2. FUNDAMENTAL INDEXATION IN EUROPEAN EMERGING MARKETS

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Abstract

Fundamental indexation for common stocks refers to weighting portfolio constituents on the basis of fundamental variables. We examine the cost efficiency of this approach in the three largest European emerging markets: Poland, Russia, and Turkey. We form portfolios based net profits, sales, book values, and dividends, and evaluate their performance in the 2002-2015 period. The fundamentally weighted portfolios deliver higher risk-adjusted returns than standard capitalization-weighted portfolios, but the differences are predominantly statistically insignificant. The abnormal performance remains positive after controlling for trading costs. As a result, the study offers a cost-effective portfolio construction method that could be implemented by international investment managers with a focus on emerging markets.

Keywords: fundamental indexation, value investing, trading costs, emerging markets
JEL Classification: G11, G15

1. Introduction

Fundamental indexation is a relatively new approach to index investing. This technique refers to weighting portfolio constituents by fundamental variables, *e.g.*, book value, cash flow, revenues, sales, dividends, or employment. The first fundamental indices were designed and put into practice already in the '90s (e.g., by Goldman Sachs and Global Wealth Allocation (GWA)), but the real growth of interest in the fundamental indexation started in the middle of last decade. It was partially fueled by a seminal paper by Arnott *et al*. (2005), who discovered that the fundamental portfolios display superior risk-return characteristics compared with the standard capitalization-weighted portfolios. From that moment on, the fundamental indices have become a subject of interest for two major groups: investment professionals and academic society.

The investment community includes, *e.g.*, index providers and asset managers, who design fundamental indices and offer index-based investment products to customers.

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Exchange traded funds or notes, which replicate the fundamental indices, meet the growing interest of investors in recent years, particularly in the US market. On the other hand, the academic researchers strive to uncover the sources of the overperformance of the fundamental indices (see, *e.g.*, Chen *et al.,* 2015). So far, these studies have been focused primarily on developed markets.

The main contribution of this study is to present the concept of fundamental indexation and to examine its applicability in European emerging markets (abbreviated: EEM). As far as we are concerned, this is the first study to examine the performance and cost efficiency of the fundamental indexation in emerging markets.

In order to investigate this issue we form fundamentally weighted portfolios of stocks and analyze their performance with the use of standard CAPM-based measures. We test various weighting methods based on book values, net profits, sales, dividends, and also long-term means of these variables. We include a control on small and penny stocks in the samples. We also adjust the returns for the commissions and bid-ask spreads, based on real market data. The tests are conducted within a broad sample of companies listed in the three largest emerging markets in Europe, i.e., Poland, Russia, and Turkey, in the years 2002-2015.

The choice of European emerging markets is not accidental. A few characteristics of this region make it especially attractive. First, emerging markets are characterized by significantly higher transaction costs (Silva and Chaves, 2004; Schoenfeld and Cubeles, 2007; Pittman *et al.,* 2009). A recent report by Investment Technology Group indicates that in 2014 the total transaction costs in the markets of Emerging Europe were nearly threefold as high as in the United States. Second, the emerging markets are less liquid (Lesmond, 2005; Bekaert *et al.,* 2007), which not only boosts transaction costs but also hinders implementation of certain strategies. Third, the stock markets in Emerging Europe have been rapidly growing in the recent years: both regarding market capitalization and an absolute number of shares. The Polish NewConnect market could serve as an excellent example. Originally intended as a trading venue for small companies, it was launched in 2007, and only five years later, in 2012, it became the second largest market for small and medium- sized businesses in Europe. The rapid growth of the European emerging markets matters for two reasons. On the one hand, it reflects the increasing importance for the international investors. On the other hand, the expanding equity universe may require more frequent portfolio reviews. This may, in turn, additionally contribute to portfolio turnover and negatively impact the profitability of the portfolio. Finally, the fundamentally indexed portfolios are tilted towards value style, which proved very profitable in Emerging Europe (Cakici *et al*., 2013; Hanauer and Linhart, 2015; Zaremba, 2015). The exposure to the value factor may potentially result in an improved performance of the fundamentally weighted indexes and portfolios. Nonetheless, the question whether the performance of the value factor in emerging markets is stronger than in the developed ones is still under discussion (see, e.g., Jacobs, 2015). Thus, this paper contributes also as a voice also in this ongoing debate.

The main findings of this paper can be summarized as follows. The concepts of fundamental indexation worked effectively in the European emerging markets during the last 14 years. With the exception of a few portfolios in Russia, the fundamentally weighted portfolios delivered higher returns than the standard capitalization-weighted portfolios, although the differences in returns were frequently insignificant. The

outperformance remained visible also after adjusting the returns for risk and trading costs.

The rest of the paper is organized as follows. The next section presents the review of the related literature; further on, Section 3 contains the description of data sources and sample preparation. In Section 4 we describe our research methods, i.e., the portfolio construction and evaluation approaches; in Section 5 we present our findings, and in the last section we draw the conclusions from the presented research.

2. Related Literature

This study is related to two strains of academic literature considering 1) the cost-adjusted performance of fundamentally indexed portfolios and 2) the performance of value-oriented quantitative stock selection strategies in European emerging markets.

While the results of the majority of previous studies were clearly supportive of the idea of fundamentally indexed portfolios, these investigations focused primarily on developed markets (*e.g.*, Tamura and Shimizu, 2005; Hsu and Campolo, 2006; Estrada, 2008). Interestingly, recent examinations were carried out also for emerging markets, including Eastern Europe. Walkshäusl and Lobe (2010) analyzed a broad sample covering 22 emerging markets, including the Czech Republic, Hungary, Poland, and Russia. They created six fundamental indexes based on individual measures: book value, cash flow, dividend, the number of employees, net income, and revenue. The results provided only partial support for the enhanced-indexing strategies in Eastern Europe – while usually the returns and Sharpe ratios historically exceeded the benchmark portfolios, the overperformance was hardly significant. In fact, after adjustment with factor models, only in Poland the enhanced-indexing strategy recorded significant alphas.

Despite the disappointing results in Eastern Europe, the comprehensive study by Walkshäusl and Lobe (2010) provided empirical evidence in support of the hypothesis formulated by Hsu *et al.* (2007) and Arnott and Shepherd (2010). These authors argued that fundamentally weighted indices have an additional advantage in emerging countries due to low informational efficiency. Nevertheless, as far as we are concerned, none of the studies discussed above considered the impact of trading costs, which could play a major role in the emerging markets.

Importantly, it is worth noting that not all of empirical investigations provided support for the efficiency of fundamental indexation. A study by Estada (2008) may serve as an example. He tested enhanced indexation in 16 country equity markets, including one emerging market – South Africa, for years 1974-2005. Estrada argued that overperformance of fundamental indexation could be easily explained by its exposure to the value factor (to a larger degree) and the size factor (to a lesser degree). Indeed, while the dividend-weighted index of Estrada outperformed a global cap-weighted index regarding raw and risk-adjusted returns, it was not able to beat naïve equal-weighted portfolios or simple value-oriented strategies. Analogous conclusions were reached by Heng-Hsing (2013), who formed fundamentally indexed portfolios based on the S&P Emerging LargeMidCap Index and tested them for years 1996-2010. Both studies cast doubt on the alleged profitability of fundamental indexation.

The academic literature on the second strain of research linked to this paper - on the performance of value-oriented strategies - is relatively abundant. The early studies on the EEM have been conducted in the '90s by, among others, Rouwenhorst (1999). Later on, Barry *et al.* (2002), Kargin (2002), Rouwenhorst and Salomons (2003) have demonstrated benefits of stock selection based on value-related variables measures, like price-to-book ratio, price-to-earnings ratio or price-to-cash flow ratio for EEM investors. Also, the most recent studies confirm that the value premium is present in emerging markets, although it may vary from country to country (*e.g.*, Dimson *et al.*, 2014; Cakici *et al*., 2013; Lischewski and Voronkova, 2010; Hanauer and Linhart, 2015; Zaremba, 2015). Most recently, Zaremba and Czapkiewicz (2016) identified and replicated ten various value-oriented return-predictive signals in a very similar sample covering the Czech Republic, Hungary, Poland, Russia, and Turkey. Having examined the years 1997 – 2015, they verified 8 of these strategies significantly profitable.

3. Data Sources and Sample Preparation

Our sample covers the three largest emerging stock markets in Europe, *i.e.*, Poland, Russia, and Turkey. The country choice is based on the composition of the MSCI Emerging Europe Index. Nonetheless, we decided to drop the Czech Republic and Hungary due to the insufficient number of available data.

We use international stock returns and accounting data sourced from Bloomberg, considering both listed and delisted companies to avoid any form of survivorship bias. Computations are based on monthly time-series as they provide us with a sufficient number of observations (163) to ensure the power of the conducted tests and allow us to avoid excessive exposure to the micro-structure issues (de Moor and Sercu, 2013). The returns are adjusted for corporate actions (splits, reverse splits, issuance rights, etc.) and cash distributions to investors (dividends). The sample period of returns runs from May 2002 to November 2015. The late start date was chosen deliberately in order to avoid a small sample bias and fundamental data unavailability. A company was included in the sample when we were able to calculate its return in month *t* and its total capitalization, book-to-market ratio, and bid-ask spread at the end of month *t*-1.

To ensure the quality of data and, also, to align our sample with market practice, we applied some static and dynamic filters. The sample is composed of common stocks only, so we dropped closed-end funds, ETFs, GDRs, and similar investment vehicles. We included only these securities, for which Poland, Russia, or Turkey were primary markets. Furthermore, we considered also the practical problems with so-called "penny stocks", so we dropped a company from the sample in month *t*, when at the end of month *t*-1 either its nominal share price was below 0.30 US$, or the total stock market capitalization was below 8 million US$. Finally, following, *e.g.*, Rouwenhorst (1999), we manually screened the data for suspicious returns. We used all the companies available in Bloomberg. The precise number of companies varied in particular months varied from 216 to 771, and the time-series average is 562. The basic composition of the research sample is presented in Figure 1.

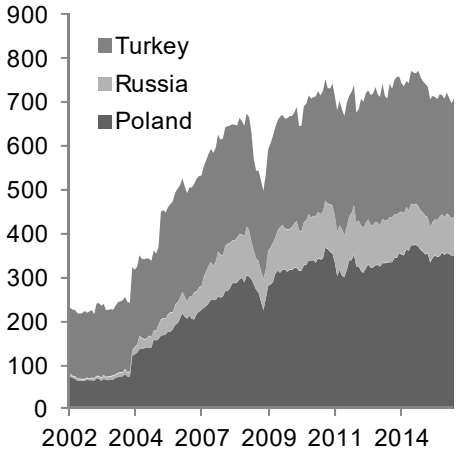
All the data was collected in local currencies; nevertheless, we agree with, *e.g.*, Liew and Vassalou (2000) or Bali *et al*. (2013) that comparisons using different currency units may be misleading. This is an essential issue for emerging markets where inflation rates

might be high and differs significantly across markets. Thus, we used the approach employed, for example, by Bekaert *et al*. (2007) or Brown *et al*. (2008), and convert all the data to a single currency - US dollar. Furthermore, whenever a given strategy relies on accounting data, we use lagged values from month *t*-4 to avoid a look-ahead bias.

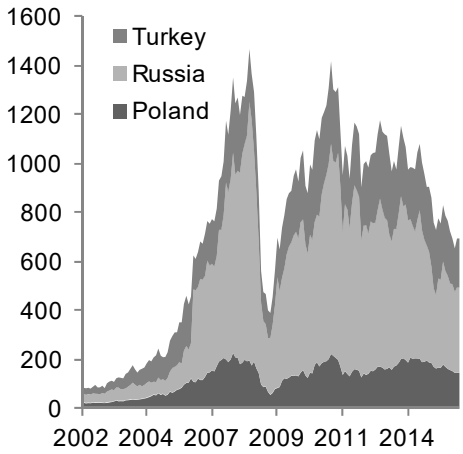
Figure 1

Composition of the Research Sample

Panel A: Number of firms.



Panel B: Total stock market capitalization.



Note. The figure provides an overview of the geographical composition of the research sample. The Panel A presents the number of firms, while the Panel B shows the aggregation of their total stock market capitalizations.

4. Portfolio Construction and Evaluation

In this study, we tested the performance of seven different fundamentally weighted portfolios. The portfolios are weighted according to their most recent: 1) book values of equity, 2) trailing 4-quarter net profits, 3) trailing 4-quarter sales and 4) trailing 4-quarter dividends. Additionally, following Arnott *et al.* (2005), we also use trailing 20-quarter averages of the three latter variables, *i.e*., 5) net earnings, 6) sales, and 7) dividends. Moreover, we also built standard capitalization-weighted portfolios. All the portfolios were monthly reformed and rebalanced. The precise number of companies in the particular portfolios varied depended on the data availability. For instance, many companies in European emerging markets do not pay dividends. The time-series average of the number of firms in the portfolios is presented in Table 1.

One of the important traits of the fundamental indexation is the cost efficiency of this approach. Therefore, we also accounted for the impact of the trading costs on the performance.

Table 1

Number of Companies in the Tested Portfolios

	Cap	BV	E	Mean E	S	Mean S	D	Mean D
EE	562	562	424	518	513	533	216	317
Poland	251	251	201	236	238	241	91	131
Russia	68	68	53	61	60	62	32	41
Turkey	242	242	170	222	215	230	94	146

Note. The table reports the time-series mean of the number of firms in the portfolios weighted on capitalizations ("Cap"), book value ("BV"), earnings ("E"), mean trailing 20-quarter earnings ("Mean E"), sales ("S"), mean trailing 20-quarter sales ("Mean S"), dividends ("D"), and mean trailing 20-quarter dividends ("Mean D"). EE represents Emerging Europe, i.e., Poland, Russia, and Turkey combined.

We examined the influence of the transaction costs in a direct way, considering two separate "cost-layers": bid-ask spreads and commissions. We employed a simple proportional cost model proposed by Korajczyk and Sadka (2004) to describe the cost function:

$$\mathrm{f}\left(\mathrm{P_{j,t}}\right) = \mathrm{P_{j,t}} \times \mathrm{k_{j,t}}, \tag{1}$$

where: $P_{j,t}$ is the price of stock j at the time t, and $k_{j,t}$ is the constant cost component specific for a security j at time t.

We used two-step approaches to consider $k_{j,t}$. Firstly, we closely follow Zaremba and Konieczka (2015) and assess it as a half of the quoted spread:

$$\mathrm{k_{j,t}} = \frac{1}{2} \times \frac{\mathrm{P_{j,t}^{ask}} - \mathrm{P_{j,t}^{bid}}}{\mathrm{P_{j,t}^{mid}}}, \tag{2}$$

where: $P_{j,t}^{ask}$, $P_{j,t}^{bid}$, and $\mathrm{P_{j,t}^{mid}}$ are, respectively, offer, bid and mid prices of stock j at time t.

Secondly, we increased $k_{j,t}$ by a fixed component reflecting trading commissions. We assumed a constant value of 0.18%, which represent a typical level of commissions on equities, which is faced by institutional investors in the European emerging markets. Summing, we calculated the returns on the anomalies in two variants: raw and adjusted for both bid-ask spreads and commissions. In the result, our approach reflects not only the commissions associated with different portfolio rotation on various strategies but also cross-sectionally and time-varying bid-ask spreads on various securities.

We evaluated the performance with the traditional Capital Asset Pricing Model (Sharpe, 1964), abbreviated CAPM, according to which asset returns depend solely on the market portfolio.[3] It is based on the following regression equation:

$$\mathrm{R_{i,t}} - \mathrm{R_{f,t}} = \alpha_{\mathrm{i}} + \beta_{\mathrm{rm,i}} \cdot \left(\mathrm{R_{m,t}} - \mathrm{R_{f,t}}\right) + \varepsilon_{\mathrm{i,t}}, \tag{3}$$

where: $R_{i,t}$, $R_{m,t}$ and $R_{f,t}$ are returns on the analyzed asset i, market portfolio, and risk-free asset at time t; α_i and $\beta_{rm,i}$ are regression parameters.

The intercept α_i (Jensen-alpha) measures the average abnormal return. All of the regression parameters were estimated by using the OLS method in line with the remarks

[3] *We do not consider any more sophisticated multifactor model due to two reasons: 1) we are only interested in the outperformance of the standard capitalization-weighted index, 2) the cross-sectional multifactor models based on] do not consider any costs drags.*

of Cochrane (2005), who considers this approach usually more robust than, for instance, GLS. Furthermore, all of the statistical interference was based on logarithmic excess returns, and *t*-statistics were estimated using bootstrap standard errors to avoid any distributional assumption.[4] According to our null hypothesis, the intercept from the CAPM model is equal to zero, whereas the alternative hypothesis assumes the opposite.

To be consistent with the US$ convention, we use a one-month US T-Bill rate as a proxy for the risk-free rate use to compute the excess returns. The return on the market portfolio is represented by the value-weighted portfolio of all the companies in the sample (single country or pooled - dependent on the tested portfolio). Furthermore, we always calculate the return on the market portfolio in the rebalancing and cost-adjustment approach consistent with the formation procedures of the examined fundamentally indexed portfolios. In other words, we adjust it for the bid-ask spreads and commission in the same way as the tested strategies.

Beside the formal CAPM intercept, we also compute two standard measures used to evaluate portfolios performance: 1) the Sharpe ratio (Sharpe, 1966), *i.e.*, the relation of a mean excess return to a standard deviation of the returns, and 2) the information ratio (Sharpe, 1994), *i.e.*, the relation of a mean the benchmark-adjusted returns to a portfolio tracking error.

5. Results and Discussion

The general performance of the fundamentally indexed portfolios in the European emerging markets within out sample period was very good. Table 2 reports the basic statistics on the returns on the portfolios weighted according to various fundamental variables. Let us first focus on the strategies tested within the entire pooled sample of Russia, Poland, and Turkey (Table 2, Panel A).

All of the examined strategies delivered historically higher average excess returns than the standard market portfolio. The excess return on the capitalization-weighted portfolio equaled 0.36% monthly, while the excess returns on the fundamentally weighted portfolios ranged from 0.43% (dividend-weighting) to 1.01% (sales-weighting). The intercepts from the CAPM model on all of the fundamentally indexed strategies were also positive, amounting from 0.05% to 0.63%. However, these alphas were significantly different from 0 only in two cases, *i.e.*, weighting according to the sales and according to the mean past dividends.

Interestingly, the alternatively weighted portfolios were also relatively riskier than the classical capitalization-weighted portfolio, both regarding volatility and beta. The standard deviation of the returns on the market portfolio amounted to 8.74%, while the standard deviations of the fundamentally indexed portfolios ranged from 9.14% to 12.01%. Also, the betas in all the cases slightly exceeded 1. This observation contradicts the evidence presented in the original study of Arnott *et al.* (2005), who found that the fundamentally indexed portfolios were less risky.

[4] *We compute the bootstrap t-statistics based on 10.000 random draws.*

Table 2

Pre-cost Excess Returns on Fundamentally Indexed Portfolios

	Cap	BV	E	Mean E	S	Mean S	D	Mean D
Panel A: Emerging Europe - full sample								
Mean	0.36	0.46	0.73	0.67	1.01	0.84	0.43	0.70
Alpha		0.08	0.35	0.24	0.63*	0.45	0.05	0.33**
		(0.59)	(0.93)	(0.49)	(1.78)	(1.19)	(0.20)	(2.54)
Vol	8.74	9.39	10.42	12.01	10.24	10.49	9.59	9.14
Beta		1.06	1.06	1.18	1.05	1.07	1.04	1.03
TE		1.77	4.79	6.40	4.54	4.87	2.97	1.65
SR	0.14	0.17	0.24	0.19	0.34	0.28	0.15	0.26
IR		0.19	0.27	0.16	0.50	0.34	0.07	0.71
Panel B: Poland								
Mean	0.49	0.62	0.56	0.64	0.74	0.76	0.56	0.80
Alpha		0.12	0.03	0.11	0.24*	0.24	0.07	0.29**
		(1.19)	(0.21)	(0.87)	(1.83)	(1.44)	(0.45)	(2.17)
Vol	8.85	9.10	9.60	9.60	9.09	9.47	8.97	9.23
Beta		1.02	1.07	1.07	1.01	1.04	0.99	1.03
TE		1.24	1.72	1.68	1.69	2.17	2.07	1.72
SR	0.19	0.24	0.20	0.23	0.28	0.28	0.22	0.30
IR		0.35	0.12	0.29	0.51	0.42	0.11	0.61
Panel C: Russia								
Mean	0.09	0.07	0.29	-0.06	0.68	0.47	-0.12	0.13
Alpha		-0.01	0.20	-0.15	0.60	0.38	-0.21	0.04
		(-0.05)	(0.50)	(-0.33)	(1.57)	(0.93)	(-0.62)	(0.23)
Vol	10.16	10.34	11.50	11.88	11.00	11.35	11.78	10.84
Beta		0.99	1.01	1.03	0.97	0.99	1.08	1.04
TE		2.52	5.16	5.61	4.85	5.24	4.43	2.41
SR	0.03	0.02	0.09	-0.02	0.21	0.14	-0.04	0.04
IR		-0.02	0.14	-0.09	0.42	0.25	-0.16	0.07
Panel D: Turkey								
Mean	0.79	1.00	1.08	1.15	1.00	1.06	1.11	1.14
Alpha		0.14	0.24*	0.26	0.16	0.24	0.32*	0.34**
		(1.20)	(1.95)	(1.11)	(1.07)	(1.63)	(1.80)	(2.47)
Vol	10.98	12.16	11.75	12.76	11.82	11.62	11.25	11.39
Beta		1.10	1.06	1.13	1.06	1.04	1.00	1.02
TE		1.83	1.72	3.32	2.04	1.93	2.26	1.76
SR	0.25	0.29	0.32	0.31	0.29	0.32	0.34	0.35
IR		0.41	0.59	0.38	0.36	0.49	0.50	0.70

*Note. The table reports the pre-cost monthly log excess returns on portfolios weighted on capitalizations ("Cap"), book value ("BV"), earnings ("E"), mean trailing 20-quarter earnings ("Mean E"), sales ("S"), mean trailing 20-quarter sales ("Mean S"), dividends ("D"), and mean trailing 20-quarter dividends ("Mean D"). "Mean" is a mean log excess return, "Alpha" is an intercept from the CAPM model, "Vol" is standard deviation of monthly excess returns, "TE" is a tracking error, "SR" is a Sharpe ratio, and "IR" is an information ratio. Mean, alpha, Vol, and TE are expressed as percentages. Numbers in brackets are t-statistics. *, **, and *** indicate values significantly different from 0 at 10%, 5% and 1% level respectively. Values significantly higher than 0 at 5% level are in bold.*

The tracking error varied from 1.65% in the case of portfolio weighted on mean dividends to 6.40% for the mean earnings. These values are similar to the ones observed by Arnott *et al.* (2005). Finally, all of the fundamentally indexed portfolios performed favorably also on the risk-adjusted basis. Their Sharpe ratios were higher than in the case of the capitalization-weighted portfolios, and also all of the information ratios were positive.

The performance of the alternative weighting strategies within individual countries was consistent with the results for the aggregated multi-country portfolios. In Poland and Turkey, all of the fundamentally indexed strategies outperformed the capitalization-weighted portfolios. Nonetheless, the performance in Russia was noticeably weaker. In fact, three of the seven investigated strategies displayed negative (although insignificant alphas). The majority of the portfolios still delivered positive benchmark-adjusted returns.

The statistics in Table 3 provide insights in the stability of the performance of the fundamentally indexed portfolios by splitting the primary sample into two roughly equal subsamples. For the brevity, we only report excess returns, tracking errors, and information ratios.

The outperformance of the strategies based on the fundamental indexation approach was far from stable. Within the entire region, the strategies showed visibly higher benchmark-adjusted returns in the 2002-2009 period than in the 2009-2015 period. For instance, the excess returns on the book value-weighted portfolios equaled 0.39% monthly in the first subsample. In the latter period, they were negative and amounted to -0.19%. In the cases of the individual countries, there is no consistent pattern regarding the outperformance of some specified subsample. Nonetheless, the important conclusion from Table 3 is that the fundamentally indexed portfolios show significant time variation in returns and the underperformance may last even for a few years.

Table 3

Pre-cost Performance of the Fundamentally Indexed Portfolios in Subperiods

	BV	E	Mean E	S	Mean S	D	Mean D
Panel A: May 2002 - February 2009							
Emerging Europe - full sample							
ER	0.39	0.98	0.73	1.10	0.64	-0.04	0.41
TE	1.80	6.39	8.71	6.27	6.73	3.89	2.08
IR	0.79	1.63	1.04	3.02	1.53	-0.08	1.34
Poland							
ER	0.20	-0.15	0.15	0.14	0.24	0.10	0.45
TE	1.26	1.78	1.63	1.47	2.37	2.58	2.06
IR	0.57	-0.32	0.30	0.25	0.42	0.25	1.23
Russia							
ER	0.34	0.82	-0.06	1.28	0.61	-0.59	-0.12
TE	3.21	7.04	7.44	6.64	7.08	6.04	3.01
IR	0.81	1.62	-0.08	3.03	0.97	-1.32	-0.26
Turkey							
ER	0.20	0.32	0.55	-0.10	0.11	0.33	0.33
TE	2.30	2.13	4.59	2.45	2.25	2.68	2.15

	BV	E	Mean E	S	Mean S	D	Mean D
IR	0.56	0.95	1.99	-0.25	0.25	0.65	0.92
Panel B: March 2009 - November 2015							
Emerging Europe - full sample							
ER	-0.19	-0.25	-0.12	0.20	0.30	0.16	0.26
TE	1.70	2.09	2.42	1.26	1.46	1.59	1.07
IR	-0.39	-0.42	-0.18	0.55	0.72	0.36	0.84
Poland							
ER	0.05	0.28	0.14	0.36	0.28	0.03	0.15
TE	1.21	1.65	1.73	1.90	1.97	1.40	1.27
IR	0.14	0.58	0.27	0.66	0.50	0.08	0.41
Russia							
ER	-0.37	-0.41	-0.22	-0.09	0.15	0.19	0.21
TE	1.47	1.75	2.76	1.46	2.18	1.55	1.58
IR	-0.87	-0.82	-0.28	-0.23	0.23	0.42	0.46
Turkey							
ER	0.24	0.26	0.18	0.53	0.44	0.32	0.38
TE	1.21	1.18	0.96	1.46	1.55	1.77	1.25
IR	0.68	0.76	0.63	1.26	0.99	0.62	1.06

Note. The table reports the pre-cost performance of portfolios weighted on capitalizations ("Cap"), book value ("BV"), earnings ("E"), mean trailing 20-quarter earnings ("Mean E"), sales ("S"), mean trailing 20-quarter sales ("Mean S"), dividends ("D"), and mean trailing 20-quarter dividends ("Mean D"). "ER" is an excess (benchmark-adjusted) return, "TE" is a tracking error, and "IR" is an information ratio. ER and TE are expressed as percentages.

Let us now concentrate on the adjustment of the fundamentally indexed portfolios for the trading costs. One of the biggest advantages of the fundamental indexation is that it constitutes a viable compromise between the low portfolio turnover and the exposure to value-oriented quantitative strategies. Thus, the positive benchmark-adjusted returns should withstand the impact of the trading costs. Table 4 presents the monthly portfolio turnover of the examined strategies, *i.e.*, the monthly dollar trading volume divided by the portfolio value. The portfolio turnover on the capitalization-weighted portfolios was very low and amounted to about 2-3%. The portfolios whose components were weighted according to the fundamental variables displayed turnover which was typically a few percentage points higher. Nonetheless, these values are still very low in comparison to the regular turnover of the quantitative value strategies reported by, *e.g.*, Novy-Marx and Velikov (2015). The low turnover displayed by the fundamentally indexed portfolios constitutes a promising predictor of a cost-effective strategy.

Table 4

Turnover of the Fundamentally Indexed Portfolios

	Cap	BV	E	Mean E	S	Mean S	D	Mean D
EE	2.2	8.9	11.7	8.2	10.2	6.4	11.1	4.1
Poland	1.7	7.7	9.7	2.9	7.3	2.7	9.6	2.7
Russia	2.8	7.2	10.4	8.7	9.2	8.0	11.1	4.8
Turkey	3.3	10.3	8.7	10.0	20.5	11.9	10.8	5.8

Note. The table reports the mean monthly portfolio turnover, i.e., the average percentage share of stocks replaced every month, of portfolios weighted on capitalizations ("Cap"), book value ("BV"), earnings ("E"), mean trailing 20-quarter earnings ("Mean E"), sales ("S"), mean trailing 20-quarter sales ("Mean S"), dividends ("D"), and mean trailing 20-quarter dividends ("Mean D"). "ER" is an excess return, "TE" is a tracking error, and "IR" is an information ratio. ER and TE are expressed as percentages.

Table 5 depicts the performance of the fundamentally indexed portfolios adjusted for the trading costs. For the conciseness, we drop the statistics related to risk, which display no qualitative differences from the values reported in Table 2. The insights from this table lead to a conclusion that the overperformance of this approach remains largely unaffected by the trading costs.

Let us again concentrate firstly on the full Emerging Europe sample presented in Panel A. The mean returns on all of the fundamentally weighted portfolios were higher than on the capitalization-weighted portfolios, although the difference was sometimes as low as 0.03 percentage points. The highest alpha was recorded on the portfolio weighted according to the mean dividend. In this case, it amounted to 0.33% monthly. All of the portfolios showed positive information ratios ranging from 0.04 (dividend) to 0.72 (mean dividend).

The outcomes for stock markets in individual countries were largely similar. Both in Poland (Panel B) and Turkey (Panel D) the mean excess returns on the alternatively weighted portfolios exceeded the profits on the capitalization-weighted portfolio. Again, the Russia turned out to be an exception. Nearly half of the tested strategies proved unprofitable in the examined period. Nonetheless, even in these cases, the post-cost profitability was qualitatively indifferent from the pre-cost returns. In other words, the fundamental indexation is almost equally effective before and after adjustment for bid-ask spreads and commissions.

6. Concluding Remarks

This study presented the benefits of implementing the fundamental indexation in the three largest European emerging markets: Poland, Russia, and Turkey. We have found that the fundamentally weighted portfolios predominantly displayed historically higher returns than the traditional capitalization-weighted portfolios. Our results are thus consistent with the groundbreaking findings of Arnott *et al.* (2005). The payoffs on the alternatively weighted portfolios outperformed the capitalization-weighted portfolios even after adjustment for risk and trading costs, although the differences were frequently statistically insignificant.

Table 5

Cost-adjusted Excess Returns on Fundamentally Indexed Portfolios

	Cap	BV	E	Mean E	S	Mean S	D	Mean D
Panel A: Emerging Europe - full sample								
Mean	0.33	0.40	0.64	0.61	0.93	0.78	0.36	0.67
Alpha		0.05	0.29	0.22	0.58	0.42	0.02	0.33***
		(0.35)	(0.77)	(0.45)	(1.63)	(1.11)	(0.07)	(2.58)
SR	0.13	0.15	0.21	0.18	0.31	0.26	0.13	0.25
IR		0.13	0.22	0.15	0.46	0.32	0.04	0.72

	Cap	BV	E	Mean E	S	Mean S	D	Mean D
Panel B: Poland								
Mean	0.48	0.57	0.50	0.62	0.69	0.74	0.52	0.78
Alpha		0.08	-0.02	0.10	0.20	0.24	0.04	0.29**
		(0.81)	(-0.14)	(0.83)	(1.52)	(1.40)	(0.23)	(2.14)
SR	0.19	0.22	0.18	0.22	0.26	0.27	0.20	0.29
IR		0.25	0.03	0.28	0.42	0.41	0.05	0.60
Panel C: Russia								
Mean	0.07	-0.01	0.19	-0.12	0.57	0.38	-0.18	0.09
Alpha		-0.07	0.12	-0.19	0.50	0.31	-0.25	0.03
		(-0.36)	(0.29)	(-0.42)	(1.33)	(0.76)	(-0.74)	(0.14)
SR	0.02	0.00	0.06	-0.03	0.18	0.12	-0.05	0.03
IR		-0.10	0.08	-0.11	0.36	0.21	-0.19	0.04
Panel D: Turkey								
Mean	0.72	0.94	1.02	1.09	0.85	0.98	1.05	1.11
Alpha		0.15	0.26**	0.27	0.08	0.22	0.32*	0.37***
		(1.27)	(2.02)	(1.13)	(0.48)	(1.48)	(1.78)	(2.71)
SR	0.23	0.27	0.30	0.30	0.25	0.29	0.32	0.34
IR		0.41	0.60	0.38	0.20	0.45	0.49	0.76

*Note. The table reports the post-cost monthly log excess returns on portfolios weighted on capitalizations ("Cap"), book value ("BV"), earnings ("E"), mean trailing 20-quarter earnings ("Mean E"), sales ("S"), mean trailing 20-quarter sales ("Mean S"), dividends ("D"), and mean trailing 20-quarter dividends ("Mean D"). "Mean" is a mean log excess return, "Alpha" is an intercept from the CAPM model, "Vol" is the standard deviation of monthly excess returns, "TE" is a tracking error, "SR" is a Sharpe ratio, and "IR" is an information ratio. Mean, alpha, Vol, and TE are expressed as percentages. Numbers in brackets are t-statistics. *, **, and *** indicate values significantly different from 0 at 10%, 5% and 1% level respectively. Values significantly higher than 0 at 5% level are in bold.*

The insights provided in this paper are particularly important for individual investors and portfolio managers with an investment mandate focused on Emerging Europe. They offer a smart, simple, and cost-effective approach to portfolio and index construction that has not been used in practice in this region yet.

One of the limitations of this study of potentially high importance is the relatively short research period. Nevertheless, provided the young age of the stock markets in Eastern Europe, longer time-series are hardly available, particularly when it comes to fundamental data. One of the possible consequences of the short research sample is the lack of the statistical significance of the results.

The further research on the issues presented in this paper can be pursued in a few directions. First of all, this study relies on a relatively simple cost function. We do not consider many components of an implementation shortfall, particularly related to a market impact. Thus, our study does not reflect problems that could be encountered by portfolios of various sizes. Consideration of, *e.g.*, trade size, would provide further insights and the better reflection of a standpoint of institutional investors. Future research may utilize more sophisticated cost functions, like for example, Glosten and Harris (1988), Breen *et al.* (2002), or Almgreen *et al.* (2005). Furthermore, the research sample could be expanded to another market (emerging, frontier) and asset classes

(*e.g.*, bonds). In fact, many cross-sectional patterns have their parallel phenomena across other asset classes (see, *e.g.*, Asness *et al*., 2013).

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