# THE RELATIONSHIP BETWEEN DIVERSIFICATION AND VOLATILITY IN THE SHARE PRICES: EVIDENCE FROM BIST

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## Abstract

This paper, following the review of the relevant literature and setting out a theoretical background surrounding diversification, its reasons and the expected effects, intends to provide an empirical analysis regarding the relationship between volatility of the share prices and the diversification of activity fields of firms traded on Borsa Istanbul (BIST) and listed in the BIST Holding and Investment Companies index. Annual consolidated financial statements for 29 different companies are used between 2009-2016. According to the results, there is a negative relationship between the number of fields of activity and the annual average volatility of the share values. Given the relatively high market risks in emerging markets, such as Turkey, it could be asserted that diversification will continue to be a useful tool in decreasing volatility.

**Key Words:** Diversification, volatility, BIST, XHOLD

# HİSSE SENETLERİ FİYATLARI OYNAKLIĞI VE ÇEŞİTLENDİRMESİ ARASINDAKİ İLİŞKİ: BORSA İSTANBUL'DAN BULGULAR

## Özet

Bu makale, ilgili literatürün gözden geçirilmesini takiben ve çeşitlendirme, nedenleri ve beklenen etkileri içeren teorik bir arka plan ortaya koyarak, hisse senedi fiyatlarındaki oynaklık ile Borsa İstanbul'da (BIST) ve BIST Holding ve Yatırım Şirketleri endeksinde işlem gören firmaların faaliyet alanlarının çeşitlendirilmesi arasındaki ilişkiyi ortaya koymayı amaçlamaktadır. 2009-2016 yılları arasında 29 farklı şirket için yıllık konsolide finansal tablolar kullanılmaktadır. Sonuçlara göre, faaliyet alanlarının sayısı ile hisse senedi değerlerinin yıllık ortalama oynaklığı arasında negatif bir ilişki gözlemlenmiştir. Türkiye gibi gelişmekte olan piyasalarda görece yüksek piyasa riskleri göz önüne alındığında, çeşitliliğin oynaklığın azaltılmasında yararlı bir araç olmaya devam edeceği söylenebilir.

**Anahtar kelimeler:** Çeşitlendirme, oynaklık, BIST, XHOLD

## INTRODUCTION

Turkish business groups historically have and continue to use diversification as a tool to minimize risks (Özkara, Kurt, & Karayormuk, 2008: 65) (Global Investment Holding, 2010: 10). Although there is obviously a consensus on the expected effects of diversification on risk aversion, to the best of our knowledge there are no empirical studies concerning Turkish companies that test whether the expected effects can actually be observed in the share price volatility.

Our study aims to test the hypothesis that there is a negative relationship between the share value volatilities listed in XHOLD and the diversification of the sample firms. For that purpose, we analyse the correlation between share value volatilities of companies traded on Borsa Istanbul, which are at the same time listed in the BIST Holding and Investment Companies index with the number of activities classified in accordance with Eurostat's statistical classification of economic activities.

In this context, we first try to summarise the literature in relation to the definition, motives, means and directions of diversification and also the relationship between the value of the firm and diversification and its effects on stock prices. We then set out the basis upon which we have chosen our data for the purposes of our analysis and the methodology surrounding the development of the data.

Finally, we set out our methodology in analysing the relationship between volatility of the share prices and the number of activities of the sample firms. Following the analysis we conclude that, although the graphical observation and a correlation analysis indicate that there is a negative correlation between the increase in the fields of activity and the share value volatility, this conclusion cannot be confirmed through statistical means.

The rest of the paper is organised as follows. Section 2 reviews the previous literature. In Section 3, the empirical data and sample are presented. Section 4 gives the details of the methodology. The empirical results and findings of the paper are discussed briefly in Section 5. Finally, Section 6 concludes and discusses some implications for further researches.

## 1. LITERATURE REVIEW

The value of a firm is primarily dictated by the risk and the return provided by its investments. The risks can be classified in two groups: (i) market or undiversifiable risk; and (ii) specific or idiosyncratic risk (Vernimmen, Quiry, Dallocchio, Le Fur, & Salvi, 2014: 314). Markowitz, in his Nobel acclaimed studies, has set out the basis of the modern portfolio theory and suggested that investors are risk averse and they will choose the less risky alternative in case two portfolios offer the same return (Markowitz, 1952). The idiosyncratic risk can be reduced through holding a diversified portfolio of assets (Lee & Lee, 2010: 167).

From a practical perspective, diversification can either be used to reduce the idiosyncratic risk for a given level of return; and/or improve the return for a given level of idiosyncratic risk (Vernimmen, Quiry, Dallocchio, Le Fur, & Salvi, 2014: 314).

In line with this theoretical background, growth, risk aversion and benefiting from economies of scale have been identified as the main drivers for diversification (Karaevli, 2008: 87). Moreover, internal capital markets' efficiencies, market power advantages, and others (including tax and other financial benefits) have been considered as the benefits that may be driven from diversification (George, 2007). Similar to Karaevli and George, Cretu (2012) has conceived all of these factors to be the drivers for diversification and summarises these as: (i) scale and range of economies; (ii) the power on the market; (iii) profit stability; (iv) improvement of financial performance; and (v) growth of the company's dimension.

Noting various definitions of diversification, Ramanujam and Varadarajan offer "the entry of a firm or business unit into new lines of activity, either by processes of internal business development or acquisition, which entail changes in its administrative structure, system and other management processes" as a definition for diversification (1989: 525).

The theoretical perspectives underlying the choice for diversification worth mentioning threefold, and these are: (i) agency theory; (ii) the resource based view; and (iii) market power (Montgomery, 1994).

Scholars who argue that agency theory is one of the main reasons for diversification claim that free cash flows made available to managers lead managers to expand the scale of their firms, even if that behaviour means undertaking poor projects, thereby reducing firm value (Park & SooCheong, 2014: 52). This over-investing problem derives from the fact that the shareholders and the managers have conflicting interests given that there is high positive correlation amongst diversification; increased firm size and management compensation (Finkelstein & Hambrick, 1996).

Wernerfelt (1984) considers the firm as a bundle of resources and argues that firms intend to better their positions with respect to these resources through either internal development or through mergers and acquisitions. Taking this approach as the basis, the resource-based view considers that firms diversify to extend their resources into new markets and businesses (Nath, Nachiappan, & Ramanathan, 2010: 319).

Market power is the ability of a market participant to raise and maintain price above the level that would prevail under competition (Organisation for Economic Co-operation and Development, 2002: 57). Montgomery has explained that firms will tend to diversify with a view to generate market

power through cross-subsidisation,[1] mutual forbearance,[2] and reciprocal buying.[3] It has been further acknowledged that the means asserted to be used by market power holders (obtained through diversification or otherwise) had raised concerns as to their potential in giving rise to reduced competition and higher concentration in the relevant markets (Montgomery, 1994: 165).

In line with Montgomery's (1994) concerns, legislatures have considered these means, cross-subsidisation, mutual forbearance and reciprocal buying, to be anti-competitive actions if these are made amongst separate economic enterprises. However, these actions would not be deemed to create lessened competition or higher concentration in a market where these actions are carried out within the same group, such as a holding structure or a conglomerate structure. The relevant governmental authorities could, however, limit the creation of these conglomerates through mergers or acquisitions however diversification through internal business development would not be prevented by governmental authorities as these would not be limiting competition or giving rise to higher concentration in the relevant markets.

The method for diversification has been reviewed from different perspectives, either from the type of the market where the diversification was made or from the choice of diversification mode. First distinction is made in relation to whether the diversification has been made towards related or unrelated markets. Related diversification is defined as corporate development beyond current products and markets, but within the capabilities or value network of the organisation. Related diversification can be achieved through vertical integration including backward or forward integration and horizontal integration. Unrelated diversification is defined as development of products or services beyond the current capabilities and value network (Johnson, Scholes, & Whittington, 2008: 265).

Another approach to assessing the method for diversification is the method utilised for the diversification. The methods utilised for this purpose could be: (i) acquisitions including mergers; (ii) internal development; and (iii) formation of joint ventures. It has been noted that firms typically enter new markets through internal development and less often through acquisitions while joint ventures are utilised to enter into foreign markets (Lee & Lieberman, 2010).

There is considerable amount of study focusing on whether there is any relationship between the market to be entered into is a related or an unrelated market and the method of choice for diversification (Rumelt, 1982; Yip, 1982). Lee and Lieberman (2010), taking a more resource based view, suggest that acquirers tend to use acquisitions either for close reinforcement of existing skills or for substantial jumps into new skill sets. According to their study, acquisition is utilised for the

[1] Cross subsidisation has been explained by Montgomery (1994) as the case where one firm uses its profits from one market to support predatory pricing activities in another.
[2] Mutual forbearance has been explained by Montgomery (1994) as the case where competitors meet each other in multiple markets and recognize their interdependence and compete less vigorously.
[3] Reciprocal buying has been explained by Montgomery (1994) as the case where the interrelationships among large diversified firms foreclose markets to smaller competitors.

purposes of exploiting existing resources where the expansion (diversification) is conducted in related markets; and acquisition is utilised for exploration purposes where the expansion (diversification) is conducted in unrelated markets.

Diversification for any of the reasons or any of the modes above naturally gives rise to the establishment of business groups or holding companies. In their important study, Marshall, Yawitz and Greenberg have provided empirical evidence that a systematic effort to achieve firm-level diversification underlies the structure of the conglomerate firm[4] (1984: 21). Moreover, Echanis has referred to holding companies as being an appropriate corporate structure for managing diversification (2009: 1).

Holding companies have been mainly defined by focusing on one of the two elements: (i) control; and (ii) purpose. Bonbright & Means have focused on the entity's ability to control or materially influence the management of one or more other entities (1932: 10);[5] legislatures have focused on the purpose upon which the entity was incorporated in order to assess whether such entity was a holding company. The Turkish Grand National Assembly, through the Turkish Commercial Code (Turkish Grand National Assembly, 2011), has defined holding company as "companies whose sole purpose is to participate in other entities" in Article 519 (Poroy, Tekinalp, & Çamoğlu, 2014: 295). Black's Law Dictionary's definition of "Holding Company" also focuses on the purpose upon which the company is formed by stating "a company formed to control other companies, usu. confining its role to owning stock and supervising Management" (Black, 2004: 298).

Business groups have been defined as "collections of firms bound together in some formal and/or informal ways, characterized by an 'intermediate' level of binding" (Granovetter, 1995: 95). Granovetter further considers holding companies to fall within the scope of the term business group.

Diversification effects on firm performance are also another popular research area. Isakovski's studies provide that corporate diversification has an impact on firm value through changes of the firm's characteristics where it has been further analysed that geographic diversification positively effects the firm value (2003). In their study comparing the effects of diversification on firm performance, Yigit and Akpinar have found that unrelated diversification positively affects performance in Turkey, the same cannot be said of related diversification (2016). Furthermore, Marinelli's study (2011) provides empirical evidence that "diversified firms [have] a higher ability to absorb negative financial shock." Additionally, Berger and Ofek (1995) have found that diversification reduces value. Contrary to Marinelli (2011) and Berger & Ofek's (1995) findings, Isakovski has found that the share returns of diversified and focused firms are indifferent (2003: 39).

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4 Marshall, Yawitz and Greenberg use the term "conglomerate firm" for firms "engaged in two or more distinct lines of business where the motive for combining the activities under the control of one firm does not increase market power, vertical integration, or any conventional technological economies of scale." (Marshall, Yawitz, & Greenberg, p. 1)

5 Bonbright & Means (1932, p. 10) have defined holding company as: "Any company, incorporate or unincorporated, which is in a position to control, or materially to influence, the management of one or more other companies by virtue, in part at least, of its ownership of securities in the other company or companies."

Marinelli (2011) further asserts that lower diversification results to higher degrees of volatility. Kuppuswamy and Villalonga (2015) assessed the effects of the financial crisis of 2008 on diversified firms. They have found that the value of diversified firms have significantly increased relative to single-segment firms in this period.

## 2. DATA AND SAMPLE SELECTION

Given that the main purpose of this study is to assess the level of the impact of diversification on the volatility of the share values; we have chosen to limit the scope of our sample with diversified entities. As discussed above, there may be different motives,[6] means[7] or directions[8] for diversification. For the purposes of our study, we believe that none of these distinctions carry any weight given that, whatever the motive, means or directions of the diversification, the end result is that the relevant firm has diversified. For this reason, we have not tried to make any distinction within our dataset due to any of these reasons.

Accordingly, and in line with the approach followed in the literature, we have relied on the main activity fields Turkish companies have reported to the stock exchange and have therefore chosen to limit our analysis to the companies listed in the BIST Holding and Investment Companies index ("**XHOLD**"). The main field of activity of all companies in XHOLD are all classified under Code 64.2 – holding companies' activities in accordance with the statistical classification of economic activities in the European Community ("**NACE Rev. 2**") as adopted by the Turkish Statistical Institute. According to Article 7.7 of the BIST Share Indices Fundamental Rules (Borsa Istanbul Anonim Şirketi) companies whose main field of activity changes are removed from the relevant share index and registered to the relevant share index. Accordingly, the sample chosen for the purposes of the study, have remained to be relevant throughout the period in which the data was gathered.[9]

Considering the impact that the financial crisis of 2008 had on the value of the diversified firms (Kuppuswamy & Villalonga, 2015), we have focused on the time period after 2009 and until 2016 ("**Research Period**") for the sample companies so as to be able to access their annual activity reports and financial statements. We expect this to have limited the effects of the market risk on the sample firms. However, we have not conducted any tests to see whether the selection of this Research Period has had any impact on our findings.

[6] Such as growth, risk aversion or benefiting from economies of scale.
[7] Such as internal development, acquisition or formation of joint ventures.
[8] Such as related or unrelated diversification.
[9] We have observed that in a limited number of cases and for certain periods of time, certain entities have either invested in a single entity (i.e. not diversified) or they have seized to carry out any operation the relevant entity listed on the index. At least the purpose of the relevant entity remained to be investing in other entities.

This approach yielded a sample of 29 firms. Given that certain entities had become a part of XHOLD later than others, but still during the research period, we have taken into account only the years in which they were listed on XHOLD.

Given the nature of the firms constituting the sample, we have assumed that the firms in the sample achieve diversification through a holding structure. This is due to the fact that holding companies are not permitted to carry out their own operations and are only allowed to invest in other entities. Due to the legal restriction, the only possible method for diversification in holding companies would be through incorporation of new subsidiaries or acquisition of operational firms. Considering the legal limitation and the unavailability of comparable information in relation to the number of industries in which holding companies (through subsidiaries or affiliates) operate,[10] we have reviewed the annual audited financial statements for the Research Period and have generated the data.

During the review of the financial statements, we have classified the operations of the subsidiaries and affiliates of sample firms by reference to two-digit numerical codes (divisions) of NACE Rev. 2. This level of detail gave us the ability to differentiate the operations by: (i) the character of the goods and the services produced; (ii) the uses to which the goods and services are put; and (iii) the inputs, the process and the technology of production (European Commission, 2008: 21).

Irrespective of whether or not they were consolidated; all affiliates, subsidiaries and joint ventures in which the sample firms had stakes were taken into account in determining the number of industries in which the sample firms were involved. This is due to the fact that irrespective of the level of control exercised in affiliates, subsidiaries or joint ventures, all of these investments provide return and therefore provide diversification in all, market or idiosyncratic, risks to which the sample firm is exposed. Therefore, we expect any diversification, albeit small or large, to have an effect on the volatility of the share value of the sample firms. As a result of our review of the annual audited financial statements, we have obtained the results provided in Appendix in relation to the number of fields of activity of the sample firms.

In order to calculate the share value volatilities, we have used daily closing share prices of the firms listed on XHOLD obtained from Thomson Reuters Eikon (Thomson Reuters Eikon, 2017).

The summary data containing the tickers of the firms, the relevant years, the standard deviation of logarithmic changes in the closing prices, the number of trading days in the relevant year, the volatility calculated in accordance with the methodology are explained below and the number of

[10] For the study, we have first commenced our research with the review of the annual activity reports of the sample firms, however given the different approaches by different firms in relation to the way in which they classified their operations it was not possible to adopt a consistent approach through reviews of their activity reports.

fields of activity of the sample firms in the given year are provided in Appendix – The Summary Dataset.

## 3. METHODOLOGY

The position in relation to holding companies under Turkish law, which prevents holding companies to carry out activities other than owning interests in other entities, envisages them as organisational tools to manage a portfolio. In line with the modern portfolio theory, given that investors – in this case the holding companies – will be risk averse and they will choose the least risky alternative in case two portfolios offer the same return, we would expect the diversification carried out by holding companies (or other entities which are incorporated and operating with a purpose of investing in other entities) would result with a lower volatility. In this vein, in the event the number of activity fields would increase, we would expect the overall volatility of the portfolio would decrease. Given that in this context the portfolios are held through the holding or investment companies, the volatility in the share price would decrease with the increase in the number of activity fields.

As a result, we have hypothesised that there is a negative relationship between the volatility of the value of the shares listed on XHOLD and the diversification of the sample firms.

For the purposes of testing our hypothesis, we have structured our methodology to first calculate the realised volatility of the value of the shares of sample firms for the Research Period. Due to the annual issuance of audited financial statements and therefore the availability of data regarding the activity fields on an annual basis, we have calculated the volatility of the share price on an annual basis. In calculating the volatility of the shares we have followed the methodology suggested by Karabıyık and Anbar (2007: 65):

$$x_i = \ln\left(\frac{S_i}{S_{i-1}}\right)$$

$$X = \frac{1}{n}\sum_{1}^{n} x_i$$

$$\sigma = \sqrt{\frac{1}{n-1}\sum_{1}^{n}(x_i - X)^2}$$

Where $S_i$ represents the value of the share in the relevant time period, $x_i$ represents the return in the *i.* timeframe; X, the average of $x_i$; $\sigma$, the realised volatility and n, the number of observations.

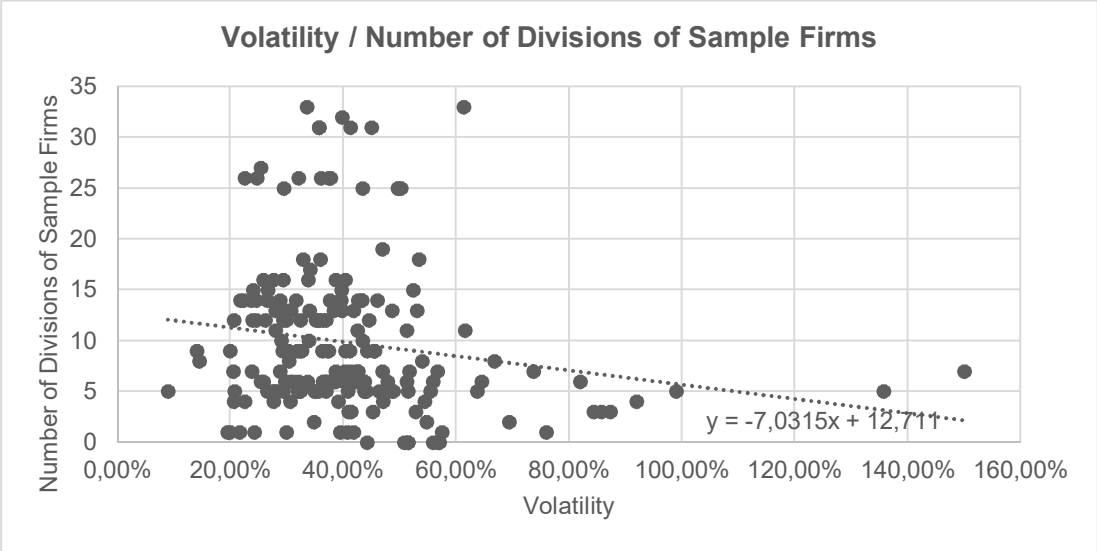
We then calculated the correlation between the annual volatility data series and the annual number of fields of activity of the sample firms data series.

In order to assess whether our findings statistically support our hypothesis we have also conducted a linear regression.

## 4. FINDINGS

As a result of the application of the above methodology, we found that there was a 16.73% negative correlation between the volatility and the number of fields of activity of the sample firms. A scatter plot with a linear trend line is provided below:

**Figure 1**. Scatter Plot - Volatility / Number of Fields of Activity of the Sample Firms




From *Figure 1* we can observe that there is a negative relationship between the number of activity fields and the volatility of the share prices. This finding was in line with the modern portfolio theory and Marinelli's (2011) empirical findings.

In order to assess whether the findings were statistically significant and confirmatory of our hypothesis we have conducted a regression analysis. The summary output of our regression statistics were:

**Figure 2**. Regression Summary Output

| ***Regression Statistics*** | |
|---|---|
| *Multiple R* | 0.167341 |
| *R Square* | 0.028003 |
| *Adjusted R Square* | 0.023044 |
| *Standard Error* | 0.174164 |
| *Observations* | 198 |

**ANOVA**

| | *df* | *SS* | *MS* | *Significance F* |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| *Regression* | 1 | 0.171283 | 0.171283 | 0.018451413 |
| *Residual* | 196 | 5.945.279 | 0.030333 | |
| *Total* | 197 | 6.116.562 | | |

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* |
|---|---|---|---|---|
| *Intercept* | 0.44632 | 0.020631 | 2.163.375 | 7.9E-54 |
| *# of Field of Activity* | -0.00398 | 0.001676 | -237.629 | 0.018451 |

From the low R square statistics (0.028) we find that approximately only 3% of the variation in volatility is driven by the number of fields of activity of the sample firms. Furthermore, the F statistics significance illustrates that there is approximately 22% chance that any fit of the trend line on the data is by chance.

Given the 24.6% annual average volatility of XHOLD; the 17.35% annual average volatility of the BIST100 in the Research Period; and the theoretical background confirming diversification's inability to lower the exposure to market risk in accordance with the modern portfolio theory, we do not find the lowness of diversification's effects on volatility to be surprising.

Due to the increased market risks attributed to emerging markets, as also illustrated by higher BIST100 annual average volatility against S&P500's annual average volatility, minimising exogenous risks carries much more importance. As a tool for risk minimisation diversification will continue to be important in decreasing volatility. Lower volatility levels would be expected to result in lower cost in terms of cost of capital given the lower borrowing costs and thereby contribute to the delivering value.

Higher debt to equity ratio would result in lower free cash flows (Park & SooCheong, 2014) and we would, in line with the agency theory, expect it to lead the managers to make less but better diversification choices.

In the Turkish market context, given the low levels of capital accumulation in single economic enterprises and general low levels of market concentration, we would not share Montgomery's (1994) concerns in relation to diversification leading to consolidation and thereby reducing competition in the market. This trend is also confirmed by the fact that the Turkish Competition Authority has not rejected any merger or acquisition transaction in the period between 2009 and 2014 (Turkish Competition Authority).

While diversification appears to be risk aversion method, this will also lead the group into facing additional exogenous risk with each new geographical or product market expanded. Despite the fact that the overt seizure of assets in emerging markets has decreased since 1960s, there is a perception that political risks are asserted on enterprises through regulatory means (Henisz & Zelner, 2010).

The increase in the number of markets the diversified firms operate in will naturally give rise to the increase in the regulatory constraints and therefore the risks to be increased. Despite the fact that unrelated diversification positively affects firm value as opposed to unrelated diversification, it should be noted that related diversification would result in relatively less added regulatory risk exposure.

## CONCLUSION

Despite the common expectation in the literature, the rationale for diversification in practice and the correlation in a manner supporting our hypothesis, the data available in the Research Period did not provide statistically significant proof that there was indeed a correlation between the volatility and the number of fields of activity of the sample firms. Given the inability of the data utilised in this study to be stripped of externalities we suspect that these externalities have concealed the statistical significance of the correlation between the volatility and the number of fields of activity of the sample firms.

However, despite the lack of a statistically fulfilling result; given the correlation established the general trendline observed in the scatter diagram we observe that there is a negative relationship between the number of fields of activity and the annual average volatility of the share values. Given the relatively high market risks in emerging markets, such as Turkey, we believe that diversification will continue to be a useful tool in minimising volatility. Higher stability in the share values will result in steadier dividend payouts yielding higher interest in equity market instruments of diversified firms and lower interest rates to be obtained by the diversified firms in debt markets. In a country where access to cheap financing is a grand leverage over the competitors, diversification will continue to be important in creating access to cheap financing.

Further research focusing on the volatility of share prices with solely the idiosyncratic risk of diversified firms could be carried out to better assess the existence of any relationship between those two. Additionally, the related question whether a firm can be over-diversified is also an intriguing one.

**Appendix – Summary Dataset**

| *Company* | Year | Standard Deviation | # of Trading Days | Volatility | # of Fields of Activity |
|---|---|---|---|---|---|
| *ALARK.IS* | 2009 | 0.0225072 | 252 | 35.73% | 12 |
| *ALARK.IS* | 2010 | 0.0185699 | 250 | 29.36% | 12 |
| *ALARK.IS* | 2011 | 0.0154073 | 253 | 24.51% | 12 |
| *ALARK.IS* | 2012 | 0.0150206 | 253 | 23.89% | 12 |
| *ALARK.IS* | 2013 | 0.0233358 | 250 | 36.90% | 12 |
| *ALARK.IS* | 2014 | 0.0165283 | 251 | 26.19% | 12 |
| *ALARK.IS* | 2015 | 0.0175537 | 253 | 27.92% | 11 |
| *BOYP.IS* | 2009 | 0.0264122 | 252 | 41.93% | 6 |
| *BOYP.IS* | 2010 | 0.0276756 | 250 | 43.76% | 5 |
| *BOYP.IS* | 2011 | 0.0323165 | 253 | 51.40% | 5 |
| *BOYP.IS* | 2012 | 0.0255479 | 253 | 40.64% | 6 |
| *BOYP.IS* | 2013 | 0.0242315 | 250 | 38.31% | 6 |
| *BOYP.IS* | 2014 | 0.0163065 | 251 | 25.83% | 6 |
| *BOYP.IS* | 2015 | 0.0265956 | 253 | 42.30% | 7 |
| *BRYAT.IS* | 2009 | 0.0259075 | 252 | 41.13% | 9 |
| *BRYAT.IS* | 2010 | 0.0206274 | 250 | 32.61% | 9 |
| *BRYAT.IS* | 2011 | 0.028531 | 253 | 45.38% | 9 |
| *BRYAT.IS* | 2012 | 0.0200003 | 253 | 31.81% | 9 |
| *BRYAT.IS* | 2013 | 0.0287191 | 250 | 45.41% | 9 |
| *BRYAT.IS* | 2014 | 0.0235469 | 251 | 37.31% | 9 |
| *BRYAT.IS* | 2015 | 0.0286419 | 253 | 45.56% | 9 |
| *DENGE.IS* | 2012 | 0.0344588 | 102 | 34.80% | 2 |
| *DENGE.IS* | 2013 | 0.0533377 | 250 | 84.33% | 3 |
| *DENGE.IS* | 2014 | 0.025813 | 251 | 40.90% | 3 |
| *DENGE.IS* | 2015 | 0.0284203 | 253 | 45.21% | 3 |
| *DOHOL.IS* | 2009 | 0.0386228 | 252 | 61.31% | 33 |
| *DOHOL.IS* | 2010 | 0.0212015 | 250 | 33.52% | 33 |
| *DOHOL.IS* | 2011 | 0.0282392 | 253 | 44.92% | 31 |
| *DOHOL.IS* | 2012 | 0.0258945 | 253 | 41.19% | 31 |
| *DOHOL.IS* | 2013 | 0.0225759 | 250 | 35.70% | 31 |
| *DOHOL.IS* | 2014 | 0.0225207 | 251 | 35.68% | 31 |
| *DOHOL.IS* | 2015 | 0.0249606 | 253 | 39.70% | 32 |
| *ECILC.IS* | 2009 | 0.0264549 | 252 | 42.00% | 6 |
| *ECILC.IS* | 2010 | 0.0231415 | 250 | 36.59% | 6 |
| *ECILC.IS* | 2011 | 0.019499 | 253 | 31.02% | 6 |
| *ECILC.IS* | 2012 | 0.0148963 | 253 | 23.69% | 7 |
| *ECILC.IS* | 2013 | 0.0181679 | 250 | 28.73% | 7 |
| *ECILC.IS* | 2014 | 0.0129302 | 251 | 20.49% | 7 |
| *ECILC.IS* | 2015 | 0.0258799 | 253 | 41.16% | 7 |
| *ECZYT.IS* | 2009 | 0.0230378 | 249 | 36.35% | 12 |
| *ECZYT.IS* | 2010 | 0.022174 | 250 | 35.06% | 12 |
| *ECZYT.IS* | 2011 | 0.0222627 | 253 | 35.41% | 12 |
| *ECZYT.IS* | 2012 | 0.0203588 | 253 | 32.38% | 12 |

| *Company* | Year | Standard Deviation | # of Trading Days | Volatility | # of Fields of Activity |
|---|---|---|---|---|---|
| *ECZYT.IS* | 2013 | 0.01889 | 250 | 29.87% | 12 |
| *ECZYT.IS* | 2014 | 0.0129793 | 251 | 20.56% | 12 |
| *ECZYT.IS* | 2015 | 0.0279554 | 253 | 44.47% | 12 |
| *EUHOL.IS* | 2010 | 0.0475684 | 132 | 54.65% | 2 |
| *EUHOL.IS* | 2011 | 0.0435978 | 253 | 69.35% | 2 |
| *EUHOL.IS* | 2012 | 0.0260117 | 253 | 41.37% | 3 |
| *EUHOL.IS* | 2013 | 0.0333927 | 250 | 52.80% | 3 |
| *EUHOL.IS* | 2014 | 0.0540736 | 251 | 85.67% | 3 |
| *EUHOL.IS* | 2015 | 0.0548532 | 253 | 87.25% | 3 |
| *GLYHO.IS* | 2009 | 0.0334126 | 252 | 53.04% | 13 |
| *GLYHO.IS* | 2010 | 0.0241671 | 250 | 38.21% | 13 |
| *GLYHO.IS* | 2011 | 0.0272146 | 253 | 43.29% | 14 |
| *GLYHO.IS* | 2012 | 0.0167467 | 253 | 26.64% | 15 |
| *GLYHO.IS* | 2013 | 0.0250765 | 250 | 39.65% | 15 |
| *GLYHO.IS* | 2014 | 0.0151666 | 251 | 24.03% | 15 |
| *GLYHO.IS* | 2015 | 0.0329654 | 252 | 52.33% | 15 |
| *GOZDE.IS* | 2010 | 0.0369266 | 235 | 56.61% | 0 |
| *GOZDE.IS* | 2011 | 0.0419277 | 253 | 66.69% | 8 |
| *GOZDE.IS* | 2012 | 0.0190274 | 253 | 30.26% | 9 |
| *GOZDE.IS* | 2013 | 0.0341165 | 250 | 53.94% | 8 |
| *GOZDE.IS* | 2014 | 0.0234963 | 251 | 37.23% | 6 |
| *GOZDE.IS* | 2015 | 0.0177072 | 253 | 28.17% | 5 |
| *GSDHO.IS* | 2009 | 0.0351808 | 252 | 55.85% | 6 |
| *GSDHO.IS* | 2010 | 0.0229456 | 250 | 36.28% | 6 |
| *GSDHO.IS* | 2011 | 0.0273777 | 253 | 43.55% | 6 |
| *GSDHO.IS* | 2012 | 0.0201488 | 253 | 32.05% | 6 |
| *GSDHO.IS* | 2013 | 0.0407659 | 250 | 64.46% | 6 |
| *GSDHO.IS* | 2014 | 0.026739 | 251 | 42.36% | 6 |
| *GSDHO.IS* | 2015 | 0.0232691 | 253 | 37.01% | 6 |
| *GYHOL.IS* | 2009 | 0.0262991 | 252 | 41.75% | 1 |
| *GYHOL.IS* | 2010 | 0.0249314 | 250 | 39.42% | 1 |
| *GYHOL.IS* | 2011 | 0.0152134 | 253 | 24.20% | 1 |
| *GYHOL.IS* | 2012 | 0.013642 | 251 | 21.61% | 1 |
| *GYHOL.IS* | 2013 | 0.0128872 | 227 | 19.42% | 1 |
| *GYHOL.IS* | 2014 | 0.0132769 | 225 | 19.92% | 1 |
| *GYHOL.IS* | 2015 | 0.0227037 | 173 | 29.86% | 1 |
| *HDFGS.IS* | 2015 | 0.0604685 | 231 | 91.90% | 4 |
| *IEYHO.IS* | 2009 | 0.0478429 | 252 | 75.95% | 1 |
| *IEYHO.IS* | 2010 | 0.0362976 | 250 | 57.39% | 1 |
| *IEYHO.IS* | 2011 | 0.0852609 | 253 | 135.62% | 5 |
| *IEYHO.IS* | 2012 | 0.0289428 | 232 | 44.08% | 5 |
| *IEYHO.IS* | 2013 | 0.0292789 | 250 | 46.29% | 5 |
| *IEYHO.IS* | 2014 | 0.023276 | 251 | 36.88% | 5 |
| *IEYHO.IS* | 2015 | 0.0256005 | 253 | 40.72% | 5 |
| *IHLAS.IS* | 2009 | 0.0358813 | 252 | 56.96% | 0 |

| *Company* | Year | Standard Deviation | # of Trading Days | Volatility | # of Fields of Activity |
|---|---|---|---|---|---|
| *IHLAS.IS* | 2010 | 0.0279099 | 250 | 44.13% | 0 |
| *IHLAS.IS* | 2011 | 0.0272407 | 253 | 43.33% | 25 |
| *IHLAS.IS* | 2012 | 0.0184874 | 253 | 29.41% | 25 |
| *IHLAS.IS* | 2013 | 0.0314189 | 250 | 49.68% | 25 |
| *IHLAS.IS* | 2014 | 0.0316587 | 251 | 50.16% | 25 |
| *IHLAS.IS* | 2015 | 0.0311943 | 253 | 49.62% | 25 |
| *IHYAY.IS* | 2010 | 0.0659109 | 37 | 40.09% | 6 |
| *IHYAY.IS* | 2011 | 0.0274832 | 253 | 43.71% | 6 |
| *IHYAY.IS* | 2012 | 0.0239196 | 253 | 38.05% | 6 |
| *IHYAY.IS* | 2013 | 0.0269427 | 250 | 42.60% | 7 |
| *IHYAY.IS* | 2014 | 0.0357269 | 251 | 56.60% | 7 |
| *IHYAY.IS* | 2015 | 0.0321932 | 253 | 51.21% | 6 |
| *ISGSY.IS* | 2009 | 0.0211859 | 252 | 33.63% | 6 |
| *ISGSY.IS* | 2010 | 0.0244288 | 250 | 38.63% | 7 |
| *ISGSY.IS* | 2011 | 0.019067 | 253 | 30.33% | 8 |
| *ISGSY.IS* | 2012 | 0.0181984 | 253 | 28.95% | 10 |
| *ISGSY.IS* | 2013 | 0.0125847 | 250 | 19.90% | 9 |
| *ISGSY.IS* | 2014 | 0.0090941 | 251 | 14.41% | 8 |
| *ISGSY.IS* | 2015 | 0.0087785 | 253 | 13.96% | 9 |
| *ITTFH.IS* | 2010 | 0.0307266 | 250 | 48.58% | 13 |
| *ITTFH.IS* | 2011 | 0.0262384 | 253 | 41.73% | 13 |
| *ITTFH.IS* | 2012 | 0.0139723 | 253 | 22.22% | 14 |
| *ITTFH.IS* | 2013 | 0.0250029 | 250 | 39.53% | 14 |
| *ITTFH.IS* | 2014 | 0.02491 | 251 | 39.46% | 14 |
| *ITTFH.IS* | 2015 | 0.0288893 | 253 | 45.95% | 14 |
| *KCHOL.IS* | 2009 | 0.02375 | 252 | 37.70% | 26 |
| *KCHOL.IS* | 2010 | 0.0202334 | 250 | 31.99% | 26 |
| *KCHOL.IS* | 2011 | 0.02349 | 253 | 37.36% | 26 |
| *KCHOL.IS* | 2012 | 0.0154763 | 253 | 24.62% | 26 |
| *KCHOL.IS* | 2013 | 0.0227828 | 250 | 36.02% | 26 |
| *KCHOL.IS* | 2014 | 0.0142218 | 251 | 22.53% | 26 |
| *KCHOL.IS* | 2015 | 0.0159141 | 253 | 25.31% | 27 |
| *KOMHL.IS* | 2012 | 0.1026827 | 27 | 53.36% | 18 |
| *KOMHL.IS* | 2013 | 0.0296609 | 250 | 46.90% | 19 |
| *KOMHL.IS* | 2014 | 0.0226661 | 251 | 35.91% | 18 |
| *KOMHL.IS* | 2015 | 0.0206673 | 253 | 32.87% | 18 |
| *METRO.IS* | 2009 | 0.05171 | 251 | 81.92% | 6 |
| *METRO.IS* | 2010 | 0.0296499 | 250 | 46.88% | 7 |
| *METRO.IS* | 2011 | 0.0277441 | 253 | 44.13% | 9 |
| *METRO.IS* | 2012 | 0.0272605 | 253 | 43.36% | 10 |
| *METRO.IS* | 2013 | 0.0388814 | 250 | 61.48% | 11 |
| *METRO.IS* | 2014 | 0.0268116 | 251 | 42.48% | 11 |
| *METRO.IS* | 2015 | 0.0321871 | 253 | 51.20% | 11 |
| *NTHOL.IS* | 2009 | 0.0275143 | 252 | 43.68% | 5 |
| *NTHOL.IS* | 2010 | 0.0220332 | 250 | 34.84% | 5 |

| *Company* | Year | Standard Deviation | # of Trading Days | Volatility | # of Fields of Activity |
|---|---|---|---|---|---|
| *NTHOL.IS* | 2011 | 0.0202053 | 253 | 32.14% | 5 |
| *NTHOL.IS* | 2012 | 0.0130022 | 253 | 20.68% | 5 |
| *NTHOL.IS* | 2013 | 0.0173311 | 250 | 27.40% | 5 |
| *NTHOL.IS* | 2014 | 0.0130017 | 251 | 20.60% | 4 |
| *NTHOL.IS* | 2015 | 0.0184085 | 253 | 29.28% | 5 |
| *OSTIM.IS* | 2012 | 0.1220644 | 151 | 150.00% | 7 |
| *OSTIM.IS* | 2013 | 0.0465678 | 250 | 73.63% | 7 |
| *OSTIM.IS* | 2014 | 0.0325693 | 251 | 51.60% | 7 |
| *OSTIM.IS* | 2015 | 0.0252366 | 253 | 40.14% | 7 |
| *POLHO.IS* | 2012 | 0.0182367 | 152 | 22.48% | 4 |
| *POLHO.IS* | 2013 | 0.0246982 | 250 | 39.05% | 4 |
| *POLHO.IS* | 2014 | 0.0174047 | 251 | 27.57% | 4 |
| *POLHO.IS* | 2015 | 0.0191878 | 253 | 30.52% | 4 |
| *RHEAG.IS* | 2009 | 0.0324087 | 252 | 51.45% | 0 |
| *RHEAG.IS* | 2010 | 0.0627 | 249 | 98.94% | 5 |
| *RHEAG.IS* | 2011 | 0.0348013 | 253 | 55.35% | 5 |
| *RHEAG.IS* | 2012 | 0.0203447 | 253 | 32.36% | 5 |
| *RHEAG.IS* | 2013 | 0.0308342 | 250 | 48.75% | 5 |
| *RHEAG.IS* | 2014 | 0.0296433 | 251 | 46.96% | 4 |
| *RHEAG.IS* | 2015 | 0.0341489 | 253 | 54.32% | 4 |
| *SAHOL.IS* | 2009 | 0.027162 | 252 | 43.12% | 14 |
| *SAHOL.IS* | 2010 | 0.019988 | 250 | 31.60% | 14 |
| *SAHOL.IS* | 2011 | 0.0236547 | 253 | 37.63% | 14 |
| *SAHOL.IS* | 2012 | 0.0180813 | 253 | 28.76% | 14 |
| *SAHOL.IS* | 2013 | 0.0251479 | 250 | 39.76% | 13 |
| *SAHOL.IS* | 2014 | 0.0189525 | 251 | 30.03% | 13 |
| *SAHOL.IS* | 2015 | 0.0175364 | 253 | 27.89% | 13 |
| *SISE.IS* | 2009 | 0.0234131 | 252 | 37.17% | 9 |
| *SISE.IS* | 2010 | 0.019026 | 250 | 30.08% | 9 |
| *SISE.IS* | 2011 | 0.0253583 | 253 | 40.33% | 9 |
| *SISE.IS* | 2012 | 0.0183334 | 253 | 29.16% | 9 |
| *SISE.IS* | 2013 | 0.0229397 | 250 | 36.27% | 9 |
| *SISE.IS* | 2014 | 0.0203225 | 251 | 32.20% | 9 |
| *SISE.IS* | 2015 | 0.0212708 | 253 | 33.83% | 10 |
| *TAVHL.IS* | 2009 | 0.0220501 | 252 | 35.00% | 5 |
| *TAVHL.IS* | 2010 | 0.0224947 | 250 | 35.57% | 5 |
| *TAVHL.IS* | 2011 | 0.0200758 | 253 | 31.93% | 5 |
| *TAVHL.IS* | 2012 | 0.0159123 | 253 | 25.31% | 6 |
| *TAVHL.IS* | 2013 | 0.0302286 | 250 | 47.80% | 6 |
| *TAVHL.IS* | 2014 | 0.0191944 | 251 | 30.41% | 6 |
| *TAVHL.IS* | 2015 | 0.0186551 | 253 | 29.67% | 6 |
| *TKFEN.IS* | 2009 | 0.0243489 | 252 | 38.65% | 16 |
| *TKFEN.IS* | 2010 | 0.0213566 | 250 | 33.77% | 16 |
| *TKFEN.IS* | 2011 | 0.0213954 | 253 | 34.03% | 17 |
| *TKFEN.IS* | 2012 | 0.016221 | 253 | 25.80% | 16 |

| *Company* | Year | Standard Deviation | # of Trading Days | Volatility | # of Fields of Activity |
|---|---|---|---|---|---|
| *TKFEN.IS* | 2013 | 0.0255001 | 250 | 40.32% | 16 |
| *TKFEN.IS* | 2014 | 0.0185171 | 251 | 29.34% | 16 |
| *TKFEN.IS* | 2015 | 0.0173511 | 253 | 27.60% | 16 |
| *USAS.IS* | 2009 | 0.025636 | 252 | 40.70% | 1 |
| *USAS.IS* | 2010 | 0.0352848 | 250 | 55.79% | 0 |
| *USAS.IS* | 2011 | 0.0318816 | 253 | 50.71% | 0 |
| *USAS.IS* | 2012 | 0.0323298 | 253 | 51.42% | 0 |
| *USAS.IS* | 2013 | 0.0402799 | 250 | 63.69% | 5 |
| *USAS.IS* | 2014 | 0.0306369 | 251 | 48.54% | 5 |
| *USAS.IS* | 2015 | 0.0242838 | 253 | 38.63% | 6 |
| *VERUS.IS* | 2013 | 0.0159518 | 31 | 8.88% | 5 |
| *VERUS.IS* | 2014 | 0.0167152 | 251 | 26.48% | 5 |
| *VERUS.IS* | 2015 | 0.0175015 | 253 | 27.84% | 5 |
| *YAZIC.IS* | 2009 | 0.0213819 | 252 | 33.94% | 13 |
| *YAZIC.IS* | 2010 | 0.0194285 | 250 | 30.72% | 13 |
| *YAZIC.IS* | 2011 | 0.013662 | 253 | 21.73% | 14 |
| *YAZIC.IS* | 2012 | 0.0148798 | 253 | 23.67% | 14 |
| *YAZIC.IS* | 2013 | 0.0269482 | 250 | 42.61% | 14 |
| *YAZIC.IS* | 2014 | 0.0154691 | 251 | 24.51% | 14 |
| *YAZIC.IS* | 2015 | 0.0166084 | 253 | 26.42% | 14 |

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