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# Are Value, Size and Momentum Premiums in CEE Emerging Markets Only Illusionary?

Adam ZAREMBA—Poznań University of Economics, Poland (adam.zaremba@ue.poznan.pl) *corresponding author*
Przemysław KONIECZKA—Warsaw School of Economics, Poland (przemyslaw.konieczka@doktorant.sgh.waw.pl)

*Abstract*
*The answer to the question posed in the title is mostly yes. Using sorting and cross-section, we investigate the impact of illiquidity and transaction costs on value, size and momentum premiums in 11 CEE stock markets (Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia) for the years 2000–2013. We find very high value and size premiums and strong synergy effects between value and momentum strategies. However, the impact of illiquidity and transaction costs is almost lethal. After accounting for varying bid-ask spreads and liquidity, only the value premium survives. The size and momentum effects get obliterated.*

## 1. Introduction

Emerging markets differ very much from established and developed markets. They usually offer higher returns because they are considered riskier. They are also less efficient, more illiquid and less developed in terms of market infrastructure.

This paper asks the question of how much this peculiarity impacts the standard patterns of asset pricing. Do standard value, size and momentum effects hold for Central and Eastern European emerging markets? Do they withstand the influence of market illiquidity and transaction costs? In this research, we make an attempt to resolve these issues.

The neoclassical portfolio theory proposed by Markowitz (1952) formed the theoretical basis for development of the Capital Asset Pricing Model (CAPM) by Sharpe (1964), Lintner (1965) and Mossin (1966).[1] Later empirical tests of the CAPM did not give an unambiguous answer regarding the model's validity. Since the close of the 1970s, a series of articles has appeared providing observations that have called the effectiveness of the CAPM into question. Many of these investigations were related to size effect[2], value effect[3] and momentum effect[4]. Taking into account their observations concerning the size and value effects, Fama and French (1993) demonstrated how to extend the CAPM with two additional risk factors and proposed

[1] The pioneers in CAPM testing were Black, Jensen and Scholes (1972) along with Fama and MacBeth (1973). Other tests confirming the validity of the CAPM were conducted by Blume (1970), Friend and Blume (1970), Miller and Scholes (1972), and Blume and Friend (1973).

[2] The size effect means that small cap companies tend to generate higher returns on average. Tests on the size effect were provided by many researchers for the US and other developed markets (Banz, 1981; Reinganum, 1981; Cook and Roseff, 1982; Stambaugh and Blum, 1983; Brown *et al.*, 1983; Amihud and Mendelson, 1986; Herrera and Lockwood, 1994; Heston *et al.*, 1999; Rouwenhorst, 1999; Horowitz *et al.*, 2000; Fama and French, 2008 and 2012; and Michou *et al.*, 2010; Dimson *et al.*, 2011) and for emerging markets (Fama and French, 1998; Barry *et al.*, 2002).

a three-factor model.[5] Over several years, it was observed that the Fama and French model does not explain returns if the momentum effect occurs. Carhart (1997) took the momentum effect into account and extended the Fama and French model by adding another variable that reflected the momentum factor in returns.[6]

The Fama-French and Carhart multi-factor models (Fama and French, 1993; Carhart 1997) replaced the classical CAPM model used in the past. They are currently often employed in developed markets in portfolio management, investment performance evaluation and even in legal practice for assessing damages in lawsuits (Mitchell and Netter, 1994) and by competition authorities to evaluate mergers (e.g. Beverley, 2007). However, employing the Fama-French or Carhart models is not yet a common practice in the CEE markets. One of the reasons for that is that it is uncertain, given all the CEE's peculiarities and characteristics, whether the value, size and momentum factors are fully applicable in this region. There are two basic properties of emerging markets, which may impede (or improve) the performance of factor strategies. First, emerging markets are characterized by significantly higher transaction costs (Silva and Chaves, 2004; Schoenfeld and Cubeles, 2007; Pittman *et al.*, 2009). A report by Investment Technology Group indicates that in 2013 the total trading costs and investment shortfall in the emerging European markets were nearly twice as high as in the United States. Second, the emerging markets are less liquid (Lesmond, 2005; Bekaert *et al.*, 2007), which not only contributes to transaction costs, but also makes implementation of certain strategies more difficult. The impact of higher liquidity and transaction costs may be multidimensional. On the one hand, they may erase profits from momentum, size and value factors. Similarly, for example, Marchal *et al.* (2013) find that the trading costs in emerging markets are so high that they may de,prive investors of any diversification benefits of this asset class. On the other hand, some explanations of the factor premiums clearly refer to liquidity and transaction costs (Ball *et al.*, 1995; Grundy and Martin, 2001; Amihud, 2002; Lesmond *et al.*, 2004; Hanna and Ready, 2005; Sadka, 2006), so higher costs and illiquidity may imply more impressive value, size and momentum returns. The exact size and direction of the impact of these issues on the factor profits is not yet known. More research needs to be done to understand the performance of size, value and momentum factors in emerging markets, particularly in the CEE region. This paper aims to fill this gap.

[3] The value effect is the tendency of value stocks to generate higher risk-adjusted returns than growth stocks. Formal statistical proofs were given and the presence of the value effect confirmed by Stattmann (1980), Rosenberg *et al.* (1985), Fama and French (1992, 1993, 1995, 1996, 1998, 2012), Davis (1994), Chan *et al.* (1991), Capaul *et al.* (1993), Rouwenhorst (1999), Chui, Titman and Wei (2010) and Asness, Moskowitz and Pedersen (2013). Taking into account the emerging markets, Barry *et al.* (2002) observed the value effect in stocks' returns.

[4] The momentum effect is related to the occurrence of autocorrelation between short-term returns from stocks. Evidence for the momentum effect in returns from stocks on international markets was put forward by DeBondt and Thaler (1985), Lo and MacKinlay (1990), Jagadeesh and Titman (1993, 2001), Asness (1994), Fama and French (1998, 2012), Rouwenhorst (1998), Grinblatt and Moskowitz (2004), Chui, Wei and Titman (2010), and Asness, Moskowitz and Pedersen (2013).

[5] The model developed by Fama and French (1993, 1996) was later tested multiple times, in particular with respect to the US market by Fama and French (1995, 1996), Daniel and Titman (1997) and Davis, Fama and French (2000).

[6] The model developed by Carhart (1997) was later tested by Jegadeesh (2000), Liew and Vassalou (2000), Kim and Kim (2003), L'Her, Masmoudi and Suret (2004), Bello (2007), and Lam, Li and So (2011).

Firstly, we provide new evidence on value, momentum and size premiums from Central and Eastern European markets. We find extraordinarily strong value and size effects, but we detect no momentum premium.

Next we find that value and size can be efficiently combined, but value and momentum and size and momentum tend to offset each other. Size combined with value can result in superior performance, whereas size or value in tandem with momentum tend to cancel each other out. The last observation is specific for CEE markets and contrasts with the typical findings for developed markets.

Finally, we find that, although the value premium remains in place after simultaneous accounting for illiquidity and risk, the size premium becomes entirely obliterated.

The findings in this paper have implications for three distinct areas: investment practice, portfolio performance measurement and cost of capital calculation. First, they may be important for international investors who pursue factor strategies with a regional focus, may be useful in designing investment policies for active investment strategies and can induce an emergence of new passive factor-based investment products designed specifically for the CEE markets. Second, the regional versions of factor models may be implemented in testing portfolio performance. The measures should take into account not only market risk, but also value and size factors. Third, it seems reasonable to use the additional factors and corporate investment and budgeting decisions, as value and size factors appear to be valid determinants of cross-sectional variation in stock returns.

## 2. Methodology

This paper examines two hypotheses. First, we test whether the value, size and momentum premiums are present in the CEE emerging markets. Second, we investigate whether those effects hold after accounting for illiquidity and transaction costs. We build equally, value- and turnover-weighted portfolios from sorts on stocks' characteristics and evaluate their performance with the CAPM. Additionally, we adjust the returns for transaction costs.

### 2.1 Playing Field

We base our computations on stocks listed between December 20, 2000 and December 20, 2013 in the CEE markets, including Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia (used country classification by the OECD[7]). We use stock-level data from Bloomberg. Both listed and delisted stocks are used in order to avoid a survivorship bias.

We include a given stock in a sample in period *t*, when we are able to compute a return in *t* and three characteristics:

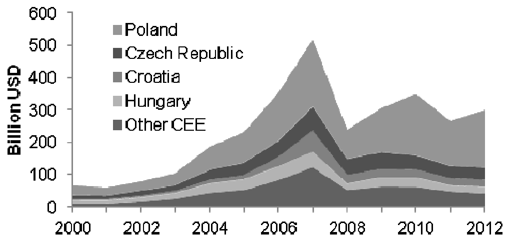
– value (*V*)—book value to market value ratio (*BM/VM*) at the end of period *t*-1;

– size (*S*)—total market capitalization of a company at the end of *t*-1;

– momentum (*M*)—12-month realized total rate of return at the end of *t*-1.

[7] It should be highlighted that the OECD definition does not encompass Russia, contrary to many popular "investment" classifications.

**Figure 1 Market Capitalizations of Stock Markets in the CEE Area**




*Notes: Figure 1* exhibits capitalizations of stock markets in the CEE area in period 2000–2012 expressed in USD billion.

Source: World Bank database (http://data.worldbank.org/)

**Table 1 Companies in the Sample**

| | 2013 | 2012 | 2011 | 2010 | 2009 | 2008 | 2007 | 2006 | 2005 | 2004 | 2003 | 2002 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bulgaria | 22 | 37 | 38 | 48 | 43 | 27 | 21 | 0 | 0 | 0 | 0 | 0 | 0 |
| Croatia | 112 | 117 | 126 | 140 | 142 | 122 | 25 | 0 | 0 | 0 | 0 | 0 | 0 |
| Czech Rep. | 10 | 11 | 7 | 7 | 8 | 8 | 5 | 8 | 4 | 2 | 2 | 0 | 0 |
| Estonia | 13 | 13 | 13 | 11 | 10 | 10 | 8 | 3 | 2 | 1 | 1 | 3 | 5 |
| Hungary | 0 | 0 | 0 | 0 | 25 | 24 | 20 | 16 | 16 | 5 | 6 | 0 | 13 |
| Latvia | 10 | 11 | 19 | 10 | 11 | 8 | 14 | 15 | 3 | 1 | 0 | 0 | 2 |
| Lithuania | 16 | 19 | 21 | 19 | 15 | 13 | 18 | 20 | 0 | 0 | 0 | 0 | 0 |
| Poland | 535 | 426 | 384 | 334 | 273 | 211 | 181 | 149 | 110 | 52 | 47 | 47 | 26 |
| Romania | 89 | 92 | 95 | 89 | 96 | 94 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Slovakia | 9 | 5 | 5 | 3 | 6 | 8 | 7 | 4 | 0 | 0 | 0 | 0 | 0 |
| Slovenia | 16 | 16 | 0 | 21 | 12 | 18 | 14 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 832 | 747 | 708 | 682 | 641 | 543 | 313 | 215 | 135 | 61 | 56 | 50 | 46 |

*Note: Table 1* exhibits the number of distinct companies in the sample during the examined years.

*Sources:* Bloomberg; data include all available common stocks (both currently listed and delisted) from CEE countries in the database.

All data are converted into EUR; however, the results of our analysis are resilient to changes in the functional currency. The number of stocks in the sample grows along with the development of CEE capital markets and varies from 46 at the beginning of the research period to 832 at the end. The detailed composition of the sample is presented in *Table 1*. As can be seen, Poland is the most strongly represented country due to the fact that it is the biggest and the most liquid market in the region, additionally attracting a large number of small companies. According to statistics from Quandl.com, the capitalization of the Warsaw Stock Exchange at the end of 2012 amounted to USD 178 billion, constituting 60% of the market value of all companies of the CEE region. At the same time, market size in Latvia, Lithuania, Slovakia and Estonia did not exceed USD 5 billion. The precise decomposition of stock market capitalization of the markets in the sample is depicted in *Figure 1*.

## 2.2 Portfolio Construction and Tests

First, we focus on the performance of portfolios from single sorts. Based on the *V*, *S* and *M* characteristics, we form three separate portfolios corresponding to the following proportions: 30% of stocks with the lowest factor, 30% of stocks with the highest factor and the remaining 40% of mid-stocks. Also, three different weighting schemes are implemented. The first portfolio is equally weighted, meaning that each stock participated equally in the portfolio at the time of its formation. The second method implemented is capitalization weighting, meaning that the weight of each stock is proportional to the total market capitalization of a company at the time of portfolio formation. The last scheme is liquidity weighting. Liu (2006) defines liquidity as the ability to trade large quantities quickly at low cost with little price impact. The euro volume, i.e. the time-series average of daily volumes in the year preceding portfolio formation multiplied by the last closing price calculated in euro, is used as a proxy for liquidity. The reason for the implementation of liquidity weighting is that many stocks in emerging markets tend to be significantly illiquid. As a result, a regular reconstruction and rebalancing of equally or capitalization-weighted portfolios might be completely unrealistic. Liquidity-weighted portfolios are the easiest to be reconstructed and rebalanced within a market segment. In other words, the usage of liquidity-weighted portfolios made it possible to avoid an illiquidity bias, which might arise due to some inherent illiquidity premium linked to illiquid companies.[8] Participation of such companies in equally and capitalization-weighted portfolios might be artificially overweighted to an unrealistic extent, something that is impossible to achieve by a real investor. Thus, liquidity weighting is far better aligned with a real investor's point of view, as it avoids the impact of "paper" profits from illiquid assets.

It is also important to point out that liquidity weighting does not entirely deal with the issue of the illiquidity premium, as some securities with similar characteristics (like high BV/MV) might be illiquid as a group, thus bearing some illiquidity premium. Nonetheless, this research paper assumes the viewpoint of an individual investor with a medium-sized portfolio, for whom such group illiquidity is not prob-

[8] The article by Amihud and Mendelson (1986) prompted a number of studies that proved illiquidity to be a major factor able to explain returns from stocks. These assumptions are supported by the following premise: an investor allocating its funds to illiquid companies must be aware of higher trading costs, which are compensated by higher returns. Amihud and Mendelson (1986) proposed a model in which the illiquidity premium is proportional to the present value of transaction costs multiplied by an exogenous trading frequency. Transaction costs therefore represent a cash outflow that reduces future returns. Brennan and Subrahmanyam (1996) believe that one of the reasons of illiquidity on financial markets is the wrong selection of stocks caused by the presence of so-called informed traders. The pair also state that the illiquidity effect is caused by asymmetric information on financial markets and its impact on stock prices. Amihud (2002) asserts that illiquidity is a possible explanation for the small stocks effect. He believes that, in times of high liquidity on markets, small stocks bear a higher liquidity risk and therefore should carry an additional premium for illiquidity risk. The observations made by Amihud (2002) run parallel to the observations of Stoll and Whaley (1983), who believed that one of the possible explanations of the size premium is the illiquidity risk for small stocks. On the other hand, Sadka (2006) maintains that the liquidity factor may in part explain the momentum effect. There are numerous publications that confirm the presence of the liquidity effect on the US market (Brennan *et al.*, 1998; Chordia *et al.*, 2001; Garleanu, 2009). Empirical testing also proves the existence of the liquidity effect on other foreign stock exchanges (Amihud *et al.*, 1997; Hu, 1997; Chan and Fa, 2005). Rouwenhorst (1999) and Claessens *et al.* (1995) also considered the role of liquidity in explaining emerging market stock returns.

lematic. A detailed analysis, taking advantage of a more sophisticated price impact function to account for illiquidity, is beyond the scope of this paper.

Along with the factor portfolios, returns on the market portfolio, i.e. the portfolio of all stocks in the sample, are also calculated. In each case market portfolios are computed using the same methodology as for the factor portfolios in order to enable better comparison. In other words, three different market portfolios are computed: equally, capitalization- and liquidity-weighted. All factor and market portfolios are reconstructed and rebalanced once a year on the 20th of December in each case. This date is selected intentionally in order to avoid any look-ahead bias.

Next, fully collateralized long/short (LS) portfolios are formed. These reflect a behavior pattern of specific factors. LS portfolios are constructed on the basis of existing theoretical and empirical evidence in the field to make them positively exposed to factor-related premiums. In other words, portfolios are always long in 30% of stocks that yield the highest risk-adjusted returns, short in 30% of stocks that yield the lowest risk-adjusted returns and long in risk-free assets. As a result, three various portfolios are formed:

– value-reflecting long/short portfolio ("value LS"), which is 100% long in 30% of the highest BV/MV stocks, 100% short in 30% of the lowest BV/MV stocks and 100% long in risk-free assets;
– size-reflecting long/short portfolio ("size LS"), which is 100% long in 30% of the smallest companies, 100% short in 30% of the biggest companies and 100% long in risk-free assets;
– momentum-reflecting long/short portfolio ("momentum LS"), which is 100% long in 30% of the highest momentum stocks, 100% short in 30% of the lowest momentum stocks and 100% long in risk-free assets.

Similarly to the previous case, stocks in portfolios are weighted in accordance with three various schemes: equal-based, capitalization-based and liquidity-based.

Finally, the performance of long/short portfolios is tested against the Capital Asset Pricing Model (CAPM). The long/short portfolios' excess returns are regressed on market portfolios' excess returns, according to the CAPM equation

$$R_{pt} - R_{ft} = \alpha_i + \beta_i \left( R_{mt} - R_{ft} \right) + \varepsilon_{pt} \tag{1}$$

where $R_{pt}$, $R_{mt}$ and $R_{ft}$ are annual long/short portfolio, market portfolio and risk-free asset returns, while $\alpha_i$ and $\beta_i$ are regression parameters. A one-year Euribor rate represents a risk-free rate. The $\alpha_i$ intercept is a measure of the average annual abnormal return (so-called Jensen-alpha). In each case, a proxy for a market portfolio is computed on the basis of the cross-sectional average of all stocks in the sample and with the use of the same weighting scheme as in the case of factor portfolios. This means that, depending on the construction of factor portfolios, a market portfolio is either equally, capitalization- or liquidity-weighted. According to the zero hypothesis, the alpha intercept is not statistically different from zero, whereas an alternative hypothesis states that it is, in fact, different from zero. Equation parameters are found on the basis of OLS and tested in a parametric way.

Next, we analyze interactions between separate factors. For presentational purposes, time-series correlation matrices of LS portfolios are computed first. Next, we provide more formal statistical inferences. At this stage, all computations were based on equally weighted portfolios. Stocks are divided into separate double-sorted groups based on combinations of their fundamental features described above: *V*, *S* and *M* characteristics, as follows. The first step is to determine the 30$^{th}$ percentile and the 70$^{th}$ percentile breakpoints of each characteristic. Next, pairs of these break points are intersected. Finally, equally weighted double-sorted portfolios are formed.

The next step is to construct double-sorted collateralized long/short portfolios for each pair. Again, the premises of specific long/short portfolios are based on existing theoretical and empirical evidence. Thus, the following equally weighted portfolios are formed:

- 100% long in high *V* and high *M*, 100% short in low *V* and low *M*, 100% long in risk-free assets;
- 100% long in high *V* and low *S*, 100% short in low *V* and high *S*, 100% long in risk-free assets;
- 100% long in high *M* and low *S*, 100% short in low *M* and high *S*, 100% long in risk-free assets.

For example, the first long/short portfolio is 100% long in stocks that simultaneously belong to the high-value and high-momentum subgroups, whereas it is 100% short in stocks that belong to the low-value and low-momentum subgroups at the same time. Finally, the above-described portfolios are examined against the CAPM with the use of procedures identical to those mentioned above.

### 2.3 Transaction Costs

The last phase of research is related to transaction cost differences in various portfolios. Financial publications contain numerous examples of research which indicates,that the returns premiums may be merely compensation for transaction costs. Ball, Kothari and Shanken (1995) observed that bid/ask spreads significantly reduce the profitability of a contrarian investing strategy. Kenz and Ready (1996) studied the effects of price impact on the profitability of a trading strategy based on weak auto-correlation between small-firm and large-firm portfolios. They demonstrated that trading costs significantly decrease the profitability of the studied investment strategies. Grundy and Martin (2001) observed that after taking trading costs at the level of 1.5% into account in a momentum-based strategy, returns become statistically insignificant. Mitchell and Pulvino (2001) estimated the impact of trading costs on investment strategies and discovered that trading costs decreased returns by 300 basis points per year. Lesmond, Schill and Zhou (2004) and Hanna and Ready (2005) showed that accounting for trading costs in a momentum-based strategy entirely compromises a strategy's profitability. Korajczyk and Sadka (2004) showed that accounting for trading costs causes the profitability of a momentum strategy to decrease. Additionally, they estimated the break-even fund sizes for long-momentum portfolios, which in their opinion range from USD 2 billion to 5 billion. Frazzini, Israel and Moskowitz (2012) studied the impact of trading costs on returns from size, value and momentum strategies, using actual data from stock exchange trades between 1998 and 2011. They estimated that actual trading costs are almost ten times smaller than shown in previous research. Frazzini, Israel and Moskowitz (2012) provided evidence that the impact of trading costs on the profitability of size, value and premium strategies is five times smaller than shown in previously conducted research. Concluding their studies, they found that the size, value and premium strategies may generate high returns in real-world conditions regardless of the fund size due to the lack of significant impact of trading costs on the profitability of the strategy. They stated that the premiums associated with size, value and momentum appear to be robust, sizeable and implementable.

In this research, the simple proportional cost model proposed by Korajczyk and Sadka (2004) is implemented to describe the cost function:

$$f(p) = k \times p \tag{2}$$

where:
$p$ is the stock price at the time of portfolio formation and $k$ is the constant cost component. Half of the quoted spread, defined as outlined below, is used as the proxy for $k$:

$$k_{j,t} = \frac{1}{2} \times k^{Q}_{j,t} \tag{3}$$

where:

$$k^{Q}_{j,t} = \frac{P_{ask,j,t} - P_{bid,j,t}}{P_{mid,j,t}} \tag{4}$$

where $P_{ask,j,t}$, $P_{bid,j,t}$ and $P_{mid,j,t}$ are offer, bid and mid prices of stock $j$ at time $t$. Using the $k^{Q}_{J,t}$ measure, full sample time-series averages of cross-sectional averaged spreads within specific market and factor portfolios are computed. All three weighting schemes are implemented.

Next, simplified post-cost returns are calculated with the use of the formula:

$$R_{post-cost} = R_{pre-cost} - \left(k_{j,t_0} + k_{j,t_1}\right) \tag{5}$$

where $k_{j,t_0}$ and $k_{j,t_1}$ are the constant cost components (halves of the quoted spreads) at the beginning and at the end of the measurement period. In other words, a simplified approach is taken by assuming an equal 100% turnover rate in all portfolios. Finally, all computations and statistical interferences are repeated in an identical way as in the case of raw pre-cost returns, using post-cost returns and log returns. It is equally important to emphasize that all returns on portfolios, including market portfolio returns, are computed on the basis of post-cost returns. The aim is to avoid disproportionate and inadequate comparisons in the analysis.

## 3. Results and Interpretation

In this section, we first describe the performance of single-sorted portfolios. Next, we present the findings regarding double-sorted portfolios. Finally, the impact of transaction costs is reported.

*Table 2* presents the pre-cost returns of factor portfolios. A computation of equally weighted factor portfolios indicates a strong presence of value and size effects in the CEE markets; however, the results concerning momentum are inconclusive and implausible. Considering value, the top 30% portfolio delivered an average annual return rate which is higher by 24.3 p.p. than the bottom 30% portfolio and by 1.3 p.p. better than the market portfolio. It seemed that the value anomaly is far

**Table 2 Pre-Cost Factor-Sorted Portfolios**

| | Equal-weighted portfolios | | | | Capitalization-weighted portfolios | | | | Liquidity-weighted portfolios | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Return | Volatility | Beta | Volume | Return | Volatility | Beta | Volume | Return | Volatility | Beta | Volume |
| *Value portfolios* | | | | | | | | | | | | |
| Low 30% | 5.7% | 43.8% | 0.88 | 782 | 1.2% | 32.9% | 0.84 | 8 551 | -1.6% | 32.2% | 0.71 | 12 616 |
| Mid 40% | 14.9% | 44.4% | 1.04 | 563 | 9.9% | 33.0% | 0.96 | 6 239 | 10.5% | 38.4% | 1.07 | 12 093 |
| High 30% | 30.0% | 39.7% | 1.06 | 254 | 19.7% | 31.3% | 0.92 | 1 934 | 16.0% | 43.9% | 1.17 | 2 983 |
| Market | 17.1% | 42.0% | 1.00 | 534 | 5.6% | 33.5% | 1.00 | 7 245 | 5.4% | 36.5% | 1.00 | 11 838 |
| *Size portfolios* | | | | | | | | | | | | |
| Low 30% | 27.5% | 45.2% | 1.34 | 34 | 22.2% | 44.4% | 1.35 | 36 | 14.7% | 47.5% | 1.15 | 144 |
| Mid 40% | 15.0% | 47.1% | 1.07 | 76 | 8.2% | 44.3% | 1.08 | 99 | 2.2% | 50.7% | 1.05 | 254 |
| High 30% | 7.5% | 35.3% | 0.58 | 1 629 | 5.3% | 33.4% | 0.99 | 7 615 | 5.3% | 36.3% | 0.99 | 12 610 |
| Market | 17.1% | 42.0% | 1.00 | 534 | 5.6% | 33.5% | 1.00 | 7 245 | 5.4% | 36.5% | 1.00 | 11 838 |
| *Momentum portfolios* | | | | | | | | | | | | |
| Low 30% | 17.8% | 45.4% | 1.09 | 271 | 4.5% | 42.1% | 1.12 | 1 949 | -7.2% | 51.3% | 1.07 | 3 093 |
| Mid 40% | 13.0% | 39.6% | 0.89 | 746 | 7.1% | 34.6% | 1.05 | 7 395 | 9.1% | 38.9% | 1.09 | 12 727 |
| High 30% | 19.2% | 46.0% | 1.06 | 511 | 4.8% | 42.2% | 1.10 | 5 373 | 0.0% | 46.4% | 0.96 | 8 145 |
| Market | 17.1% | 42.0% | 1.00 | 534 | 5.6% | 33.5% | 1.00 | 7 245 | 5.4% | 36.5% | 1.00 | 11 838 |

*Notes: Table 2* presents the pre-cost return characteristics of factor portfolios. Portfolios are sorted according to BV/MV ("value"), company capitalization ("size") and the total price change in the year preceding portfolio formation ("momentum"). "Return" is the average annual geometric rate of return, "volatility" is an annual standard deviation of log returns, "beta" is the regression coefficient calculated against a defined market portfolio and "volume" is the cross-sectional weighted average of single stocks' time-series averaged daily trading volumes over the month preceding portfolio formation multiplied by the stock price. The liquidity-weighted portfolios are weighted according to the "volume" as defined above. The market portfolio in each case is built using the same methodology as the remaining portfolios, which means it is either equally, capitalization or liquidity-weighted.

All prices and returns are converted to EUR.

*Sources:* Bloomberg and the computations based on listings of CEE companies during the period 12/20/2000–12/20/2013.

**Table 3 Pre-Cost Factor-Mimicking Portfolios**

| | Value LS portfolios | | | Size LS portfolios | | | Momentum LS portfolios | | |
|---|---|---|---|---|---|---|---|---|---|
| | EW | CW | LW | EW | CW | LW | EW | CW | LW |
| Return | 25.2% | 19.5% | 20.7% | 24.0% | 19.8% | 12.4% | -1.9% | -0.9% | -5.5% |
| *t*-stat | *5.20* | *3.66* | *2.43* | *2.93* | *2.30* | *1.52* | *-0.18* | *-0.12* | *-0.32* |
| Volatility | 17.4% | 19.2% | 30.7% | 29.6% | 31.0% | 29.5% | 38.9% | 26.3% | 62.6% |
| | *CAPM model* | | | | | | | | |
| $\beta$ | 0.13 | 0.19 | 0.44 | 0.41 | 0.27 | 0.15 | -0.06 | -0.04 | -0.26 |
| *t*-stat | *1.07* | *1.00* | *1.75* | *2.32* | *0.83* | *0.52* | *-0.19* | *-0.13* | *-0.37* |
| $\alpha$ | 17.4% | 12.1% | 10.9% | 14.4% | 13.4% | 8.1% | -5.1% | -3.9% | -8.9% |
| *t*-stat | *3.16* | *2.10* | *1.29* | *1.80* | *1.35* | *0.85* | *-0.39* | *-0.45* | *-0.39* |

*Notes*: *Table 3* presents pre-cost return characteristics of factor-mimicking portfolios. Portfolios are created based on BV/MV ("value"), company capitalization ("size") or the total price change in the year preceding portfolio formation ("momentum"). "Return" is the average annual geometric rate of return and "volatility" is an annual standard deviation of log returns. "EW", "CW" and "LW" denote equal-, capitalization- and liquidity-based weighting schemes, respectively. The liquidity-weighted portfolios are weighted according to the "volume" defined as stocks' time-series averaged daily trading volume in the month preceding portfolio formation multiplied by the stock price. $\alpha$ and $\beta$ are model parameters computed in accordance with the model's specification. The market portfolios in each case are built using the same methodology as the remaining portfolios, which means they are either equal, capitalization or liquidity-weighted. If necessary, a one-year bid for the 12-month EURIBOR rate is employed as a proxy for the risk-free rate.
All prices and returns are converted to EUR.

*Sources:* Bloomberg and computations based on listings of CEE companies during the period 12/20/2000–
–12/20/2013.

more significant in the CEE markets than in developed markets. Interestingly, the high BV/MV portfolio is, in fact, somewhat less risky than market and low BV/MV portfolios in terms of standard deviation, though its beta is higher. The differences were also surprisingly large in relation to the size premium. Small companies yielded returns which are higher by 20.0 p.p. than those of large companies and by 10.1 p.p. than the market portfolio. This seemed to be even more impressive than in other studies in emerging and developed markets (Fama and French, 2012; Cakici *et al.*, 2013). However, higher profits are connected with higher risk, which is measured either by standard deviation or beta. Finally, the momentum effect presented very weak evidence. The difference in returns between high- and low-momentum stocks amounted only to 1.4 p.p. This observation is consistent also with remarks made by Cakici *et al.* (2013), who revealed no evidence of momentum in emerging European markets. Alas, some factor profits disappeared with the use of capitalization rather than equal-weighting. The difference between top and bottom portfolios decreased to 18.5 p.p. in the case of the value factor and to 16.9 p.p. in the case of the size factor. Nonetheless, its size is still significant in comparison with the existing evidence related to developed markets. In fact, the momentum effect disappeared nearly entirely and high-momentum stocks yielded results that are higher by only 0.3 p.p. than in the case of low-momentum stocks. The first two factor premiums—value and momentum—turned out to be non-resilient to liquidity weighting. Remaining premiums are relatively high. In the case of momentum, top momentum portfolios still delivered zero returns, i.e. lower returns than those of a market portfolio. The aforementioned results correspond to previous studies

**Table 4 Factor Correlations**

| | Value LS | Size LS | Momentum LS | Market | Cash |
|---|---|---|---|---|---|
| | | *Equal-weighted portfolios* | | | |
| Value LS | 1.00 | | | | |
| Size LS | 0.51 | 1.00 | | | |
| Momentum LS | -0.30 | 0.09 | 1.00 | | |
| Market | 0.33 | 0.60 | -0.05 | 1.00 | |
| Cash | 0.18 | 0.47 | 0.27 | 0.03 | 1.00 |
| | | *Capitalization-weighted portfolios* | | | |
| Value LS | 1.00 | | | | |
| Size LS | 0.08 | 1.00 | | | |
| Momentum LS | -0.43 | -0.50 | 1.00 | | |
| Market | 0.29 | 0.26 | -0.05 | 1.00 | |
| Cash | -0.31 | 0.34 | 0.01 | -0.10 | 1.00 |
| | | *Liquidity-weighted portfolios* | | | |
| Value LS | 1.00 | | | | |
| Size LS | 0.17 | 1.00 | | | |
| Momentum LS | -0.40 | -0.76 | 1.00 | | |
| Market | 0.49 | 0.17 | -0.14 | 1.00 | |
| Cash | 0.19 | 0.42 | -0.52 | -0.13 | 1.00 |

*Notes:* *Table 4* depicts Pearson's correlation coefficients of pre-cost log returns among long/short factor-mimicking portfolios, stock market portfolio ("market") and yields in the cash market ("cash"). Portfolios are created based on BV/MV ("value"), company capitalization ("size") or the total price change in the year preceding portfolio formation ("momentum"). The liquidity-weghted portfolios are weighted according to the "volume" defined as stocks' time-series averaged daily trading volume in the month preceding portfolio formation multiplied by the stock price. The market portfolios in each case are built using the same methodology as the remaining portfolios, which means they are either equal, capitalization or liquidity-weghted.

All prices and returns are converted to EUR.

*Source:* Bloomberg; the computations are based on listings of CEE companies during the period 12/20/2000–12/20/2013.

conducted in developed economies and suggesting that liquidity might seriously impede factor profits (Amihud, 2002; Sadka, 2006).

The above-described results are generally confirmed by the analysis of factor reflecting portfolios, although not all of them are statistically significant (see *Table 3*). All value- and size-based portfolios yielded superior results, particularly in terms of the equal-weighting scheme. Again, the value of alphas exceeding 10% annually is a much higher result in comparison with the usual observations in developed markets. The last factor—momentum—generated close to zero negative returns.

*Table 4* presents time-series correlations among LS factor reflecting portfolios. It is striking that correlations are highly dependent on the weighting scheme. For instance, the correlation between value and size LS equally weighted portfolios accounted for 0.51, whereas it reached only 0.08 after the adjustment of portfolio weights to capitalization. Interactions of equally weighted factor portfolios are presented in *Table 5*. The interdependencies between value and size seem to prove the previous empirical evidence gained in developed markets. Earlier tests covering the US market and developed markets show that the size premium (if is statistical

**Table 5 Interactions between Factors**

| | Return | | | Volatility | | | Beta | | |
|---|---|---|---|---|---|---|---|---|---|
| *Value and size portfolios* | | | | | | | | | |
| | V: low 30% | V: mid 40% | V: high 30% | V: low 30% | V: mid 40% | V: high 30% | V: low 30% | V: mid 40% | V: high 30% |
| S: low 30% | 4.6% | 17.1% | 35.5% | 37.8% | 58.7% | 43.1% | 0.57 | 1.20 | 0.90 |
| S: mid 40% | 4.5% | 10.8% | 25.6% | 58.7% | 47.0% | 41.2% | 1.20 | 0.93 | 0.79 |
| S: high 30% | 0.4% | 9.6% | 16.6% | 36.9% | 34.0% | 34.6% | 0.61 | 0.60 | 0.63 |
| *Value and momentum portfolios* | | | | | | | | | |
| | V: low 30% | V: mid 40% | V: high 30% | V: low 30% | V: mid 40% | V: high 30% | V: low 30% | V: mid 40% | V: high 30% |
| M: low 30% | -0.8% | 6.5% | 30.1% | 51.7% | 50.4% | 44.0% | 0.89 | 1.04 | 0.88 |
| M: mid 40% | -1.0% | 12.1% | 30.2% | 38.1% | 41.3% | 48.2% | 0.74 | 0.83 | 0.92 |
| M: high 30% | 11.4% | 20.9% | 22.0% | 52.0% | 48.8% | 34.3% | 0.94 | 0.92 | 0.60 |
| *Size and momentum portfolios* | | | | | | | | | |
| | S: low 30% | S: mid 40% | S: high 30% | S: low 30% | S: mid 40% | S: high 30% | S: low 30% | S: mid 40% | S: high 30% |
| M: low 30% | 31.2% | 7.7% | 2.9% | 47.4% | 55.0% | 38.8% | 0.96 | 0.88 | 0.74 |
| M: mid 40% | 20.7% | 9.6% | 9.2% | 52.0% | 43.8% | 34.3% | 1.04 | 0.88 | 0.61 |
| M: high 30% | 25.6% | 19.2% | 4.2% | 46.8% | 55.6% | 39.6% | 0.87 | 1.12 | 0.64 |

*Notes:* *Table 5* presents pre-cost return characteristics of portfolios sorted simultaneously on two separate cross-sectional factors. All portfolios are equally weighted and created based on pairs of the following variables: BV/MV (“value”), company capitalization (“size”) or the total price change in the year preceding portfolio formation (“momentum”). “Return” is the average annual geometric rate of return and “volatility” is an annual standard deviation of log returns. The market portfolios in each case are built using the same methodology as the remaining portfolios, which means they are all equally weighted.

All prices and returns are converted to EUR.

*Source:* Bloomberg; the computations are based on listings of CEE companies during the period 12/20/2000–12/20/2013.

**Table 6 Double-Sorted Portfolios**

| | ***V + S*** | ***V + M*** | ***S + M*** |
|---|---|---|---|
| Return | 37.5% | 10.9% | -1.9% |
| *t*-stat | *4.15* | *1.20* | *-0.18* |
| Volatility | 32.6% | 32.9% | 38.3% |
| | | *CAPM model* | |
| *β* | 0.16 | -0.03 | -0.14 |
| *t*-stat | *1.09* | *-0.22* | *-0.75* |
| *α* | 29.91% | 8.26% | -4.23% |
| *t*-stat | *3.07* | *0.84* | *-0.36* |

*Notes: Table 6* presents pre-cost return characteristics of portfolios created based simultaneously on two separate cross-sectional factors. All portfolios are equally weighted and created based on pairs of the following variables: BV/MV ("*V*"), company capitalization ("*S*") or the total price change in the year preceding portfolio formation ("*M*"). The market portfolios in each case are built using the same methodology as the remaining portfolios, which means they are all equally weighted.

If necessary, a 12-month bid for the EURIBOR rate is employed as a proxy for the risk-free rate. All prices and returns are converted to EUR.

*Source:* Bloomberg; the computations are based on listings of CEE companies during the period 12/20/2000–‒12/20/2013.

significant) is stronger among small- and micro-cap stocks. Fama and French (2012) showed that the value premium is significant for small stocks. For emerging markets, research on interdependences between factors has been carried out by Cakici, Fabozzi and Tan (2012). They observed that the value premium is present both among small- and large-cap stocks. In our research, the value premium is particularly high in small stocks and relatively lower in large caps. High-value small caps earned as much as 35.5% annually. Interestingly, it appeared that observations related to momentum contradicted the observations made in developed markets. Momentum and value or size effects, seemed to eliminate rather than amplify each other. In other words, momentum seems to be stronger in low-value and large stocks and turns negative in high-value stocks and large caps. Similar synergy effects could be noticed in the case of size and momentum factors. A similar dependence is observed for the other studies. Hong, Stein and Lim (2000) and Fama and French (2012) observed that on developed markets, the momentum premium is stronger among small cap stocks. Additionally, Asness, Moskowitz and Pedersen (2013) noted the occurrence of a negative correlation between the value factor and momentum factor. For emerging markets, Cakici, Fabozzi and Tan (2012) demonstrated that the momentum premium is larger in the case of small cap stocks and decreases when the size is increased. They also confirmed the negative correlation between the value factor and momentum factor already observed by Asness, Moskowitz and Pedersen (2013) on developed markets.

In general, the above-described observations are confirmed by a statistical examination of double-sorted long/short portfolios (see *Table 6*). First of all, *S*+*M* portfolios revealed rather weak performance, delivering a negative CAPM alpha. Secondly, *V*+*M* portfolios performed relatively well; however, their performance is worse than in the case of a sole value factor. Alpha significance is also quite low. Finally, *V*+*S* portfolios yielded a superb annual rate of return at the level of 29.9% and delivered an annual CAPM alpha of 23.6%.

**Table 7  Bid-Ask Spreads (in %)**

| | Value portfolios | | | Size portfolios | | | Momentum | | |
|---|---|---|---|---|---|---|---|---|---|
| | EW | CW | LW | EW | CW | LW | EW | CW | LW |
| Low 30 | 4,18 | 1,00 | 0,86 | 10,89 | 10,74 | 6,41 | 7,38 | 2,26 | 1,35 |
| Mid 40 | 4,07 | 1,46 | 0,98 | 4,77 | 4,62 | 2,23 | 4,76 | 1,04 | 0,77 |
| High 30 | 9,38 | 2,55 | 2,04 | 1,81 | 0,91 | 0,71 | 5,32 | 1,27 | 0,89 |
| Market | 5,99 | 1,11 | 0,82 | 5,99 | 1,11 | 0,82 | 5,99 | 1,11 | 0,82 |

*Notes: Table 7* presents average bid-ask spreads for factor and market portfolios. The spreads are computed as $\frac{P_{ask} - P_{bid}}{P_{mid}}$, where $P_{ask}$, $P_{bid}$ and $P_{mid}$ denote consecutively the best available offer, the best available offer bid and the mid-prices at the time of portfolio formation. Portfolios are created based on BV/MV ("value"), company capitalization ("size") or the total price change in the year preceding portfolio formation ("momentum"). "EW", "CW" and "LW" denote equal-, capitalization- and liquidity-based weighting schemes, respectively. The liquidity-weghted portfolios are weighted according to the "volume" defined as stocks' time-series averaged daily trading volume in the month preceding portfolio formation multiplied by the stock price. The market portfolios in each case are built using the same methodology as the remaining portfolios, which means they are either equal, capitalization or liquidity-weghted.

All prices are converted to EUR.

*Source:* Bloomberg; the computations are based on listings of CEE companies during the period 12/20/2000–
–12/20/2013.

Initially, in order to verify whether factor premiums are resilient to trading costs, average spreads in various portfolios are computed, resulting resulted in a few interesting observations as presented in *Table 7*. First and foremost, the average spreads of equally weighted (EW) portfolios are significantly higher than the spreads of capitalization-weighted (CW) and liquidity-weighted (LW) portfolios, in accordance with expectations. In terms of the entire market portfolio, the EW is equal to 5.99% and in the case of LW it is more than sevenfold less, reaching 0.82%. The reason for this is very large spreads in the smallest stocks. The average spread is as high as 6.41% even in liquidity-weighted small-cap portfolios. Finally, in terms of momentum portfolios, spreads are generally wider in the case of low-momentum portfolios than in high-momentum portfolios. To summarize, the effects of spread variations in different groups of companies might result in a decrease in small-cap and value premiums, whereas they might increase in momentum stocks. The latter is particularly interesting as it contradicts all previous studies conducted in developed markets. For instance, Grundy and Martin (2001), Schill and Zhou (2004), and Hanna and Ready (2005) indicated that transaction costs might have a negative rather than positive impact on momentum profits.

*Table 8* presents the post-cost returns of various factor portfolios. Analysis of this table leads to a few interesting conclusions. First of all, transaction costs translated into a significant increase in the size premium. The difference between the performance of small caps and large caps also noticeably dropped. In fact, in the case of liquidity weighting it is almost entirely obliterated. In other words, it appeared that transaction costs are so high that they could not be compensated even by the size premium after considering liquidity. Finally, the results for momentum stocks are mixed and they do not bring any convincing evidence of a momentum premium.

**Table 8 Post-Cost Factor-Sorted Portfolios**

| | Equal-weighted portfolios | | | | Capitalization-weighted portfolios | | | | Liquidity-weighted portfolios | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Return | Volatility | Beta | Volume | Return | Volatility | Beta | Volume | Return | Volatility | Beta | Volume |
| *Value portfolios* | | | | | | | | | | | | |
| Low 30% | 0.8% | 46.6% | 0.86 | 782 | 0.2% | 33.2% | 0.84 | 8 551 | -2.5% | 32.2% | 0.71 | 12 616 |
| Mid 40% | 10.0% | 47.3% | 1.02 | 563 | 8.3% | 33.8% | 0.98 | 6 239 | 9.5% | 38.8% | 1.08 | 12 093 |
| High 30% | 18.1% | 46.9% | 1.10 | 254 | 17.1% | 31.7% | 0.93 | 1 934 | 13.9% | 44.4% | 1.18 | 2 983 |
| Market | 9.9% | 46.2% | 1.00 | 534 | 4.5% | 33.9% | 1.00 | 7 245 | 4.6% | 36.6% | 1.00 | 11 838 |
| *Size portfolios* | | | | | | | | | | | | |
| Low 30% | 13.0% | 54.6% | 1.39 | 34 | 8.5% | 52.5% | 1.41 | 36 | 6.9% | 51.6% | 1.16 | 144 |
| Mid 40% | 9.3% | 50.5% | 1.05 | 76 | 3.0% | 47.0% | 1.09 | 99 | -0.4% | 52.0% | 1.06 | 254 |
| High 30% | 5.5% | 36.2% | 0.55 | 1 629 | 4.4% | 33.6% | 0.99 | 7 615 | 4.6% | 36.4% | 0.99 | 12 610 |
| Market | 9.9% | 46.2% | 1.00 | 534 | 4.5% | 33.9% | 1.00 | 7 245 | 4.6% | 36.6% | 1.00 | 11 838 |
| *Momentum portfolios* | | | | | | | | | | | | |
| Low 30% | 9.0% | 49.7% | 1.08 | 271 | 2.2% | 42.6% | 1.12 | 1 949 | -8.8% | 52.3% | 1.08 | 3 093 |
| Mid 40% | 7.3% | 43.0% | 0.88 | 746 | 6.1% | 34.8% | 1.05 | 7 395 | 8.4% | 39.0% | 1.09 | 12 727 |
| High 30% | 12.0% | 51.6% | 1.07 | 511 | 3.1% | 44.0% | 1.12 | 5 373 | -1.1% | 47.4% | 0.97 | 8 145 |
| Market | 9.9% | 46.2% | 1.00 | 534 | 4.5% | 33.9% | 1.00 | 7 245 | 4.6% | 36.6% | 1.00 | 11 838 |

*Notes: Table 8* presents the post-cost return characteristics of factor portfolios. Portfolios are sorted according to BV/MV (“value”), company capitalization (“size”) or the total price change in the year preceding portfolio formation (“momentum”). “Return” is the average annual geometric rate of return, “volatility” is an annual standard deviation of log returns, “beta” is a regression coefficient calculated against a defined market portfolio and “volume” is the cross-sectional weighted average of single stocks’ time-series averaged daily trading volumes in the month preceding portfolio formation multiplied by the stock price. The liquidity-weghted portfolios are weighted according to the “volume” as defined above. The market portfolio in each case is built using the same methodology as the remaining portfolios, which means it is either equal-, capitalization- or liquidity-weighted.

All prices are converted to EUR.

*Source:* Bloomberg; the computations are based on listings of CEE companies during the period 12/20/2000–12/20/2013.

**Table 9 Post-Cost Factor- Mimicking Portfolios**

| | Value LS portfolios | | | Size LS portfolios | | | Momentum LS portfolios | | |
|---|---|---|---|---|---|---|---|---|---|
| | EW | CW | LW | EW | CW | LW | EW | CW | LW |
| Return | 10.0% | 16.1% | 17.6% | 8.3% | 5.5% | 3.6% | -18.5% | -4.7% | -8.0% |
| *t*-stat | *1.41* | *3.02* | *2.02* | *0.75* | *0.49* | *0.37* | *-1.17* | *-0.60* | *-0.45* |
| Volatility | 25.7% | 19.2% | 31.4% | 39.8% | 40.0% | 36.0% | 57.0% | 28.2% | 64.4% |
| | *CAPM model* | | | | | | | | |
| *β* | 0.23 | 0.19 | 0.43 | 0.51 | 0.36 | 0.15 | 0.06 | -0.03 | -0.27 |
| *t*-stat | *1.48* | *0.98* | *1.63* | *2.36* | *0.83* | *0.43* | *0.16* | *-0.10* | *-0.38* |
| *α* | 3.9% | 9.4% | 8.8% | 1.7% | -0.6% | -0.6% | -26.3% | -8.2% | -12.0% |
| *t*-stat | *0.54* | *1.64* | *1.00* | *0.17* | *-0.05* | *-0.05* | *-1.41* | *-0.88* | *-0.51* |

*Notes: Table 9* presents post-cost return characteristics of factor-mimicking portfolios. Portfolios are created based on BV/MV ("value"), company capitalization ("size") or the total price change in the year preceding portfolio formation ("momentum"). "Return" is the average annual geometric rate of return and "volatility" is an annual standard deviation of log returns. "EW", "CW" and "LW" denote equal-, capitalization- and liquidity-based weighting schemes, respectively. The liquidity-weighted portfolios are weighted according to the "volume" defined as stocks' time-series averaged daily trading volume in the month preceding portfolio formation multiplied by the stock price. *α* and *β* are model parameters computed according to the model's specification. The market portfolios in each case are built using the same methodology as the remaining portfolios, which means they are either equal, capitalization or liquidity-weighted.

If necessary, a 12-month bid for the EURIBOR rate is employed as a proxy for the risk-free rate. All prices and returns are converted to EUR.

*Source:* Bloomberg; the computations are based on listings of CEE companies during the period 12/20/2000–
–12/20/2013.

The examination of factor reflecting portfolios[9] (see *Table 9*) is generally consistent with the results presented in *Table 8*. The only factor delivering positive alphas is a value factor. Nonetheless, even in the case of the value factor, alphas are not statistically significant. In the meantime, size and momentum alphas turned out to be close to zero or even negative. In conclusion, transaction costs had a generally negative influence on returns to value, size and momentum. If combined with the impact of liquidity, only value survived. The remaining factors vanished.

## 4. Conclusions

In this paper, we confirm the presence of value and size factors and show that some of the investigated strategies may be combined to achieve superior risk-adjusted returns. Unfortunately, the observations presented in this research paper are only partly optimistic from an investor's viewpoint. It is discovered that the value premium is not illusionary, but real, and remains resilient to illiquidity and transaction costs. However, this does not prove true with regard to size and momentum factors, which do not survive a simultaneous negative impact of transaction costs and liquidity.

The findings result in lessons for investors, asset managers, fund pickers and corporate decision-makers. First, it seems sensible for portfolio managers to implement value strategies (or introduce value-based products, such as ETFs or index

[9] It is important to note that the MN portfolios are actually more costly than the standard portfolios of factor-sorted companies. The reason for this is that if positions are both initiated and unwound, the costs are borne twice: for the long and the short positions.

funds) in the CEE markets. On the other hand, pursuing the size strategies seems rational only with a transaction cost advantage over other market participants. Second, when evaluating the performance of portfolios of CEE stocks, either for investment decisions or for academic research, one should consider the influence of value and size effects. Ignoring their impact could seriously distort the results of the analysis. Finally, the corporate decision-makers in CEE could take into account the value and size factors when determining the cost of capital for budgeting decisions.

It should be highlighted that the research in question has two potential limitations of high importance. First, the relatively small sample in the early years may result in a small-sample bias. Secondly, the research period also covered the years of the global financial crisis, which may distort the findings in a way that is difficult to assess.

Further research on issues discussed in this paper could be pursued in several directions. First, this research builds a paradigm for future studies on pricing models and could be applicable to the CEE countries while simultaneously considering their specific features. Second, this study is limited, among others things, by the fact that interactions are tested solely with the use of the equal-weighting scheme. In any future research, interactions between factors should be analyzed with the use of various weighting schemes of the analyzed portfolios. Third, one of the drawbacks of the computations is the use of a relatively simple cost function and rather strong assumptions on portfolio turnover. On the one hand, it might be interesting to introduce a varied portfolio turnover, though the research results might be improved by using more sophisticated cost functions that consider market impact as in, for example, Glosten and Harris (1988), Breen, Hodrick and Korajczyk (2002) or Almgreen, Thun, Hauptmann and Li (2005). Finally, the most important issue for further investigation is probably the impact of liquidity on factor premiums. Such analysis should concentrate on the question of whether liquidity is the missing link that could entirely or at least partially explain the phenomena of value and size premiums in emerging markets.

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