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RESEARCH ARTICLE

BETA ANOMALY IN TURKISH EQUITY MARKET

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ABSTRACT

The Capital Asset Pricing Model (CAPM), the de-facto standard in asset pricing for over half a century, dictates that rational agents invest in portfolios with the highest excess return per unit of risk by maximizing Sharpe ratio. However, there are numerous empirically documented anomalies that are violating this basic premise of the CAPM. These anomalies yield opportunities for statistical arbitrage in the market. Beta anomaly is the empirical observation that high beta assets return lower risk-adjusted returns than low beta assets as documented in numerous markets, thus yielding a flatter security market line than the CAPM implies. Leverage constraints, margin requirements or behavioral biases are offered as explanation for the excessive demand for high beta assets. An investor can exploit this observed anomaly by constructing an appropriate portfolio. In this study, we investigate whether Beta anomaly is indeed present in Borsa Istanbul (BIST). By using the price information of the stocks quoted in BIST, we form test portfolios sorted through the ex-ante Betas of stocks. The evaluation of the results over 31 years of monthly data reveals that Beta anomaly is present in Borsa Istanbul, and sophisticated investors can arbitrage this anomaly to generate excess returns.

Keywords: Asset pricing, Investments, Anomalies, CAPM

1. INTRODUCTION

The relationship of risk and return is one of the most important and vital concept of today's financial management. The famous Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965), which has been widely used by numerous portfolio managers and investors all around the world for 50 years, models this relationship by using market beta as the only source of risk that is needed. The CAPM dictates that the rational agents invest in portfolios with highest excess return per unit of risk. More technically, CAPM predicts that the security market line, relation between expected return and beta, has an intercept equal to nominal risk-free rate available for the market and a slope equal to market risk premium.

Even though CAPM is still a widely used in practice and academia, there are several studies in the literature documenting anomalies that violates the basic tenets of CAPM. The empirical evidence manages to show that the security market line (SML) is flatter than what theory implies (Black, 1972), the real market data implies a flatter SML than the theory. This difference between the theory and the markets means that there is an average underperformance of high beta stocks relative to the return prediction of asset pricing models. Since these patterns are not explained by other well-known asset pricing anomalies like value, momentum, size, or price reversals, it becomes possible to investigate whether it's possible to generate any positive returns by exploiting these beta-return relationships.

In this study, we develop a framework that documents potential existence of a Beta anomaly in Borsa Istanbul (BIST) equities. If higher Beta securities are indeed generating lower risk-adjusted returns than lower Beta securities, a sophisticated investor can exploit the difference via statistical arbitrage strategies such as a simple self-financing long-short portfolio to generate positive excess returns. The success of such a strategy depends on an any existing anomaly sustaining itself going forward, hence one has to know the time and conditions leading to a sustained anomaly.

To that end, we investigate the Beta-return relationship in BIST by comparing the value-weighted beta ranked portfolios that include every possible stock between the years 1988 and 2020. We

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further break down the long history of Turkish stock market into three decades, which has their own peculiar economic dynamics, to document the time-changing nature of the Beta anomaly.

2. LITERATURE

Traditional asset pricing models has long been studied since the seminal study by Markowitz (1952) provided the first justification for portfolio selection and diversification with an eye towards optimizing risk and return trade-off. Building on this earlier work, four economists, Treynor (1961), Sharpe (1964), Lintner (1965) and Mossin (1966) independently introduced CAPM that elegantly ties return on a security with its risk. The main conclusion of this widely used and studied Capital Asset Pricing Model is that firms with higher systematic risk, measured with Beta, are expected to generate higher returns than firms with low systematic risks.

The subsequent years, academics began to establish an empirical foundation for this model. Although there exist several supporting the theoretical relationship, the studies that contradict it found more traction within the financial literature. Black, Jensen, and Scholes (1972) and Black (1993) introduce beta factor. They create a market neutral long-short portfolio which is long in low-beta securities and short in high-beta securities, and show that the beta factor generates positive excess returns (alphas). They provide empirical evidence contradicting the classical CAPM theory.

Similar findings are also confirmed in the research study of Fama and French (1992), which further claims that the slope of the security market line, showing the relationship between returns and Beta, is equal to zero. More recent studies such as Blitz, Pang, and Van Vliet (2013), Baker, Bradley, and Taliaferro (2014), Frazzini and Pedersen (2014) also confirm the existence of low-beta anomaly in both US and non-US developed markets.

Since this particular anomaly seems attractive, there are some series of research studies focusing on the variety of possible explanations and methods of exploiting such phenomenon. Hirshleifer and Subrahmanyan (2001) show that the beta pricing is strongly related to market conditions. They argue that the beta pricing is stronger when the overconfidence in the economy is low, so that the beta return relationship gets closer to theory when the market is performing badly. Lamont and Thaler (2003) provide an alternative explanation on the deformation of security market line. They link this deformation to the presence of unsophisticated investors. During the blooming periods of stock markets, unsophisticated investors are more likely to enter the market and this leads to more noise trading. The biggest assumption of SML and CAPM, the rationality of the investors, is broken by these noise trading activities and so that the SML is easily deformed. Also, in another study, Antoniou, Doukas and Subrahmanyam (2016) document that optimism in the market causes mispriced beta.

In addition to studies focusing on investigating the presence of beta-return anomalies, there are also some important works concentrating on the attempts of generating arbitrage returns by exploiting these relationships. Frazzini and Pedersen (2014) attempt to generate positive arbitrage returns by forming an arbitrage trade in various markets. They find evidence, consistent with the literature, that high beta is associated with low return in markets across countries and asset classes. They document that a betting against beta (BAB) factor, which is long leveraged low-beta assets and short high-beta assets, produces significant positive risk-adjusted returns. Huang, Lou, and Polk (2016) provide an alternative study where they argue that the beta-arbitrage activity generates booms and busts in the strategy's abnormal trading profits. They manage to show that the beta-arbitrage positions are present and that the returns are highly correlated with the market activity.

3. DATA AND METHODOLOGY

Following prior studies on beta anomalies, all possible common stocks in Borsa Istanbul that can be used in this model with available price and trading time information between January 1988 and December 2020 are included. Following the literature, pre ranking betas are calculated using monthly returns to reduce the impact of noisy return data. Pre ranking betas are estimated using rolling regressions of returns on market returns, which are calculated as the value weighted average return of all traded stocks. The Betas are calculated using the following time-series regression model with a rolling window of 60 months and a minimum data availability of 24 months.

$$r_{it} - r_{ft} = \alpha_i + \beta_i(r_{mt} - r_{ft}) + \varepsilon_{it}$$

where r_{it} is the monthly return for security i in month t, r_{ft} is the risk-free return and r_{mt} is the market return. β_i denotes the Beta estimate for security i, measuring the security's market risk exposure. ε_{it} is the error term measuring the idiosyncratic risk of the security with an expected value of zero. α_i is the Jensen's alpha measuring the abnormal return that cannot be explained by CAPM. The resulting data allow us to for Beta-sorted portfolios for 31 years or 372 months from January 1990 to December 2020, since we need at least 24 months of return data to compute Beta values.

4. EMPRICAL FINDINGS

In order to identify potential arbitrage strategies, we begin or assessment of Beta anomaly with documenting return differential between high Beta securities and low Beta securities. Each month, we rank all equities according to their estimated Beta and divide the stocks into two portfolios across the median Beta level. We continue to rebalance our portfolios each month based on changing Beta estimates and available stocks.

Figure 1 below assumes that 1 Lira invested in each of these portfolios in January 1990 and tracks the portfolios' cumulative returns across 31 years. These portfolios are based on a value-weighted self-financing portfolio strategy to see if it's possible to generate any arbitrage returns, positive alphas consistently across different time horizons. As it can be seen in the Figure 1, the portfolio consisting of Low Beta equities constantly overperforms the High Beta portfolio. The difference of cumulative return of a unit of Turkish Lira invested in Low and High Beta portfolios constantly grows for the time horizon of the data.

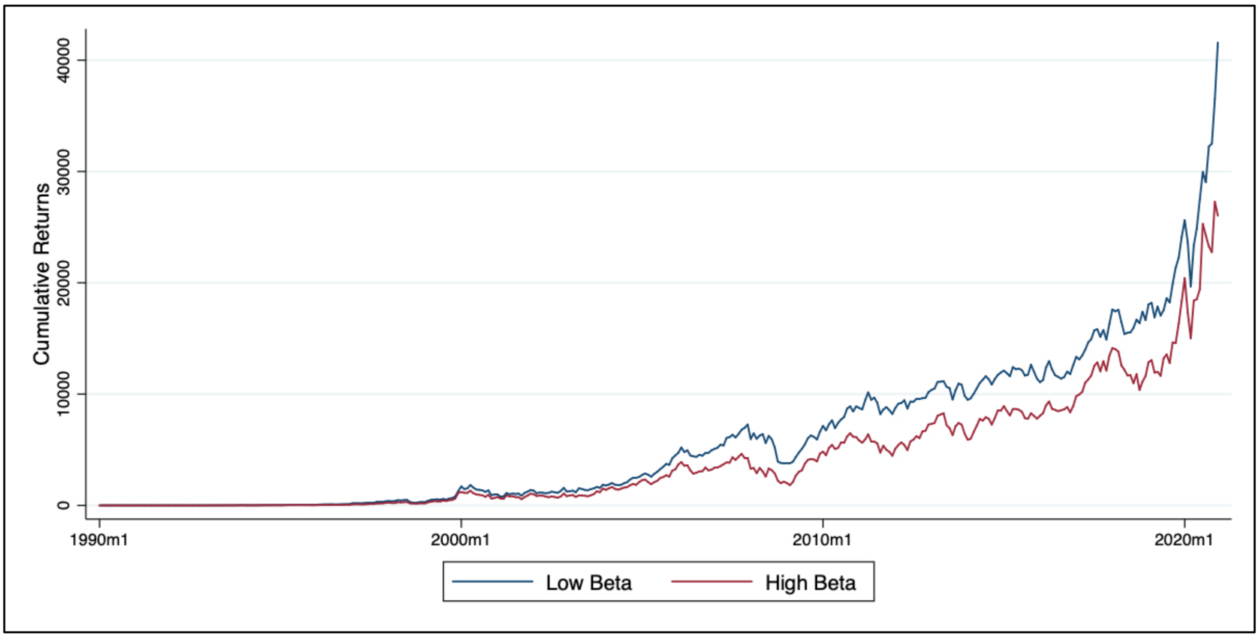

Figure 1. Cumulative Return of 1Turkish Lira invested in Low and High Beta Portfolios from 1990m1 to 2020m12

Subsequently, to be able to compare and understand beta-return relationship, every available stock is sorted in ascending order according to their beta levels at each reallocation point, which is monthly, and returns are computed. At the beginning of each trading month, the ranked stocks are assigned to value-weighted portfolios according to their beta ranks and rebalanced at the end. We form five different levels of Beta portfolios for testing the risk and return levels with P_1 being with the lowest Beta to P_5 the highest. Descriptive statistics for generated portfolios can be seen in Table

1 below. The entire dataset is divided into three decades of time horizons to be able to further investigate and understand distinctive portfolio behaviors depending on market conditions.

Figure 2 and Figure 3 are constructed for five different quintiles of beta levels of portfolios. In Figure 2, the mean monthly returns are reported for Beta-Sorted portfolios of four different trading periods. Then, the monthly Sharpe ratios for same portfolios and same trading periods are also reported in Figure 3. It can be seen that, especially for 2000s period, in Borsa Istanbul there exist a relative underperformance of high beta stocks compared to the low beta stocks. The average returns of the different beta portfolios are implying the relatively flat security market line in BIST, similar to foreign capital markets. The results for Turkish equities show how the security market line is deformed when it's compared with the theory.

The deformation in Security Market Line, as hypothesized in beta arbitrage literature and our main motivation for the study, can be clearly seen in Figure 2. The P_5, portfolio with highest possible beta, constantly generates lower returns than the portfolio with lowest beta values, P_1. The average returns of the various beta portfolios are similar or descending as the beta gets higher, which is the well-known comparatively flat or deformed SML. Risk-adjusted returns measured by Sharpe ratios also show an even stronger anomaly as can be surmised in Table 1 and Figure 3.

Table 1. Descriptive Statistics for entire period and three different sub periods.

Entire Period (1990m1 – 2020m12)						
Variable	Obs	Mean	Std. Dev.	Min	Max	Sharpe
P_1	372	0.04	0.171	-0.342	2.433	0.096
P_2	372	0.037	0.133	-0.4	0.7	0.101
P_3	372	0.035	0.138	-0.416	0.994	0.083
P_4	372	0.043	0.153	-0.472	0.876	0.124
P_5	372	0.037	0.155	-0.384	0.796	0.083
R_M	372	0.036	0.132	-0.393	0.81	0.09
R_f	372	0.024	0.026	-0.013	0.235	-
1990s (1990m1 – 1999m12)						
Variable	Obs	Mean	Std. Dev.	Min	Max	Sharpe
P_1	120	0.087	0.27	-0.342	2.433	0.134
P_2	120	0.08	0.188	-0.4	0.7	0.153
P_3	120	0.07	0.195	-0.416	0.994	0.099
P_4	120	0.091	0.216	-0.472	0.876	0.188
P_5	120	0.073	0.202	-0.384	0.796	0.108
R_M	120	0.076	0.181	-0.393	0.81	0.137
R_f	120	0.051	0.025	-0.006	0.235	-
2000s (2000m1 – 2009m12)						
Variable	Obs	Mean	Std. Dev.	Min	Max	Sharpe
P_1	120	0.021	0.098	-0.318	0.349	0.067
P_2	120	0.017	0.111	-0.362	0.378	0.024
P_3	120	0.019	0.119	-0.299	0.436	0.039
P_4	120	0.019	0.131	-0.338	0.447	0.03
P_5	120	0.022	0.142	-0.362	0.571	0.049
R_M	120	0.018	0.122	-0.353	0.499	0.028
R_f	120	0.015	0.017	-0.012	0.103	-
2010s (2010m1 – 2020m12)						
Variable	Obs	Mean	Std. Dev.	Min	Max	Sharpe
P_1	132	0.015	0.07	-0.146	0.336	0.087
P_2	132	0.017	0.064	-0.183	0.227	0.103
P_3	132	0.018	0.069	-0.184	0.197	0.107
P_4	132	0.02	0.07	-0.166	0.194	0.126
P_5	132	0.017	0.104	-0.17	0.698	0.081
R_M	132	0.015	0.065	-0.149	0.205	0.085
R_f	132	0.007	0.01	-0.013	0.063	-

For the same trading windows as in Figure 2 and Figure 3, CAPM regression results are estimated for further analyzes of Beta anomalies. In table 2 the results for the CAPM regression are reported. Beta values are statistically significant for all portfolios and trading periods. 1990s, a volatile and noisy period for Turkey shows that ex-post Beta values for portfolios are not following the expected ordering based on Beta-sorted portfolios.

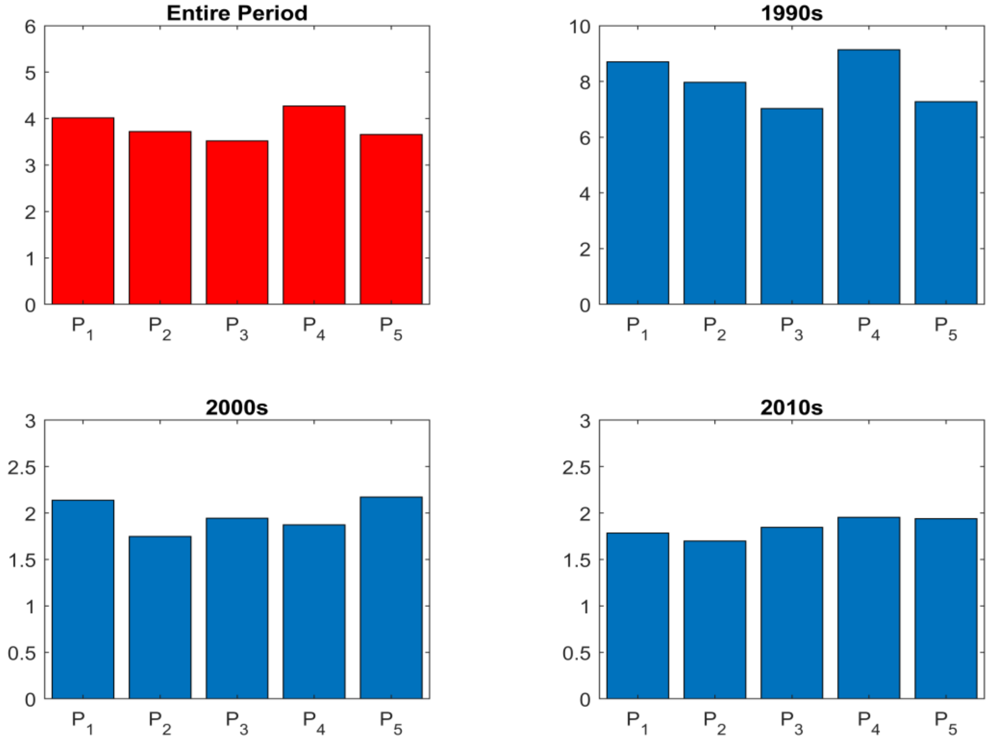

Figure 1. Mean Monthly Returns for Beta-Sorted (P_1–lowest to P_5–highest) Test Portfolios.

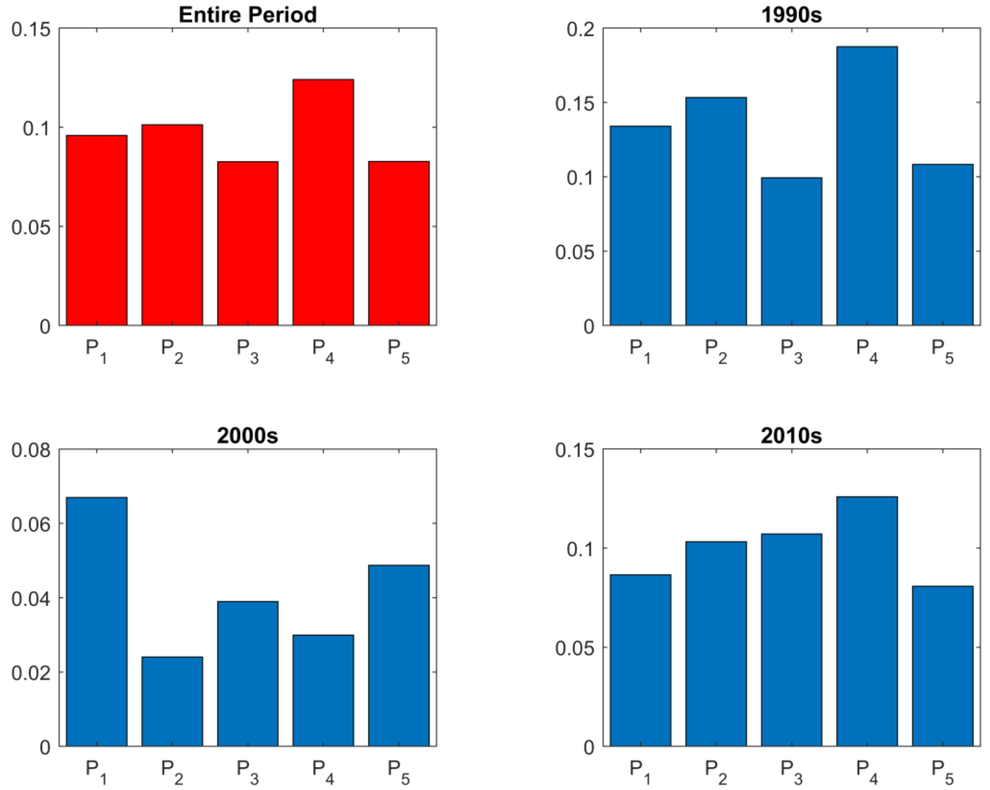

Figure 2. Monthly Sharpe Ratios for Beta-Sorted (P_1–lowest to P_5–highest) Test Portfolios.

Table 1. CAPM Regression Results

Entire Period (1990m1 – 2020m12)					
Variable	P_1	P_2	P_3	P_4	P_5
$R_M - r_f$ (β)	0.930***	0.878***	0.973***	1.059***	1.095***
	(0.047)	(0.024)	(0.021)	(0.025)	(0.022)
Constant (α)	0.005	0.003	-0.000	0.006*	-0.000
	(0.006)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	372	372	372	372	372
R-squared	0.516	0.783	0.859	0.827	0.865
Adjusted R-squared	0.514	0.782	0.858	0.827	0.865
1990s (1990m1 – 1999m12)					
Variable	P_1	P_2	P_3	P_4	P_5
$R_M - r_f$ (β)	1.058***	0.915***	1.012***	1.088***	1.041***
	(0.095)	(0.042)	(0.035)	(0.048)	(0.036)
Constant (α)	0.010	0.006	-0.006	0.014	-0.004
	(0.018)	(0.008)	(0.007)	(0.009)	(0.007)
Observations	120	120	120	120	120
R-squared	0.515	0.800	0.874	0.815	0.876
Adjusted R-squared	0.510	0.798	0.873	0.813	0.875
2000s (2000m1 – 2009m12)					
Variable	P_1	P_2	P_3	P_4	P_5
$R_M - r_f$ (β)	0.691***	0.812***	0.894***	1.026***	1.138***
	(0.039)	(0.039)	(0.035)	(0.030)	(0.024)
Constant (α)	0.004	-0.000	0.002	0.000	0.003
	(0.005)	(0.005)	(0.004)	(0.004)	(0.003)
Observations	120	120	120	120	120
R-squared	0.729	0.783	0.847	0.909	0.949
Adjusted R-squared	0.727	0.781	0.846	0.909	0.948
2010s (2010m1 – 2020m12)					
Variable	P_1	P_2	P_3	P_4	P_5
$R_M - r_f$ (β)	0.707***	0.793***	0.952***	0.912***	1.376***
	(0.072)	(0.049)	(0.042)	(0.051)	(0.073)
Constant (α)	0.002	0.003	0.003	0.006	-0.001
	(0.005)	(0.003)	(0.003)	(0.003)	(0.005)
Observations	132	132	132	132	132
R-squared	0.423	0.666	0.802	0.708	0.730
Adjusted R-squared	0.418	0.663	0.800	0.705	0.728

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

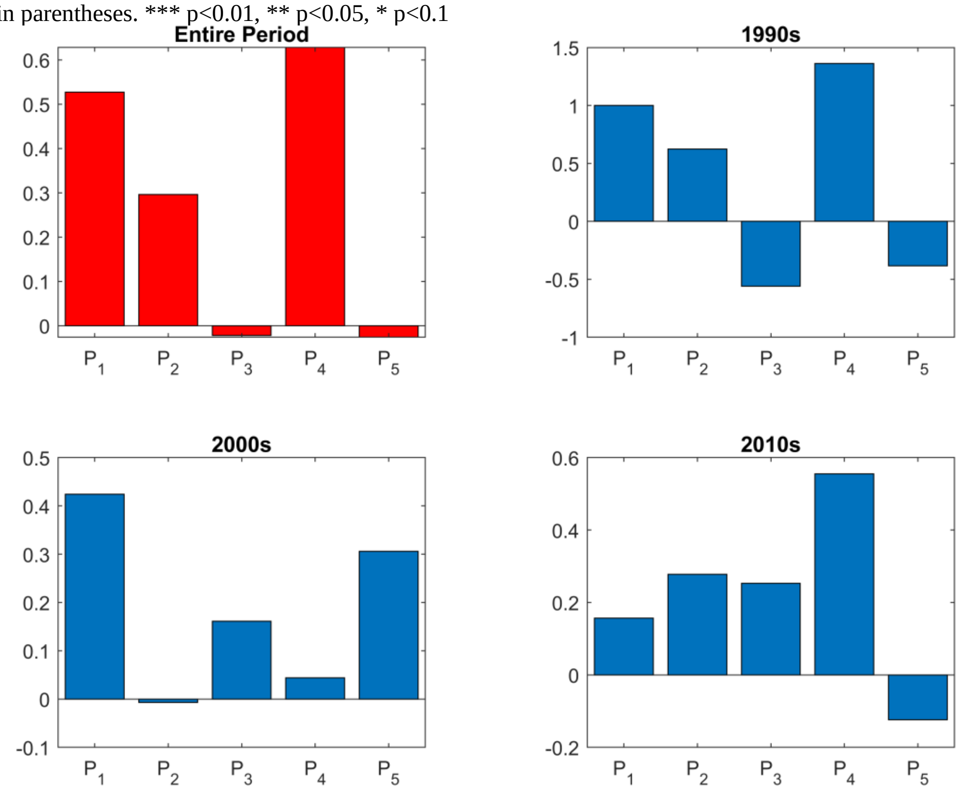

Figure 3. Monthly CAPM Alphas for Beta-Sorted (P_1–lowest to P_5–highest) Test Portfolios.

When the risk and return relationship is filtered through CAPM to document any return differential above and beyond the expected returns implied by market risk Beta, we see an abnormal return for low-Beta portfolios. The alpha values documented in Table 1 and displayed in Figure 4 show that low Beta portfolios consistently generate abnormal returns above high-Beta portfolios. Although the alphas are not statistically significant, the returns are consistent and economically significant. P_5, the portfolio with highest possible beta, constantly generates lower returns than the portfolio with lowest beta values, P_1.

The amount of return generation is strongly dependent on the market conditions. As it is documented in the literature many times, the market sentiment periods have direct influence on beta arbitrage returns because of the existence of beta-return anomalies. As it's specified in Black (1986), the optimistic beliefs trigger noise trading and that noise trading leads into the deformation of the SML. Since one of the biggest assumptions of CAPM and SML is the rationality in the market, it should be normal to see different results in the presence of noise traders for different time windows. Distinct sentiments of traders in separate market conditions leads into different patterns of CAPM returns as it can be seen from results. Even though the market conditions, Beta-Return anomaly levels and SML shapes show different behaviors through our data set, the deformation of SML which questions the rationality of the stock market is clearly present in BIST.

5. CONCLUSION

Following both the arbitrage and beta-return anomaly studies in the literature, we manage to show that the "Beta Anomaly" that is documented in foreign capital markets, is also present in Borsa Istanbul. It might be possible to exploit this relationship by using a high-low beta portfolio generation strategy. As it can be seen in the study, the return levels of the strategy strongly depend on the market conditions and sentiment. The varieties in the results can be explained by the behavioral phenomena in the literature. Deformation of Security Market Line is present in all periods of trade windows.

This study contributes to the literature by investigating and applying a Beta Anomaly strategy to Turkish equity markets. We manage to clarify the anomaly and the portfolio return behaviors with the help of existing literature on beta pricing. We also show how this deviation from the standard CAPM can be captured by betting against beta. Following the existing literature, we interpret that it becomes possible to exploit such anomaly as long as the unsophisticated investors and noise trading is present in the equity market. In practice, however, it might be difficult to capture positive returns due to the limits to the arbitrage. Transaction costs, limits, and unavailability of short selling for certain stocks and bid-ask spreads might eliminate the positive excess returns that the anti-beta investment strategy is able to attain in theory.

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