed period. This finding contradicts that of Bhattacharya & Galpin (2011) who found that value-weighting was becoming less popular on the Swedish stock market. Our second (2) significant finding is that value-weighting is more popular on the subset OMXS30 than on the market (OMX All Share Index). Our third (3) and final significant finding is that value-weighting one's portfolio becomes less popular in times of financial turmoil. We discuss all three findings in greater detail in the following sections.

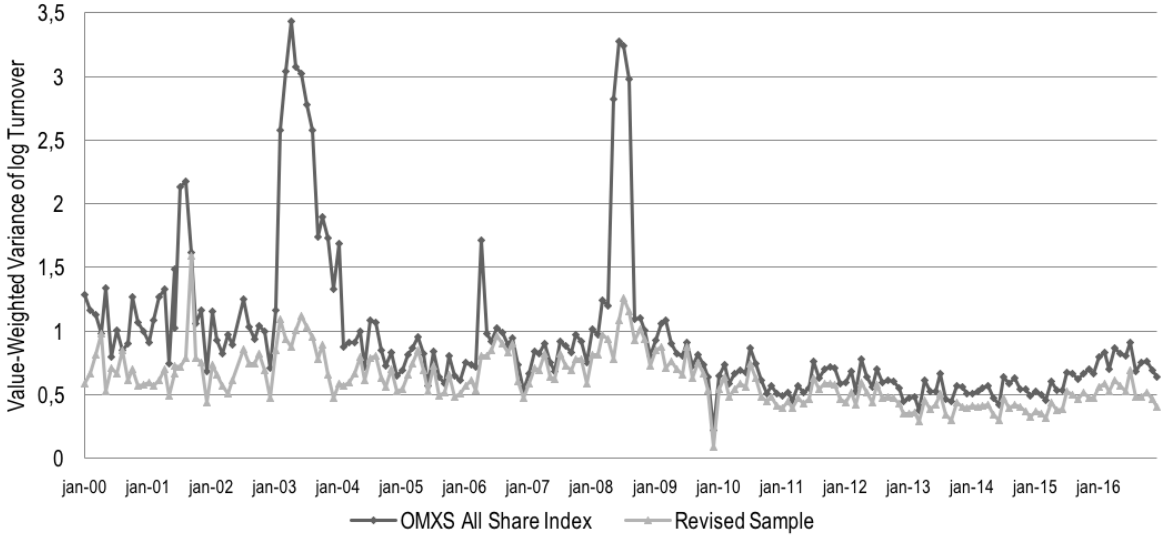
[13] Although data is collected daily it is done to retrieve monthly data on share volume as share volume is not summarized monthly by Bloomberg. No summation of the number of daily observations has been made but an estimate can be obtained by multiplying the average monthly observations by the average number of trading days in each month. An estimate resulting in 1 634 261 observations with the use of an annual average of 251 trading days per year.
[14] Many of which are ETFs, and thus excluded per metric definition
[15] No data regarding the constituents of the OMXS30 attainable through Bloomberg for the period January 2000 to June 2000. Hence the period for the OMXS30 is revised to July of 2000 to December of 2016.

3.2.1 OMXS All Share Index

Graph 3.1 plots the metric over the investigated period. The spikes for the OMXS All Share Index occur during the bust of the IT-bubble on the Swedish stock market and the financial crisis of 2007 through 2008. We cannot describe the spike in 2003 and 2004 by any macro trends or occurrences. However, when examining the data on a company level, it is profoundly affected by a few equities demonstrating an unusual trading pattern during this given period. The Revised sample plots our metric with the 1 % most extreme observations excluded, which eliminates the unusual pattern over this period. Amongst the observations removed in the revised sample are, Vodafone Europolitan Ab, Ericsson Ab and Svea Skog Ab whom all under this particular time period demonstrate a deviant trading pattern. Vodafone Europolitan Ab was under investigation of the Swedish Competition Authority (Jelmeni, 2004) and prohibited by Marknadsdomstolen in case MD 2004:24 (2004) from continuing their aggressive marketing. Ericsson Ab was during the same period experiencing a period of rough turmoil (Dagens Nyheter, 2003).

Graph 3.1: OMXS All Share Index & Revised Sample

For each time period *t* (month) we calculate the value weighted variance of log turnover. The graph plots the metric over the investigated period. In the revised sample, the 1 % most extreme observations (outliers) have been removed.



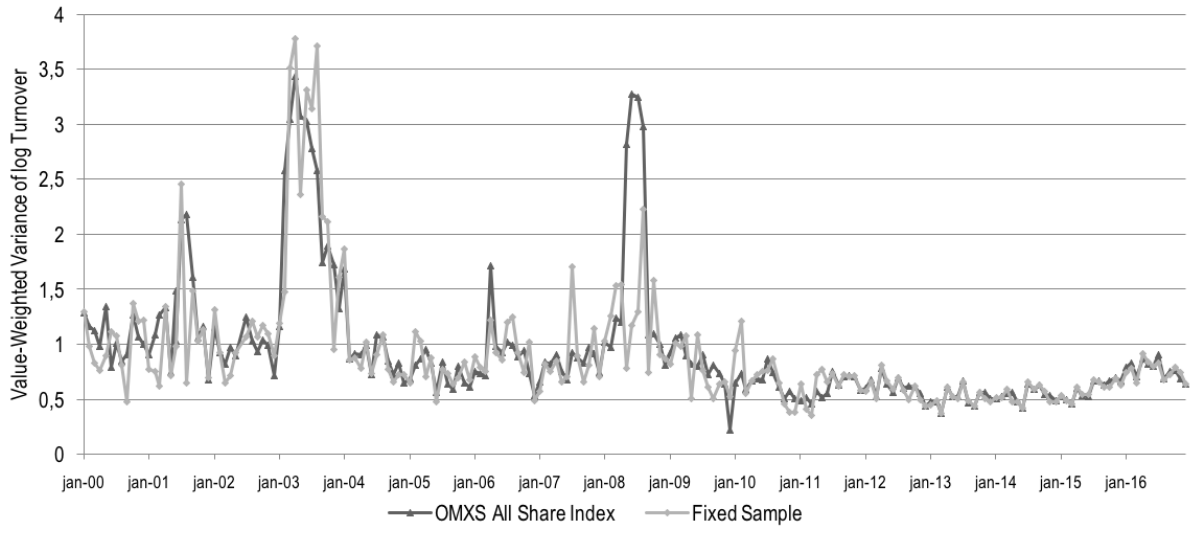
What this tells the reader is that, since the metric value-weighted, the idiosyncratic components of the metric becomes more prominent as the market capitalization of the individual constituent grows. That is if the value of the company in relation to the market increases. It seems plausible that investors - in cases where the future of specifically listed

companies seems highly uncertain - deviate more heavily from value-weighting when it comes to their holdings in these stocks. The revised sample corrects for these extreme occurrences and showcases a less noisy plotted metric.

As mentioned previously, our sample size for the OMXS All Share Index changes nearly every month since stocks are listed and delisted continuously. The metric developed by Bhattacharya & Galpin (2011) is biased, and the bias falls to 0 as the sample size reaches infinity. In consequence, sample size matters (Bhattacharya & Galpin, 2011; Dougherty, 2016). To correct for changes in the sample size, we have calculated the metric for a fixed sample of 250 stocks that are randomly selected for each period *t*. We assign each observation *i* in every period *t* with a random value. All observations in period *t* were sorted by the random value assigned. The 250 observations with the lowest values are included in the fixed sample of 250 stocks. When evaluating the OMX All Share Index for a random fixed sample of 250 stocks one can see that these follow each other closely with a Pearson's correlation coefficient of 0,8088, indicating that the metric is feasible and robust for analyzing the trends in the popularity of value-weighting. The OMXS All Share Index, together with the fixed sample, is plotted in *Graph 3.2*.

Graph 3.2: OMXS All Share Index & Fixed Sample

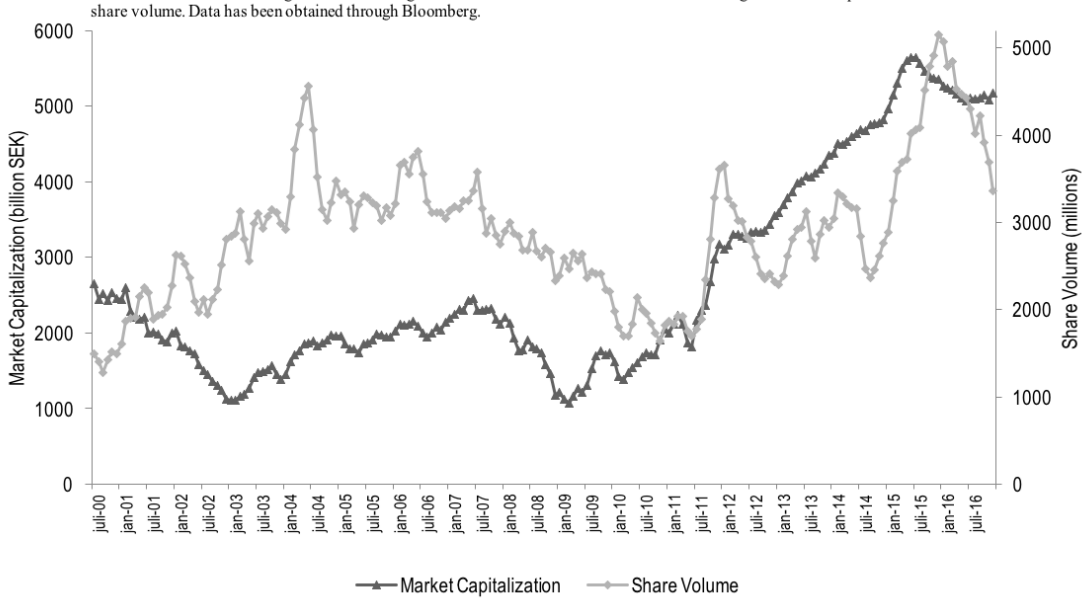
For each time period *t* (month) we calculate the value weighted variance of log turnover. The graph plots the metric over the investigated period. For the Fixed Sample we plot the metric for 250 observations that have been selected randomly.



To provide a more general picture of the trend on the OMX All Share Index we have chosen to include a graph that plots the market capitalization and share volume over time. As the number of listed stocks on the OMXS All Share Index increases over time *Graph 3.3* plots the share volume and market capitalization for our fixed sample of 250 randomly selected stocks. As the constituents of the fixed sample differ in each period *t* we correct for this by plotting a six-month moving average to visualize a trend not affected by an increased sample size.

Graph 3.3: Market Capitalization & Share Volume for the fixed sample

The market capitalization and share volume is calulated for a randomly selected fixed sample of 250 stocks on the OMXS All Share Index. To correct for differing constituents and get rid of the noise we calculate the 6 month averages of market capitalization and share volume. Data has been obtained through Bloomberg.



When comparing share volume and market capitalization as plotted in *Graph 3.3* to the value-weighting metric plotted in *Graph 3.2* one notices that the spike in the value-weighted metric during the years of 2003 and 2004 occurs simultaneously as a rise in share volume on the OMXS All Share Index and the fixed sample. This confirms the argument made previously regarding abnormal trading patterns ultimately affected the value-weighting proxy.

Graph 3.2 together with *Graph 3.3* tells the reader that one cannot tell a story which refers to investing in the market as becoming more popular linearly. The metric and market efficiency is, as suggested by Lo (2012), affected by the overall state of the financial market and its constituents. A similar spike in share volume occurs during the IT-bubble and the financial crisis. During these two periods, there is also a significant drop of overall market

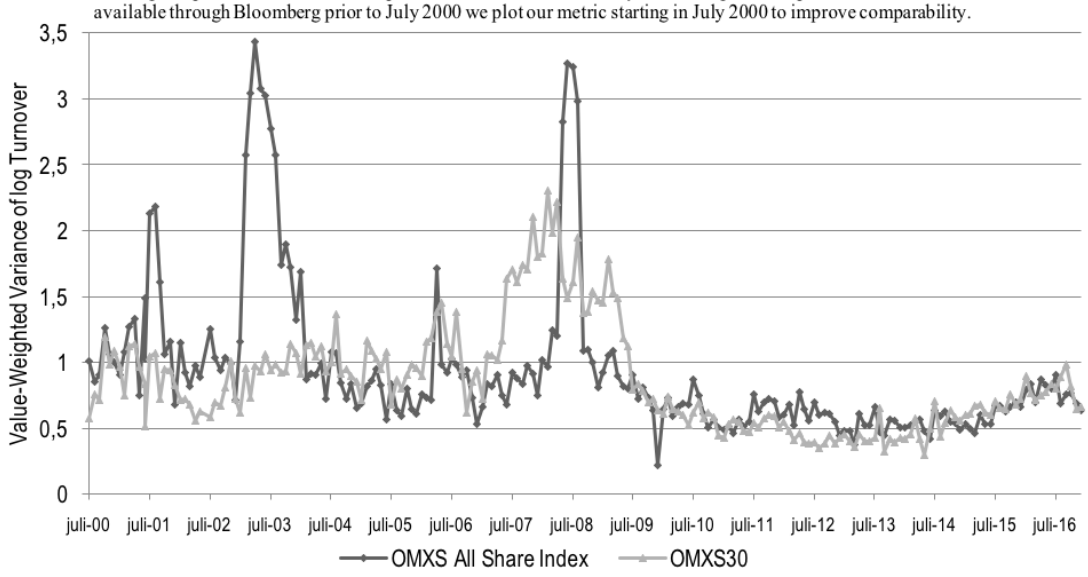
capitalization or market value. The theory suggests that these periods are also affected by declined market efficiency, more on this in *Section 3.2.4*.

3.2.2 OMXS30

Calculating the means for the OMXS All Share Index and the OMXS30 over the investigated period we reach a significant mean difference of 0.0977 (or 10.42 %) with a p-value of 0,0165. Thus, the popularity of value-weighting is significantly higher on the OMXS30 compared to the OMXS All Share Index. Bhattacharya & Galpin reaches a similar conclusion when comparing large stocks to smaller stocks on the U.S. stock exchanges, where they conclude that value-weighting is 70 % more common amongst companies followed by 10 or more analysts compared to companies followed by one analyst (Bhattacharya & Galpin 2011). As analysts closely follow the OMXS30 constituents, this betters the information disclosure of this segment. Bhattacharya & Galpin (2011) correspondingly find that the value-weighting amongst S&P 500 equities is more popular than on non - S&P 500 equities. *Graph 3.4* plots the metric over the investigated period for the OMXS30 and the OMXS All Share Index.

Graph 3.4: OMXS All Share Index & OMXS30

For each time period *t* (month) we calculate the value weighted variance of log turnover. The gaph plots the metric over the investigated period. For OMXS30 we plot the constituents as stated by Bloomberg for each period *t*. Since not data is available through Bloomberg prior to July 2000 we plot our metric starting in July 2000 to improve comparability.



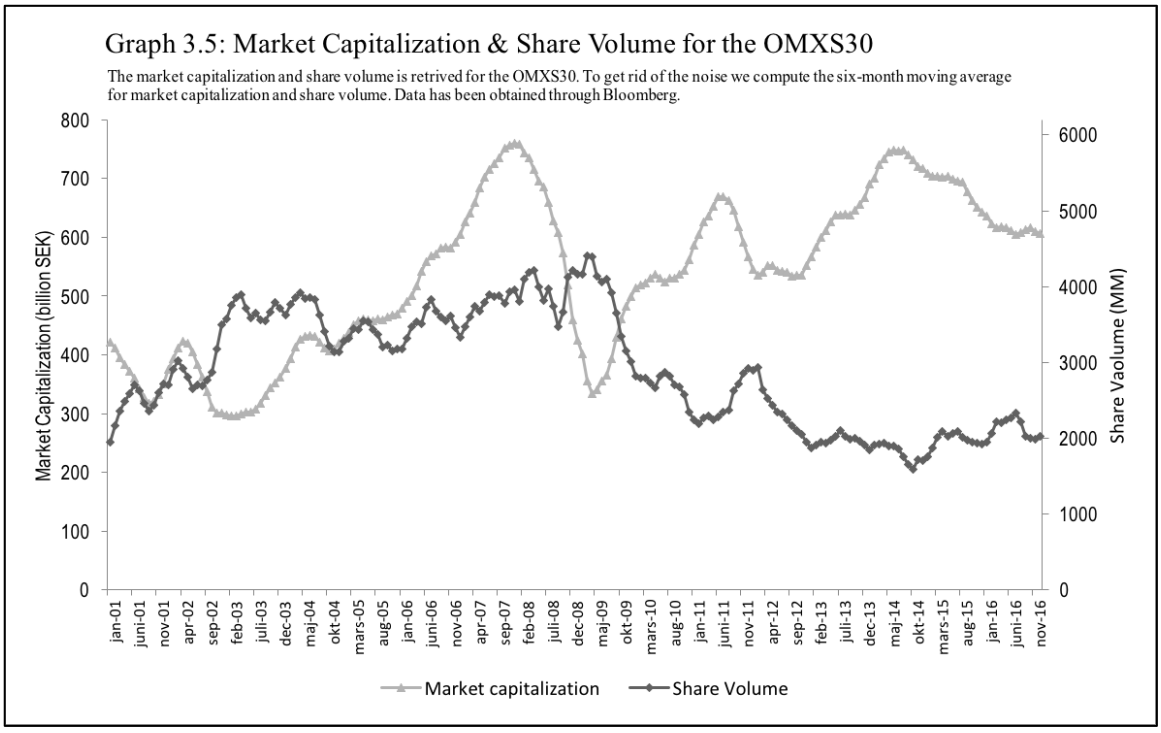
The constituents of OMXS30 are the companies with the highest traded value per six months (Nasdaq Global Indexes, 2017). In consequence, its constituents are transparent and highly

liquid stocks. According to previous research (Fama, 1970; Morck, Yeung & Yu, 2000; Bhattacharya & Galpin, 2011; Crawford, Roulstone & So, 2012), this should better the information disclosure in this segment, making it more efficient. Since the metric is developed on the foundations of modern portfolio - which assume markets to be efficient (Sharpe, 1964; Lo, 2004; Bhattacharya, 2011) - better information disclosure should affect the popularity of value-weighting, and thus the metric used in this thesis. The incentives for stock picking decrease as the incentives for rational investors to value-weight increase. As mentioned in in *Section 2.2*, the theory suggests that value-weighting should be more popular on the OMXS30. Consequently, the theory aligns with our empirical findings.

That the value-weighting one's portfolio is more popular on the OMXS30 than on the OMXS All Share Index seems reasonable for more reasons than that of better information disclosure. The ETFs, as shown in *Figure 2.1*, have increased during the investigated period. However, there are several ETFs and mutual funds that track this exact index - many of which use physical replication - meaning that the ETFs and Mutual Funds purchase actual stocks to replicate the index performance of OMXS30 (Avanza, 2017; Nasdaq, 2017b; Xact, 2017). This, in turn, makes it easier for investors to value-weight the OMXS30.

During the period the year of 2006, that is prior to the global financial crisis of 2008, the popularity of value-weighting decreases. Most of this is due to Nokia who in 2006 started experiencing trouble with its business model (Gripenberg, 2006) and introduced a new CEO due to the crisis that the company was facing (Jakobsson, 2012). The discussion is similar to the one presented in *Section 3.2.1* concerning the revised sample. One should keep in mind that there are factors other than time affecting the popularity of value-weighting one's portfolio.

The same exercise as for the OMX All Share Index - concerning plotting the market capitalization and share volume - is conducted for the OMXS30. To display the overall trend rather than a noisy scatter we compute the six-month moving averages. The results are plotted in *Graph 3.5*.



When studying share volume and market capitalization as plotted in *Graph 3.5* one notices that during the global financial crisis the market capitalization of the OMXS30 decreases significantly and share volume increases during the same period as the value-weighting becomes less popular. The pattern affirms the conclusions reached by Lo (2002) and Horta, Lagoa & Martins (2014) as has been discussed previously. More on the popularity of value-weighting in times of financial turmoil in *Section 3.2.4*.

3.2.3 The Value-Weighted Portfolio over Time

As this thesis seeks to investigate how the popularity of value-weighting changes over time two tests have been conducted to analyze this further. First; we divide our sample into two periods, each covering half of the total investigated period. The first period reaches from January of 2000 until June of 2007, and the second from July of 2007 to December of 2016. The means are calculated for the full period and the two periods separately, after which we test for a significant difference in the popularity of value-weighting between the two investigated periods. The results express that the means of the two periods are significantly separated from each other. Hence, the popularity of value-weighting has increased from the first period to the second. The results are displayed in *Table 3.1*.

Table 3.1: Two Period Popularity of Value-Weighted Portfolios

For each time period *t* (month) from 2000-2016 we calculate the value-weighted variance of log turnover for the defined segments as stated in the table. We define the 1st period as 2000.1-2007.06 and 2nd period as 2007.07-2016.12. We then compare the means over the 2 periods and investigate the difference (Δ) to see if it is significant. The means are rounded to the fourth decimal place. *, ** and *** denote significance at the 5%, 1% and 0,1% levels, respectively.

	OMXS All Share Index	Fixed Sample	Revised Sample	OMXS30
Full Period	0.9726	0.8992	0.6218	0.8396
1st period	1.1914	1.1221	0.7387	1.1053
2nd period	0.7630	0.7180	0.5525	0.8061
Δ 1st - 2nd	-0.4284***	-0.4041***	-0.1862***	-0.2992***

As the table suggest, there is a significant decrease in the metric developed by Bhattacharya & Galpin (2011) and thus an increase in the popularity of value-weighting one's portfolio in the second period. As illustrated in *Graph 3.1* and *Graph 3.2* as well as discussed in *Section 3.2.*1 the fixed sample together with the OMXS All Share Index are exposed to deviations in the trading pattern that shocks the metric during the years of 2003 and 2004. These occur in the first period. The deviation affect the mean in the first period and the difference in means over the two periods are therefore not an absolute truth or proof of the popularity of value-weighting increasing by a significant magnitude from one period to the next. However, the revised sample, with the 1 % most extreme observations removed; demonstrate the same trend, as does the OMXS30. Therefore; the popularity of value-weighting has risen from the first period to the second. However, not as dramatically as the OMXS All Share Index and the fixed sample data suggests.

To further analyze the popularity of the value-weighted portfolio a chi-squared trend regression test is used to investigate the occurrence of any trends in the data. *Table 3.2* presents the trend estimations for all data samples.

Table 3.2: Trend Estimation of the Value-Weighted Portfolio

For each time period *t* (month) from 2000-2016 we calculate the value-weighted variance of log turnover for the following defined segments as stated in the table. We calculate the mean for the entire period, the means are rounded to the fourth decimal place. We estimate an annualized trend in percentages. The trend estimate and its *p*-value are presented in the last 2 columns.

Segment	Mean 2000-2016	Trend	Trend p-value
OMXS All Share Index	0.9726	-0.164	0.000
Fixed Sample	0.8992	-0.164	0.000
Revised Sample	0.6218	-0.067	0.000
OMXS30	0.8396	-0.107	0.002

The trend estimates over the investigated period differ from the results reached by Bhattacharya & Galpin (2011) in more ways than one. First: Bhattacharya & Galpin reaches the conclusion that the Swedish stock market demonstrates a different trend from the one observed worldwide. They reach a mean for Sweden of 0.979 and annualized trend in percentages of 0.227; meaning that value-weighting one's portfolio becomes less popular over their investigated period that stretched from 1995 to 2005 (Bhattacharya & Galpin, 2011). Second: the annualized trend estimates are lower than those presented in "The Global Rise of the Value-Weighted Portfolio" where Bhattacharya & Galpin (2011) reaches a worldwide annual trend of -0.956 % and a trend of -0.993 % for the developed countries in their article[16]. However, their study doesn't only cover a different period, but also includes 46 countries that they divide into developed - and emerging markets. When examining their findings per country the trend estimate presented for Sweden in this thesis is less of an outlier than what the aggregated means and trends presented by Bhattacharya & Galpin (2011) suggest. In this context it is important to stress the fact that Bhattacharya & Galpin (2011) conduct their investigation over a different period than that of this thesis, therefore it possible that the trend has shifted. When considering the IT-bubble having pronounced effects on the Swedish stock exchange (Jakobsson, 2002) and consequently affecting the proxy for value-weighting their deviant trend could connect to the IT-bubble, more on this in *Section 3.2.4*.

When observing *Table 3.2* one can conclude that the trend demonstrated by the Swedish stock exchange no longer is deviant from the worldwide trend presented by Bhattacharya & Galpin (2011). Over the investigated period the popularity of value-weighting one's portfolio has

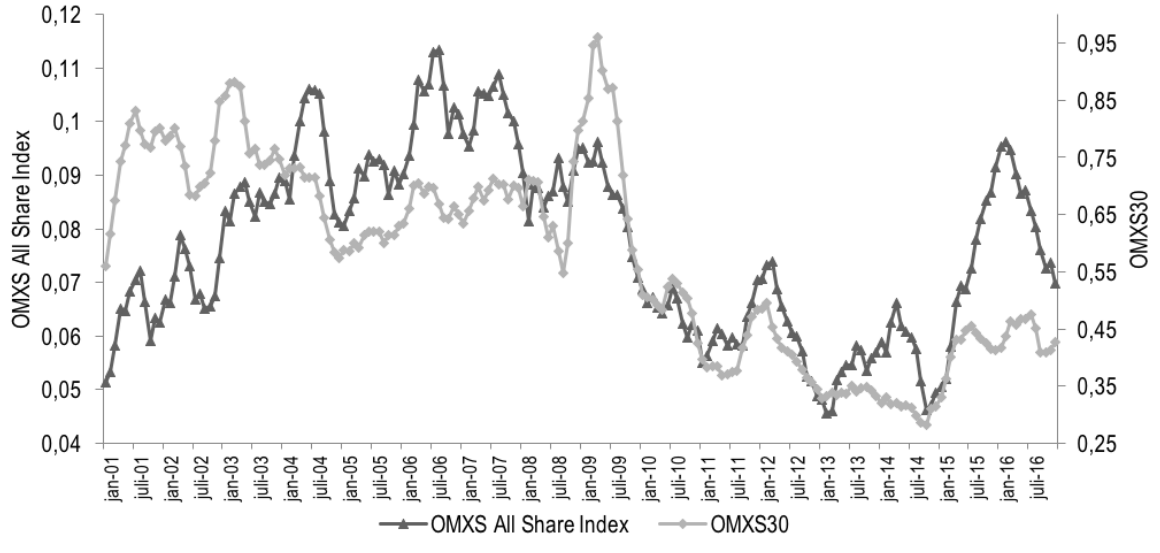
[16] Bhattacharya & Galpin (2011) divides their sample in emerging markets and developed markets. The trend presented here is the finding for markets that they classify as developed, amongst which Sweden is one of the markets that they investigate.

increased significantly for all samples. However, as suggested by the graphs presented in previous sections, the metric used as a proxy for the popularity of value-weighting is by no means a metric linearly reduced over time as the popularity of value-weighting becomes steadily more popular. Rather it is profoundly affected in certain periods. The trend, however, seems to be that investing in the market is becoming more and more popular. All of which is consistent with the findings of Lo (2012) presented in *Section 3.2*. Lo (2012) concludes that the tradeoff between risk and reward is not constant over time, and that fear rules the markets in times of market dislocation and financial turmoil. At times moving markets away from the assumptions underlying the CAPM, and thus the metric used in thesis.

To better understand the underlying mechanism of the proxy used for the purpose of investigating the popularity of value-weighting we plot the turnover of the OMXS30 and the OMXS All Share Index over the examined period. *Graph 3.6* exhibits the results. To get rid of the noise and better visualize the trend we calculate the six-month moving average of turnover.

Graph 3.6: Turnover for the OMXS All Share Index & OMXS30

The graph plots the turnover for the OMXS All Share Index and the OMXS30. Turnover is calculated on the aggregate level for both segments as share volume over shares outstanding. The get rid of the noise and better vizualize the trend we plot the 6 month moving average of turnover.



As *Equation 3.1* suggests, the metric evaluates the deviations from constant turnover for every stock *i* regarding the value-weighted variance of log turnover. When studying *Graph 3.6*, there does not seem to be a direct link between the metric. One can, when investigating

Graph 3.6 more carefully, assert that the turnover moves more in a more volatile manner during the periods in which we see a rise in the value-weighting metric. When there is a greater dispersion in the data, the variance of turnover, or deviations from constant turnover might increase. *Graph 3.6* reaffirms the picture discussed previously, that value-weighting is heavily affected in periods; whether it is financial turmoil or deviant observations. Studying *Graph 3.6* keeping the picture of *Graph 3.3* and *Graph 3.5* in mind, curiosities regarding the market microstructure and abnormal trading patterns arise. These seem to be occurring both in times of market up- and downturns. As firm-level returns[17] affect the market capitalization of the listed equities, and as our metric peak during turns is market capitalization, there might be a connection. These connections are mere speculations as the individual weights of the constituents are not accounted for in *Graph 3.6* or make any formal connections to the metric[18].

The increased popularity of value-weighting is consistent with the existing theory of market efficiency (Bhattacharya & Galpin, 2011; Morck, Yeung, & Yu, 2013). The occurrence of ETFs is another possible explanation for this trend. As ETFs provides a vehicle for investors to invest in the market or sub-segment of the market at a lower cost than that of reconstructing the market weights in an individual portfolio. This thesis makes no formal connection between the occurrence of ETFs and the popularity of value-weighting. Only that the circumstances and existing theory seem to be pointing in the direction of a possible liaison between the existence of ETFs and the popularity of value-weighting.

As the study conducted by Kadapakkam, Krause & Tse (2014) suggests, the increased popularity of ETFs has resulted in markets becoming more efficient. The effect of the ETFs on the popularity of value-weighted portfolio can, therefore, be claimed as two-fold. First; they enable investors to invest in the market at a lower cost (Hill, 2016), and second; they make markets more efficient which reduce the incentives to stock pick. The case described by Hill (2016) - where the explosion of ETFs suggests a quest in which investors move closer to value-weighted portfolios - are not supported by the findings of this thesis, only that the trend seems to be that more investors tend to value-weight over time.

[17] Although we do not investigate firm-level return on a direct basis we get a secondary insight of firm-level return as we plot the market capitalization of our sample. Market capitalization is heavily affected by firm-level return as valuations are based on discounted cash-flows (Bodie, Kane & Marcus, 2014).
[18] In addition, as mentioned is *Section 2.2*, scaling does not affect the variance of log turnover.

3.2.4 The Value-Weighted Portfolio and Financial Turmoil

As discussed previously, market efficiency is not constant over time (Lin, Brooks & Kim, 2008; Lo, 2012) and is affected in times of financial turmoil (Lesmond, Schill & Zhou, 2004; Choudhry & Jayasekera, 2013). When the underlying assumptions of the CAPM and traditional assumptions of modern portfolio theory break down (Sharpe, 1964; Lo & Wang, 2000; Bhattacharya & Galpin, 2011), the metric developed by Bhattacharya & Galpin (2011) should be affected. In *Section 2.3.1* it was put forth that mean-variance optimizing one's portfolio might not be optimal with all available information not reflected in the price of the securities and that there are arbitrage opportunities present (Choudhry & Jayasekera, 2013). As the finding manifested by Horta, Lagoa & Martins (2014) suggests, market efficiency is affected in times of financial turmoil; hence the popularity of value-weighting should decrease during these periods.

To investigate this further, periods that fit the two financial crises on the Swedish stock market are defined. We define the IT-bubble on the Swedish stock market as the years 2000 and 2001 (Aronsson, 2014) and the most recent global financial crisis as the years 2007 and 2008 (Sveriges Riksbank, 2009). The means are calculated for these two periods and compared to the mean for the whole period. *Table 3.3* displays the results.

Table 3.3: The Value-Weighted Portfolio in Times of Financial Turmoil

For each time period *t* (month) from 2000-2016 we calculate the value weighted variance of log turnover for the defined segments as stated in the table. We calculate the means over the full period, the IT-bubble and the 2008 crisis. The means are rounded to the fourth decimal place. The IT-bubble is defined as 2001-2001 and the 2008 crisis as 2007-2008. We investigate whether there is a significant difference between these two periods and the mean for the full period. *, ** and *** denote significance at the 5%, 1% and 0,1% levels, respectively.

Segment	Full Period	IT-bubble	Global Finacial Crisis
OMXS All Share Index	0.9726	1.1841***	1.2775*
Fixed Sample	0.8992	1.0279**	1.0494*
Revised Sample	0.6218	0.7062**	0.8285***
OMXS30	0.8396	0.9251***	1.5874***

The data presented in *Table 3.3* tells the reader that the means are significantly higher both during the IT-bubble and the global financial crisis. Before reaching further conclusions, one should question whether it is reasonable to compare the years of 2000 and 2001 to the entire

period when a trend that showcases the rising popularity of value-weighting portfolios was put forth in *Section 3.2.3*. To present further conclusions regarding the IT-bubble one should extend the observed to cover years before what this thesis defines as the IT-bubble. However, when combining the study conducted by Bhattacharya & Galpin (2011) with this thesis, one can assert the following. First: the means for the entire period are similar in the two studies. Bhattacharya & Galpin (2011) compute a mean of 0.979 with an annualized trend in percentages of 0.227 compared to 0.9726 with an annualized trend in percentages of -0.164 that we find in this study. Second: Bhattacharya & Galpin (2011) conclude that the first-period means of their research (that is 1995 through 2001) is significantly lower than the one they find in their second period (2001 through 2007). With the two studies combined one the years before the IT-bubble seems to have had a lower. This point in the direction of the IT-bubble having a significant impact on the popularity of value-weighting.

The defined global financial crisis is primarily occurring in what *Section 3.2.3* refers to as the second period; the period with the significantly lower mean than the first. The mean during the global financial crisis is significantly separated from that of the entire investigated period, thus indicating that value-weighting becomes less prevalent during times of financial turmoil. As mentioned earlier, economic disruption stresses the market, its general information disclosure worsens and markets become less efficient (Choudhry & Jayasekera, 2013; Horta, Lagoa & Martins, 2014). With information disclosure deteriorating information asymmetry amongst market actors arises, and incentives to stock pick increases in relation to value-weighting. As *Table 3.3* tells the reader the mean is separated for all investigated samples, for the OMXS30 and the revised sample the significance is at the 0.1 % level, and for the fixed sample and the OMXS All Share Index on the 5 % level. Noticing that the difference in the degree of significance improves on the OMXS30 and revised sample one can surmise their respective full period means not affected by the deviant trading patterns of the years 2003 and 2004 as discussed in *Section 3.2.1.*

4 Conclusion

In the final chapter of the thesis, we review our three significant findings and their interpretations in *Section 4.1*. As our study leaves questions unanswered, we dedicate *Section 4.2* to suggestions for future research.

4.1 Key Findings

We do three things in this thesis. We first describe a metric based on theory designed to work as a proxy for the popularity of value-weighting on a market or a subset of the market. We conclude that theory suggests that the metric is affected by market efficiency, market irregularities and the occurrence of ETFs. We then compute the metric to analyze data gathered from Bloomberg. We document that: (1) value-weighting is becoming increasingly popular on the Swedish stock exchange. That (2) value-weighting is more popular on the sub-segment OMXS30 than on the market as a whole. Finally, (3) value-weighting becomes less popular in times of financial turmoil.

Although we cannot prove the underlying reasons for our findings, existing theory suggests that our first (1) finding is explained by market efficiency improving over time, due to both technological inventions bettering the information disclosure and an increasing popularity of ETFs. We perceive our second (2) finding most probably attributed to the fact the OMXS30, being closely followed by analysts, experiencing higher levels of information disclosure and efficiency; making it harder for stock pickers to find mispriced equities on this particular sub-segment. The OMXS30 also provides easily accessible means for value-weighting through ETFs and other index-tracking investment vehicles. The third (3) finding is possibly explained by the theory presented by Lo (2004; 2012), Morck Yeung & Yu (2000; 2013) and Horta, Lagoa & Martins (2014) stating that market moves away from efficiency during times of financial turmoil leaving actors driven by fear rather than rationality. Resulting in investors deviating from the market portfolio, for two possible reasons; irrational fear-driven behavior and/or mean-variance optimization no longer standing as the most rational strategy.

Our findings suggest that although distinct sub-segments and periods in time seem to favor the Irish Jig performed by stock pickers, they are worse of over time. Taking on what the CAPM would describe as unnecessary risk. The market as a whole seems to, although

stochastic, moving in the direction of value-weighted portfolios. Hopefully indicating that investors are becoming more aware of the risk posed by an undiversified portfolio.

Of our three finding the first (1) and second (2) are aligned with those of Bhattacharya & Galpin (2011), although they present a deviant trend for Sweden our finding aligns with their worldwide trend found in their article. The third (3) is not, to the best of our knowledge, previously documented and the underlying causes for this deviation remain to be investigated.

4.2 Suggestions for Future Research

Although this thesis is contributing with three significant findings, questions are left unanswered. First; this thesis does not investigate the causality of value-weighting in greater detail. Theory suggests that value-weighting is heavily affected by market efficiency. Our findings seem to correlate with existing theory, but it stands to be proven empirically. A suggestion would be to investigate the market efficiency in terms of auto-correlation of stock return and see whether the value-weighting metric can be explained by the results. Further, this thesis does not investigate the relative popularity of value-weighting vis-a-vis stock picking. Future studies could, therefore, put the two philosophical investment strategies against one another, to study their proportions on the Swedish stock exchange.

5 References

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