

Is there a low-risk anomaly in the UAE stock market?

Jan Jakub Szczygielski^a, Mateusz Mikutowski^{b*}, Adam Zaremba^{b,c}

^a Department of Financial Management, University of Pretoria, Pretoria, South Africa, kuba.szczygielski@up.ac.za.

^b Department of Investment and Capital Markets, Faculty of Management, Poznań University of Economics and Business, Poland, mateusz.mikutowski@ue.poznan.pl, adam.zaremba@ue.poznan.pl.

^c Dubai Business School, University of Dubai, Dubai, United Arab Emirates, adam.zaremba@ud.ac.ae.

*Corresponding author.

Received: 24 June 2019; revised: 3 July 2019; accepted: 3 July 2019; published: 5 July 2019.

ABSTRACT

We investigate the low-risk anomaly in the United Arab Emirates stock market. Using a sample of stocks listed on the DFM and ADX, we examine the performance of portfolios from one-way sorts on several prominent measures of risk: total volatility, beta, idiosyncratic risk, and value at risk. We find no significant relationship between these measures of risk and future returns – either positive or negative. In consequence, our results do not support the hypothesis that the low-risk anomaly is present in the UAE stock market. Low-risk stocks do not significantly outperform high-risk securities.

Keywords: equity market, pricing anomalies, low-risk anomaly, asset pricing, return predictability, United Arab Emirates, UAE, emerging markets.

JEL codes: G11, G12, G14

1. INTRODUCTION

The low-risk anomaly is a tendency of securities characterized by low systematic or idiosyncratic volatility to outperform high-risk counterparts. This anomaly fundamentally departs from the basic assumption of the CAPM model (Sharpe, 1965), which implies that higher risk should be associated with a higher expected return. The body of evidence supporting this anomaly is increasing in recent finance literature. Friend and Blume (1970) investigated stock market returns in the 1960s and found that the relationship between risk-adjusted performance and risk is inverted. Haugen and Heins (1975) confirmed this observation. In the decades that followed, a plethora of studies confirmed the same anomaly – low-risk does not necessarily mean low returns (e.g. Black, 1993; Chan et. al 1999; Clarke et. al., 2010; Dimitriou and Simos, 2011; Baker and Haugen, 2012; Walkshausl; 2014a; b; Zaremba 2016; Zaremba and Czapkiewicz, 2017).

This study aims to examine whether the low-risk anomaly is also present in equity returns for the United Arab Emirates (UAE). To this end, we investigate the returns on 124 stocks listed on the Dubai Financial Market and Abu Dhabi Stock Exchange. We form portfolios from one-way sorts on several well-established measures of risk – total volatility, beta, idiosyncratic risk, and value at risk – and evaluate their performance to establish the existence of patterns in cross-sectional returns.

We find no significant relationship between these measures of risk and future returns – either positive or negative. Consequently, our results do not support the hypothesis that the low-risk anomaly is present in the UAE stock market. High-risk stocks do not significantly underperform low-risk securities.

This study contributes to the literature on asset pricing and equity anomalies in the UAE equity market (Moustafa, 2004; Al-Kahazali, 2008; Bedier & Abdel-Azim, 2019; Chiang and Zheng, 2010; Al-Hajieh et al., 2011; Al-Tamimi et al., 2011; Medhioub and Chaffai, 2018; Mikutowski, Kambouris, & Zaremba, 2019; Zaremba, 2015, 2016; Zaremba & Shemer, 2018).

The remainder of the article proceeds as follows. Section 2 describes our dataset. Section 3 outlines the methodology. Section 4 examines the low-risk anomaly in the UAE stock market with the use of portfolios sorts. Finally, Section 5 concludes the study.

<http://dx.doi.org/10.30585/jrems.v1i2.348>

© 2019 the Authors. Production and hosting by Avicenna FZ LLC. on behalf of Dubai Business School, University of Dubai, UAE. This is an open-access article under the CC BY-NC license (<https://creativecommons.org/licenses/by-nc/4.0/>).



2. DATA

The study uses returns on all firms listed in the UAE, including two markets, the Dubai Financial Market (DFM) and Abu Dhabi Stock Exchange (ASX). We analyze primary securities only and use monthly returns for the period January 2004 to March 2019 (all data is obtained from Datastream). We also divide the sample into two subsamples: 1) all listed companies and 2) large firms (market value exceeding AED 10 bln). The dataset comprises 124 firms although the number of companies at particular points in time varies between 33 and 109. Figure 1 shows the number of companies in the sample over the period of analysis.

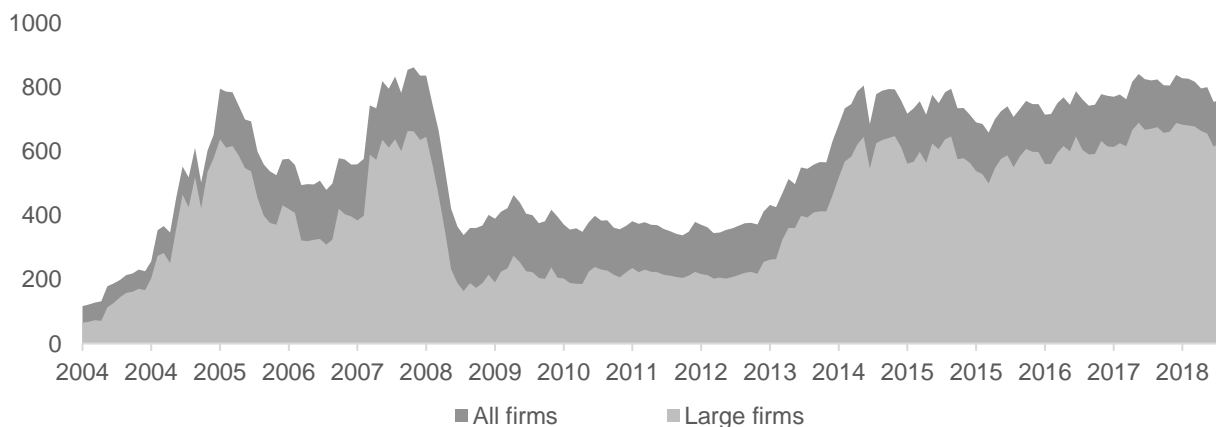
Figure 1. Number of firms in the sample



Note: This figure presents the number of companies in the analyzed sample. *Source:* Bloomberg.

The aggregate value of all companies in the sample varies between 65.17 bln to 688.81 bln AED. The market capitalization of the UAE stock market has grown rapidly between 2013-2015 after a significant decline in 2008. At the time of writing of this study (March 2019), the UAE stock market has a market capitalization of AED 758.89 bln and 82.6% of its value was created by 14 out of 83 listed companies. In earlier periods, large companies accounted for between 48.2% to 88.9% of entire market in capitalization terms. Graph 2 shows the value of firms in the sample:

Figure 2. Value of firms in the sample (in AED bln)



Note: This figure presents the value of companies in the analyzed sample. *Source:* Bloomberg.

All stocks prices are in UAE dirhams (AED). As a risk-free rate, we used the 3-month US T-bill from Kenneth French' website (the currency in UAE is pegged to the US dollar).

3. METHODS

All tests are conducted on two major samples: a) all firms and b) large companies only. We use four different return predictive variables representing the price risk of the examined companies: 1) *Total volatility* (Baker et. al 2011; Vilet et al. 2011), measured by a trailing 24-month standard deviation of excess returns; 2) *Stock*

market beta (Frazzini and Pedersen, 2014; Asness et al., 2014) measured by the beta from the CAPM estimated over a trailing 24-month window; 3) *Idiosyncratic risk* (Ang et. al, 2009) measured by idiosyncratic volatility from the CAPM derived for the same period; and 4) *Value at risk* (Bali and Cakici, 2004), or VaR estimated as the empirical value at risk based on a 5% cut-off point and a trailing 24-month period of returns.

In the empirical part of this study, we examine portfolios from one-way sorts on measures of risk. To form these portfolios, we rank all stocks in the sample on different risk measures each month. Subsequently, we form equal-weighted and value-weighted tercile portfolios from single sorts. Also, we build long-short portfolios that are long in the tercile of stocks with the highest risk and short in the securities characterized by the lowest risk.

We evaluate these portfolios using Sharpe ratios and CAPM alphas (Sharpe, 1964). The *t*-statistics are estimated using the bootstrap method for mean returns and the Newey-West (1987) method for alphas.

4. ANALYSIS AND RESULTS

4.1 Portfolio sorts

4.1.1. Strategies in all companies

Table 1 demonstrates the results of portfolio sorts for the full sample of all companies. A quick overview of the outcomes suggests that there is no clear low-risk anomaly. Regardless of the risk measures and weighting scheme that we use, the mean returns and alphas for the long-short portfolios do not significantly differ from zero. In short, we find no evidence supporting the existence of a low-risk anomaly in the UAE.

Table 1. Strategies in full sample

| | Equal-weighted portfolios | | | | Value-weighted portfolios | | | |
|---|---------------------------|------------------|------------------|------------------|---------------------------|---------------------|------------------|------------------|
| | Low | Medium | High | High-Low | Low | Medium | High | High-Low |
| <i>Panel A: Portfolios from sorts on total volatility</i> | | | | | | | | |
| R | 0.13 (0.55) | 0.15 (0.35) | 0.15 (0.24) | 0.02 (-0.01) | 0.16 (0.40) | 0.17 (0.37) | 0.03 (0.08) | -0.13 (-0.20) |
| Vol | 3.50 | 5.71 | 7.62 | 5.94 | 5.35 | 7.00 | 9.49 | 7.27 |
| SR | 0.13 | 0.09 | 0.07 | 0.01 | 0.10 | 0.08 | 0.01 | -0.06 |
| α | 0.06 (0.32) | 0.02 (0.07) | -0.03 (-0.08) | -0.09 (-0.22) | 0.04 (0.14) | 0.00 (-0.01) | -0.19 (-0.56) | -0.23 (-0.44) |
| <i>Panel B: Portfolios from sorts on stock market beta</i> | | | | | | | | |
| R | 0.01 (0.07) | 0.32 (0.80) | 0.11 (0.14) | 0.09 (0.13) | 0.00 (-0.02) | 0.35 (0.77) | 0.26 (0.46) | 0.27 (0.46) |
| Vol | 3.00 | 5.14 | 9.28 | 8.46 | 5.44 | 5.54 | 8.89 | 8.65 |
| SR | 0.01 | 0.22 | 0.04 | 0.04 | 0.00 | 0.22 | 0.10 | 0.11 |
| α | -0.03 (-0.11) | 0.20 (0.95) | -0.12 (-0.32) | -0.09 (-0.18) | -0.07 (-0.15) | 0.22 (1.13) | 0.03 (0.14) | 0.10 (0.17) |
| <i>Panel C: Portfolios from sorts on idiosyncratic risk</i> | | | | | | | | |
| R | 0.56 (1.41) | 0.48 (0.80) | 0.35 (0.53) | -0.21 (-0.75) | 0.97** (2.13) | 0.25 (0.28) | 0.18 (0.23) | -0.79 (-1.31) |
| Vol | 4.25 | 5.16 | 5.05 | 3.73 | 4.97 | 6.15 | 7.25 | 6.64 |
| SR | 0.46 | 0.32 | 0.24 | -0.20 | 0.68 | 0.14 | 0.09 | -0.41 |
| α | -0.04 (-0.21) | -0.15 (-0.57) | -0.30 (-1.07) | -0.26 (-0.76) | 0.21* (1.88) | -0.62*** (-2.71) | -0.52 (-1.07) | -0.73 (-1.26) |
| <i>Panel D: Portfolios from sorts on value at risk</i> | | | | | | | | |
| R | 0.09 (0.17) | 0.36 (0.78) | 0.21 (0.72) | 0.12 (0.31) | -0.04 (0.01) | 0.47 (0.95) | -0.08 (-0.14) | -0.03 (-0.14) |
| Vol | 6.93 | 5.72 | 3.78 | 5.07 | 8.82 | 6.47 | 5.72 | 6.47 |
| SR | 0.04 | 0.22 | 0.19 | 0.08 | -0.02 | 0.25 | -0.05 | -0.02 |
| α | -0.03 (-0.11) | 0.26 (1.08) | 0.15 (0.80) | 0.19 (0.54) | -0.20 (-0.68) | 0.34** (1.99) | -0.18 (-0.83) | 0.02 (0.06) |

Note. This table presents the performance of equal- and value-weighted tercile portfolios from sorts on total volatility (*Panel A*), the market beta (*Panel B*), idiosyncratic risk (*Panel C*), and value at risk (*Panel D*). *High (Low)* represents the portfolio of stocks with the 1/3 highest (lowest) values of predictive variables representing a low-risk anomaly, *Medium* represents the portfolio of stocks with predictor values between groups of 1/3 highest and 1/3 lowest. *High-Low* is the zero-investment portfolio going long (short) the *High (Low)* tercile. *R* is the mean monthly return, *Vol* represents the standard deviation, *SR*

is annualized Sharpe ratio and the α represents the average annual abnormal return derived from the CAPM. Average returns, volatilities and alphas are expressed in percentage terms. The numbers in the parentheses are bootstrap and Newey-West (1987) adjusted t -statistics for the means of returns and alphas, respectively. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Admittedly, when we focus on particular measures, some patterns may be noticed, but lack statistical significance. The sorts on idiosyncratic risk may serve as an example. For equal-weighted (value-weighted) portfolios, the Sharpe ratio on the high-risk tertile amounts to 0.24 (0.09), while for the low-risk portfolios it equals 0.46 (0.68). Indeed, the risk-adjusted profile of the low-risk assets historically proves to be better from an investor perspective. Nevertheless, the evidence is too weak to draw firm inferences.

4.1.2. Strategies in large firms

We are also interested in how these strategies perform within a subsample of large stocks which better reflect the actual investment opportunities in the UAE stock market. The results are reported in Table 2. Outcomes are consistent with what we have observed in Table 1. There are a number of insignificant differences between the Sharpe ratios for portfolios associated with high and low idiosyncratic risk. Nevertheless, we find no convincing evidence of the low-risk anomaly in UAE stocks. No long-short portfolio exhibits significant mean raw or risk-adjusted returns.

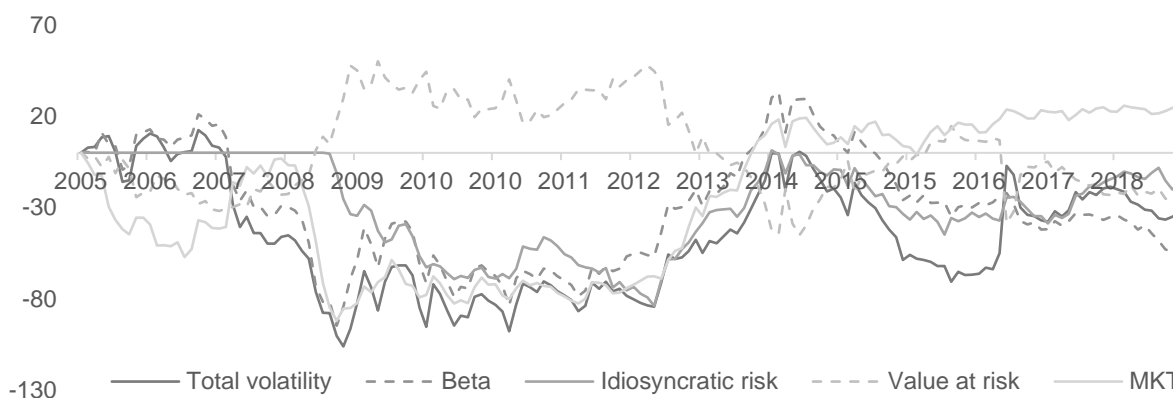
Table 2. Strategies in large firms

| | Equal-weighted portfolios | | | | Value-weighted portfolios | | | |
|---|---------------------------|----------------|------------------|------------------|---------------------------|------------------|------------------|------------------|
| | Low | Medium | High | High-Low | Low | Medium | High | High-Low |
| <i>Panel A: Portfolios from sorts on total volatility</i> | | | | | | | | |
| R | 0.39 (0.72) | 0.20 (0.33) | 0.29 (0.38) | -0.10 (-0.14) | 0.49 (0.96) | 0.33 (0.56) | 0.28 (0.41) | -0.21 (-0.29) |
| Vol | 6.74 | 8.09 | 10.40 | 8.30 | 6.51 | 8.47 | 10.61 | 8.66 |
| SR | 0.20 | 0.09 | 0.10 | -0.04 | 0.26 | 0.13 | 0.09 | -0.08 |
| α | 0.24 (0.87) | 0.02 (0.05) | 0.03 (0.10) | -0.21 (-0.36) | 0.34 (1.23) | 0.15 (0.40) | 0.03 (0.08) | -0.31 (-0.47) |
| <i>Panel B: Portfolios from sorts on stock market beta</i> | | | | | | | | |
| R | 0.11 (0.10) | 0.68 (1.20) | 0.20 (0.29) | 0.10 (0.26) | 0.42 (0.81) | 0.59 (1.07) | 0.07 (0.12) | -0.35 (-0.56) |
| Vol | 6.83 | 8.69 | 10.01 | 8.26 | 6.30 | 8.65 | 9.50 | 7.48 |
| SR | 0.06 | 0.27 | 0.07 | 0.04 | 0.23 | 0.24 | 0.03 | -0.16 |
| α | -0.03 (-0.10) | 0.49 (1.15) | -0.04 (-0.15) | -0.01 (-0.02) | 0.29 (0.88) | 0.39 (0.91) | -0.17 (-0.56) | -0.46 (-0.84) |
| <i>Panel C: Portfolios from sorts on idiosyncratic risk</i> | | | | | | | | |
| R | 1.33** (2.21) | 0.99 (1.61) | 1.01 (1.40) | -0.32 (-0.46) | 1.07* (1.91) | 1.11** (1.97) | 0.94 (1.39) | -0.14 (-0.23) |
| Vol | 6.16 | 6.87 | 8.05 | 5.88 | 5.38 | 6.59 | 7.41 | 5.34 |
| SR | 0.75 | 0.50 | 0.43 | -0.19 | 0.69 | 0.58 | 0.44 | -0.09 |
| α | 0.49** (2.07) | 0.04 (0.13) | -0.09 (-0.23) | -0.58 (-1.08) | 0.36 (1.41) | 0.26 (0.85) | -0.11 (-0.33) | -0.48 (-0.98) |
| <i>Panel D: Portfolios from sorts on value at risk</i> | | | | | | | | |
| R | 0.19 (0.27) | 0.56 (1.01) | 0.13 (0.26) | -0.06 (-0.16) | 0.25 (0.34) | 0.61 (1.07) | 0.07 (0.14) | -0.18 (-0.37) |
| Vol | 10.67 | 7.38 | 6.88 | 7.34 | 10.82 | 7.43 | 6.40 | 7.78 |
| SR | 0.06 | 0.26 | 0.07 | -0.03 | 0.08 | 0.28 | 0.04 | -0.08 |
| α | -0.01 (-0.03) | 0.43 (1.42) | 0.01 (0.02) | 0.01 (0.03) | 0.05 (0.15) | 0.49 (1.29) | -0.05 (-0.25) | -0.10 (-0.22) |

Note. This table presents the performance of equal- and value-weighted tertile portfolios from sorts on total volatility (*Panel A*), the market beta (*Panel B*), idiosyncratic risk (*Panel C*), and value at risk (*Panel D*). *High (Low)* represents the portfolio of stocks with the 1/3 highest (lowest) values of predictive variables representing a low-risk anomaly, *Medium* represents the portfolio of stocks with predictors values between groups of 1/3 highest and 1/3 lowest. *High-Low* is the zero-investment portfolio going long (short) the *High (Low)* tertile. *R* is the mean monthly return, *Vol* represents the standard deviation, *SR* is the annualized Sharpe ratio and the α represents the average annual abnormal return derived from the CAPM. Average returns, volatilities and alphas are expressed in percentage terms. The numbers in parentheses are bootstrap and Newey-West (1987) adjusted t -statistics for the means of returns and alphas, respectively. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Additionally, Figure 3 reports the cumulative returns on the long-short tercile value-weighted portfolios of large firms formed on different risk measures. Payoffs are time-variant, and, on average, underperform the market. As before, there is no clear pattern of outperformance or underperformance. In short, there is no low-risk anomaly in the UAE stock market.

Figure 3. Cumulative returns for large firms



Note: This Figure presents the cumulative returns for each of the analyzed strategies and the market capitalization of the analyzed firms. *Source:* Authors' own.

5. CONCLUSIONS

This study investigates the low-risk anomaly in the UAE stock market. We use all firms listed in the UAE for the period January 2004 to March 2019. The dataset comprises 124 companies. We perform portfolio sorts based on several proxies of risk (total volatility, stock market beta, idiosyncratic risk, and VaR).

Our results do not provide evidence supporting the low-risk anomaly in the UAE stock market. The mean raw and adjusted returns on the long-short portfolios from sorts on risk are generally low with no strong statistical significance. Notably, while our findings do not confirm the examined phenomenon, they still have some implications for investment practice. They indicate that the investors should not necessarily refrain from low-risk securities because of lower expected return. What we demonstrate is that lower risk bears no major implications for the size of expected returns.

Future studies on the topics discussed in this paper should focus on finding the reason why the low-risk pattern works differently in different countries. The question why there is no low-risk anomaly in the UAE, while present in numerous other markets, remains unanswered.

FUNDING

This paper is a part of the project No. 2016/23/B/HS4/00731 of the National Science Centre of Poland.

REFERENCES

- Al-Hajieh, H., Redhead, K. & Rodgers, T. (2011), Investor sentiment and calendar anomaly effects: a case study of the impact of Ramadan on Islamic Middle Eastern markets. *Research in International Business and Finance*, 25(3), 345-356.
- Al-Khazali, O. M. (2008) The impact of thin trading on day-of-the-week effect: *Evidence from the United Arab Emirates. Review of Accounting and Finance*, 7(3), 270-284. <https://doi.org/10.1108/14757700810898258>
- Al-Tamimi, H. A. H., Alwan, A. A., & Abdel Rahman, A. A. (2011). Factors affecting stock prices in the UAE financial markets. *Journal of Transnational Management*, 16(1), 3-19. <https://doi.org/10.1080/15475778.2011.549441>
- Ang, A., Chen, J., & Xing, Y. (2006). Downside risk. *Review of Financial Studies*, 19, 1191–1239.
- Ang, A., Hodrick, R., Xing, Y., & Zhang, X. (2009). High idiosyncratic volatility and low returns: International and further U.S. evidence. *Journal of Financial Economics*, 91, 1–23.
- Asness, C. S., Frazzini, A., & Pedersen, L. H. (2014). Low-risk investing without industry bets. *Financial Analysts Journal*, 70(4), 24–41.
- Baker, M., Bradley, B., & Wurgler, J. (2011). Benchmarks as limits to arbitrage: Understanding the low-volatility anomaly. *Financial Analysts Journal*, 67(1), 40–54.
- Baker, N. L., & Haugen, R. A. (2012). Low-risk stocks outperform within all observable markets of the world (Working paper). Available at SSRN: <https://doi.org/10.2139/ssrn.2055431>. Accessed 25 Oct 2015.

- Bali, T. G., & Cakici, N. (2004). Value at risk and expected stock returns. *Financial Analyst Journal*, 60(2), 57–73.
- Bedier, R. E., & H. Abdel-Azim, M. H. (2019). Information processing effects of accounting consistency: Evidence from Egypt. *Journal of Research in Emerging Markets*, 1(2), 1-15. <https://doi.org/10.30585/jrems.v1i2.322>
- Black, F. (1993). Beta and returns. *Journal of Portfolio Management*, 20(1), 8–18.
- Chan, L., Karceski, J., & Lakonishok, J. (1999). On portfolio optimization: Forecasting covariances and choosing the risk model. *Review of Financial Studies*, 12, 937–974.
- Chiang, C.T. & Zheng, D. (2010), An empirical analysis of herd behavior in global stock markets. *Journal of Banking and Finance*, Vol. 34 No. 8, pp. 1911-1921.
- Clarke, R., de Silva, H., & Thorley, S. (2006). Minimum-variance portfolios in the US equity market. *Journal of Portfolio Management*, 33(1), 10–24.
- Dimitriou, D., & Simos, T. (2011). The relationship between stock returns and volatility in the seventeen largest international stock markets: A semi- parametric approach. *Modern Economy*, 2, 1–8.
- Frazzini, A., & Pedersen, L. H. (2014). Betting against beta. *Journal of Financial Economics*, 111, 1–25. <https://doi.org/10.1016/j.jfineco.2013.10.005>.
- Friend, I., & Blume, M. (1970). Measurement of portfolio performance under uncertainty. *American Economic Review*, 60, 561–575.
- Haugen, R. A., & Heins, A. J. (1975). Risk and the rate of return on financial assets: Some old wine in new bottles. *Journal of Financial and Quantitative Analysis*, 10(5), 775–784.
- Levy, H. (1978). Equilibrium in an imperfect market: A constraint on the number of securities in the portfolio. *American Economic Review*, 68, 643–658.
- Malkiel, B., & Xu, Y. (1997). Risk and return revisited. *Journal of Portfolio Management*, 23(3), 9–14. <https://doi.org/10.3905/jpm.1997.409608>.
- Malkiel, B., & Xu, Y. (2004). Idiosyncratic risk and security returns (AFA 2001 New Orleans meetings). Available at SSRN: <http://ssrn.com/abstract=255303> or <https://doi.org/10.2139/ssrn.255303>. Accessed 25 Oct 2015.
- Medhioub, I. & Chaffai, M. (2018) Islamic finance and herding behavior: an application to Gulf Islamic stock markets. *Review of Behavioral Finance*, 10 (2), 192-206. <https://doi.org/10.1108/RBF-02-2017-0014>
- Merton, R. (1987). A simple model of capital market equilibrium with incomplete information. *Journal of Finance*, 42, 483–510.
- Mikutowski, M., Kambouris, G. D., & Zaremba, A. (2019). A note on value investing in the UAE stock market. *Journal of Research in Emerging Markets*, 1(2), 33-38. <https://doi.org/10.30585/jrems.v1i2.339>
- Moustafa, M. (2004), Testing the weak-form efficiency of the United Arab Emirates stock market. *International Journal of Business*, 9, 309-325.
- Newey, W.K. & West K.D. (1987). A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Covariance Matrix, *Econometrica* 55 (3), 703-708
- Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *Journal of Finance*, 19(3), 425–442.
- Sharpe, W. F. (1966). Mutual fund performance (pp. 119–138). *January: Journal of Business*.
- Tinic, S. M., & West, R. R. (1986). Risk, return and equilibrium: A revisit. *Journal of Political Economy*, 94, 126–147
- van Vliet, P., Blitz, D., & van der Grient, B. (2011). Is the relation between volatility and expected stock returns positive, flat or negative? Available at SSRN: <http://ssrn.com/abstract=1881503> or <https://doi.org/10.2139/ssrn.1881503>. Accessed 25 Oct 2015.
- Walkshausl, C. (2014a). International low-risk investing. *Journal of Portfolio Management*, 41(4), 45–56.
- Walkshausl, C. (2014b). The MAX effect: European evidence. *Journal of Banking and Finance*, 42(1), 1–10. <https://doi.org/10.1016/j.jbankfin.2014.01.020>.
- Zaremba, A. (2015). Low risk anomaly in the CEE stock markets. *Romanian Journal of Economic Forecasting*, 3, 81-102.
- Zaremba, A. (2016). Is there a low-risk anomaly across countries? *Eurasian Economic Review* 6 (1): 45-65. <https://doi.org/10.1007/s40822-015-0036-3>
- Zaremba, A., & Czapkiewicz, A. (2017). Digesting anomalies in emerging European markets: A comparison of factor pricing models. *Emerging Markets Review*, 31, 1–15. <https://doi.org/10.1016/j.ememar.2016.12.002>.
- Zaremba, A., & Shemer, J. “Koby.” (2018). No pain, no gain? The puzzle of risk-return relationship. *Price-Based Investment Strategies*, 125–165. doi:10.1007/978-3-319-91530-2_4