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PAVIC KRAMARIC, TOMISLAVA; MILETIC, MARKO; PEPUR, PETAR

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THE TREYNOR RATIO AS A RISK-ADJUSTED RETURN OF CROATIAN LISTED FIRMS

TOMISLAVA PAVIC KRAMARIC, MARKO MILETIC, PETAR PEPUR

Abstract:

Motivated by the importance of determinants of firm performance, especially in terms of risk-adjusted performance that considers underlying risks, this paper explores the effects of firm-specific determinants on risk-adjusted returns such as the Treynor ratio. Specifically, the authors explore whether firm size, capital expenditures, capital intensity, equity ratio, leverage, profitability, listing age, and liquidity affect the performance of Croatian non-financial listed companies that form the CROBEXplus equity index in the period 2014 – 2021. Utilizing dynamic panel analysis, several key deterministic factors of risk-adjusted performance are identified including firm size, capital intensity, equity ratio, leverage, profitability, and listing age. In other words, larger firms tend to experience greater risk adjusted returns than their smaller counterparts as well as firms with higher equity ratios, i.e. those not overly indebted. Results also show that capital intensity, which is viewed as a source of entry barrier, is positively related to risk adjusted-performance which is also true for profitability. Furthermore, companies that have a longer presence in the market in terms of being listed on the stock exchange document enhanced risk-adjusted returns. These findings have significant policy and practical implications.

Keywords:

the Treynor ratio, risk-adjusted returns, listed firms, Croatia

JEL Classification: G10, G23, L25

Authors:

TOMISLAVA PAVIC KRAMARIC, University of Split, University Department of Forensic Sciences, Croatia, Email: tpkramaric@forenzika.unist.hr
MARKO MILETIC, University of Split, University Department of Professional Studies, Croatia, Email: mamiletic@oss.unist.hr
PETAR PEPUR, University of Split, University Department of Professional Studies, Croatia, Email: ppepur@oss.unist.hr

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1. Introduction

Evaluating stock performance is an important topic in finances. Inherently, investment is a two-dimensional process based on both returns and the risks taken to accomplish those returns (Amédée-Manesme & Barthélémy, 2022). Since higher returns are always desirable in contrast to risks, it is further questioned what additional returns would be adequate compensation for additional risks. Volatility inherent to stock markets creates additional risks that investors should take into account when making investment decisions. In this case, risk-adjusted performance plays an important role. Specifically, joining the returns and risks into a sole risk-adjusted number is the strategic performance measurement task (Amédée-Manesme & Barthélémy, 2022). Numerous traditional performance measures have been employed in the empirical research including return on assets (ROA), return on equity (ROE), Tobin's Q, etc. while the risk-adjusted returns encompass the Sharpe ratio, the Treynor ratio, Sortino, Jensen, Omega, Kappa, Calmar, etc. Among these, the Sharpe ratio has been extensively applied in the empirical literature (Schuhmacher & Eling, 2012; Hodoshima, 2018; Vidal-García & Vidal, 2021; Guo & Ou-Yang, 2021; Amédée-Manesme & Barthélémy, 2022) due to its clear interpretation and simplicity (Hodoshima, 2018). However, the use of the Sharpe ratio has been criticised for not differentiating between downside and upside possibilities, for not considering the liabilities, and for not performing well for non-normal distributions (van Heerden, 2020; Amédée-Manesme & Barthélémy, 2022). Thus, the utilization of the Treynor ratio, deemed an alternative reward-to-risk ratio reflecting systematic risk (Pilotte & Sterbenz, 2006), is chosen.

Since analyses typically employ returns rather than risk-adjusted returns to quantify performance (Hensawang, 2022), an evaluation of several factors on stock performance considering the associated risk is proposed. For this purpose, risk-adjusted return such as the Treynor ratio is employed in the analysis. Along with that, this study, to the best of our knowledge, is the first one to unravel determinants of risk-adjusted returns taking into account the Treynor ratio in a small frontier economy like Croatian giving a broader perspective on firm characteristic – risk-adjusted returns relationship. Thus, this analysis is oriented on the understudied area of research by exploring the relationship between risk-adjusted return such as the Treynor ratio and predictor variables including firm size, capital expenditures to sales, capital intensity, equity ratio and leverage, profitability, listing age, and liquidity. Besides extending the scarce literature focused on frontier markets, this study contributes to the debate by providing novel evidence on whether a set of firm-specific characteristics helps generate extra risk-adjusted returns.

The manuscript proceeds as follows. After the introductory part, where the the background on the topic investigated is given, a section providing relevant research papers in the field follows. Section three presents the variables used and explains their potential direction grounded on the relevant literature. In the fourth section, our empirical approach is presented while section five examines the robustness of the main findings with alternative specifications. The results and discussion are summarized in section six while a final section concludes.

2. Literature Review

In the realm of performance analysis utilizing various risk-adjusted metrics, several studies have made significant contributions. These are given below.

Focusing on the Chinese emerging market between 2000 – 2013, Kiymaz (2015) conduct a thorough examination of the risk-adjusted performance of mutual funds. This is done using a few risk-adjusted measures such as the Sharpe ratio, Treynor ratio, Jensen's α, Information ratio, and M-squared. The author employs three categories of variables including firm-specific variables such as age, tenure, turnover, frontload, management fees and redemption fees, market-specific variables such as price-to-book ratio, price-to-earnings ratio and market capitalization, and fund type as independent variables. The study finds, among others, that funds with higher fees, older funds, funds with higher price-to-book ratios as well as smaller funds have superior performance.

Turning our attention to the United States, Zhang, Nielson & Haley (2019) examine the determinants of reward-to-risk in the insurance industry. Specifically, it is intended to find out whether firm-specific financial characteristics such as overall profitability, liquidity, leverage, business growth, and size as well as executive compensation schemes, affect a firm's risk-adjusted returns taking into account the major stock exchange on which the insurance company is listed and type of insurance business it conducts. For this purpose, two risk and two reward-to-total risk ratios including the Sharpe and the Treynor ratio are employed. However, the findings of the model in which The Treynor ratio served as a performance measure showed that none of these factors are significant determinants of risk-adjusted performance.

Moving to a different geographical context, Dash & Raithatha (2019) direct their research towards non-financial firms listed on the Bombay Stock Exchange during the period 2006 to 2015. They investigate the influence of corporate governance on firm performance as well as on the stock risk-adjusted performance focusing on monthly data. Firm performance is expressed with the return on assets and Tobin's Q while the stock risk-adjusted returns are proxied with excess portfolio returns, i.e. portfolio return reduced by risk-free rate. Corporate governance variables comprise of number of independent directors, number of all directors, share of independent directors, board size, and board meetings. A set of control firm-specific variables such as sales growth, capital expenditures, leverage, market price-to-book ratio, the ratio of research and development, and many others are also employed. Their findings provide evidence that corporate governance proxies are key factors in determining firm performance, however, this does not hold for stock risk-adjusted returns.

Shifting the focus to Thailand, Hensawang (2022) investigates the performance of equity mutual funds in the period 2016 – 2020 using different performance measures including the Sharpe ratio, Treynor ratio as well as Jensen's alpha. The factors that the author uses as potential determinants of funds' performance encompass liquidity, leverage, turnover, return on equity, volatility, management fee, fund age, fund unit trust sold, fund size, consumer price change, private investment index change, GDP growth, exchange rate, market return, the average deposit interest rate, and money supply. The results, among other things, suggest that significant variables explaining performance expressed with the Treynor ratio are the volatility of return, fund age, consumer price index, market return, and exchange rate.

Trying to extend our overview to Croatian context, Balen, Jagrić, Kolanović & Podobnik (2007) examine the stock market performance using the Treynor ratio. Specifically, the stock market performance of Croatian and Slovenian mutual funds as well as of Bosnian investment funds are evaluated. However, their paper ranks funds in the observed markets using risk-adjusted

returns in order to see which fund exhibits superior performance in comparison to the benchmark.

The field of performance analysis, particularly concerning risk-adjusted measures, witnesses valuable contributions from various studies. These research efforts span across different regions and sectors, contributing to the understanding of risk-adjusted measures and their applications in diverse contexts.

3. Methodology and Data

In order to conduct econometric data analysis, dynamic panel data analysis is applied in the study. The dynamic panel data model is estimated using the Arellano-Bond (1991) estimator. Arellano and Bond dynamic panel model estimator with independent variables is presented with the following equation:

$$y_{it} = \mu + \gamma y_{i,t-1} + x'_{it}\beta + \alpha_i + \varepsilon_{it},\ i = 1, \dots, N, t = 1, \dots, T \qquad (1)$$

where y_{it} is the dependent variable expressed with the Treynor ratio, $y_{i,t-1}$ is the lagged dependent variable, x'_{it} is a matrix of type 1×K independent variables which are debated in more detail below. α_i stands for an unobserved individual effect while ε_{it} is an unobserved white noise disturbance. γ and β are regression coefficients.

The dependent variable is presented with the risk-adjusted return, specifically, the Treynor ratio. Risk-adjusted performance measures are more appropriate to assess firm performance as compared to traditional accounting-based measures (Braun, Schmeiser & Schreiber, 2018). This ratio is a widely used measure to express reward-to-risk, i.e. it indicates the profitability of an investment considering the level of risk taken.

The Treynor ratio represents reward to systematic risk ratio, i.e. the risk-adjusted return with a higher Treynor ratio higher the risk-adjusted return. Ling & Naranjo (2002) and Lee & Jang (2007) observe the Treynor ratio as return per unit of systematic risk. It is calculated following an approach applied by Zhang, Nielson & Haley (2019) and van Heerden (2020):

$$Treynor\ ratio = \frac{r_i - r_f}{ß} \qquad (2)$$

where r_i denotes annual stock return based on closing stock prices on the last trading day of the year including dividends as in Dash & Raithatha (2019). Following Damodaran (2014), annual stock returns are algebraically given as:

$$annual\ stock\ return = \frac{price_t - price_{t-1} + div}{price_{t-1}} \qquad (3)$$

Furthermore, r_f stands for risk-free rate presented with annual T-bill interest rate. The risk-free rate is presented with the Ministry of Finance annual T-bill interest rate based on Fang et al. (2021) who use the US T- bill rates as the risk-free benchmark as well as Pilotte & Sterbenz (2006), Smales (2021) and Hensawang (2022). Likewise, in a study by Ooi & Liow (2004), the risk-free rate is represented by the yield on the local 3-month treasury bills. ß, beta coefficient, is the standard risk measure for an individual security showing how sensitive an individual security is to market movements (Brealey, Myers & Allen, 2011). In other words, it describes the sensitivity of changes in excess returns for the security involved to changes in excess returns for the market portfolio (Van Horne & Wachowicz, 2009). Being inherent to classic

capital structure theory, it measures the co-movement of the stock price of an individual firm with the overall market movement (Zhang, Nielson & Haley, 2019).

Following Damodaran (2014), the beta of a stock is calculated as:

$$ß = \frac{covariance\ of\ stock\ i\ with\ market\ portfolio}{variance\ of\ the\ market\ portfolio} \qquad (4)$$

The Treynor ratio of the individual companies is regressed against a set of firm-specific variables including firm size, capital expenditures to sales, capital intensity, equity ratio and leverage, profitability, listing age, and liquidity. Their description, expected impact, and its basis in previous research are given in the rows below.

In order to control variations in size, firm size is employed following Ma & Elango (2008), Shim (2010), Madanoglu, Lee & Castrogiovanni (2011), Lee & Li (2012), Pasiouras & Gaganis (2013), Eling & Marek (2014), Lee (2017), Dash & Raithatha (2019) and Paltrinieri et al. (2021). For this purpose, the logarithmic value of total sales (ln_sales) is employed in the analysis as in e.g. Segarra & Terruel (2012) and Gabaix, Landier & Sauvagnat (2014). Eling & Marek (2014) hypothesize that larger corporations realize economies of scale adding that they receive more media attention than their smaller counterparts affecting managerial behavior and consequently the level of investor protection. Ma & Elango (2008) further explain that larger firms might reduce risks through greater portfolio diversification and achieve competitive benefits through efficient facilities. Similarly, Ooi & Liow (2004) add that larger firms tend to be more diversified and less risky. Valaskova & Gregova (2017) also note that it is assumed in general that larger firms are less risky and more stable which is represented by specific premium for the size of the company. On the contrary, Goddard, Tavakoli & Wilson (2005) argue that the firm size – profitability relation might be negative if firm growth leads to diseconomies of scale. Thus, it does not come as a surprise that the empirical evidence on the size-firm performance relationship is not uniform. Goddard, Tavakoli & Wilson (2005) provide evidence of a reduction in profitability with an increase in firm size. Madanoglu, Lee & Castrogiovanni (2011) find the firm size to be positively related to the Sharpe ratio whereas they document its insignificant effect in terms of the Treynor ratio. The insignificant effect of size on risk-adjusted performance also found in the model with the Treynor ratio in Zhang, Nielson & Haley (2019), suggests that economy of scale advantages in large firms could be offset by their pursuit of risk-enhancing activities. To sum it up, the expected sign of this variable is ambiguous.

The ratio of capital expenditures to sales (CAPEX/sales) is employed by e.g. Santalo & Becerra (2008), Lee and Li (2012), and Dash & Raithatha (2019) when investigating risk-adjusted performance. As argued by Dalbor & Upneja (2004) and Lee (2006), it represents a firm's growth opportunity. Moreover, in order to capture investment opportunities, Anagnostopoulou (2013), also uses CAPEX, although scaling it by total assets. For this purpose, capital expenditures are presented with cash payments for the purchase of fixed tangible and intangible assets obtained from statements of cash flows. The positive impact of capital expenditures to sales ratio is found by Santalo & Becerra (2008) in models with industry-adjusted market to sales and industry-adjusted market to book as dependent variables. Berger & Ofek (1995) document s positive effect of capital expenditures to sales ratio on performance as well as King & Santor (2008) who find a positive impact of capital expenditures to sales ratio on Tobin's Q. Thus, a positive impact of this variable is expected.

Capital intensity is measured as total assets to total sales ratio following Lee (2009) who investigates the firm performance of US public firms, Lee & Jungbae Roh (2012) who tried to find the relationship between corporate reputation and financial performance as well as Madanoglu, Lee & Castrogiovanni (2011) who employ this variable while investigating the

influence of franchising on risk-adjusted financial performance. As suggested by the former author, since capital intensity is commonly considered as a source of entry barriers, this variable might be regarded as an industry-oriented factor. Lee (2009) also adds that capital intensity, as a source of entry barrier, raises the market power of a company, thus, a positive sign of this variable might be expected. However, Vu et al. (2019) find a negative association of capital intensity with firm performance expressed with net assets over the number of employees. Lee & Xiao (2011), citing Brealey and Myers (1984) as well as Shapiro and Titman (1986), interpret the opposite influence of capital intensity on firm performance with the fact that a high degree of capital intensity increases a company's risk arising from higher variability in profits since fixed costs do not vary with sales accordingly. Thus, the ambiguous influence of this variable is expected.

Equity ratio, expressed as the equity over total assets, is applied in the research following e.g. Cebenoyan & Strahan (2004), Gaganis, Liu & Pasiouras (2015), Paltrinieri et al. (2021) who also employed this variable as a potential determinant of risk-adjusted returns. It reflects leverage effects and, according to Valaskova & Gregova (2017), it is a part of many econometric models. Moreover, since this variable is often expressed inversely as leverage, i.e. gearing ratio, leverage variable, expressed as total debt over total assets, is employed in the research as well. Following Paltrinieri et al. (2021) higher values of equity ratio indicate a lower level of financial fragility. Cebenoyan & Strahan (2004) find a positive effect of equity ratio on risk-adjusted ROE while Gaganis, Liu & Pasiouras (2015) find mostly insignificant effect of equity ratio on Sharpe ratio, except in some models. Similarly, Paltrinieri et al. (2021) document an insignificant effect of equity ratio on risk-adjusted returns except for banks that achieved an average cost-income ratio below the median value where its influence is found to be positive. Moreover, Shim (2017) finds leverage expressed as the ratio of net premium written to policyholders' surplus, to have a negative impact on risk-adjusted ROA. Furthermore, the empirical results obtained by Ooi & Liow (2004) also suggest that companies employing high gearing tend to underperform firms that employ less debt. Moreover, Madanoglu, Lee & Castrogiovanni (2011) also find a negative effect of leverage, i.e. debt on the Sharpe ratio adding that a company's leverage increases its level of risk. Lee & Li (2012) also highlight the relationship of increased financial leverage with an increase in the default risk adding, that besides the potential benefits of an increased debt in the form of a tax shield, it has a negative impact on firm performance when no bankruptcy costs are present. Thus, a positive sign of the equity ratio variable is expected whereas we assume a negative influence of leverage.

Furthermore, following e.g. Zhang, Nielson & Haley (2019) and Hensawang (2022), profitability measure, i.e. return on assets (ROA) is also employed. It is calculated as profit before tax over total assets. Higher profitability represents superior operating performance and consequently improved financial stability (Zhang, Nielson & Haley, 2019). Thus, it is expected that ROA is positively related to risk-adjusted return, i.e. the Treynor ratio. Hensawang (2022) predicts a positive sign of return on equity (ROE) on risk-adjusted returns finding its insignificant effect. Zhang, Nielson & Haley (2019) find a positive effect of profitability on risk-adjusted returns presented with the Sharpe ratio while its insignificant effect is found in the model with the Treynor ratio. Moreover, Setiawan & Oktariza (2013) also find a positive effect of profitability expressed with ROE.

Age of the firm is commonly employed in studies dealing with risk-adjusted returns such as in Payne, Prather & Bertin (1999), Madanoglu, Lee & Castrogiovanni (2011), Shim (2017), Dash & Raithatha (2019) and Hensawang (2022). Following Vu (2019), the age of the firm is presented with the listing age which is calculated as the difference between the year of analysis and the first listing year reflecting the number of years the company has been listed on the stock

exchange. This value is further logarithmized as in Dash & Raithatha (2019). Madanoglu, Lee & Castrogiovanni (2011) state that more mature firms can benefit from an established brand and experience effect although they document both positive and negative effects of age on risk-adjusted returns depending on whether Sharpe ratio, Treynor ratio, or other ratios are employed. Moreover, findings by Shim (2017) support the view that incumbent firms achieve higher returns. Accordingly, the expected sign of this variable is not clear.

Liquidity, presented with the current ratio, i.e. current assets over short-term liabilities is used as a potential determinant of risk-adjusted returns following Gaganis, Liu & Pasiouras (2015), Zhang, Nielson & Haley (2019) and Hensawang (2022). Hensawang (2022) finds a negative effect of liquidity on a fund's return whereas it is an insignificant predictor of performance when it is expressed with both the Sharpe and the Treynor ratio. Similarly, Zhang, Nielson & Haley (2019) also document on insignificant effect of the current ratio on risk-adjusted returns. Zhang, Nielson & Haley (2019) note that higher liquidity serves as a buffer against risk adding that it may also indicate suggest inefficient use of resources resulting in reduced returns. However, Gaganis, Liu & Pasiouras (2015) testify to a positive influence of liquidity on the Sharpe ratio. Based on the previously stated, the direction of this variable is inconclusive.

The summarized overview of all variables employed in the research together with their symbols and explanation is given in Table 1.

Table 1 Summarized explanation of variables

Variable	Symbol	Definition
Treynor ratio	Treynor ratio	the difference between annual stock return and risk-free rate divided by beta of a stock
Treynor ratio - lagged	Traynor L1	a lagged value of the Treynor ratio
size	ln_sales	the natural logarithmic value of total sales
ratio of capital expenditures to sales	CAPEX/sales	capital expenditures over sales
capital intensity	capital intensity	total assets to total sales ratio
equity ratio	equity ratio	the equity over total assets
leverage – gearing ratio	leverage	total debt over total assets
return on assets	ROA	profit before tax over total assets
listing age	listing age	the natural logarithmic value of the difference between the year of analysis and the first listing year
liquidity- current ratio	liquidity	current assets over short-term liabilities ratio

Data for calculation of these variables are obtained from financial reports via multiple sources including Zagreb Stock exchange web pages, corporate web pages of observed companies, and the Annual Financial Reports Registry provided by the Croatian Financial Agency (Fina) ensuring the quality and reliability of data. Furthermore, when both unconsolidated and consolidated financial reports are available, following Pasiouras & Gaganis (2013), the use of the former is chosen to avoid double-counting. Moreover, in order to calculate the Traynor ratio, data on risk-free rates, i.e. interest rates on Croatian Ministry of Finance one-year treasury bills

are used, which are obtained from statistical data on general government debt published by Croatian National Bank.

Our sample comprises listed companies that form the CROBEXplus equity index. This index requires its constituents to have 60% trading days and free-float market capitalization greater than 1,3 million EUR. Although it is composed of 20 firms, 17 firms entered our sample since we omitted financial firms, following e.g. Yatim, Kent & Clarkson (2006), Lee & Li (2012), Aldamen et al. (2012) and Graham, Leary & Roberts (2015), due to their specific debt structure that intrinsically differs from those that adhere to non-financial firms, distinctive accounting practices as well as different regulatory environment and compliance making comparisons with other industries more difficult. Additionally, we omitted the firms that reported negative equity as it is done in Ebben & Johnson (2011) and Vermoesen, Deloof & Laveren (2013) since it might provide misleading results. Finally, the firms that have not operated in at least five years in the observed period are eliminated from the sample.

4. Empirical Results and Discussion

Descriptive statistics for all variables (both dependent and independent) in the considered period of research are given in Table 2.

Table 2 Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Treynor ratio	136	48.20	360.67	-1,011.37	3,228.31
ln_sales	136	19.60	1.62	13.45	22.53
CAPEX/sales	136	0.22	0.78	0.00	8.09
capital intensity	136	56.74	288.36	0.49	2,437.61
equity ratio	136	60.64	22.96	-13.30	118.43
leverage	136	53.03	166.40	0.70	1,848.64
ROA	136	0.49	57.69	-621.19	152.96
listing age	136	2.76	0.24	1.79	3.14
liquidity	136	3.89	8.73	0.06	76.37

Source: Authors' calculation.

With the purpose of testing the problem of multicollinearity, the matrix of Pearson correlation coefficients is employed. The correlation matrix for independent variables is provided in Table 3. Considering the fact that an absolute value of the Pearson coefficient higher than 0.7 specifies a strong correlation between independent variables, it is evident that there is no multicollinearity problem between variables used in research.

Table 3 Correlation matrix

	ln_sales	CAPEX /sales	capital intensity	equity ratio	leverage	ROA	listing age	liquidity
ln_sales	1.0000							
CAPEX/sales	-0.3317*	1.0000						
capital intensity	-0.5635*	0.5106*	1.0000					
equity ratio	-0.0750	0.2532*	0.2755*	1.0000				
leverage	-0.0719	-0.0581	-0.0533	-0.1538*	1.0000			
ROA	0.0543	0.0047	0.0061	-0.0852	-0.6690*	1.0000		
listing age	0.0154	0.1156	0.1601*	0.1281	-0.0218	1.0000		
liquidity	-0.3664*	0.6218*	0.3598*	0.4460*	-0.1013	0.0231	0.1115	1.0000

** p<10%*

Source: Authors' calculation.

After providing descriptive statistics and testing the problem of multicollinearity, a stationarity test is conducted as well. Specifically, in order to test whether a time series variable is nonstationary, Fisher type unit root test based on an augmented Dickey Fuller is applied. The results, given in Table 4, show that all variables are stationary.

Table 4 Fisher-type unit-root test

Variable	Inverse chi-squared p-value	Inverse normal p-value	Inverse logit p-value	Modified inverse chi-squared p-value
Treynor ratio	0.0000	0.0000	0.0000	0.000
ln_sales	0.0000	0.0000	0.0000	0.0000
CAPEX/sales	0.0000	0.0000	0.0000	0.0000
capital intensity	0.0000	0.0000	0.0000	0.0000
equity ratio	0.0678	0.0534	0.0495	0.0571
leverage	0.0000	0.0000	0.0000	0.0000
ROA	0.0000	0.0000	0.0000	0.0000
listing age	0.0000	0.0000	0.0000	0.0000
liquidity	0.0000	0.0338	0.0048	0.0000

Source: Authors' calculation.

Finally, the Arellano and Bond dynamic panel estimator is used in the research. The findings of dynamic panel data analysis are demonstrated in Table 5 as well as the results of the Arellano-Bond test for autocorrelation and the Sargan test. Based on the *p* value of Sargan's test, which accounts for 0.42, it is determined that the instruments are not correlated with the residuals and no endogeneity problem in the model exists. Moreover, on the basis of the *p* value of the Arellano-Bond test for autocorrelation of the second order, amounting to 0.25, the null hypothesis of no correlation is not rejected. Thus, there is no autocorrelation problem in the model.

Table 5 Parameter Estimates of the Dynamic Panel Model

Variables	Traynor ratio
Treynor L1	0.12* (0.06)
ln_sales	131.94** (59.91)
CAPEX/sales	1.04 51.33)
capital intensity	0.25** (0.12)
equity ratio	10.92*** (3.23)
leverage	-4.12*** (0.78)
ROA	8.00*** (2.39)
listing age	414.72** (204.97)
liquidity	-0.86 (6.60)
cons	-4301.00*** (1478.70)
Model p value	0.00
Number of instruments	15
Number of groups	17
Sargan test	p value = 0.42
Arellano-Bond test for autocorrelation - order 2	p value = 0.25

,,*** Statistically significant at the; 10%, 5%, 1% level, respectively. Standard errors are between parentheses.*

Source: Authors' calculation.

As presented in Table 5, the model itself has statistical significance of 0.00. Furthermore, variables firm size (ln_sales), capital intensity, equity ratio, leverage, ROA, and listing age are statistically significant factors when explaining the Traynor ratio.

Firm size is commonly found to be one of the key variables having a significant impact on firm performance. However, the empirical findings on its direction are inconclusive which also holds for risk-adjusted performance. Specifically, Ooi & Liow (2004), Ma & Elango (2008), and Kiymaz (2015) find a negative effect of size variable on risk-adjusted performance whereas our findings are aligned with those of Gaganis, Liu & Pasiouras (2015), Shim (2017) and Paltrinieri et al. (2021) who document of its positive sign. This can be rationalized with advantages arising from marginal cost reduction, economies of scale, confidence, and trust which overcome potential disadvantages in the form of higher costs, agency problem risks, and liquidity (Hensawang, 2022).

Furthermore, capital intensity is also found to be a significant determinant of risk-adjusted returns expressed with the Treynor ratio. Lee (2009) and Madanoglu, Lee & Castrogiovanni

(2011) assert its favourable impact since it is viewed as an entry barrier raising the market power. Such prediction can be substantiated with Lee & Jungbae Roh (2012) who debate that financial investments in a technological base can be viewed as a way of reducing the cost of labour diluting short-term resources, nonetheless paying off in the long run.

Equity ratio and leverage are also important factors in explaining risk-adjusted returns where the equity ratio holds positive whereas leverage has a negative impact on performance. These findings are according to our expectations and their opposite directions are also expected considering the method of their calculation since equity ratio takes into account equity whereas leverage considers total debt. This can be interpreted by Lee & Li (2012) who highlight the relationship of increased financial leverage with an increase of the default risk adding, that besides the potential benefits of increased debt in the form of a tax shield, it has a negative impact on firm performance when no bankruptcy costs are present.

The profitability of the firm, expressed as profit before tax over total assets, positively affects risk-adjusted returns as anticipated since it stands for superior performance and enhanced financial stability (e.g. Cummins, Rubio-Misas & Vencappa (2017) and Zhang, Nielson & Haley (2019)). Cummins, Rubio-Misas & Vencappa (2017) also note that such firms are more capable to withstand unfavourable developments. We can also add benefits in terms of better investment opportunities, increased shareholder value, creditworthiness, resilience, being able to allocate more resources to research and development activities, etc.

According to findings presented in Table 5, the listing age of the firm contributes positively to risk-adjusted returns. It is worth noting that firm age has been a widely investigated topic in academic journals and gained enormous interest among scholars in recent decades (Coad et al., 2018). The findings of previous research explaining the positive or negative influence of age on firm performance are demonstrated. Hence, a positive influence of listing age on risk-adjusted returns is pertinent to accumulated reputation, experience, maturity, learning effects, routines, and capabilities (Coad et al., 2018).

5. Conclusion

By highlighting the importance of evaluating stock performance, it is necessary to emphasize that investment involves a trade-off between returns and risks. Thus, this paper discusses the significance of risk-adjusted performance and uses the Treynor ratio as a key measure.

Although there is a vast majority of related studies that explore risk-adjusted performance using different measures in various settings, the empirical research examining risk-adjusted returns on the sample of a small frontier economy like Croatian is rather scarce. Hence, this paper explores whether a set of firm-specific factors including firm size, CAPEX/sales ratio, capital intensity, equity ratio and leverage, ROA, listing age, and liquidity are significant determinants of the risk-adjusted returns. For this purpose, the Treynor ratio is employed which stands for the reward to systematic risk ratio using the sample of 17 Croatian non-financial listed firms in the period spanning eight years, i.e. from 2014 – 2021 making a total of 136 observations.

The estimated dynamic panel analysis results reveal a statistically significant and positive influence of firm size, capital intensity, equity ratio, ROA, and listing age whereas leverage has a negative impact on risk-adjusted performance. The investors should consider larger and more mature firms, capitally intensive ones as well as those that are more profitable whereas avoid over-indebted ones.

In addition to the practical implications, it is essential to acknowledge several inherent limitations in this study. Firstly, the selected performance measures used in this research may benefit from future expansion to incorporate a broader range of risk-adjusted performance metrics. While

the measure employed here offers valuable insights, using a more comprehensive set of measures can enhance the comparability and robustness of the results. Including additional measures, such as the Sharpe ratio, and Sortino ratio, could provide a more complete view of firm performance by considering different facets of risk. This expanded set of measures would enable a more in-depth evaluation of a firm's financial performance, offering a more nuanced understanding of the relationship between risk and return.

Moreover, if data availability allows, the sample might be extended to more firms. Therefore, future research endeavors should aim to extend the sample size to encompass a more diverse array of firms. A larger and more diverse sample can help mitigate potential biases and provide a more comprehensive overview of the relationship between risk-adjusted returns and their determinants. Additionally, a broader sample can facilitate the exploration of potential variations in this relationship across different industries, firm sizes, and geographical regions, contributing to a more robust understanding of this issue.

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