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The momentum effect in country-level stock market anomalies

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ABSTRACT

The paper investigates the momentum effect in country-level anomalies in global equity markets. By using a sample of 78 countries for the period from 1995 to 2015, we test a set of potential 40 cross-sectional inter-market anomalies, some of which had never been examined before. Based on the findings, according to which half of these return patterns serve as reliable and robust sources of returns, we provide convincing evidence that the anomalies with good performance over the past 6–12 months tend to outperform in the future. Furthermore, returns on individual country-level strategies are weakly correlated. Consequently, developing a portfolio consisting of past top-performing strategies may constitute a valuable approach for international investors.

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1. Introduction

Momentum is defined as the tendency of assets with good (poor) past performance to outperform (underperform) in the future. The phenomenon applies to the most pervasive anomalies ever discovered. The evidence for momentum has been found across international equities in developed and numerous other classes (Asness, Moskowitz, & Pedersen, 2013).

This study shows the momentum anomaly in an entirely new dimension and examines the possibility of applying it to the selection of country-level investment strategies. We formulate a hypothesis that the momentum effect should be observable in the anomalies themselves if either is present within the constituents of portfolios based on inter-market anomalies. In other words, this study investigates whether the phenomenon of momentum works not only for financial assets but also for inter-market anomalies. To this end, in the first place, a set of 40 cross-sectional country-level anomalies is examined, including some that had never before been investigated.

The concept of applying meta-strategies to anomalies or factor portfolios is not entirely new. Multiple research papers have demonstrated that it is possible to apply momentum strategies to successfully rotate between styles (Chen, Jiang, & Zhu, 2012; Clare, Sapuric, & Todorovic, 2010; Tibbs, Eakins, & DeShurko, 2008). Nonetheless, all of the previous

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evidence focused on the stock-level factors, so our research constitutes a natural extension of country-level data.

This article aims to contribute to the academic literature in two ways. First, it re-examines the largest data-set of country-level anomalies ever investigated. Some of the 40 different cross-sectional effects tested here have not yet been covered by the academic literature. Second, the paper examines whether the phenomenon of momentum is also present across the anomalies. In other words, we study the feasibility of choosing between country-selection strategies based on their past performance.

This study is based on the performance of 78 country equity markets in the period from 1995 to 2015. We use sorting procedures to form equal- and capitalisation-weighted portfolios of countries, and we test their performance with country-level and stock-level asset-pricing models. Having selected the most robust effects, we create equally weighted portfolios of anomalies. Finally, we use Patton and Timmerman's (2010) monotonic relationship (MR) tests to verify whether there are cross-sectional patterns in the anomalies related to past performance of portfolios.

The main conclusions of this paper may be summarised as follows. First, we confirm the presence of a number of cross-country anomalies that are parallels of stock-level phenomena related to value, momentum, liquidity, skewness, issuance, volatility and quality. It is proved that countries with stock markets composed of companies' high selected fundamentals relative to price, good intermediate past performance, negative skewness, low levels of debt, low liquidity, low equity issuance or high value at risk metrics tend to outperform other countries. Second, we find convincing evidence for the momentum effect across the anomalies. The anomaly-based country-selection winner strategies that performed well over the past 6–12 months tend to continue to outperform the laggard strategies over the next month.

The remaining part of the paper is organised into three sections. The next section describes the data and research methods employed, followed by the discussion of research results. The final section concludes the paper.

2. Data sources and research methods

This section presents the data sources and the procedures employed in the construction of anomaly-based portfolios. Next, it describes the asset-pricing models employed in this study to test the anomalies. Further, the procedures used to detect the momentum within the filtered sample of strategies are described. Finally, we outline the robustness checks performed are outlined.

2.1. Data sources and preparation

This research is based on monthly returns on international stock market indices from 78 countries.¹ All source data are obtained from the Bloomberg database. The MSCI indices are adopted for all of the countries included in this study to maintain the consistency of return computation methodology. If an MSCI index is not available for a country, the second choice is the Dow Jones index, and the third choice is STOXX.

Returns are calculated by capitalisation-weighted total return indices, i.e., indices adjusted for corporate actions and cash distributions to investors. The sample period runs from January 1995 to May 2015, as available. The total sample includes 78 country equity

markets, including both existing and discontinued indices (e.g., MSCI Venezuela) to avoid survivorship bias. A stock market is included in the sample in month t when it is possible to compute its returns in month t , its capitalisation at the end of month $t-1$, and the metric necessary to sort the countries for the need of portfolio formation at the end of month $t-1$.² The initial index values and capitalisation are collected in local currencies and subsequently denominated in U.S. Dollars to obtain pooled international results. To ensure consistency with the U.S.D. approach, excess returns are computed over returns on the Bloomberg generic U.S. 1-month T-Bill.

2.2. Examined portfolios and anomalies

This paper examines the performance of long/short zero-investment portfolios from sorts on variables stemming from cross-sectional anomalies. This section provides a short review of the investigated anomalies. The choice of examined strategies is mostly motivated by the outcomes of previous research studies, although some of the country-level parallels of stock-level effects have been studied for the first time in this paper. Furthermore, following Jacobs (2015), two additional screens are imposed on the anomalies. First, the anomaly could be computed using accounting and market data from standard databases, e.g., the Bloomberg database. Second, the anomaly should exist at a monthly frequency. Finally, the anomaly should be naturally calculated on the country level, which is untrue, for instance, for anomalies related to dual-listed stocks, dual-class shares, closed-end funds, or anomalies related to price, such as the low-price anomaly. All of the examined strategies are described in detail in Table A1 of the Online Appendix.³ The anomalies could be categorised into several groups.

Group 1: Value investing. Some studies indicated that stocks with high fundamentals relative to price outperform stocks with low fundamentals. This phenomenon is robust and has been documented with the use of multiple valuation ratios: the book-to-market ratio ((1), e.g., Rosenberg, Reid, and Lanstein (1985)), earnings-to-price-ratio ((2), e.g., Basu (1983)), dividend yield ((3), e.g., Litzenberg and Ramaswamy (1979)) and cash flow-to-price ratio ((4), e.g., Lakonishok, Shleifer, and Vishny (1994)). The evidence for the country-level parallels of these effects is provided by Kim (2012) and Zaremba (2015a). Additionally, there are several less frequently used fundamental variables related to expected returns: EBITDA-to-EV ratio ((5), e.g., Loughran & Wellman, 2011), EBITDA-to-price ratio (6), sales-to-EV ratio (7) and sales-to-price ratio ((8), e.g., Lewellen (2014)). Eventually, the performance of portfolios formed on the book-to-market ratio tend to be better within small countries and stocks than within large ones ((9), e.g., Kim (2012)).

Group 2: Momentum. Hou, Xue, and Zhang (2014) differentiated between two basic types of momentum. The first one is the original short-term momentum (10) with a 6-month sorting period developed by Jegadeesh and Titman (1993). The second is the standard momentum (11) with portfolios formed by 12-month past performance with the most recent month skipped (Fama & French, 2008). The inter-market parallels of these momentum anomalies were investigated by Bhojraj and Swaminathan (2006) and Balvers and Wu (2006). Moreover, Novy-Marx (2012) argued that the key source of momentum is the intermediate performance over months $t-12$ to $t-7$ (12); however, this effect has not yet been examined for equity indices. Moreover, several studies suggest that specific stock characteristics may amplify sources underlying momentum and subsequently enhance profits.

Therefore, we test a series of enhanced momentum strategies based on double sorts with the use of the following variables: idiosyncratic volatility ((13), e.g., Jiang, Lee, and Zhang (2005), stock market capitalisation ((14), e.g., Jegadeesh and Titman (1993), turnover ratio and raw turnover ((15, 16), e.g., Lee and Swaminathan (2000)), and book-to-market ratio ((17), e.g., Daniel and Titman (1999), Sagi and Seasholes (2007)).

Group 3: Reversal. Two basic reversal effects discovered in stock markets are the short-term reversal ((18), e.g., Lehmann (1990)) and long-term reversal ((19), e.g., DeBondt and Thaler (1985)). The country-level evidence on the long-term reversal effect is rather mixed. Balvers and Wu (2006) examined 16 equity markets between 1969 and 1999 and confirmed the profitability of the mean-reversion strategy, especially when combined with momentum. On the other hand, Malin and Bornholt (2013) showed an absence of long-run reversal profits for developed markets in their post-1989 sample.

Group 4: Skewness. The prospect theory developed by Kahneman and Tversky (1979) implies that investors overvalue right-skewed return distributions and undervalue left-skewed return distributions. Thus, the country equity markets with high positive skewness of prior return distributions should underperform markets with large negative skewness (20). The stock-level evidence for the impact of skewness was provided by Kraus and Litzenberger (1976) and Harvey and Siddique (2000), whereas Harvey (2000) found a similar pattern across countries.

Group 5: Quality. Some recent papers have suggested that the financial shape of a company may be linked to its future returns. First, companies with high returns on assets (21), or returns on equity ((22), e.g., Haugen and Baker (1996)), outperform the companies with low corresponding metrics. Zaremba (2015b) also investigated these questions at the country level. Furthermore, this study is extended to another profitability measure, namely, gross profit margin (23), which was found to be related to future returns, for example, by Lev and Thiagarajan (1993), Abarbanell and Bushee (1997). Furthermore, we examine the change in the gross profit margin (24), which was found to predict returns positively by Piotroski (2000). Second, Bhandari (1988) found a relationship between the company's financial leverage and its future returns. Furthermore, many practitioners employ indebtedness ratios, such as the assets-to-debt ratio (25) or EBITDA-to-debt ratio (26), finding that low-leveraged, high-quality companies show impressive performance (van de Maele & Jallet, 2015). This practice is also consistent with the recent studies that provide evidence that low credit risk positively predicts performance (Barbee, Mukherji, & Raines, 1996; George & Hwang, 2010; Penman, Richardson, & Tuna, 2007). Zaremba (2015b) discovered some country-level parallels and proves that stock markets with companies having high assets-to-debt or EBITDA-to-debt ratios show better historical performance than other companies. Third, Palazzo (2012) discovered that cash-rich companies outperform those with low cash-to-assets ratios (27). These metrics showed the potential to be used at the country-level (Zaremba, 2015b). Eventually, we also replicate the country-level parallel of the pattern discovered by Cooper, Gulen, and Schill (2008), who suggested that total asset growth negatively predicts future returns (28). We are not aware of any study that has examined the inter-market version of this effect so far.

Group 6: Volatility. This group examines four distinct anomalies related to price risk. First, Frazzini and Pedersen (2014) discovered that low-beta stocks outperform high-beta stocks on a risk-adjusted basis (29). Second, Blitz and van Vliet (2007) found that stocks with low return volatility outperform companies with high volatility (30) on a risk-adjusted

basis. Third, Bali and Cakici (2004) revealed a positive relationship between the absolute value at risk and future returns (31). Fourth, numerous papers documented the link between idiosyncratic volatility and expected performance (32). Merton (1987) and Malkiel and Xu (2002) suggested a positive relationship between returns and idiosyncratic volatility, while Ang, Hodrick, Xing, and Zhang (2006, 2009) indicated that this relationship is negative. Multiple country-level studies (e.g., Hueng and Yau (2013), Umutlu (2015), Zaremba and Konieczka (2016)) provided results showing that any relationship between price risk and future returns seems to be rather positive, particularly within large countries and for the value at risk, if it exists at all.

Group 7: Liquidity. Since the initial studies of Amihud and Mendelson (1986) and Amihud (2002), the impact of cross-sectionally varying liquidity has been documented with the use of many distinct metrics. Datar, Naik, and Radcliffe (1998) and Easley, Hvidkjaer, and O'Hara (2002) found that companies with high turnover ratios, i.e., the ratio of trading volume to total capitalisation, underperformed companies where this ratio was low (33). Brennan, Chordia, and Subrahmanyam (1998) found that turnover was negatively related to future returns (34). Finally, the standard size metric, i.e., total stock market capitalisation, is a sort of proxy for liquidity that negatively correlates with returns: the larger a company, the lower are its future returns ((35), e.g., Banz (1981)). Certain promising observations on country-level parallels related to turnover and turnover ratios were provided by Zaremba (2015b) and Zaremba and Konieczka (2016). About the size factor, Keppler and Traub (1993) and Keppler and Encinosa (2011) showed the outperformance of small markets.

Group 8: Issuance. This group includes only one anomaly related to the total issuance. Many stock-level studies prove that average returns are negatively related to the past net and gross stock issuance ((36), e.g., Daniel and Titman (2006), Fama and French (2008), Pontiff and Woodgate (2008)). Zaremba and Okoń (2016) provided convincing evidence for the successful performance of this phenomenon across national equity indices.

Group 9: Seasonal anomalies. This group includes two cross-sectional patterns. Heston and Sadka (2008) discovered the seasonality momentum, i.e., the phenomenon that companies systematically display high (or low) returns in the same calendar month every year (37). Furthermore, Cooper, McConnell, and Ovtchinnikov (2006) documented that a high (low) return in January predicts good (poor) performance over the rest of the year (38). We call this anomaly 'the other January effect'.

Group 10: Combinations. The last group does not include any standalone anomalies, but rather two meta-strategies based on double rankings of national capital markets. Zaremba (2017) indicated that two particular combinations, which are based on sorting equity indices on averaged rankings of two variables, perform particularly well and are highly robust: the earnings-to-price ratio combined with reversed skewness (39), and the reversed turnover ratio combined with reversed skewness (40). The two above-described meta-strategies are included in this study.

Portfolios are formed on all of the described strategies with the use of a uniform procedure. To this end, all of the stock market indices are ranked against the current value of one of the metrics related to the anomalies at the end of each month $t-1$. With each use of the accounting data in a given strategy, however, the lagged metric values from month $t-4$ are applied to avoid a look-ahead bias.⁴ All of the metrics employed are described in detail in Table A1 of the Online Appendix.

Next, we define the 20th and 80th percentiles as breakpoints, consequently forming three subgroups. Finally, the indices included in the top and the bottom subgroups are used to form capitalisation-weighted or equally weighted portfolios. Finally, the differential portfolios – in other words, zero-investment portfolios – are formed as long/short portfolios: 100% long in the quintile of markets with the highest metric, and 100% short in the quintile of markets with the lowest metric. To ensure consistency and clarity of data presentation across all of the anomalies, each time, we go long in the highest variable portfolio and short in the lowest one, no matter which strategy we investigate. This approach is applied across all of the anomalies, whereas in the further analysis, the focus is placed on the obtained zero-investment portfolios.

2.3. Performance evaluation

The examination of multi-country international portfolios requires the use of an appropriate asset-pricing model complying with the perspective of an international investor who is motivated to invest in foreign indices-based instruments, e.g., exchange-traded funds or futures contracts. Two asset-pricing models are applied in this research. To begin with, we employ the country-level capital asset-pricing model (C.A.P.M.) (Sharpe, 1964). By this approach, the global market portfolio is composed of all of the country index portfolios in the sample weighted according to their capitalisations. Second, an attempt is made to include other cross-sectional asset-pricing effects, such as value, size and momentum. However, no global stock-level asset-pricing factors are employed because such practices are inconsistent with the assumption that investors allocate money to index-based vehicles. On the other hand, no country-level asset-pricing factors are used, in line with research by Umutlu (2015), as it seems irrational to test certain cross-national anomalies that play an integral part in the pricing models. Therefore, except for the country-level C.A.P.M., we examine whether the quantitative country-selection strategies extend the frontier for a U.S. stock-level investor, and the four-factor model by Carhart (1997), which is based on the U.S. stock-level data, is used. The stock-level data stem from Andrea Frazzini's data library.⁵

In following with, for example, Fama and French (2012), all of the regression parameters are estimated using ordinary least squares regressions. Furthermore, all of the statistical interference is based on log-returns, and *t*-statistics are estimated using bootstrap standard errors to avoid any distributional assumptions. According to our null hypothesis, all of the intercepts are equal to zero, whereas the alternative hypothesis assumes the contrary.

2.4. Examination of momentum across anomalies

The basic goal of re-examining the anomalies outlined in the previous subsection is to filter out the set of relatively robust cross-sectional effects that may be investigated for the cross-anomaly momentum effect. Thus, after having selected a subset of reliable anomalies, they are tested for these phenomena. To this end, the anomalies are sorted on their past returns at the end of each month *t*-1. To ensure the robustness of results, we apply four alternative sorting periods: 3, 6, 9 and 12 months. The lengths of the sorting periods are based on previous academic studies on momentum (Jegadeesh & Titman, 1993). Next, the anomalies are grouped into three tertiles, thus creating three subsets. Subsequently,

the returns on the anomalies in month t are equally weighted to obtain portfolio returns. This method is repeated for both equal- and capitalisation-weighted strategies; however, they are not weighted on capitalisation as the anomaly-based portfolios – effectively quasi dollar-neutral zero-investment portfolios – have no inherent capitalisation. Finally, we examine the performance of portfolios composed of country-level strategies from sorts on their past performance.

The examination of the cross-sectional pattern of anomaly-based portfolios poses some challenges. Essentially, it seems unreasonable to evaluate them using the same asset-pricing models that are employed in the first part of this research because anomalies themselves have already revealed abnormal returns about these models. On the other hand, there is a broadly accepted cross-sectional country-level model that may explain the abnormal returns on anomalies. Zaremba (2015a) and Umutlu (2015) offer cross-country variations of the standard four-factor (Carhart, 1997) and three-factor (Fama & French, 1993) models. As is shown in the second section of this study, however, none of the factors employed in these models appears to be significant for the country-level cross-section. Furthermore, our portfolios are composed of anomalies that by their very nature are characterised by abnormal returns. As a result, whenever any of the above-described methods is applied, the standard asset-pricing tests, such as the G.R.S. test (Gibbons, Ross, & Shanken, 1989), are rejected.

To overcome the abovementioned impediments, the non-parametric test of MR proposed by Patton and Timmerman (2010) is employed. This simulation-based test is designed to detect monotonically increasing cross-sectional patterns in asset returns.⁶ According to our basic hypothesis, there is no monotonically increasing pattern in returns related to past performance or past volatility, whereas the alternative hypothesis assumes that such a pattern exists. Each MR test in this paper is based on 10,000 random draws.

2.5. Robustness checks

To verify the outcomes of this study, a range of robustness checks was performed and applied at various stages of this research.

Alternative weighting schemes. We use both capitalisation-weighted and equal-weighted portfolios in this study.⁷

Adjustment for taxes on dividends. The majority of country-level studies are based on gross returns, i.e., without adjusting for the taxes on dividends. In this research, except for the standard ‘gross’ return convention, the alternative ‘net’ approach is also applied. The ‘net’ convention of the indices means that dividends are calculated on an after-tax basis. In other words, it provides control for different tax rates on dividends in various countries.⁸

Alternative currency approaches. This study addresses investments denominated in U.S. Dollars. Nonetheless, the returns on the strategies are re-examined under alternative currency conventions, the European Euro and Japanese Yen. We find no major differences between the efficiency of the strategies for American, European or Japanese investors.⁹

Alternative sorting periods. Regarding the momentum across anomalies, the 3, 6, 9 and 12-month sorting periods were applied. Nonetheless, shorter (1-month) and longer (24–48-month) sorting periods are also examined to explore any momentum or reversal effects. No cross-sectional patterns related to either momentum or reversal are found. These outcomes are also left out to ensure the conciseness of the paper.¹⁰

3. Results

This section presents the findings of the conducted research. First, the focus is placed on the performance of country-level anomalies and the selection of the most robust ones for further analysis. Next, the evidence for the momentum across the cross-country anomalies is described.

3.1. Performance of country-level anomalies

A careful examination shows that not all of the investigated anomalies are reliable and robust. Table 1 presents the performance of equally weighted portfolios from sorts on metrics related to the anomalies.

In the equal-weighting approach, the performance of three anomalies is particularly robust. The zero-investment portfolios from sorts on EBITDA-to-EV (EBEV), EBITDA-to-price (EBP) and sales-to-EV (SEV) ratios display mean monthly returns that are positive and significantly different from zero, ranging from 0.69% to 0.96% and from 0.58% to 0.73% in gross and net approaches, respectively. The Sharpe ratios are relatively high and range from 0.61 for the sales-to-EV ratio to 0.79 for the EBITDA-to-EV ratio (gross approach). Furthermore, all of the intercepts from the C.A.P.M.s and the four-factor models are positive and significantly different from zero. The country zero-investment portfolios from sorts on a book-to-market ratio (B.M.) and an earnings-to-price ratio (E.P.) have significant, positive mean monthly returns within the net approach that are to some extent explained by the asset-pricing models. The mean returns and alphas on these two anomalies within the gross approach are also positive, but they are not significantly different from zero. The performance of portfolios formed on the sales-to-price ratio (S.P.) is characterised by small positive returns, which are insufficient to prove significant difference from zero. Finally, the size-enhanced book-to-market ratio strategy does not prove to be successful.

To some extent, the performance of momentum strategies is disappointing. The returns on short-term momentum (StMom) are positive but insignificant. Furthermore, the standard momentum (StdMom) is characterised by positive and significant abnormal returns within the gross approach. This observation confirms the earlier findings, for example, of Asness et al. (2013); however, it is found that returns on the standard momentum strategy are no longer significantly positive after their adjustment for taxes on dividends. The most robust type of momentum examined is the intermediate momentum (IntMom). This strategy delivers returns and alphas of approximately 0.70% per month, within both the net and gross return approach. This evidence resembles analogous stock-level findings of Novy-Marx (2012). Finally, for zero-investment portfolios from the double-ranking of momentum and additional metrics, i.e., turnover, idiosyncratic volatility, book-to-market ratio, turnover ratio and capitalisation, the momentum profits no longer significantly differ from zero.

In the framework of the research sample of this study, reversal effects do not prove useful for investors. First, the mean returns and alphas for the two potential anomalies are not significantly different from zero. Second, their values are inconsistent with the theoretical expectations. The mean returns and intercepts are positive, although, in theory, they should be negative due to the reversal of the past returns. These outcomes are essentially compatible with observations made by Malin and Bornholt (2013), who documented an absence of cross-sectional contrarian profits for developed markets in their post-1989 sample. Our

Table 1. The performance of equally weighted country-level strategies.

Value	Gross returns				Net returns									
	R	t-stat	a _{CAPM}	a _{MF}	t-stat	R	t-stat	a _{CAPM}	a _{MF}	t-stat	SR			
BM	0.28	(0.85)	0.25	(0.81)	0.22	(0.69)	0.21	(0.69)	0.54*	(1.91)	0.47	(1.67)	0.48	(1.49)
EP	0.32	(1.47)	0.29	(1.16)	0.24	(0.97)	0.28	(0.97)	0.41	(2.00)	0.38	(1.60)	0.45	(1.51)
DY	0.08	(0.21)	0.11	(0.54)	0.18	(0.89)	0.08	(0.89)	0.16	(0.31)	0.12	(0.73)	0.10	(0.64)
CFP	0.37	(1.49)	0.34	(1.44)	0.24	(1.00)	0.36	(1.00)	0.16	(0.86)	0.07	(0.68)	0.23	(0.28)
EBEV	0.96***	(3.54)	0.95***	(3.51)	0.88***	(3.26)	0.79	(3.26)	0.57***	(2.27)	0.53**	(2.24)	0.57	(2.04)
EBP	0.84***	(3.00)	0.80***	(3.12)	0.70***	(2.84)	0.71	(2.84)	0.64***	(2.20)	0.56**	(2.23)	0.60	(2.05)
SEV	0.69***	(3.09)	0.68***	(2.64)	0.64**	(2.56)	0.61	(2.56)	0.52**	(3.15)	0.47**	(2.42)	0.65	(2.25)
SP	0.34	(1.44)	0.31	(1.28)	0.21	(0.80)	0.61	(0.80)	0.37	(1.73)	0.27	(1.38)	0.41	(0.98)
BMSmall	-0.03	(-0.09)	-0.04	(0.81)	-0.22	(0.43)	-0.01	(0.43)	-0.05	(-0.09)	-0.18	(1.07)	-0.02	(0.48)
<i>Momentum</i>														
StMom	0.45	(1.47)	0.49	(1.50)	0.36	(1.17)	0.32	(1.17)	0.34	(0.91)	0.24	(0.99)	0.21	(0.78)
LtMom	0.64**	(1.96)	0.68**	(2.18)	0.52*	(1.82)	0.47	(1.82)	0.49	(1.40)	0.34	(1.55)	0.34	(1.21)
IntMom	0.74**	(2.52)	0.77***	(2.71)	0.63**	(2.20)	0.58	(2.20)	0.72**	(2.36)	0.64**	(2.53)	0.57	(2.14)
MomIvol	0.43	(0.70)	0.51	(1.20)	0.30	(0.62)	0.22	(0.62)	0.18	(0.18)	0.05	(0.50)	0.10	(0.91)
MomSmall	0.31	(1.16)	0.36	(1.26)	0.16	(0.61)	0.24	(0.61)	0.24	(0.79)	0.04	(0.88)	0.17	(0.18)
MomTratio	-0.17	(-0.58)	-0.15	(0.39)	-0.18	(-0.46)	-0.11	(-0.46)	-0.29	(-0.87)	-0.33	(-0.02)	-0.19	(-0.87)
MomTurn	0.36	(0.96)	0.43	(1.34)	0.19	(0.63)	0.24	(0.63)	-0.12	(-0.47)	-0.27	(-0.36)	-0.10	(-0.92)
MomBM	0.67	(1.40)	0.74*	(1.88)	0.57	(1.29)	0.38	(1.29)	0.62*	(1.47)	0.54	(1.68)	0.40	(1.33)
<i>Reversal</i>														
StRev	-0.38	(-1.30)	-0.40	(-1.30)	-0.45	(-1.39)	-0.29	(-1.39)	-0.38	(-1.10)	-0.37	(-1.06)	-0.27	(-1.10)
LtRev	-0.25	(-0.75)	-0.20	(-0.66)	-0.36	(-1.27)	-0.22	(-1.27)	-0.19	(-0.71)	-0.34	(-0.63)	-0.21	(-1.22)
<i>Skewness</i>														
Skew	-0.38*	(-1.69)	-0.34	(-1.53)	-0.24	(-1.02)	-0.38	(-1.02)	-0.37	(-1.76)	-0.32	(-1.63)	-0.42	(-1.44)
<i>Quality</i>														
ROA	0.05	(0.23)	0.03	(0.19)	-0.02	(-0.02)	0.04	(-0.02)	0.18	(0.86)	0.18	(0.77)	0.23	(0.71)
ROE	0.20	(0.68)	0.23	(0.91)	0.14	(0.50)	0.16	(0.50)	-0.03	(-0.14)	-0.05	(-0.04)	-0.03	(-0.11)
GM	0.38	(1.45)	0.43*	(1.78)	0.36	(1.44)	0.33	(1.44)	0.15	(0.12)	0.04	(0.66)	0.06	(0.19)
GMChange	0.06	(0.16)	0.03	(0.13)	0.10	(0.48)	0.06	(0.48)	0.00	(-0.11)	0.03	(0.02)	0.01	(0.14)
AD	0.27	(0.81)	0.24	(0.81)	0.29	(1.00)	0.20	(1.00)	0.57***	(1.98)	0.61***	(2.03)	0.51	(2.13)
ED	0.48**	(1.68)	0.45*	(1.83)	0.45*	(1.77)	0.42	(1.77)	0.69***	(2.95)	0.71***	(2.95)	0.80	(2.93)
Cash	0.02	(0.05)	0.06	(0.27)	0.10	(0.48)	0.02	(0.48)	0.26	(0.70)	0.23	(1.04)	0.19	(0.95)
AG	0.30	(1.40)	0.28	(1.34)	0.30	(1.52)	0.33	(1.52)	0.50**	(2.13)	0.48**	(2.04)	0.30	(2.10)

(Continued)



Table 1. (Continued).

	Gross returns				Net returns								
	R	t-stat	a _{CAPM}	a _{4F}	SR	t-stat	R	t-stat	a _{CAPM}	a _{4F}	t-stat	SR	
DYChange	-0.25	(-0.73)	-0.31	(-1.20)	-0.24	(-0.82)	-0.21	(-0.82)	-0.07	(-0.20)	-0.08	(-0.34)	-0.07
Volatility													
Beta	-0.40	(-0.70)	-0.71*	(-1.90)	-0.59	(-1.59)	-0.21	(-0.71)	-0.32	(-0.47)	-0.46	(-1.49)	-0.47
SD	0.24	(0.86)	0.03	(0.13)	0.07	(0.26)	0.16	(0.53)	0.50	(1.55)	0.23	(0.83)	0.35
Var	-0.33	(-0.83)	-0.52	(-1.59)	-0.53	(-1.65)	-0.22	(-0.82)	-0.04	(-0.08)	-0.30	(-0.97)	-0.20
Ivol	0.23	(0.82)	0.02	(0.10)	0.06	(0.22)	0.16	(0.53)	0.48	(1.51)	0.22	(0.80)	0.34
Liquidity													
TR	-0.41	(-0.95)	-0.28	(-0.80)	-0.52	(-1.51)	-0.27	(-0.95)	-0.75*	(-1.83)	-0.61*	(-1.77)	-0.77**
Turn	-0.64**	(-2.14)	-0.62**	(-2.15)	-0.66**	(-2.26)	-0.51	(-1.51)	-0.67**	(-1.98)	-0.63**	(-2.03)	-0.65**
Cap	-0.23	(-0.67)	-0.32	(-1.03)	-0.26	(-0.82)	-0.15	(-0.51)	-0.30	(-0.95)	-0.44	(-1.50)	-0.35
Issuance													
Iss	-0.66*	(-1.88)	-0.61*	(-1.75)	-0.75**	(-2.15)	-0.43	(-1.44)	-1.06***	(-3.15)	-0.99***	(-3.06)	-1.05***
Seasonal effects													
OtherJan	0.15	(0.50)	0.24	(0.74)	0.15	(0.45)	0.11	(0.36)	0.00	(-0.05)	0.04	(0.10)	-0.05
SeasMom	0.22	(0.75)	0.21	(0.89)	0.27	(1.14)	0.23	(0.73)	0.23	(0.73)	0.22	(0.95)	0.29
Combinations													
TR&skew	0.52	(1.48)	0.42	(1.44)	0.51	(1.63)	0.38	(1.23)	0.78***	(2.96)	0.69***	(2.89)	0.79***
EP&skew	0.66***	(3.36)	0.64***	(2.80)	0.55**	(2.46)	0.68	(2.46)	0.60***	(3.08)	0.57***	(2.43)	0.49***

Note: The table presents the performance of equally weighted zero-investment portfolios based on country-level strategies. R is the mean monthly return, S.R. is the annualised Sharpe ratio, α_{CAPM} and α_{4F} are intercepted from the country-level C.A.P.M. and the U.S. stock-level four-factor model, respectively. 'Gross' and 'Net' approaches refer to the adjustment for taxes on dividends. The means, standard deviations and intercepts are expressed in percentage terms. The numbers in brackets are t-statistics based on bootstrap standard errors and the significance at the 10% level is given in bold characters. *, ** and *** indicate values significantly different from zero at the 10, 5, and 1% levels, respectively. The symbols of the strategies are explained in the Online Appendix. Source: Own calculations.

results also contradict the earlier evidence found by Richards (1997) or Balvers and Wu (2006), based on older samples.

The theoretical expectations are partially confirmed with the behaviour of skewness-based portfolios. As the right-skewed portfolios significantly underperform the left-skewed portfolios, the mean returns on zero-investment portfolios are negative. The returns, however, are no longer significantly abnormal after their adjustment to risk-factors from asset-pricing models.

The variables related to debt – asset-to-debt ratio (A.D.) and particularly EBITDA-to-debt ratio (E.D.) – function well as the determinants of cross-sectional patterns across equity indices. The low-indebted markets outperform the high-indebted markets, and this outperformance is most significant within the net returns approach. The Sharpe ratio of the E.D. zero portfolio is high and amounts to 0.80. Other metrics related to financial quality do not achieve such a good performance and thus reveal no significant cross-sectional pattern.

Regarding volatility, in line with Zaremba and Konieczka (2016), no significant and consistent pattern is observed across countries. These strategies show better performance in the case of capitalisation-weighted portfolios.

The cross-country impact of liquidity is strong and robust, particularly when manifested by the turnover ratio (TR) or dollar trading volume (Turn). Returns on portfolios of the most liquid markets underperform the least-liquid markets. The effect is strong within the net returns approach. However, returns on the portfolio from sorts on total capitalization are characterized by no abnormal returns that would significantly differ from zero. The insignificance of the previous evidence discovered by Keppler and Traub (1993) and Keppler and Encinosa (2011) is proven. We agree with Asness, Ilmanen, Israel, and Moskowitz (2015), who claim that the ‘size factor’ merely constitutes another proxy for the liquidity premium with worse performance, compared to other metrics such as turnover or turnover ratio.

The strongest of all of the strategies appears to be the issuance-based strategy due to its very high absolute returns and alphas, especially within the net returns approach. The intercepts and mean monthly returns on zero-investment portfolios are significantly different from zero, suggesting that the countries with high issuance underperform the countries with the low issuance by approximately 1% on a monthly basis.

The seasonal anomalies tested in this study – the seasonality momentum and the other January effect – appear to have no parallels at the country level. None of the raw or risk-adjusted returns on these country-level strategies differs significantly from 0.

Finally, the combination of strategies proposed by Zaremba (2017) is characterised by high Sharpe ratios and highly significant positive abnormal returns. The only exception is zero-investment portfolios from double-ranking on turnover ratio and skewness (TR&skew) within the gross approach. Admittedly, such portfolios have Sharpe ratio of 0.38 and positive returns of approximately 0.52% monthly but are not significantly different from zero.

For the robustness, we also replicated the strategies described above using the capitalisation-weighted portfolios, displayed in Table A2 of the Online Appendix. The observations made within the equally weighted portfolios are to a large extent confirmed by the performance of capitalisation-weighted portfolios; however, there were some minor discrepancies. Perhaps the crucial difference was the momentum strategy, which delivered no significant profitability when the value-weighted portfolios were employed. This observation is, however, consistent with the observations of Zaremba and Konieczka (2016), who also

found that returns on momentum strategies are very disappointing after the application of a capitalisation-weighting scheme.

For further investigation of momentum across country-level anomalies, only the strategies that were revealed to be the most reliable were chosen in the initial examination. The filtered out set includes 16 strategies from various groups. For this reason, four value metrics (earnings-to-price, cash flow-to-price, EBITDA-to-EV, EBITDA-to-price and sales-to-EV), two momentum metrics (standard momentum and intermediate momentum), the skewness-based strategy, two indebtedness variables from the quality group (assets-to-debt and EBITDA-to-debt), the value at risk metric from the volatility group, two liquidity-based strategies (turnover and turnover ratio), the issuance anomaly, and both examined double-ranking strategies (turnover ratio with skewness and earnings-to-price ratio with skewness) are selected. Only the anomalies that delivered the most robust returns are chosen, in compliance with the theory and previous evidence. Thus, perhaps the most controversial decision is to include the standard momentum, computed according to the methods introduced by Fama and French (2008), in this set. It turned out to function only within the equal-weighting framework and showed confusing results regarding capitalisation-weighted portfolios. Due to the pervasiveness of the anomaly and the abundance of evidence from numerous asset classes (Asness et al., 2013), however, we decided to include it in further investigations. The second controversial decision is the inclusion of the portfolios from sorts on the assets-to-debt ratio, which also performs poorly in the event of capitalisation-weighted returns. Zaremba and Koniczka (2016), however, show that capitalisation weighting is the only framework within which the anomaly does not work, although it works within other weighting schemes, such as liquidity weighting, and delivers robust abnormal returns. Thus, this strategy is also included in the second phase of research.

3.2. Momentum across anomalies

Table 4 presents the performance of portfolios of various country-level strategies formed on their past performance, examined within the sample of 16 pre-selected anomalies. The portfolios comprise zero-investment portfolios investigated previously with a single slight modification. In the case of the anomalies for which the high-variable portfolios underperformed the low-variable portfolios (skewness, turnover, turnover ratio, and issuance), the short versions of these portfolios (long for the low variable, short for the high variable) were employed to examine portfolios that deliver positive average returns and alphas. The returns on these portfolios are simply the returns on the original anomalies with reversed signs.

Naturally, the anomalies we examine are not totally independent. Nonetheless, the average pair-wise correlation of the gross returns on equally weighted anomaly-based zero-investment portfolios is only 0.10, indicating that we capture a diverse set of return patterns. The low correlation suggests that the diversification of the portfolio based on country-level anomalies may significantly reduce the risk of a composite strategy. This effect is presented in Table 2, which reports the performance of equally weighted portfolios composed of all of the 16 selected strategies.

The low correlations across the anomalies indeed lead to significant risk reduction in the composite portfolios. The monthly standard deviations of the returns vary in the various approaches from 1.69% to 2.98%. As a result, all of the Sharpe ratios of the composite strategies exceed 1.00 and the alphas are positive and differ significantly from 0. Interestingly,

the mean monthly raw returns on the capitalisation-weighted strategies, which are equal to 0.93% and 0.92% in gross and net approaches, respectively, are very high. They are higher than the simple mean return on all of the 16 selected strategies. Given the low correlation across strategies, this additional premium may have its source in the diversification return, which is discussed by Willenbrock (2011). The diversification return grows along with the volatility of the constituent assets, so this approach also provides an explanation as to why the overperformance of the composite strategies; it is also particularly vivid in the case of capitalisation-weighted portfolios (see Table A3 of the Online Appendix).

Table 3 presents the performance of equally weighed multi-strategy portfolios. First of all, the risk of composite anomaly portfolios is much lower than it is in the case of single strategies, which constitutes an interesting observation. The monthly standard deviations in

Table 2. The performance of composite country-level strategies.

	R	<i>t</i> -stat	Vol	SR	α_{CAPM}	<i>t</i> -stat	α_{4F}	<i>t</i> -stat
Gross returns	0.54***	(4.96)	1.69	1.11	0.51***	(4.68)	0.45***	(4.08)
Net returns	0.60***	(4.96)	1.70	1.23	0.59***	(4.87)	0.50***	(4.15)

Note: The table presents the performance of equal-weighted portfolios of the strategies based on 16 selected country-level anomalies that are described in the Results section. *R* is the mean monthly return, *Vol* is the standard deviation of monthly returns, *S.R.* is the annualised Sharpe ratio, α_{CAPM} and α_{4F} are intercepted from the country-level C.A.P.M. and the U.S. stock-level four-factor model, respectively. 'Gross' and 'Net' approaches refer to the adjustment for taxes on dividends. The means, standard deviations and intercepts are expressed in percentage terms. The numbers in brackets are *t*-statistics based on bootstrap standard errors and the significance at the 10% level is given in bold characters. *** indicates values significantly different from zero at the 1% level.

Source: Own calculations.

Table 3. Returns on portfolios of country-level strategies formed on their past performance.

	Low	Middle	High	MR	Low	Middle	High	MR	
	Gross returns approach				Net returns approach				
				<i>3-month sorting period</i>					
Mean	0.25 (1.02)	0.61*** (5.03)	0.67*** (3.66)	20.0	0.24 (1.06)	0.71*** (4.89)	0.77*** (4.24)	15.6	
Volatility	3.27	2.07	2.90		2.68	2.13	2.50		
Sharpe ratio	0.26	1.03	0.80		0.31	1.15	1.06		
				<i>6-month sorting period</i>					
Mean	0.23 (1.00)	0.56*** (3.97)	0.77*** (4.26)	3.0**	0.35 (1.56)	0.59*** (3.76)	0.76*** (4.19)	1.3**	
Volatility	3.12	2.48	2.71		2.63	2.29	2.36		
Sharpe ratio	0.26	0.79	0.99		0.47	0.88	1.12		
				<i>9-month sorting period</i>					
Mean	0.20 (0.94)	0.59*** (3.89)	0.74*** (4.18)	5.0**	0.43** (2.01)	0.61*** (3.89)	0.73*** (3.84)	6.2*	
Volatility	3.13	2.39	2.78		2.62	2.10	2.52		
Sharpe ratio	0.22	0.85	0.93		0.57	0.99	1.00		
				<i>12-month sorting period</i>					
Mean	0.38* (1.76)	0.52*** (3.61)	0.78*** (4.18)	5.7*	0.43** (2.01)	0.60*** (3.89)	0.73*** (3.84)	8.7*	
Volatility	3.12	2.19	2.69		2.62	2.10	2.52		
Sharpe ratio	0.42	0.83	0.99		0.57	0.99	1.00		

Note: The table presents the performance of equally weighted portfolios of country-level strategies formed on the past performance. 'Low' denotes markets with the lowest past returns and 'High' with the highest returns. 'Gross' and 'Net' approaches refer to the adjustment for taxes on dividends. The mean, standard deviations and intercepts are expressed in percentage terms. The numbers in brackets are *t*-statistics based on bootstrap standard errors and the significance at the 10% level is given in bold characters. *, ** and *** indicate values significantly different from zero at the 10, 5, and 1% levels, respectively. The Sharpe ratios are based on the annualised values. MR is the *p*-value from the MR (Patton & Timmerman, 2010) test.

Source: Own calculations.

various approaches range from 2.07% to 3.27%, so they are approximately 2–3 times lower than in the case of the average single strategy. The portfolios clearly benefit from the low correlations across the strategies.

The returns on equally weighed multi-strategy portfolios demonstrate a clear cross-sectional pattern. The portfolios of strategies with the best past performance continue to perform well in the future; thus, their mean returns are higher than the returns on other portfolios. Contrary to the preceding, the strategies that performed worst in the past continue to perform poorly in the subsequent month. This phenomenon is statistically significant for the multi-strategy portfolios of sorts on past 6–12-month performance. Interestingly, the duration of these sorting periods resembles the standard sorting periods employed in momentum studies, including the groundbreaking study by Jegadeesh and Titman (1993). In the case of the sorting periods of 6, 9 and 12 months, the MR test developed by Patton and Timmerman (2010) suggests vivid cross-sectional monotonicity in returns, i.e., the better the past returns, the better the performance in the subsequent month. This effect is most remarkable for the 6-month ranking period. In this case, within the gross returns approach, the mean monthly returns on the three portfolios ascending on the past performance of the constituent strategies are equal to 0.23, 0.56, and 0.77%, respectively. Furthermore, the portfolio of past losers is also the riskiest regarding standard deviation; thus, the amplitude of the Sharpe ratios amounts to 0.26 for the portfolio of loser strategies and 0.99 for the portfolio of winner strategies. The cross-anomaly pattern withstands the robustness check within the net returns approach. Analogously, there is a significant ascending monotonic cross-sectional pattern in returns related to past returns. Furthermore, Table A4 in the Online Appendix confirms the momentum across country-level anomalies also in the value-weighted portfolios. The only exception is the robustness check within the capitalisation-weighted portfolios under the net returns approach somewhat undermines the robustness of the cross-anomaly momentum. This approach reveals no clear cross-sectional pattern related to the past performance of the anomalies. The question of why the cross-anomaly momentum, significant and robust across three different approaches, is invisible in the fourth one, and whether it is just a random case or results from some underlying structural reason, remains open for further research.

It is also interesting to compare the anomaly portfolios formed on their past performance with the composite equal-weighted portfolios of all 16 anomalies, depicted in Table 2. The composite portfolios of strategies display lower returns than the portfolios composed of past winners. Nevertheless, when the Sharpe ratio is considered, the performance of the composite strategies is better than all of the other portfolios in Table 3. This observation naturally does not undermine the cross-anomaly momentum. Nonetheless, it suggests that it may sometimes be more reasonable to include a broad range of strategies in the portfolio than to select a smaller group of past winners.

4. Conclusions

This paper examines the momentum phenomenon across country-level equity market anomalies. This study attempts to address this question based on the performance of 16 significant and robust inter-market strategies that were pre-selected from an initial sample of 40 anomalies. We deliver convincing evidence showing that the momentum effect is also observable across anomalies. The anomalies that perform best over the past 6–12 months

continue to do so in the future. Nevertheless, both of the cross-anomaly phenomena studied in this paper – the momentum effect – may potentially prove to be useful tools for global investors.

The observations resulting from this study are important mainly for market practitioners, particularly fund pickers and asset managers with a global investment mandate. Some reliable and robust quantitative cross-sectional inter-market strategies are presented. Sorting markets on the selected value, momentum, liquidity and indebtedness indicators, as well as on skewness, value at risk and past share issuance, provides long-term sources of returns. Furthermore, the correlations among these strategies are essentially low; thus, they may be efficiently combined in a diversified portfolio. Finally, selecting strategies with the best performance over the past 6–12 months may improve the performance of a multi-strategy portfolio.

Any future studies of the problems discussed in this paper should involve further meta-analysis of the cross-country patterns in the global equity market. There are at least two potential directions to be pursued in further research. First, according to some research studies, the performance of stock-level anomalies may be forecast with various variables. For example, Cohen et al. (2003) and Liu and Zhang (2008) test the application of so-called ‘value spread’ as a predictor of future returns on value strategies. With the possibility of applying such tools at the country level, they may be very beneficial for international investors. Second, the country-level investments clearly lack an appropriate cross-sectional asset-pricing model, explaining the abnormal returns on anomalies presented in this paper. Such a model would serve as a useful tool for both financial market practitioners and academics. The landscape of anomalies pictured in this study, as well as the papers of Kojien, Moskowitz, Pedersen, and Vrugt (2013) and Asness et al. (2013, 2015), provide a good starting point for such research.

Notes

1. Argentina, Australia, Austria, Bahrain, Bangladesh, Belgium, Brazil, Bulgaria, Canada, Chile, China, Colombia, Croatia, Cyprus, Czech Republic, Denmark, Egypt, Estonia, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Kenya, Kuwait, Latvia, Lebanon, Lithuania, Luxemburg, Malaysia, Malta, Mexico, Morocco, Mauritius, Netherlands, New Zealand, Nigeria, Norway, Oman, Pakistan, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russia, Serbia, Saudi Arabia, Singapore, Slovenia, South Africa, South Korea, Spain, Sri Lanka, Sweden, Switzerland, Taiwan, Thailand, Trinidad and Tobago, Tunisia, Turkey, Ukraine, United Arab Emirates, United Kingdom, U.S.A., Venezuela, Vietnam.
2. The number of markets in the sample was increased over time with the development of the global capital market observed in recent years. It also varied slightly for various metrics and approaches due to data availability. For example, for the gross prices, the sample initially included 27 markets and finally grew to 76 markets (two indices were discontinued). The time-series average was 58.
3. The Online Appendix is available at <http://adamzarembo.pl/>.
4. The index-level financial ratios used in this study have two limitations that are worth noting. First, if the financial statements were revised, then our financial ratios are based on the revised data. Nonetheless, we estimate that the impact of this issue on the results is limited. There are both upward and downward revisions, so we do not expect any systematic bias in this case. Second, the necessary financial data are not always available for every index constituent, although the indices are predominantly composed of large and liquid companies. Thus, we require at least 50% coverage to generate a value.

5. Data sourced from http://www.econ.yale.edu/~af227/data_library.htm [accessed on 9 June 2015].
6. The testing procedure is described in detail in the paper of Patton and Timmerman (2010).
7. For conciseness, the returns on value-weighted anomaly portfolios are presented in the Online Appendix.
8. The treatment dividends and taxes on dividends in short sales transactions vary across countries and across time. Thus, the returns on the zero-investment portfolios in the net approach should be essentially regarded as returns on differential portfolios that accentuate the outperformance of the top portfolio over the bottom portfolios.
9. For the sake of brevity, we do not report the results in alternative currencies.
10. The common practice for robustness checks is also to divide the sample into shorter periods. This study includes relatively short time series (21 years), however, so the results of the investigations of such small subsets would be inconclusive and unreliable. As a result, we do not perform this type of robustness check.

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