An Anatomy of Central and Eastern European Equity Markets*

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July 2015

Abstract

This paper provides a comprehensive and detailed analysis of Central and Eastern European (CEE) equity markets from the mid-1990s until now. Using firm-level data and custom-made indices and indicators, we show that (1) there is considerable heterogeneity in the degree, dynamics, and determinants of market development across the different markets, (2) that especially the smaller markets still offer diversification benefits to global investors, and (3) that there are substantial premiums associated with investing in small, value, low volatility and illiquid CEE stocks.

JEL Classification: F0, F3, G0, G1, O1

Keywords: Central and Eastern Europe, Financial Integration, Equity Market Development, International Diversification, Correlation Dynamics, Cross-Sectional Strategies, Parametric Portfolio Choice

* The authors greatly benefited from discussions with seminar participants at Tilburg University and at the European Bank for Reconstruction and Development (EBRD), and particular with Frank de Jong and Laurens Swinkels.

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1 Introduction

Following a liberalization process in the late 80s and early 90s, emerging equity markets have become an integral part of global equity portfolios. Their properties have, not surprisingly, been studied in detail (see, e.g., Harvey (1995), Rouwenhorst (1999b) and more recently, Bekaert and Harvey (2014)). Much less is known about emerging markets in Eastern and Central Europe, which liberalized typically later, following the fall of the Iron Curtain in 1990 and subsequent liberalization and privatization waves in a number of these countries. Previous papers typically analyze only the largest markets (Russia, Hungary, Poland, Czech Republic), mainly because commercial indices (e.g., MSCI, Datastream, and S&P 500) are only available over a sufficient time span for these particular markets (see Chelley-Steeley (2005), Schotman and Zalewska (2006), Gilmore et al. (2008), Savva and Aslanidis (2010), Caporale and Spagnolo (2011), Syllignakis and Kouretas (2011), and Gjika and Horvath (2012) amongst others). In this article, we provide a comprehensive and detailed overview of Central and Eastern European (CEE) equity markets from the mid-1990s on until now and evaluate the value of investing in these markets for global investors.

With the aim of having comparable indices for longer time spans and a larger cross-section of equity markets, we build our own indices based on a sample of more than 2,000 individual stocks from 14 CEE equity markets. These stocks pass a series of inclusion tests on data availability and liquidity. After careful checks of the return data, we construct tailor-made value-weighted indices that target about 85% of the total market capitalization as well as weekly returns in excess of the 3-month T-bill rate, both at the country and aggregate CEE level.

For nearly all countries, our self-constructed indices start (often substantially) before the earliest starting date of the commercial indices. Looking at overlapping periods, we observe considerable differences between our tailor-made indices and all of the commercial ones. We find correlations of our indices with the commercial ones to be substantially below 1, especially for the smaller equity markets. Quite strikingly, we find equally low correlations among the different commercial indices. We show that differences between our and commercial indices are not driven by using market rather than free-float adjusted weights.

Next, we characterize and evaluate equity market development in the various CEE markets. Considerable cross-sectional differences exist in the level of market development, as measured by market capitalization over GDP, liquidity proxies, and concentration indices. Russia, Turkey, and Hungary are the most developed markets, while Kazakhstan, Latvia, and the Slovak Republic are the least developed ones. We also examine which economic, financial and institutional factors determine market development, finding that market specific laws and reforms, in particular, the implementation of insider trading laws, as well as liberalization, affect market development overall, while institutional and political reforms as well as economic and financial openness foster equity market development within a country.

The CEE markets are sufficiently developed to provide another avenue for the diversification of global equity portfolios. We therefore examine how their correlations relative to the world market and other emerging markets have evolved over time. We generally find, as is true for emerging markets more generally, an upward trend in correlations which is due to both increasing global market exposures and a reduction in country-specific risks. Especially the larger, more developed equity markets, have correlations with developed markets of nearly 80%, and hence offer little diversification potential. Many of the smaller markets, typically categorized as frontier markets, have correlations below 50%, and do offer scope for diversification. Increasing benchmark betas are a stronger source of increasing correlations for those markets than are decreasing country-specific volatilities. Based on the model by Heston and Rouwenhorst (1994), we show that despite increasing industry effects, country factors still dominate in CEE markets, suggesting that country diversification is still valuable. When exploring the cross-section of correlation dynamics, we find cross-listed, large, and liquid stocks to have higher benchmark correlations and betas. We do observe, however, a catching-up effect of especially the "home-only" and small stocks over the final 10 years of our sample.

We also verify whether the CEE equity markets exhibit various cross-sectional properties of individual returns, documented for developed markets (Hou et al. (2014)) and emerging markets (see Rouwenhorst (1999a)). We confirm the presence of a size, value, low volatility, and (il)liquidity effect in CEE markets, but do not find evidence for a momentum or a low beta effect. These results continue to hold when we take free-float adjustments into consideration. We show how these premiums can be jointly exploited using the parametric portfolio policy methodology of Brandt et al. (2009) that decomposes portfolio weights into a benchmark weight and an active component that over- or underweights stocks based on their characteristics. The optimal strategy that accounts for short-sale constraints has a bias towards small firms, value firms and past winners (positive momentum). We find the size effect to dominate the value effect, which in turn dominates the momentum effect. When we add volatility, illiquidity, and local beta as additional characteristics, the optimized portfolio is tilted towards low volatility and less liquid stocks and, surprisingly, towards high, not low, beta stocks. The optimized portfolio with three characteristics has an annualized alpha with respect to CEE benchmark index of 13.9% (but also a relatively low beta and volatility). The alpha increases with an additional 2% when all 6 characteristics are taken into account.

The paper is structured as follows. Section 2 offers a detailed description of equity indices we construct and analyzes main properties relative to existing commercial indices. Section 3 explores market development and liquidity indicators over time. Section 4 analyzes time-varying co-movements and correlations, while Section 5 focuses on the cross-section of expected returns. Section 6 concludes.

2 Data Description

2.1 Data Sources and Stock Selection

Our indices and market statistics are based on firm level data for 16 equity markets, namely Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, Poland, Romania, Russia, Serbia, the Slovak Republic, Slovenia, Turkey, and Ukraine. From Datastream, we download data for all stocks (including American Depositary Receipts and Global Depositary Receipts) associated with any of the 16 country codes, yielding a total of 8,686 stocks over the period January 1990 up to May 2011. To avoid a look-ahead bias, we also include dead or suspended stocks.[1] For each stock, we download

[1] For delisted and dead stocks, we put all data after the exact delisting or bankruptcy date to missing. If such a date is not given, we take the last observation after which no change in the return index in local currency appeared any more as the delisting or bankruptcy date and again set all values after that date to

at the daily frequency the price and return index, both in local currency and in US dollars, volume (total number of traded shares), market capitalization, both in local currency and in US dollars, and the industry code.

We apply the following filters to the raw data. First, we eliminate all stocks that have no data. This rather drastically reduces our sample from 8,686 to 5,356 stocks. Second, we require a stock to be sufficiently liquid. As for many firms the data on trading volume is often missing or not reliable, we use the percentage of daily zero price returns in local currency within a year to eliminate illiquid stocks (see, e.g., Lesmond et al. (1999) and Lesmond (2005)). We consider a stock to be sufficiently liquid if in 25 percent of all trading days within the last year the daily price return in local currency was different from zero.[2] Bekaert et al. (2007) show that this measure is highly correlated with more common (high-frequency) liquidity measures. We include a firm in our sample if it meets our liquidity criterion for at least one year over the full sample. The liquidity criterion reduces the sample further from 5,356 to 2,510 stocks. Third, we removed all preferred shares from our sample as they clearly showed bond rather than equity-like properties.[3] In a last step, we compare the liquidity of cross-listed stocks, ADRs, and GDRs with the respective home stock for each year by calculating the percentage of non-zero price returns in local currency. When the foreign listing is more liquid, we use its price and total returns instead of the local data.[4] In many CEE markets, with Russia as an important example, trading is much more active in the foreign listed stocks. Our volume data count both the volume in the home and foreign market(s) (in US dollars). Our final sample consists of 2,131 stocks. Notice that we do not have a specific size threshold, as we see no ex-ante reason to exclude small stocks. Of course, many of the illiquid stocks also tend to be small.

Table 1 shows the composition of local common, local preferred and foreign stocks

missing. If the return index did not change for more than a year before the delisting or bankruptcy date, we take the last date on which a change in the return index appeared as the delisting or bankruptcy date.

[2]For Bulgaria and the Slovak Republic we use 24 percent of all trading days as it significantly changes the number of liquid stocks and the starting date.

[3]To decide whether a preferred stock is bond or equity like, we calculate the ratio of the variance of the common stock over the variance of the preferred stock. If that ratio is lower than 1.2, signaling that the volatility of the preferred stock is of about the same magnitude as that of the common stock, we conclude that it is equity like, and include it in our sample. If instead the ratio is higher than 1.2, signaling that the volatility of the common stock is much higher than that of the preferred stock, we categorize the preferred stock as bond-like, and exclude it from the sample.

[4]Some foreign stocks do not have a home stock but are still included in our sample if they meet the liquidity criterion.

(cross-listed, ADR, GDR) for the total sample and for the liquid sample, distinguishing between active and dead stocks. As many stocks in CEE markets are highly illiquid, the total number of stocks dramatically reduces to often less than half of the total sample of stocks for the liquid sample. The number of selected stocks differs greatly between countries, ranging from 8 for Kazakhstan and 14 for the Slovak Republic to 397 for Turkey and 475 for Poland. While in most countries the number of foreign stocks is small, we observe many cross-listed stocks in Poland (20), Estonia (25), the Czech Republic (37), Turkey (57), Hungary (66), and Russia (167) corresponding to respectively 4%, 47%, 17%, 13%, 47%, 33% of the total number of liquid stocks. We analyze these cross-listed stocks in more detail in Section 4.4.

The last two columns of Table 1 show the average firm and market size in millions of US dollars in 2010. The average firm market capitalization is calculated as the average market capitalization across selected firms per day and across time. The average total market capitalization stands for the total market capitalization of the selected firms per day and across time. While the Czech Republic, Russia, and Kazakhstan have the largest firms on average ($6.2bil, $4.3bil, and $2.7bil), not surprisingly Russia, Turkey and Poland represent the largest markets in the region with market capitalizations well over $100 billion.

2.2 Index Construction

Based on this sample of firms, we construct our own daily country indices. We update the composition of the index on a yearly basis (first trading day of the calendar year). For a firm to be included in the index, it needs to be active and have passed the liquidity criterion on January 1. Using returns including dividends and market capitalization in U.S. dollars, we construct value-weighted and equally-weighted indices with an objective of meeting 99%, 85% or 70% of total market capitalization.[5] For a given country, we only start constructing indices from the moment that there are at least three liquid stocks (MSCI follows a similar procedure for emerging markets, see MSCI (2011)). Finally, before constructing our indices, we check for extreme daily returns, defined as an absolute return larger than 200 percent. As a first step, we try to confirm the extreme return from alternative sources, such as

[5] In practice, it is not possible to achieve the size-based segments exactly. Therefore, we introduce market capitalization size ranges of 70% $\pm$ 5%, 85% $\pm$ 5%, and 99% + 1% or -0.5%, similar to S&P's methodology (MSCI (2011)).

Bloomberg, Yahoo Finance, the local stock exchange or the website of the firm (see, e.g., de Groot et al. (2012)). If we cannot confirm the extreme return, we replace it by the value that is most frequently reported across the different providers. In most cases, this happens to be the lowest absolute return across the different sources.[6]

2.3 Preliminary Return Analysis

Table 2 reports summary statistics for the weekly excess returns (including dividends) of our tailor-made value-weighted index, both at the country and aggregate CEE level, as well as benchmark returns from MSCI CEE, Emerging Markets, and Frontier Markets for an overlapping sample period between January 2002 and May 2011. For the Ukraine and MSCI frontier markets, the actual starting date is later than 2002, and Kazakhstan and Serbia are excluded due to their short time series. As is common for commercial indices, we focus on an index that targets about 85 percent of total market capitalization.[7] Weekly returns are based on daily index values observed on Wednesdays. All returns are in US dollars and in excess of the 3-month T-bill rate.

The first column shows the starting month and year of our indices. We observe the longest time series for Turkey (as from 01-91), Hungary (as from 01-92) and Poland (01-93). Except for Ukraine (as of 01-06), all countries have at least 11 years of daily returns. Annualized returns vary widely across markets but are mostly above 10% except for Latvia, Ukraine, and MSCI Frontier Markets which can be explained by the shorter sample periods of the latter two. The annualized value-weighted returns range between 7% for Ukraine to 44% for Bulgaria, and their standard deviations from 24% for Slovenia to 41% for Turkey. Returns exhibit on average slightly negative skewness, substantial excess kurtosis, but relatively low autocorrelation. Compared to the MSCI Emerging Market and Frontier Market indices, most CEE countries have higher means and standard deviations, while other statistics are relatively similar.

In the last column, we conduct a variance ratio test of the null that the variance of monthly returns (4 weeks) over the variance of weekly returns is equal to 1 or put

[6]We removed another 6 stocks (4 from Russia, and 1 each from Slovenia and Ukraine) because they had too many outliers. Because the weight of each of the removed stocks in the total market capitalization is (much) smaller than 0.1 percent, index values are not affected.

[7]Results for other thresholds (70%, 99%) as well as for equally rather than value-weight indices (70%, 85%, 90%) are available upon request.

differently a test of standard random walk null. Following Campbell et al. (1997), the q-period variance ratio test statistics is defined as $VR(q) \equiv \frac{Var[r_t(q)]}{qVar[r_t]}$, where $r_t(q) = r_t + r_{t-1} + ... + r_{t-q}$. The distribution of the test statistic uses a heteroskedasticity consistent asymptotic variance matrix. In our application, we set q equal to 4 (weeks). We reject the null in only 6 cases, with the rejections being at the 1% significance level for Bulgaria, Estonia, and the MSCI Frontier market index. The ratio is above one for all but one country, indicating positive return autocorrelations.

2.4 Comparison with Commercial Indices

Table 3 provides a comparison of our tailor-made indices to alternative benchmark indices for overlapping time periods. We consider MSCI, Datastream and S&P as benchmark providers. For each country, we report the starting dates of the benchmark index, the slope coefficient β from a regression of our index returns on the benchmark index returns and pairwise correlations. In the row below, we report p-values from tests of the hypothesis that betas and correlations, respectively, are equal to one. The correlation (ρ) test uses the Fisher transformation [$z = (1/2)\ln((1+\rho)/(1-\rho))$] for which the asymptotic standard error is $1/\sqrt{T-3}$.[8] The final columns report correlations between the returns on the alternative benchmark indices, and the corresponding p-values of a test that they are equal to one. All statistics are based on total weekly dollar returns in excess of the 3-month T-Bill rate.

A first striking observation from Table 3 is that there is wide dispersion in starting dates. There is no provider that systematically has the longest time series, even though for most countries S&P is among the first to report an index. While S&P and MSCI have indices for nearly all countries (MSCI misses Latvia and Slovakia), country representation is more limited for Datastream (no indices for Croatia, Slovakia, Ukraine, and the 3 Baltic states). Our self-constructed indices have in the majority of cases a starting date that is at least as early as the earliest commercial index. The exception are the S&P indices starting (several) years earlier for Bulgaria (6 years), Lithuania (3 years), Slovakia (4 years), and Ukraine (8 years). The later starting dates of our indices for these countries reflects our requirement of at least 3 sufficiently liquid stocks at a daily frequency before starting the index.

[8] Since for the null $\rho = 1$ the Fisher transformation is not valid, we use $\rho = 1 \approx 0.99$ as an approximation.

Second, the betas and correlations of our index with the alternative benchmark indices are not always close to 1 and not necessarily close to one another. For larger countries such as the Czech Republic, Hungary, Poland, Romania, Russia and Turkey the betas and correlations are mostly above 0.9. For smaller countries such as the Slovak Republic and the Ukraine, however, the betas and correlations are between 0.14 and 0.20. We overwhelmingly reject that betas are equal to 1. For the larger countries such as Czech Republic, Hungary, Poland, Romania, Russia and Slovenia, we cannot reject that betas are equal to 1 for the correlation of our tailor-made indices and the Datastream indices (sometimes also for the MSCI indices). For correlations, the test also overwhelmingly rejects that correlations are equal to 1, except for the correlation of Romania's tailor-made index with the corresponding Datastream index. On average, betas (correlations) range from 0.61 (0.63) for the S&P to 0.92 (0.90) for Datastream across countries. Note that the country coverage plays a role here as well, as it is widest for the S&P and weakest for Datastream. At the regional level, when we compare our tailor-made CEE index to alternative benchmark indices, betas and correlations range from 0.91 to 1.10.

Third, moving to the next set of columns, the correlations among the alternative benchmark indices are reasonably close for the large countries, but can be quite low for other markets, e.g. less than 75% for Bulgaria, Estonia, Romania, Slovenia, and the Ukraine. Thus, similar differences prevail among benchmark providers. Interestingly, we overwhelmingly reject that correlations among different providers are equal to 1, except for the correlation of the Datastream and S&P index for Turkey.

Several elements of index construction can cause differences between the different commercial indices and our own, including selection criteria regarding size and liquidity, the handling of cross-listings and free float, and the reviewing period to include or exclude stocks. In terms of size criteria, we do not impose minimum market capitalization requirements, whereas all the other indices do. For example, stocks must have a float-adjusted market capitalization above US$ 1 billion as of the rebalancing reference date for Standard & Poor's (Standard & Poor's (2012)), meaning that only larger companies are included in the index. In terms of liquidity, we require that stocks must have had non-zero price returns for at least 25% of all trading days. MSCI relies on the percentage of annual value traded ratios (trading value over free float-adjusted market capitalization) over the past 3 and 12 months, while S&P requires stocks to have a 3-month average daily value traded above US$ 2 million as of the rebalancing date of the index.

When it comes to cross-listings, we replace home stocks with the most liquid ADRs, GDRs or direct cross-listings which is similar to the MSCI and S&P methodologies. Datastream ignores factors such as liquidity and cross-listings overall. With respect to exposure, we try to represent 85% of the total market capitalization which is similar to MSCI. S&P aims at a 80% market capitalization representation, while Datastream targets only 75% to 80% of the market. Reviewing periods vary from quarterly for the MSCI and Datastream indices to annual for our and the S&P indices. Most importantly, there are considerable differences in free-float adjustments. While Datastream and our index do not adjust for free-float, attempting to represent the full economic value of a market, MSCI and S&P instead adjust their indices for free float. In particular, MSCI only includes stocks that have a free-float adjusted market capitalization equal or above 50% of the minimum size requirement, while S&P simply uses free-float adjusted market capitalizations and excludes stocks closely held by "strategic control" shareholders, other publicly traded companies and government agencies (Datastream (2008); MSCI (2011); Standard & Poor's (2012)).

Because government agencies still play a relatively large role in Central and Eastern European markets, the free float adjustment is perhaps the most important source of index differences and we investigate it in more detail. To this end, we build free-float adjusted indices and compare them to our proposed index as well as to alternative benchmark indices. Unfortunately, the information on free-float often becomes available much later than the original trading dates of stocks. In addition, on average, only 70% of stocks have data on free-float, ranging from 40% for Bulgaria up to 97% for Estonia (see Table 2). Nevertheless, we create two float adjusted indices from our data. The first uses only stocks for which the free-float adjusted information is available, but weights them using their full market capitalizations and we indicate it by FF1. The second index, denoted FF2, uses these stocks weighted by their actual float-adjusted market capitalizations. In Table 4, we characterize the differences between the original tailor made index (Original), its float-adjusted versions (FF1 and FF2) and the benchmark indices, by computing annualized tracking errors between various combinations of indices for overlapping time periods. The first set of columns compares the different versions of our tailor-made indices. The second set of columns report tracking errors of our original index relative to the benchmark indices from MSCI, Datastream, and S&P. The third set of columns replaces our original index by FF2, and the fourth set shows relative tracking errors among the currently available benchmark indices.

In the first set of columns, the first column suggests that focusing on the typically larger stocks for which a float adjustment can always be computed gives rise to sometimes substantial tracking errors. However, for the overall index, the tracking error is only 2.14%. Comparing the first with the second column reveals that implementing the actual float adjustments on the weights always increases the tracking error, on average by about 4%. The index tracking error is now 6%. The FF1/FF2 column measures a pure float adjustment effect as stock coverage is identical. For most countries, float adjustment (column 3) produces larger tracking errors than the use of different stocks in the sample. The index has a tracking error of 5.6%.

The second set of columns shows that the tracking error of our CEE index is 7.14% with respect to the MSCI index, 9.56% with respect to the Datastream index and a quite large 17.19% relative to the S&P. The tracking errors for individual countries are often much larger still. To help interpret these numbers, the fourth set of columns looks at the relative tracking errors among the available benchmark indices, showing them to be of similar magnitude.

Nevertheless, the float adjustment is clearly not the main reason for the differences we observe between our indices and the available benchmark indices. Comparing the results in the second set of columns (original index versus benchmarks) with those in the third set of columns (float-adjusted indices versus benchmarks), the tracking error is larger for the float-adjusted indices than it is for our original index in at least 50% of the countries. It is substantially larger for the regional CEE index.

We conclude that different indices show sometimes large tracking errors, but that the tracking error of our index relative to the current benchmarks is not driven by float adjustment. We therefore opt to use non-float adjusted indices, which have longer and broader market coverage.

3 Market Development and Liquidity Indicators

This Section characterizes the market development in each of the 16 CEE equity markets by tracking the evolution of 5 key indicators. Our first measure, the ratio of total market capitalization over GDP, tracks the overall size of the equity market relative to the real economy. Measures (2) and (3), namely equity market turnover and the average percentage of non-zero daily returns, both track the evolution of market liquidity. Amihud and Mendelson (1986) show that turnover, calculated as the ratio of total dollar trading volume per year over the end-of-year market capitalization, is negatively related to illiquidity costs. Our preferred liquidity measure, however, is the average percentage of non-zero daily returns, calculated as the yearly average of the value-weighted share of non-zero daily price returns (in local currency). The main advantage of this measure is that it does not require detailed transaction data (such as bid-ask spreads), typically not widely available in emerging markets (see Bekaert et al. (2007) for a detailed discussion). Our last measures track concentration at the firm and industry level, measured using a Herfindahl (HHI) index and the share of the largest 3 firms (industries) (C3). We expect concentration to decrease as markets become more developed. Section 3.1 discusses the state of market development at the end of our sample in 2010. In Section 3.2, we perform panel regressions to better understand the cross-country determinants of market development over time.

3.1 Market Development in 2010

Table 5 reports the 2010 values for the different market development indicators for our 16 CEE markets. Where available, we provide comparable statistics for two large developed markets, namely Germany and the US. We also indicate whether each market is frontier or emerging according to the MSCI classification.

The first column of Table 5 shows that the majority of countries (and in particular frontier markets) have a ratio of market capitalization over GDP below 15 percent, which is far below levels observed in the US (118%) or Germany (43.3%). Exceptions include Russia (58.8%), Turkey (38.6%), Poland (30%) and Hungary and the Czech Republic (both around 20%). Markets with the highest level of market capitalization over GDP also tend to have the largest turnover ratios (column 2). Except for Turkey (136.8%), Hungary (107.3%) and Russia (81.3%), all markets have turnover ratios below 50%, which is considerably lower than in Germany (114%) and the US (176%). Half of our countries even have turnover ratios below 10%. The percentage of non-zero returns (column 3) is more than 90% in the Czech Republic, Hungary, Russia, and Croatia and never drops below 60%, in part because our firms satisfy a liquidity criterion, calculated using this measure. The concentration indicators imply that most markets are highly concentrated, both at the industry and the firm level and more concentrated than are Germany and the US. Countries that have relatively low industry concentration indices using the Herfindahl index include Slovenia, Bulgaria and Hungary, with Lithuania, and Poland joining Slovenia among the three least concentrated markets using the C3 index. Because the ranking based on the HHI versus C3 indices is quite similar, we use the HHI indices going forward.

To rank the different countries according to their level of market development, we follow an ordinal approach. First, we rank indicators that increase with development (market cap/GDP, turnover, percentage zero returns) from low to high, and those that decrease with development (the Herfindahl indices both at the industry and firm level) from high to low. Second, we replace each country-indicator observation by the country's rank number for that specific indicator. Third, we calculate a joint market-development indicator by taking the average across the different indicator ranks. The country with the highest indicator value gets rank 1, the one with the lowest 16. The second to last column of Table 5 reports the resulting rank. The top-3 countries are Russia, Turkey, and Hungary, respectively. Slovenia (5) is the highest ranked frontier market, followed by Lithuania (6) and Ukraine (8). The bottom three countries are Kazakhstan, Latvia, and the Slovak Republic.

Overall, it seems that there is great variety in development across Central and Eastern European markets with large markets such as Russia and Turkey catching up with developed markets and small markets such as Kazakhstan, Latvia, and the Slovak Republic being just at the beginning of the development process. To better understand equity market development over time we performed trend and structural break tests on each of the 5 market development indicators.[9] While both trend and break tests reveal improv-

[9]In particular, we employ the linear time trend test by Bunzel and Vogelsang (2005) based on a simple time series model: $y_t = \beta_1 + \beta_2 t + u_t$, where y_t stands for the variable of interest and t for the linear time trend. We test for the null hypothesis of $\beta_2 = 0$ and use a Daniell kernel to estimate the error terms in

ing market development indicators in most countries, the effects are mostly statistically insignificant and small in economic magnitude, and are therefore relegated to the online Appendix.

3.2 Drivers of Market Development

During the sample period, many countries undertook various reforms such as stock market liberalization or introduction of insider trading laws with implementation dates somewhat clustered but far from perfectly correlated across countries. Moreover, the reform process is not complete yet along some dimensions and for some countries, making it informative to know which reforms are associated with stock market development. We therefore relate our market development indicators to: (i) institutional and political reforms measured by the EBRD Transition Indicator that assesses progress in transition based on a set of transition indicators, the Political Constraint Index, a political risk measure based on Henisz (2002), which increases when political actors face more vetos, and thus more political constraints, enacting policy changes which leads to less political risk, and the EU accession announcement year (EU Accession), (ii) capital controls and liberalization measures that include the intensity of capital controls indicator of Chinn and Ito (2006) and Chinn and Ito (2008) (Financial Openness), dummies for the official liberalization year (Official Liberalization) and for the first sign of liberalization year (First Sign of Liberalization) from Bekaert et al. (2005), (iii) market specific laws and reforms that include dummies for the year of the first insider trading prosecution (Insider Trading Law) based on Bhattacharya and Daouk (2002) and for the year of the introduction of an electronic trading system (Electronic Trading System) based on Jain (2005), as well as (iv) an economic openness measure calculated as the ratio of imports plus exports over GDP (Trade Openness). Because equity market development is also likely influenced by the state and development of the local real economy, we also include as controls the annual growth in GDP per capita ($\triangle$GDP per Capita) and the GDP deflator ($\triangle$GDP Deflator) as a measure of inflation. To the extent that the different indicators needed updating, we did so by applying the same definitions as in the original sources to hand-collected data from the websites of the

order to maximize the power of the test in small samples. We report detailed estimation results in Table 2 of the online appendix.

National Stock Exchanges. Appendix A describes the various measures in more detail. We expect all explanatory variables to have a positive impact on the MCAP/GDP and liquidity indicators, but a negative effect on the firm and industry concentration measures.

Panel A of Table 6 reports estimation results from a multivariate panel regression of each of the 5 yearly market development statistics on the different determinants and controls over the period 1990-2011, both without (left panel) and with (right panel) country fixed effects. While the model without fixed effects tells us which factors determine market development on average, the model with fixed effects captures factors that determine market development within a country over time. To control for possible dependence of residuals within a country, we cluster at the country level (see, e.g., Angrist and Pischke (2009); Cameron and Trivedi (2005)). However, when there are few clusters, in our case 16 country clusters, and few observations within a cluster, clustered standard errors might be biased (see, e.g., Wooldridge (2003), Cameron et al. (2008), Cameron and Miller (2013)). So, we also briefly comment on what happens when we simply use heteroskedasticity adjusted standard errors.

When no fixed effects are included, the only measure that seems to systematically foster development is the dummy for the first prosecution of insider trading, leading to higher levels of liquidity (in terms percentage of non-zero returns) and lower sector concentration. The 'Political Constraints Index' and 'First Sign of Liberalization' dummy are significantly negatively related to sector concentration and the former negatively to the turnover ratio. Surprisingly, economic openness is associated with higher industry concentration. An explanation might be that in developing countries only few specific industries are engaged in international transactions and trade. When we instead focus on the results with fixed effects (RHS panel), i.e., on the variation within each country across time, we find the ratio of MCAP/GDP to be increasing with economic openness and a reduction in political risks (a higher political constraint index). Market liquidity improves with the EBRD transition index and following official liberalization (but actually decreases following first signs of liberalizations and with a higher political constraint index). Both sector and firm concentration decrease with the EBRD transition indicator and following first signs of liberalization. In unreported results, we also experiment with simple heteroskedasticity adjusted standard errors. The significance of most of the determinants improves and we additionally find the prosecution of insider trading and the implementation of an electronic trading system to positively affect MCAP/GDP and the former to also improve market liquidity.

Given our relatively short sample and many explanatory variables of which at least some are likely to be highly correlated, it should not come as a surprise that many market development determinants enter the regression insignificantly. To come to a more parsimonious model, we use model reduction techniques inspired by Hendry and Krolzig (2001)'s PCGets ("general-to-specific") methodology. For each market development indicator, we start by running a multivariate regression including all determinants of market development. Subsequently, we remove all insignificant regressors with a p-value above 10% if a joint F-test of the coefficients being equal to zero is insignificant at the 10% level. In case the test is significant, we only remove the regressor with the lowest absolute t-statistic and run a new model without this regressor. We repeat all previous steps until we are left with only significant regressors.

Panel B of Table 6 reports estimation results for the reduced models, again both without (left panel) and with (right panel) country fixed effects. We report standard errors clustered at country level between brackets. Overall, we find that the market development indicators that were significant in the full model are also present in the reduced model. We do observe small changes in the estimates' magnitude and often increased significance. Rather than simply repeating the conclusions from the full model, we focus here on the economic magnitude of the estimates for the specifications with country-fixed effects. For most regressions, it is also the case that using the alternative standard errors produces virtually identical results. This is not surprising as country fixed effects may adequately account for within country correlation. As shown in the first column of the RHS of Panel B of Table 6, the MCAP/GDP is significantly positively related to economic openness, the political constraint index, the intensity of capital controls and first signs of liberalization. With respective standard deviations of 0.347 and 0.154, a one standard deviation increase in economic openness or a reduction in political risk (an increase in the political constraints index) separately lead to more than a 5.5 percentage points increase in MCAP/GDP (0.347×0.162 and 0.154×0.371). Similarly, following a one standard deviation increase in capital openness (1.448), we observe an increase of about 4.2 percentage points (1.448×0.029) in the MCAP/GDP and a 5.2 percentage points increase following a first sign of liberalization. Given an average MCAP/GDP of 16 percent, the effects are economically meaningful. The percentage of nonzero return is on average 80 percent but increases with about 8 percentage points (0.305×0.265) following a one-standard deviation increase in the EBRD transition indicator, and with 4.5 percentage points following an official liberalization. For firm and industry concentration, the EBRD transition indicator and the first sign of liberalization dummy have both a highly significant effect. A one standard deviation increase in the EBRD transition indicator (0.305) is associated with a 9 and 13 percentage points reduction in firm and industry concentration, respectively. Relative to mean values of 20 percent for firm concentration and 30 percent for industry concentration, these effects are highly economically significant. A first sign of liberalization has an even more pronounced economic effect on concentration measures, reducing firm and industry concentration by 17 and 25 percentage points, respectively. Finally and unexpectedly, the prosecution of insider trading increases (with 23.6 percent) rather than decreases firm concentration. In the case of turnover, we only find lower political risks to be associated with lower turnover. Overall, mostly the EBRD transition indicator and first signs of insider trading law seem to foster development within a country. Across countries, again, first sign of liberalization but also the prosecution of insider trading law are highly responsible for market development (see LHS of Panel B of Table 6).

4 The Diversification Benefits of CEE Equity Markets

In the early 90s, the emerging markets of primarily Latin America and South-East Asia were touted as the ideal investment, offering growth potential and great diversification benefits through the very low correlations they exhibited with developed markets (see, e.g., Harvey (1995)). Over the last two decades correlations between emerging markets and developed markets have greatly increased and their diversification benefits are much in doubt (see Bekaert and Harvey (2014), Christoffersen et al. (2012)). However, the CEE markets liberalized later and still showed relatively weak integration with world markets before the recent global financial crisis (see Bekaert et al. (2014)). Hence, they may still offer significant diversification potential. To examine this formally, we explore correlation dynamics, international hurdle rates and the importance of industry and country factors.

4.1 Correlation Dynamics

To consider correlation dynamics, we define 4 different benchmarks, the World market index, an overall European market index, the emerging market index and the Russian index, all from MSCI. The latter benchmark can reveal whether there is strong regional integration within Central and Eastern Europe. Table 7 tests for an upward trend in the quarterly non-overlapping return correlation, computed with weekly returns, of each of the CEE markets with the various benchmarks and confirms that correlations with respect to all benchmarks have substantially increased over time.[10] In nearly all countries, we find a significant upward trend in correlations with benchmark index returns. Exceptions include Croatia and the Slovak Republic (with respect to all benchmarks), Romania and Ukraine (with respect to Emerging markets and Russia) and Slovenia (with respect to Russia only). A sub-sample analysis reveals that correlations mainly moved upwards from 2007 onwards. The increase is even higher for the aggregate CEE index than at the individual country level, growing from levels below 30% in the 97-02 sub-period to more than 80% (70%) with respect to global and European index returns. Correlations with respect to Emerging Markets and Russian index returns started at slightly higher levels (42% and 47%, respectively), and reach near unity (89% and 95%, respectively) towards the end of our sample. While the average full sample correlations are lower for frontier than for emerging markets, the upward trend is more pronounced for frontier markets.

It is well-known that correlations show substantial time variation and are sensitive to volatility changes, making them temporarily higher in any crisis (see, e.g., Ang and Bekaert (2002)). Figure 1 plots a 4 quarter moving average of the benchmark quarterly correlations for the aggregate CEE index as well as for the median benchmark correlations across the individual CEE countries.

The patterns for the World, European and Emerging benchmarks are quite similar. While correlations inched up before 2003 already, correlations primarily showed large tem-

[10] In particular, we employ the linear time trend test by Bunzel and Vogelsang (2005) based on a simple time series model: $y_t = \beta_1 + \beta_2 t + u_t$, where y_t stands for the variable of interest and t for the linear time trend. We test for the null hypothesis of $\beta_2 = 0$ and use a Daniell kernel to estimate the standard errors in order to maximize the power of the test in small samples.

poral swings. From 2003 onwards a clear upward trend is visible. Currently, correlations are over 80%, which is not too different from the correlation between the emerging market index and world market returns. If these correlation increases are largely permanent, then CEE markets have lost their diversification potential just as emerging markets more generally have. However, looking at the (unreported) top and bottom quartile of benchmark correlations across all CEE markets shows that the bottom quartile remains below 50% even towards the end of our sample, suggesting that considerable diversification benefits remain at the individual country level. As for the correlations with the Russian benchmark, only the median country correlations are of interest, because Russia is the main component of the CEE index. Correlations with Russia decreased in the aftermath of the Russian crisis in 1998 and only started to trend up from 2005 onwards.

To help interpret the increase in correlations and to assess whether it is likely to be permanent or temporary, we decompose the correlation of a CEE market i with a benchmark b into three main components: the market's beta with respect to the benchmark ($\beta^b_{i,t}$), the benchmark's return volatility ($\sigma^2_{b,t}$), as well as country-specific ('idiosyncratic') volatility ($\sigma^2_{i,t}$) (see also Bekaert et al. (2009)). Consider the following one factor model:

$$r_{i,t} = \alpha_i + \beta^b_{i,t} r_{b,t} + \varepsilon_{i,t}, \tag{4.1}$$

with $r_{i,t}$ and $r_{b,t}$ the returns on CEE market i and on the benchmark index, respectively, and $\varepsilon_{i,t}$ a country-specific shock. The model-implied correlation is then simply derived as:

$$\rho^b_{i,t} = \frac{\beta^b_{i,t}\sigma^2_{b,t}}{\sqrt{\left(\left(\beta^b_{i,t}\right)^2 \sigma^2_{b,t} + \sigma^2_{i,t}\right)\sigma^2_{b,t}}} = \frac{\beta^b_{i,t}\sigma_{b,t}}{\sqrt{\left(\left(\beta^b_{i,t}\right)^2 \sigma^2_{b,t} + \sigma^2_{i,t}\right)}} \tag{4.2}$$

This illustrates that the increase in correlations can result from (a combination of) increasing benchmark betas, an increase in the benchmark's volatility, or a reduction in country-specific risk. The high levels of volatility in developed markets since the start of the global financial crisis may therefore partly explain the high levels of correlations towards the end of the sample. Alternatively, further market development and integration may have pushed up market betas (see, e.g., Bekaert and Harvey (1997), Ng (2000), or Baele (2005)) and, at the same time, reduced country-specific risk (see Baele and Inghelbrecht (2010)).

Table 7 therefore examines trends in quarterly betas and annualized idiosyncratic volatilities as well. Again, we measure both using weekly returns within the quarter. The betas of nearly all countries trend upwards, while idiosyncratic risk invariably tends to decrease over time. The benchmark betas of frontier markets are generally lower than those of emerging markets, but increase faster, as reflected by the higher average trend coefficient. Average country-specific risk is actually lower for frontier than for emerging markets, but trends more steeply downward, further contributing to a steeper increase in correlations of frontier relative to emerging markets. The upward (downward) trend in benchmark betas (country-specific risk) suggests that CEE frontier markets are gradually becoming more integrated with world equity markets, a feature they do not share with many other frontier markets (see, e.g., Berger et al. (2011)).

The statistical significance in favor of an upward trend is stronger for the betas than for residual risk, but certainly not as strong as for the correlation trends. As Figure 2 shows, the upward trend is more pronounced for the betas of the CEE index than it is for the median country betas, which is to a large extent due to the higher upward trend in the betas of Russia and Turkey, the two largest contributors to the index. Figure 3 shows that the downward trend in residual volatility was interrupted on two occasions, namely during the Russian crisis and during the burst of the TMT bubble (1998-2001), and to a much smaller extent, during the global financial crisis (2008-2010).

We quantify the relative importance of the three different channels to explain the upward trend in market correlations in Table 8. We first report the 10-year (sample correlation) (ρ_{10}), the correlation over the last two years (ρ_2) and a proposed predicted correlation (ρ_{+1}; for one-year ahead correlation), based on the linear trend model of Table 7.[11] Note that the 2-year correlation is mostly but not always higher than the 10-year correlation, reflecting the general upward trend in correlations. We report the ρ_2/ρ_{10} ratio explicitly in column 4 of each block in Table 8. It is naturally mostly above 1.

In addition, we report the ratio of three model-based correlations over their 10-year sample correlation. The model-based correlation estimates are obtained by plugging al-

[11] In particular, we calculate the one-year ahead correlation using the estimated coefficients from the Bunzel and Vogelsang (2005) trend test estimated on quarterly data: $\hat{\rho}_t = \hat{\beta}_1 + \hat{\beta}_2 t$. Our one-year ahead forecast is then simply $\hat{\rho}_{+1} = \hat{\beta}_1 + \hat{\beta}_2(T+4)$, with T the number of quarterly observations at the end of the sample. Note that if the trend coefficient is not statistically significant we use the correlation for the whole sample period.

ternate 2-year estimates of beta, benchmark volatility, and country-specific volatility in equation (4.2), while keeping the other two components at their 10-year value. Although the correlation increase likely comes from a simultaneous change in its three ingredients, we can thus visualize which component leads to the highest ρ_2/ρ_{10} ratio and therefore contributes the most to the increase. At the CEE index level, most of the increase in correlations over the last 10 years seems to be due to a decrease in region-specific volatility, and to a much smaller extent to an increase in benchmark betas. Changes in benchmark volatility have either no effect (Europe) or even a slightly negative effect (Global, Emerging, Russia). The negligible effect of factor volatility is confirmed at the individual country level. For many of the smaller markets (Estonia, Hungary, Lithuania, Romania, Slovak Republic), however, increasing benchmark betas are a stronger source of increasing correlations than is decreasing idiosyncratic volatility.

We conclude that the increase in correlation does not appear due to a temporary increase in factor volatilities but rather due to declining idiosyncratic risk and increased betas. Such trends are more generally observed for emerging markets as well. Since it is therefore possible that correlations increase further, we use the trend model to estimate correlations one year ahead at the end of the sample period, and report them in the third column. Our model predicts correlations to be over 90% with the global and overall European market and the prediction for the correlation with the emerging market index is at 100% (that is, accounting for the trend moves the correlation above 1).

4.2 International Hurdle Rates

A diversified mean-variance investor should invest in a new market as long as it improves the Sharpe ratio of her portfolio. Given a certain premium (expected excess return) on the portfolio the investor is holding, it is straightforward to compute the "hurdle" expected excess return on the foreign market the investor must exceed in order to increase the Sharpe ratio of her portfolio (see, e.g., Bekaert and Hodrick, 2011, Chapter 13). That is, given correlations and volatilities, we can compute hurdle rates, defined as the lowest possible expected (excess) return for market i that must be earned for investors with a 100 percent investment in the benchmark to improve their Sharpe ratio when they invest in market i, given a specific expected (excess) return for the benchmark market. The hurdle rate HR_i^b

(in excess of the risk-free rate) for country i with respect to benchmark b, is calculated as:

$$HR_i^b = \rho_{i,b}[E\left[r_b\right] - r_f^b]\frac{Vol\left(r_i\right)}{Vol\left(r_b\right)} = \beta_{ib}[E\left[r_b\right] - r_f^b], \tag{4.3}$$

with r_f^b, $E\left[r_b\right]$,and $Vol\left(r_b\right)$ the risk-free rate, expected return, and volatility of the benchmark market, respectively. $\rho_{i,b}$ is the correlation between returns on market i and those on the benchmark index, and $Vol\left(r_i\right)$ is local market volatility. Hurdle rates will be higher when the local market has a larger correlation with the benchmark, when the benchmark has a higher Sharpe ratio, and when the local market has a high total volatility. As a benchmark, we take MSCI World, assuming $[E[r_b] - r_f^b] = 5\%$. The key aspect of this computation is that it quantifies diversification benefits in "expected return" space without actually using average historical returns.

The first three columns of Table 9 report full sample correlations $\rho_{i,b}$, volatility ratios $(Vol\left(r_i\right)/Vol\left(r_b\right))$, and hurdle rates with respect to the world over the period 2002-2011. Subsequent columns show hurdle rates measured using data over the last 5 and 2 years as well as a 1-year forward looking hurdle rate.[12] Full sample hurdle rates are relatively low, and below 5 percent for most countries. The lowest values are observed in Latvia (2.08%), Croatia (2.50%), and Bulgaria (2.60%); the highest in Russia (7.13%), Hungary (6.42%), and Turkey (6.15%). The (more diversified) CEE index has a higher hurdle rate of 6.63%. Except for Latvia and the Slovak Republic, hurdle rates increase substantially when more recent data is used. The one-year ahead hurdle rate remains below 5% in 7 of the 13 countries, but rises to around 10% for Turkey and Russia, and to more than 7% for Hungary, Poland, and Romania. Given the large hurdle rates for Turkey and Russia, the two largest contributors to the CEE index, it is no surprise that the hurdle rate of the CEE index has increased further, to 8.59%. Therefore, to motivate investing in the CEE index or its large constituents, it is imperative that returns higher than in the overall market are earned. That is, CEE markets have become risky, high beta investments that should earn higher returns than standard benchmark indices.

Figure 4 plots the hurdle rate of the CEE index and of the median country from 1998

[12] To calculate the forward-looking HR, we use the "beta representation" of the HR, namely $HR_i^b = \beta_{i,b}[E\left[r_b\right] - r_f^b]$, and obtain the one-year ahead HR by using the one-year ahead beta prediction from the trend model discussed in Table 7.

till 2011 and shows that hurdle rates for the median country are far below those of the CEE index. Figure 5 shows the 10-year hurdle rates geographically, with lighter colors indicating lower hurdle rates and better diversification opportunities. It is apparent that the more established markets have higher hurdle rates. We conclude that the diversification potential of mainly the larger and more developed markets has decreased substantially over time. Investors can, however, still reap diversification benefits from investing in some of the smaller markets.

4.3 Industry and Country Effects

Heston and Rouwenhorst (1994) use a simple decomposition of individual stock returns into world market, country and industry effects to illustrate the dominance of country effects in developed market returns. When firm variation is dominated by country factors, country diversification will be valuable. Various authors have, however, suggested that increasing country return correlations may have made industry effects more important, especially during the nineties (see, e.g., Cavaglia et al. (2000)). In contrast, Bekaert et al. (2009) and Baele and Inghelbrecht (2009) suggest that the dominance of industry effects may have been temporary for developed markets and Phylaktis and Xia (2006) show that country effects dominate for emerging markets. Yet, as the industry concentration results of Table 5 show, many of the CEE markets are dominated by a few industries, suggesting that industry effects may play a significant role in correlation dynamics. We therefore apply the analysis to the individual stocks returns of our CEE universe.

For each stock i that belongs to industry j and country k we define the following equation for each period t:

$$r_i = \alpha + \beta_1 I_{i1} + \beta_2 I_{i2} + ... + \beta_{10} I_{i10} + \gamma_1 C_{i1} + \gamma_2 C_{i2} + ... + \gamma_{14} C_{i14} + \varepsilon_i, \tag{4.4}$$

where industry dummy I_{ij} equals one if stock i belongs to industry j and zero otherwise, and country dummy C_{ik} equals one if stock i belongs to country k and zero otherwise. We run into problems of multicollinearity if we estimate equation 4.4 directly by cross-sectional regressions for each week since each stock belongs both to a country and industry and industry and country dummies are defined for all 10 industries and 14 countries. In order to avoid having to choose one industry and country as a benchmark, Heston and Rouwenhorst (1994) propose to impose the following restrictions for each period t:

$$\sum_{j=1}^{10} w_j \beta_j = 0, \tag{4.5}$$

$$\sum_{k=1}^{14} v_k \gamma_k = 0, \tag{4.6}$$

where w_j and v_k denote the value weights of industry j and country k in the CEE market portfolio and $\sum_j w_j = \sum_k v_k = 1$. The estimated residuals of these OLS regressions are by construction orthogonal to all industry and country dummies. This implies that the average residual is zero in every industry and in every country. Since the CEE market index is simply the value-weighted average over all industries and countries, the estimated error term of the CEE index is also zero. By definition, the sum of all industries and countries for the CEE market index is zero such that the least-square estimate of α is equal to the value-weighted CEE market return.

We calculate weighted least squares (WLS) estimates for equation 4.4 each week subject to the restrictions in equations 4.5 and 4.6. The weekly cross-sectional regressions yield time series of the intercept, country and industry coefficients. The estimation procedure allows to decompose each value-weighted index of industry j (country k) into an effect common to all countries $\hat{\alpha}$, a pure industry (country) effect $\hat{\beta}_j$ ($\hat{\gamma}_k$), and the value-weighted average of country (industry) effects of the securities that make up its index:

$$r_j = \hat{\alpha} + \hat{\beta}_j + \sum_{k=1}^{14} \phi_{j,k} \hat{\gamma}_k C_{ik}, \tag{4.7}$$

$$r_k = \hat{\alpha} + \sum_{j=1}^{10} \theta_{j,k} \hat{\beta}_j I_{ij} + \hat{\gamma}_k, \tag{4.8}$$

where $\theta_{j,k}$ represents the proportion of total market capitalization of country k included in industry group j and $\phi_{j,k}$ represents the proportion of the capitalization of industry j pertaining to country k's stocks. In Table 10 and Figure 6, we investigate to what extent return variation at the individual stock level is mainly due to country or industry effects.

Table 10 reports the annualized time-series volatilities of the value-weighted country (industry) index in excess of the value-weighted CEE index, the pure country (industry) effects and the value-weighted sum of industry (country) effects. The top panel shows that excess country volatility is high for all countries with an average of 35%. Most of the volatility of the value-weighted country indices can be attributed to country-specific effects. The annualized volatility of the pure country effects is on average 30.78% compared to the annualized volatility of the value-weighted sum of industry effects which is only 5.72%. The average annualized volatility of the excess value-weighted industry index (bottom panel) is lower than the one of the excess value-weighted country (21.5% compared to 35%). The volatility of pure industry effects is less than half the volatility of the pure country effects (14.9% versus 30.78%). Most of the volatility in industry indices can be attributed to the combined country effects than to pure industry effects (17.09% versus 14.90% on average).

The relative importance of country and industry effects may have changed over time. For instance, as markets become more developed, one would expect the relative importance of country effects to decrease, and the role of common CEE market and industry shocks to increase. Figure 6 plots a 1-year moving average of both the joint and individual explanatory power of the country and industry effects, as measured by the model's R^2s, for the country returns in excess of the common market effect. The pure country (industry) R^2 is calculated by setting the industry (country) coefficients to zero. The figure clearly shows that the importance of industry effects has increased over time. The total R^2 and the country R^2 seem to have dropped since the beginning of the millennium, while the industry R^2 has been constantly on the rise.

4.4 "International" versus "Non-International" stocks

A large literature suggests that international investors primarily focus on cross-listed, large and liquid stocks (see, i.e., Ammer et al. (2012) and Kang and Stulz (1997)). Miller (1999) and Foerster and Karolyi (1999) show that announcements of cross-listings result in positive stock market reactions. According to the bonding hypothesis, cross-listed firms are valued higher because U.S. listings strengthen the legal protection of minority shareholders and reduce the agency costs of controlling shareholders (Stulz (1999), Coffee (2002), Reese and Weisbach (2002)). Controlling shareholders have thus an incentive to limit their private benefits, allowing firms to exploit valuable growth opportunities (Doidge et al. (2004)). At the same time, international cross-listings have been found to contribute to stock market development and integration (see, e.g., Errunza and Miller (2000), Bekaert et al. (2002), Karolyi (2004), and Edison and Warnock (2008)).

If international investors indeed predominantly focus on large, liquid, and cross-listed stocks, we would expect these stocks to have a higher correlation with respect to global benchmarks than small, illiquid "home" stocks. This "segmentation" may exist even in the larger and more developed markets. Similarly, large, liquid, cross-listed stocks listed in a small market may constitute an "integrated" submarket in an otherwise underdeveloped and segmented market. To test this hypothesis, we first divide our entire sample in (i) stocks with direct listings on other exchanges, ADRs or GDRs (cross-listed) and without cross-listings (home-only), (ii) stocks at the top 75th and bottom 25th quartiles of market capitalization, and (iii) stocks at the top 75th and bottom 25th quartiles of liquidity based on percentage of non-zero returns. Subsequently, we test whether (subcomponents of) correlations (Tables 7 and 8) and hurdle rates (Table 9) of small, illiquid, and home stocks with respect to global equity markets are indeed lower compared to those of large stocks, liquid stocks, and cross-listed stocks.

Table 7 reveals that cross-listed stocks have substantially higher market betas compared to home stocks (1.09 vs. 0.67), and generally steeper upward trends, suggesting that cross-listed stocks are indeed better integrated with global markets. The positive impact of betas on correlations is, however, largely eliminated by the cross-listed stocks' higher levels of idiosyncratic risk. Overall, we do not detect significant differences in benchmark correlations between home and cross-listed stocks. Interestingly, Table 8 shows that over the last 10 years correlations have increased faster for home than for cross-listed stocks, and that this is mainly due to a faster increase in benchmark betas. In other words, at least over the last 10 years, home stocks have been catching up with cross-listed stocks in their integration with global equity markets. While catching-up in betas also lead to a gradual convergence in hurdle rates (Table 9), we still find the hurdle rate based on the last 2 years of our sample period to be 1.45% higher for cross-listed stocks (5.88% vs. 4.43%).

The next rows of Tables 7, 8, and 9 show that large and liquid stocks have substantially higher benchmark correlations, betas, and hurdle rates. Trends in betas are significantly positive and large for large and liquid firms but much lower and mostly insignificant for small and illiquid firms. Similar to home stocks, the ratio of the last 2 to the last 10 year benchmark correlation (see Table 8) indicates that correlations have been increasing much faster for small than for large stocks. In fact, correlations measured over the final 2 years of our sample are roughly of the same magnitude for small and large stocks. While benchmark correlations of illiquid stocks have also benefitted from increasing benchmark betas, we still find benchmark correlations of the most liquid stocks to be nearly the double of those of the most illiquid stocks. Hurdle rates of small stocks, as measured over the final 2 years of our sample, have increased over time but are still below those of large stocks (5.88% vs. 4.43%). The persistently low benchmark correlations (betas) of the illiquid stocks imply hurdle rates below 3%, compared to more than 6% for the most liquid stocks.

5 The Cross-section of Expected Returns in CEE Markets

The literature on the cross-section of expected returns has mostly focused on the US and developed stock markets, yielding a number of well-known cross-sectional pricing effects that are inconsistent with the CAPM model. There is a lot less work in this area focusing on emerging and frontier markets. While early work by Claessens et al. (1995) did not detect size anomalies in emerging markets, Rouwenhorst (1999b), Barry et al. (2002), and Cakici et al. (2013) show that emerging market returns share many cross-sectional anomalies with developed equity markets, in particular size, value, and momentum effects. The value effect appears more robust statistically and economically across these studies. For a sample of 24 frontier markets, including 7 from the CEE area, de Groot et al. (2012) find evidence for a value and momentum but not for a size effect. In a sample of 11 CEE markets, Zaremba and Konieczka (2014) find strong value and size effects but no momentum effect. This is confirmed by Cakici et al. (2013) who, studying 18 emerging markets, find that the momentum effect does not extend to Eastern Europe.

In this section, we examine the size, value, momentum, volatility, betting against beta and liquidity effects for our sample of CEE stocks. The methodology and results are described in Section 5.1. The cross-sectional strategies may lead to portfolios that significantly outperform market indices. We consider this formally in Section 5.2, applying the

Brandt et al. (2009) parametric portfolio policy methodology, with the firms' size, book-to-market, past performance, realized volatility, local and global market beta, and liquidity as characteristics.

5.1 Cross-sectional Pricing Effects

To the extent possible, we follow the methodologies in the original papers documenting the effects, but, given the limited number of stocks, it is impossible to stratify stocks in deciles or even quintiles. Therefore, we sort stocks based on the various characteristics in quartiles and compare the performance of the top and bottom quartiles, value-weighting within the quartiles. Appendix B describes the procedure for creating the portfolios in more detail. To correct for risk, we consider regressions of the form:

$$r_{Pt} - r_{ft} = \alpha_P + \beta_P \left(r_{Mt} - r_{ft} \right) + \text{additional controls } + \varepsilon_{Pt}, \tag{5.1}$$

where r_{Pt} and r_{ft} are the monthly portfolio and risk-free return (in USD) in month t, r_{Mt} the return on a benchmark market portfolio, β_P the corresponding slope coefficient, and ε_{Pt} a white noise error term. The regression's intercept, α_P, is a measure of risk-adjusted performance. As market factor, we use returns on indices proxying for respectively global, European, CEE, and Emerging markets. We also run two specifications with either the CEE and European market factor or the global size, value, and momentum factors (see, e.g., Fama and French (1998)) as controls in addition to the global market factor. We report Newey-West standard errors.[13]

Our exercise resolutely takes the perspective of a global investor investigating the pricing of CEE stocks as a whole, relative to global, regional and emerging market wide indices. The markets are simply too small to consider ranking stocks within countries.[14] Of course, given evidence that some of our markets are still partially segmented (see Bekaert et al. (2014)), any alphas we find do not indicate the existence of pricing anomalies within a particular CEE country.

Panel A of Table 11 reports results when no restrictions are imposed on the portfolios

[13] We use $0.75T^{1/3}$as the truncation lag, with T the total number of observations.

[14] Lischewski and Voronkova (2012) find evidence for value and size, but not for liquidity effects in Poland, one of the largest CEE markets.

with respect to country/industry concentration, while in Panels B and C we impose the different portfolios to have either the same industry or country weights as the aggregate CEE index. For each strategy, we report the average return and volatility of the high, low and spread portfolios. We also report alphas with respect to various (combinations of) risk benchmarks. In addition, we record the correlation of the various portfolios with the world market, its volatility ratio relative to the world market's volatility and the hurdle rate for a world investor, assuming a 5% premium on the world market. The final column characterizes the liquidity of the portfolio by providing the average proportion of non-zero returns for stocks in each portfolio. This proportion is measured monthly but rebalancing takes place quarterly. More details on how each cross-sectional portfolio is constructed are relegated to Appendix B.

5.1.1 Size Effect

Banz (1981) and Reinganum (1981) were the first to document that stocks with lower market capitalization (small stocks) tend to have higher average returns. In their influential article, Fama and French (1992) found that the smallest size decile of US stocks outperformed the largest by 0.74% per month. While several studies, including Hirshleifer (2001) and Schwert (2003), argued that the effect disappeared in the US soon after its discovery, there is substantial support for a size effect in non-US developed and emerging markets, even today (see van Dijk (2011) for an overview).

The first row of Panel A of Table 11 shows that the average return on a value-weighted portfolio containing the 25% smallest stocks equals 24.6%, which is 8.7% higher than the return on a portfolio containing the 25% largest stocks. Annualized volatility is higher for the large cap than for the small cap portfolio (38.6% vs 32.7%). While long-only portfolios in the bottom and top size quartiles both generate positive alphas for various (combinations of) risk controls, they are, apart from being much larger in magnitude, only significant for the small stock portfolio. The alphas of the spread portfolio are economically large but significant only when controlled for by the CEE or CEE/EU/World market benchmarks. Because of its lower volatility and correlation with global market returns, the small stock portfolio has a substantially lower hurdle rate relative to the large cap portfolio (4.77% vs 7.28%). The last column shows that large caps are on average more liquid than small stocks, as reflected by their higher percentage of non-zero returns (84.4% vs 64.3%). Imposing the same industry exposure on the different portfolios as the CEE index leads to an increased performance of the large cap portfolio, and a further decrease in alphas for the spread portfolio. Imposing the same country structure, however, leads to a proportionally larger increase in the performance of small relative to large caps, so that the spread portfolio now has significant alphas of more than 13%, annually, in three cases.

We conclude that CEE size portfolios generate mostly significant alphas because of segmentation; the risk factors do not capture their returns, and this effect is overall somewhat stronger for small cap portfolios. The spread portfolio does generate high alphas, but these alphas are not generally statistically significant.

5.1.2 Value Effect

The value effect refers to the observation that value stocks, that is, stocks with high ratios of a fundamental like book value or cash flow to price, have higher average returns than growth stocks, which have low ratios of fundamentals to price (Bondt and Thaler (1985), Fama and French (1992) and Lakonishok et al. (1994)). Recent work by Asness et al. (2013), amongst many others, shows that the value effect continues to exist, both in the US and in other (developed) markets.

Rows 2 to 4 of Panel A of Table 11 show that portfolios containing the 25% stocks with the highest dividend yield (DY), or the lowest price earnings (P/E) or market-to-book (M/B) ratios, i.e. value stocks, significantly outperform portfolios containing stocks with the 25% lowest DY, or highest P/E or M/B ratios ('growth stocks').[15] The difference is substantially larger when portfolios are sorted based on P/E or M/B ratios (alphas between 20% and 25%) than on DY. Hurdle rates are similar for value and growth stocks (about 7%), and much lower than the average return on the value portfolio. We obtain similar results for the country or industry neutral strategies based on the P/E and M/B ratio, except that low dividend yield stocks now perform better. The alphas on the spread portfolios are mostly insignificant for the dividend yield sorted portfolios, and almost always significant for the P/E ratio sorts. For the market to book sorted portfolios, they are always statistically

[15] We lag all characteristics by 1 quarter to ensure they were in the information set at the time of rebalancing.

significant when the industry or country structure of the CEE index is matched. The differential performance between value and growth stocks does not seem to be driven by differences in liquidity, as both have high percentage of non-zero return ratios.

5.1.3 Momentum

Cross-sectional momentum was first documented by Jegadeesh and Titman (1993), who showed that stocks that performed well over the previous 3 to 12 months ('winner stocks') tend to outperform stocks that performed poorly ('loser stocks). Rouwenhorst (1999b) and more recently Asness et al. (2013) provide strong evidence for momentum in international markets.

We do, however, not find any evidence for momentum in CEE equity markets, irrespective of whether we sort based on the stocks' performance in months $t-12$ to $t-1$ or $t-6$ to $t-1$ (columns 5-6 in Table 11). In fact, we find generally past losers to outperform past winners. The effect is even statistically significant for one year momentum returns except when the CEE's country structure is imposed. For the 6 month momentum portfolios, the results vary a lot across weighting schemes. Our results are in line with those in Cakici et al. (2013) and Zaremba and Konieczka (2014), who also did not find momentum effects in CEE equity markets.

5.1.4 Low Volatility and Low Beta Effect

One of the strongest empirical findings is that low volatility and low beta stocks tend to outperform high volatility and beta stocks. Already in the 1970s, research showed that the relationship between risk as measured by market beta and return was much flatter than predicted by the CAPM (Black (1972) and Black et al. (1972)), or even downward sloping (Haugen and Heins (1975)). Frazzini and Pedersen (2014) show that this effect is also present in recent data and across different markets and asset classes. Ang, Hodrick, Xing, and Zhang (2006; 2009) reveal that stocks with recent past high idiosyncratic volatility underperform stocks with low past idiosyncratic volatility, both in the US and international markets. Frazzini and Pedersen (2014) show that this is also the case for low relative to high beta stocks. Blitz and Vliet (2007) and Blitz et al. (2013) confirm these findings for developed and emerging markets, respectively, but de Groot et al. (2012) do not find low volatility or low beta effects in their sample of frontier markets.

Table 11 (row 7) offers only limited evidence for a volatility effect in CEE markets. Low volatility stocks, where volatility is measured over the previous quarter, outperform high volatility stocks in the unrestricted and country-weights case, but the outperformance is not statistically significant. We do not find that stocks with low betas (either measured with respect to the local (row 8) or global (row 9) equity market, using annual windows and weekly returns outperform high beta stocks, or vice versa.

5.1.5 Liquidity

In Section 3.1, we showed that market liquidity, as measured by market turnover and the proportion of non-zero trading days, varies widely across CEE markets, and that it is generally below the levels observed in developed markets. Following Amihud and Mendelson (1986), Brennan and Subrahmanyam (1996), Datar et al. (1998), Chordia et al. (2001), and Liu (2006), a vast literature has shown that liquidity is a priced risk factor. In a sample of 19 emerging markets (mostly from Latin-America and South-East Asia), Bekaert et al. (2007) find that unexpected liquidity shocks are positively correlated with contemporaneous stock returns and negatively with dividend yields, suggesting that liquidity is a priced risk factor also in emerging markets.

The final line of Table 11 reports performance statistics for portfolios containing stocks belonging to the top and bottom liquidity quartiles. As a liquidity measure, we use the proportion of non-zero returns. Even though we eliminated the most illiquid stocks from our sample, we observe a large difference in liquidity between the top and bottom quartile. Stocks in the most liquid bucket have non-zero returns on 90% of trading days, compared to 'only' 46% for the stocks belonging to the bottom bucket. The alphas of the restricted low liquidity portfolios are typically more than 20%, about 5 to 10% higher than those of the high liquidity portfolio. In the unrestricted case, the alphas of the spread portfolio range from 5.3% to 7.2%, and are never significant. When the CEE's index industry structure is imposed, the alphas of the spread portfolio almost double and become highly statistically significant.

5.1.6 Free-Float

As discussed in Section 2.4, government agencies still play a relatively large role in CEE equity markets, and free-float market weights differ substantially from total market weights. Table 12 compares the performance of indices that are based on the full sample (Original) and on a sample of stocks for which free-float data is available, either using (rescaled) market weights as before (FF1) or using free-float market weights (FF2). Because free-float data is not available before, the sample starts in 2003 only (rather than in 1996). We find that the size effect becomes weaker when we focus on free-float data and loses its significance when we use free-float market weights. This effect might be due to the fact that we mostly select larger firms for the free-float sample. The value effect remains robust when we sort based on the market to book ratio. We still find a reverse mostly insignificant momentum effect. The low volatility effect is a bit stronger in this shorter sample than it is in the larger sample underlying the results in Table 11; it generates large and significant alphas for the spread portfolios relative to the CEE/EU/World benchmark but not relative to the global Fama and French factor benchmark. The volatility effect is somewhat weaker but nonetheless preserved in the free-float adjusted samples. Free-float adjustments do not change the conclusion that we find no statistical evidence for a low beta effect in CEE stocks. The illiquidity effect is also very similar across samples, only leading to slightly lower returns on the illiquid portfolios. In sum, although free-float adjustments seem to change the results slightly, our main conclusions are not affected.

5.2 A CEE portfolio with Cross-sectional Tilts

Because the CEE markets have high correlations with the world market, they require rather high hurdle rates before a world investor would want to include them in her portfolio. If we run a regression of our CEE index return on the world market return over the full sample from 1996 to mid 2011, we find a beta of 1.24 and an annualized alpha of 11.60 which is, however, not statistically significant (t-stat of 1.178). But section 5.1 revealed that some stock market characteristics may be associated with higher returns. In this section, we create a CEE portfolio that exploits some of these pricing anomalies and may perform better than the index. Our methodology is based on the work of Brandt et al. (2009).

They maximize a statistical function of the portfolio return, where the portfolio weights are modeled as benchmark weights (e.g. value-weights) plus an active component that over- or underweights stocks based on their characteristics (such as size, value,...). This methodology only requires finding the coefficients on the characteristics that maximize the in-sample utility, making an inherently complex optimization problem feasible. In our application, we modify the Brandt et al. (2009) framework to a tracking error framework, with the CEE index as the benchmark.

To understand our approach, we need to establish some notation. At each point in time t, we need to find the optimal weights $w_{i,t}$ for a portfolio of N_t stocks. The portfolio's return is simply calculated as $r_{p,t+1} = \sum_{i=1}^{N} w_{i,t} r_{i,t+1}$, with $r_{i,t+1}$ being the return on stock i observed over the period t to $t+1$. The return on the benchmark portfolio is calculated as $r_{b,t+1} = \sum_{i=1}^{N} w_{i,t}^{b} r_{i,t+1}$, with $w_{i,t}^{b}$ being the stock i's benchmark weight at time t. Similar to Brandt et al. (2009), we model the portfolio weights as the sum of the benchmark weight and an active component that over- or underweights a stock based on its characteristics $x_{i,t}$:

$$w_{i,t} = w_{i,t}^{b} + \frac{1}{N_t} \theta^T x_{i,t} \tag{5.2}$$

with θ being a vector of coefficients that translates the characteristics in over- or underweights. Because the characteristics $x_{i,t}$ are standardized cross-sectionally to have a zero mean and unit standard deviation across all stocks at date t, the deviations from the benchmark always sum up to zero, and the total weights to 100%. By normalizing $\theta^T x_{i,t}$ by N_t, the total active bet does not increase with the number of stocks.

Our investor maximizes the following objective function with respect to θ:

$$E\left[r_{p,t+1} - r_{b,t+1}\right] - \frac{\gamma}{2} Var\left[r_{p,t+1} - r_{b,t+1}\right] \tag{5.3}$$

While equation (5.3) looks like a mean-variance utility function, the return is the alpha over the benchmark portfolio and the risk is measured relative to the benchmark. In other words, this is a standard tracking error problem that portfolio managers would solve seeking to outperform the CEE benchmark.

As shown in Appendix C, taking first-order conditions and using sample moments to estimate the relevant theoretical moments yields the optimal θ:

$$\theta = \frac{1}{\gamma}\left[\frac{1}{T}\sum_{t=0}^{T-1}(x_t R_{t+1} - \overline{xR})(x_t R_{t+1} - \overline{xR})'\right]^{-1}\overline{xR} \tag{5.4}$$

where x_t is a k by N_t matrix containing the k (cross-sectionally standardized) characteristics for the N_t stocks observed at time t, R_t the corresponding $(N_t \times 1)$ vector of returns and $\overline{xR} = \frac{1}{T}\sum_{t=0}^{T-1} x_t R_{t+1}$ the average cross-product between characteristics and returns. Individual θ's will be positive (negative) to the extent that the corresponding characteristics correlate positively (negatively) with returns. The coefficient γ governs the portfolio manager's flexibility to deviate from the benchmark: lower (higher) values for γ will be associated with more (less) extreme tilts away from the benchmark. In our empirical implementation, we set $\gamma = 5$.

Because short selling in CEE markets is likely to be costly and only feasible for the most liquid stocks[16], we only present results for a policy than truncates portfolio weights at 0:

$$w_{i,t}^{+} = \frac{\max\left[0, w_{i,t}\right]}{\sum_{j=1}^{N_t}\max\left[0, w_{j,t}\right]} \tag{5.5}$$

where we divide by the sum of the positive weights to make the portfolio weights sum up to 100 percent. We truncate the weights obtained from the unconstrained optimization ex-post; Embedding the short-sale constraints directly within the optimization only improves performance marginally but renders our boostrapping exercise (see below) unstable.

For the analysis, we use monthly stock returns as well as firm-level characteristics for 2,090 stocks between January 1996 and May 2011. Note that we use all available stocks in our analysis and do not restrict the sample to the stocks available in our tailor-made CEE index, which represent 85% of total market capitalization. For each firm, we construct the following firm characteristics at the end of each month: the log of market capitalization of the previous quarter (*me*), the log of one plus the market to book ratio of the previous quarter (*mtbv*), the price return in US dollar between months $t-12$ and $t-1$ (*mom*),

[16]Daniel and Lhabitant (2012) reveal that the ability to short-sell in CEE markets is limited and mostly executed by hedge funds. While short-selling is possible to some extent in the larger Eastern European countries such as Turkey, Poland, Hungary, Russia, and the Czech Republic (ordered by the ease of short-selling), it is very limited in smaller and less developed markets such as the Slovak Republic, Latvia, Estonia, Romania, and Slovenia.

the volatility of daily returns over the previous quarter (*vol*), the percentage of zero daily (price) returns in local currency for each stocks over the previous year (*illiq*), and the beta from a regression of weekly returns on the value-weighted CEE index (local) over the previous year (*beta*). Before standardizing characteristics, we winsorize each characteristic at the 1% and 99% level across all stocks at each point in time in order to account for possible outliers. The benchmark weights correspond to the weight that each stock has at each point in time in a value-weighted index of all 2,090 stocks (to the extent that the stock is part of the sample at that specific point in time). We calculate bootstrapped standard errors using the procedure described in Brandt et al. (2009).[17]

We present estimation results and performance statistics in Panel A and B of Table 13, respectively. The second row of Panel A of Table 13 reports parameter estimates and portfolio characteristics for a parametric portfolio policy that includes size, value, and momentum characteristics. Columns 1 to 3 report optimal estimates for θ as well as bootstrapped standard errors. For the size and market-to-book characteristic, we find negative θ's, meaning that the portfolio policy overweights small and value firms but underweights large and growth firms. The θ for momentum is positive, tilting the portfolio towards past winners but away from past losers. Because the firm characteristics are standardized across firms, the relative importance of the characteristics can be read from the coefficients' absolute sizes. We find the size effect to dominate the value effect, which in turn dominates the momentum effect. While bootstrapped standard errors are rather large, we find the percentage of simulated thetas that are of the opposite sign to be 2.5% for the value, 8.3% for the size, and 12% for the momentum characteristic. The next columns provide more insights in the optimal portfolio weights and characteristics. Compared to the value-weighted CEE benchmark portfolio (row 1), the optimal portfolio has a lower average maximum portfolio weight (10.2% versus 17%). To get a better sense of the composition of the optimized portfolio, the last three columns report the average of the weighted characteristics of the portfolio calculated as $\sum_{i=1}^{N_t} w_{i,t}^{+} \hat{x}_{i,t}$. The benchmark portfolio has a large bias towards large firms (because of value-weighting) and positive but smaller tilts towards

[17] In particular, we generate a large number of samples of returns and characteristics. We take random draws (with replacement) from monthly observations for each stock returns and its characteristics using only liquid and selected observations of each stock. For each sample, we estimate the coefficients of the optimal portfolio and compute the covariance matrix of the coefficients across all the bootstrapped samples (1000 replications).

firms with high market-to-book ratios (growth firms) and past winners. In contrast, the optimized portfolio has a bias towards small firms, value firms, and past winners.

Panel B of Table 13 reports performance statistics for the 3-characteristics optimal parametric portfolio policy. The optimal portfolio has both a substantially higher annualized mean excess return (23.3% versus 15.3%) and a lower annualized volatility (32.5% versus 37.1%) relative to the benchmark market-weighted CEE benchmark index. This leads to a Sharpe Ratio that is 0.31 percentage points higher for the optimal compared to the benchmark portfolio (0.72 versus 0.41). The next columns report annualized alphas from univariate regressions of portfolio returns on our tailor-made CEE index (85% market capitalization threshold), the MSCI EM index, the MSCI Europe index, the MSCI World index, as well as multivariate regressions on the latter three indices and on the global Fama-French factors and momentum. The first row shows that even the simple value-weighed CEE index has relatively large (but insignificant) alphas with respect to all benchmarks.[18] For instance, an investment in the CEE index yields an alpha of 11.3%, correcting for the global Fama-French factors and momentum. We interpret this as a sign of segmentation, as global risk factors largely fail to capture CEE equity market returns. The second row shows that the parametric portfolio policy nevertheless generates substantially larger alphas than the simple value-weighted CEE index. Optimally taking into account size, value, and momentum characteristics leads to an outperformance of 13.9% relative to the benchmark CEE index. The strategy's alpha after correcting for the global Fama-French and Momentum risk factors equals 19.3%, which is nearly 8% points higher than the benchmark CEE index' alpha. The information ratio (relative to the benchmark CEE model) increases from 0.65 for the value-weighted CEE index to 1.86 for the parametric portfolio policy, a very substantial increase. The hurdle rate of the optimized portfolios with respect to the global equity market is lower than for the benchmark CEE index (6.73% versus 7.24%), mainly because of its lower volatility.

The third row of Panel A of Table 13 reports parameter estimates and portfolio characteristics for a parametric portfolio policy that includes 3 additional factors, namely lagged one-year volatility, lagged one-year liquidity, and the local beta with respect to our tailor-

[18]Note that the value-weighted CEE index, which involves all stocks, has a positive but small (3.75%) alpha with respect to the CEE benchmark, which only contains stocks (from large to low) until a 85% of total market capitalization is reached.

made CEE index. The policy tilts the portfolio towards low volatility stocks, capturing the low volatility effect, and towards less liquid stocks, potentially capturing an illiquidity risk premium. Contrary to what is typically found in developed markets, our strategy tilts weights towards high not low beta stocks.[19] We continue to find that the optimal portfolio is tilted towards small stocks, value stocks, and past winners. Now not only the θ for value but also for momentum is statistically significant at the 5% and 10% level, respectively, while size, illiquidity, and local beta are borderline significant at the 10% level.[20] Figure 7, which plots the value-weighted portfolio characteristics over time, shows that the reported tilts are relatively stable over time, and as such, that the strategy is making consistent bets over time.

Panel B of Table 13 shows that adding volatility, illiquidity, and beta characteristics improves the performance of the strategy only marginally. Relative to the 3-characteristics case, the mean return of the strategy based on 6 characteristics increases from 23.3% to 25.3%. However, because also the strategy's volatility increases from 32.5% to 34.6%, the Sharpe Ratio increases with 1 percentage point only from 0.72 to 0.73. The alpha with respect to CEE benchmark increases with 1.4% points (from 13.85 to 15.27%); the alpha with respect to the global Fama-French and momentum model with 3.03% (from 19.26% to 22.28%). Because of the strategy's larger volatility, the information ratio (with respect to the CEE benchmark) only increases slightly (from 0.1.86 to 1.91) and the hurdle rate increases from 6.71% to 7.05%.

6 Conclusions

This paper provides a comprehensive and detailed analysis of Central and Eastern European (CEE) equity markets from the mid-1990s until now. We use firm-level data to create custom-made indices and indicators to maximize coverage. We find that there are substantial differences across different CEE indices. While for the overall index, the correlation between index returns across data vendors and our index returns is well over 90%, it can be below 50% for some of the smaller markets. We show that there is considerable

[19] We continue to find this even when we eliminate the likely correlated volatility characteristic. In fact, it is even true in a univariate exercise focusing on beta.

[20] When we examine the characteristics univariately, market to book, volatility, beta, and illiquidity, all yield statistically significant θ 's; the θ for momentum is borderline significant, but the one for size is not.

heterogeneity in the degree, dynamics, and determinants of market development across the different markets. Using market size, liquidity and concentration indices, Russia, Turkey, Hungary and Poland are the most developed markets; Serbia, Latvia, the Slovak Republic, and Kazakhstan are least developed. One institutional feature that contributes most robustly to differential market development across countries is the implementation of insider trading laws.

Studying the diversification benefits to global investors, we find that CEE markets have experienced similar trends as emerging markets more generally, with strongly increasing correlations with global benchmarks over time. Increased correlations can occur because of higher benchmark volatilities, higher betas, or lower country-specific risks. We find that changes in correlations are primarily driven by increasing betas and reduced idiosyncratic risks, with their relative contributions varying across countries. For smaller markets such as Estonia, Hungary, Lithuania, Romania and the Slovak Republic, increasing betas dominate, but these markets still feature relatively low correlations with global benchmarks. At the CEE index level, reduced idiosyncratic risk plays a larger role and correlations have increased to over 80%. Finally, we examine the pricing of various stock specific characteristics and show that there are substantial premiums associated with investing in small, value, low volatility and illiquid stocks. We show how an active strategy can tilt a CEE investment towards these stock characteristics, earning an annualized alpha of 15.3% with respect to the CEE benchmark and of 22.3% with respect to the global Fama-French and momentum model. The information ratio of this strategy is more than double that of the passive value-weighted portfolio.

References

Amihud, Y., and H. Mendelson, 1986, Asset pricing and the bid-ask spread, *Journal of Financial Economics* 17, 223–249.

Ammer, John, Sara B Holland, David C Smith, and Francis E Warnock, 2012, Us international equity investment, *Journal of Accounting Research* 50, 1109–1139.

Ang, Andrew, and Geert Bekaert, 2002, International asset allocation with regime shifts, *Review of Financial Studies* 15, 1137–1187.

Ang, Andrew, Robert Hodrick, Yuhang Xing, and Xiaoyan Zhang, 2006, The cross-section of volatility and expected returns, *Journal of Finance* 61, 259–299.

Ang, Andrew, Robert Hodrick, Yuhang Xing, and Xiaoyan Zhang, 2009, High idiosyncratic volatility and low returns: International and further U.S. evidence, *Journal of Financial Economics* 91, 1–23.

Angrist, Joshua D, and Jörn-Steffen Pischke, 2009, *Mostly harmless econometrics: An empiricist's companion* (Princeton University Press).

Asness, Clifford S., Tobias J. Moskowitz, and Lasse H. Pedersen, 2013, Value and momentum everywhere, *Journal of Finance* 68, 929–985.

Baele, Lieven, 2005, Volatility spillover effects in European equity markets, *Journal of Financial and Quantitative Analysis* 40, 373–402.

Baele, Lieven, and Koen Inghelbrecht, 2009, Time-varying integration and international diversification strategies, *Journal of Empirical Finance* 16, 368–387.

Baele, Lieven, and Koen Inghelbrecht, 2010, Time-varying integration, interdependence and contagion, *Journal of International Money and Finance* 29, 791–818.

Banz, Rolf W., 1981, The relationship between return and market value of common stock, *Journal of Financial Economics* 9, 3–18.

Barry, Christopher B., Elizabeth Goldreyer, Larry Lockwood, and Mauricio Rodriguez, 2002, Robustness of size and value effects in emerging equity markets, 1985-2000, *Emerging Markets Review* 3, 1 – 30.

Bekaert, Geert, Michael Ehrmann, Marcel Fratzscher, and Arnaud Mehl, 2014, The global crisis and equity market contagion, *Journal of Finance* 69, 2597–2649.

Bekaert, Geert, and Campbell R. Harvey, 1997, Emerging equity market volatility, *Journal of Financial Economics* 43, 29–77.

Bekaert, Geert, and Campbell R Harvey, 2004, A chronology of important financial, economic and political events in emerging markets., available at *http : //people.duke.edu/ charvey/Country_risk/chronology/chronology_index.htm.*

Bekaert, Geert, and Campbell R Harvey, 2014, Emerging equity markets in a globalizing world, available at SSRN: http://ssrn.com/abstract=2344817.

Bekaert, Geert, Campbell R Harvey, and Robin L Lumsdaine, 2002, Dating the integration of world equity markets, *Journal of Financial Economics* 65, 203–247.

Bekaert, Geert, Campbell R Harvey, and Christian Lundblad, 2005, Does financial liberalization spur growth?, *Journal of Financial Economics* 77, 3–55.

Bekaert, Geert, Campbell R. Harvey, and Christian Lundblad, 2007, Liquidity and expected returns: Lessons from emerging markets, *Review of Financial Studies* 20, 1783–1831.

Bekaert, Geert, and Robert J. Hodrick, 2011, *International financial management* (Pearson Prentice Hall), (2nd edition) edition.

Bekaert, Geert, Robert J. Hodrick, and Xiaoyan Zhang, 2009, International stock return comovements, *Journal of Finance* 64, 2591–2626.

Berger, Dave, Kuntara Pukthuanthong, and Jimmy Yang, 2011, International diversification with frontier markets, *Journal of Financial Economics* 101, 227–242.

Bhattacharya, Utpal, and Hazem Daouk, 2002, The world price of insider trading, *Journal of Finance* 57, 75–108.

Black, Fisher, 1972, Capital market equilibrium with restricted borrowing, *Journal of Business* 45, 444–454.

Black, Fisher, Michael C. Jensen, and Myron Scholes, 1972, The capital asset pricing model: Some empirical tests, Studies in the Theory of Capital Markets. Michael C. Jensen, ed. New York, Praeger, pp. 79-121.

Blitz, David, Juan Pang, and Pim Van Vliet, 2013, The volatility effect in emerging markets, *Emerging Markets Review* 16, 31–45.

Blitz, David, and Pim Van Vliet, 2007, The volatility effect: Lower risk without lower return, *Journal of Portfolio Management* 34, 102–113.

Bondt, Werner F.M. De, and Richard H. Thaler, 1985, Does the stock market overreact?, *Journal of Finance* 40, 793–805.

Brandt, Michael W, Pedro Santa-Clara, and Rossen Valkanov, 2009, Parametric portfolio policies: Exploiting characteristics in the cross-section of equity returns, *Review of Financial Studies* 22, 3411–3447.

Brennan, Michael J., and Avanidhar Subrahmanyam, 1996, Market microstructure and asset pricing: On the compensation for illiquidity in stock returns, *Journal of Financial Economics* 41, 441–464.

Bunzel, Helle, and Timothy J. Vogelsang, 2005, Powerful trend function tests that are robust to strong serial correlation, with an application to the Prebisch-Singer hypothesis, *Journal of Business & Economic Statistics* 23, 381–394.

Cakici, Nusret, Frank J. Fabozzi, and Sinan Tan, 2013, Size, value, and momentum in emerging market stock returns, *Emerging Markets Review* 16, 46 – 65.

Cameron, A Colin, Jonah B Gelbach, and Douglas L Miller, 2008, Bootstrap-based improvements for inference with clustered errors, *Review of Economics and Statistics* 90, 414–427.

Cameron, A Colin, and Douglas L Miller, 2013, A practitioner's guide to cluster-robust inference, *forthcoming in Journal of Human Resources* 221–236.

Cameron, A Colin, and Pravin K Trivedi, 2005, *Microeconometrics: methods and applications* (Cambridge University Press).

Campbell, John Y, Andrew Wen-Chuan Lo, and Archie Craig MacKinlay, 1997, *The econometrics of financial markets* (Princeton University Press).

Caporale, Guglielmo Maria, and Nicola Spagnolo, 2011, Stock market integration between three CEECs, Russia, and the UK, *Review of International Economics* 19, 158–169.

Cavaglia, Stefano, Christopher Brightman, and Michael Aked, 2000, The increasing importance of industry factors, *Financial Analyst Journal* 56, 41–54.

Chelley-Steeley, Patricia L., 2005, Modeling equity market integration using smooth transition analysis: A study of Eastern European stock markets, *Journal of International Money and Finance* 24, 818–831.

Chinn, Menzie D, and Hiro Ito, 2006, What matters for financial development? Capital controls, institutions, and interactions, *Journal of Development Economics* 81, 163–192.

Chinn, Menzie D, and Hiro Ito, 2008, A new measure of financial openness, *Journal of Comparative Policy Analysis* 10, 309–322.

Chordia, Tarun, Avanidhar Subrahmanyam, and Ravi Anshuman, 2001, Trading activity and expected stock returns, *Journal of Financial Economics* 59, 3–32.

Christoffersen, Peter, Vihang Errunza, Kris Jacobs, and Hugues Langlois, 2012, Is the potential for international diversification disappearing? A dynamic copula approach, *Review of Financial Studies* 25, 3711–3751.

Claessens, Stijn, Susmita Dasgupta, and Jack Glen, 1995, Return behavior in emerging stock markets, *World Bank Economic Review* 9, 131–151.

Coffee, John C. Jr, 2002, Racing towards the top?: The impact of cross-listings and stock market competition on international corporate governance, *Columbia Law Review* 1757–1831.

Daniel, Jeannine, and François-Serge Lhabitant, 2012, *Handbook of Short Selling*, chapter 11: Reflections on Short Selling Regulations in Western and Eastern Europe (Elsevier).

Datar, V., N. Naik, and R. Radcliffe, 1998, Liquidity and stock returns: An alternative test, *Journal of Financial Markets* 1, 203–219.

Datastream, 2008, *Datastream Global Equity Inidices, User Guide*, Thomson Reuters.

de Groot, Wilma, Juan Pang, and Laurens Swinkels, 2012, The cross-section of stock returns in frontier emerging markets, *Journal of Empirical Finance* 19, 796–818.

Doidge, Craig, G Andrew Karolyi, and René M Stulz, 2004, Why are foreign firms listed in the US worth more?, *Journal of Financial Economics* 71, 205–238.

Edison, Hali J, and Francis E Warnock, 2008, Cross-border listings, capital controls, and equity flows to emerging markets, *Journal of International Money and Finance* 27, 1013–1027.

Errunza, Vihang R, and Darius P Miller, 2000, Market segmentation and the cost of the capital in international equity markets, *Journal of Financial and Quantitative analysis* 35, 577–600.

Fama, Eugene F., and Kenneth R. French, 1992, The cross-section of expected stock returns, *The Journal of Finance* 47, 427–465.

Fama, Eugene F., and Kenneth R. French, 1998, Value versus growth: The international evidence, *Journal of Finance* 53, 1975–1999.

Foerster, Stephen R, and G Andrew Karolyi, 1999, The effects of market segmentation and investor recognition on asset prices: Evidence from foreign stocks listing in the united states, *Journal of Finance* 54, 981–1013.

Frazzini, Andrea, and Lasse Heje Pedersen, 2014, Betting against beta, *Journal of Financial Economics* 111, 1–25.

Gilmore, Claire G., Brian M. Lucey, and Ginette M. McManus, 2008, The dynamics of Central European equity market comovements, *The Quarterly Review of Economics and Finance* 48, 605–622.

Gjika, Dritan, and Roman Horvath, 2012, Stock market comovements in Central Europe: Evidence from asymmetric DCC model, *William Davidson Institute Working Paper No. 1035* .

Harvey, Campbell R, 1995, Predictable risk and returns in emerging markets, *Review of Financial Studies* 8, 773–816.

Haugen, Robert A., and A. James Heins, 1975, Risk and the rate of return on financial assets: some old wine in new bottles, *Journal of Financial and Quantitative Analysis* 10, 775–784.

Hendry, D. F., and H.-M. Krolzig, 2001, *Automatic Econometric Model Selection* (Automatic Econometric Model Selection, London: Timberlake Consultants Press).

Henisz, Witold J, 2000, The institutional environment for economic growth, *Economics & Politics* 12, 1–31.

Henisz, Witold J, 2002, The institutional environment for infrastructure investment, *Industrial and corporate change* 11, 355–389.

Heston, Steven L., and K. Geert Rouwenhorst, 1994, Does industrial structure explain the benefits of international diversification?, *Journal of Financial Economics* 36, 3–27.

Hirshleifer, David, 2001, Investor psychology and asset pricing, *Journal of Finance* 56, 1533–1597.

Hou, Kewei, Chen, and Lu Zhang, 2014, Digesting anomalies: An investment approach, *Review of Financial Studies, forthcoming* .

Jain, Pankaj K, 2005, Financial market design and the equity premium: Electronic versus floor trading, *The Journal of Finance* 60, 2955–2985.

Jegadeesh, Narasimhan, and Sheridan Titman, 1993, Returns to buying winners and selling losers: Implications for stock market efficiency, *Journal of Finance* 48, 65–91.

Kang, Jun-Koo, and René M. Stulz, 1997, Why is there a home bias? An analysis of foreign portfolio equity ownership in Japan, *Journal of Financial Economics* 46, 3–28.

Karolyi, G Andrew, 2004, The role of american depositary receipts in the development of emerging equity markets, *Review of Economics and Statistics* 86, 670–690.

Lakonishok, Josef, Andrei Shleifer, and Robert W. Vishny, 1994, Contrarian investment, extrapolation, and risk, *Journal of Finance* 49, 1541–1578.

Lesmond, David A., 2005, Liquidity of emerging markets, *Journal of Financial Economics* 77, 411–452.

Lesmond, David A., Joseph Ogden, and Charles Trzcinka, 1999, A new estimate of transaction costs, *Review of Financial Studies* 12.

Lischewski, Judith, and Svitlana Voronkova, 2012, Size, value and liquidity. Do they really matter on an emerging stock market?, *Emerging Markets Review* 13, 8 – 25.

Liu, Weimin, 2006, A liquidity-augmented capital asset pricing model, *Journal of Financial Economics* 82, 631–671.

Miller, Darius P, 1999, The market reaction to international cross-listings: Evidence from depositary receipts, *Journal of Financial Economics* 51, 103–123.

MSCI, 2011, *MSCI Global Investable Market Indices Methodology*, MSCI Index Research.

Ng, Angela, 2000, Volatility spillover effects from Japan and the US to the Pacific-Basin, *Journal of International Money and Finance* 19, 207–233.

Phylaktis, Kate, and Lichuan Xia, 2006, Sources of firms' industry and country effects in emerging markets, *Journal of International Money and Finance* 25, 459–475.

Reese, William A, and Michael S Weisbach, 2002, Protection of minority shareholder interests, cross-listings in the united states, and subsequent equity offerings, *Journal of Financial Economics* 66, 65–104.

Reinganum, M. R., 1981, Misspecification of capital asset pricing: Empirical anomalies based on earnings' yield and market values, *Journal of Financial Econometrics* 9, 19–46.

Rouwenhorst, Geert, 1999a, European equity markets and EMU, *Financial Analyst Journal* 57–64.

Rouwenhorst, K. Geert, 1999b, Local return factors and turnover in emerging stock markets, *Journal of Finance* 54, 1439–1464.

Savva, C.S., and C. Aslanidis, 2010, Stock market integration between new EU member states and the Eurozone, *Empirical Economics* 39, 337–351.

Schotman, Peter C., and Anna Zalewska, 2006, Non-synchronous trading and testing for market integration in Central European emerging markets, *Journal of Empirical Finance* 13, 462–494.

Schwert, G. William, 2003, *Anomalies and market efficiency* (In: Handbook of the Economics of Finance. North Holland, Amsterdam).

Standard & Poor's, 2012, *S&P Dow Jones Indices: S&P Emerging Markets Core Index Methodology.*

Stulz, René M., 1999, Globalization of equity markets and the cost of capital, *Journal of Applied Corporate Finance* 12, 8–25.

Syllignakis, Manolis N., and Georgios P. Kouretas, 2011, Dynamic correlation analysis of financial contagion: Evidence from the Central and Eastern European markets, *International Review of Economics & Finance* 20, 717–732.

van Dijk, Mathijs A., 2011, Is size dead? A review of the size effect in equity returns, *Journal of Banking and Finance* 35, 3263–3274.

Wooldridge, Jeffrey M, 2003, Cluster-sample methods in applied econometrics, *American Economic Review* 133–138.

Zaremba, Adam, and Przemyslaw Konieczka, 2014, Illusionary value, size and momentum premiums in the CEE markets, *Working Paper* .

Table 1: Index Stock Composition and Market Size

This Table reports the composition of both the uncleaned 'Total Sample' and the cleaned 'Liquid Sample' for each of the 16 CEE markets. The sample runs from January 1990 till May 2011. For both the total and liquid sample, we record the number of active (dead) local and preferred stocks, the number of American Depositary Receipts (ADR), Global Depository Receipts (GDR) and direct cross listings (CL), as well as the total number of stocks. Stocks are considered to be liquid if (unadjusted) returns were nonzero in at least 25% of days of the previous year. For the 'Liquid Sample', we report the total number of stocks (Total) as well as the final number of stocks (Final) after replacing illiquid home stocks with the most liquid among the American Depositary Receipts (ADR), Global Depository Receipts (GDR) and direct cross listings (CL) of the same firm. Free-Float reports the average percentage of market capitalization over the sample for which we have free-float data available. The final two columns report the average firm and total market capitalization (in millions of US$) for the year 2010.

	Total Sample				Liquid Sample							
Country	Local	Preferred	ADR/ GDR/CL	Total	Local	Local Preferred	ADR/ GDR/CL	Total	Final	Free-Float (%)	Size 2010 ($mil)	
	Active (Dead)	Active (Dead)	Active (Dead)		Active (Dead)	Active (Dead)	Active (Dead)				Firm Average	Total Market
Bulgaria	374 (39)	-	13 (4)	430	170 (9)	-	-	179	179	61.93	43	3623
Croatia	17 (124)	0 (1)	2 (17)	161	14 (27)	0 (1)	1 (3)	46	41	63.55	690	8964
Czech Rep.	18 (294)	-	22 (79)	413	18 (162)	-	15 (22)	217	182	43.11	6161	43128
Estonia	16 (14)	-	23 (18)	71	15 (13)	-	16 (9)	53	28	46.97	128	1788
Hungary	51 (53)	-	64 (77)	245	39 (34)	-	40 (26)	139	75	39.62	842	28634
Kazakhstan	43 (1)	3 (1)	6 (13)	67	7 (0)	-	0 (2)	9	8	58.33	2662	15972
Latvia	11 (30)	-	32 (1)	74	11 (7)	-	-	18	18	22.71	79	864
Lithuania	36 (33)	-	36 (9)	114	35 (20)	-	0 (2)	57	55	28.35	128	4611
Poland	385 (402)	-	19 (82)	888	350 (124)	-	8 (12)	494	475	39.73	445	149417
Romania	66 (114)	-	0 (2)	182	65 (70)	-	0 (10)	136	135	41.78	291	13683
Russia	524 (256)	25 (87)	144 (146)	1182	243 (76)	2 (11)	98 (69)	499	332	33.12	4343	829480
Serbia	220 (60)	3 (0)		283	32 (0)	1 (0)	-	33	32	95.43	55	1696
Slovak Rep.	76 (32)	-	2 (4)	116	10 (2)	-	2 (2)	16	14	52.33	881	2672
Slovenia	58 (159)	-	1 (0)	218	31 (77)	-	-	108	108	50.48	381	9154
Turkey	340 (95)	-	45 (122)	602	320 (72)	-	17 (40)	449	397	89.47	890	270701
Ukraine	245 (7)	-	15 (43)	310	49 (0)	-	7 (1)	57	52	41.56	915	11796

*Note that for Russia some of the cross-listed stocks are also preferred stocks. **Note that the average size values for the Slovak Rep. are based on the year 2009.

Table 2: Summary Statistics

This Table reports summary statistics for the total weekly dollar returns in excess of the 3-month T-Bill rate of our tailor-made indices for each of the 14 CEE countries, of a tailor-made CEE index and of the MSCI CEE, Emerging Market, and Frontier Market indices for the overlapping period January 2002 until May 2011. The table reports the starting year and month for each country/region index, the mean, standard deviation, autocorrelation coefficients as well as the skewness and kurtosis. The starting dates for the tailor-made indices are based on the first date when at least 3 liquid stocks are traded. Stocks are considered to be liquid if (unadjusted) returns were nonzero in at least 25% of days of the previous year. Our tailor-made value-weighted indices include local stocks (from large to small) until 85% of total market capitalization has been reached. The mean and standard deviation are annualized and presented in percent. The column Variance Ratio Test shows the variance of monthly period returns over the variance of 4 overlapping weekly period returns and tests the null hypothesis of the ratio being equal to one which corresponds to a test of standard random walk. Stars (***,**,*) indicate significance at 1%, 5% and 10% for the null hypothesis that the variance ratio is equal to 1.

Country	Starting Date	Mean	SD	Autocorrelation Lag 1	Lag 2	Lag 3	SK	Kurt	Variance Ratio Test
Bulgaria	1/1/02	44.43	41.25	0.002	0.033	0.131	2.168	24.408	1.527***
Croatia	1/1/97	15.70	25.81	0.016	0.069	0.049	0.916	13.358	1.130
Czech Rep.	2/1/95	28.65	30.29	-0.055	-0.012	0.123	-0.506	6.607	1.073
Estonia	1/1/97	19.94	27.12	0.076	0.140	0.151	-0.027	8.102	1.356***
Hungary	1/1/92	19.36	36.10	-0.018	-0.008	0.102	-0.910	7.854	1.088
Latvia	1/1/99	6.82	25.77	0.004	0.067	0.055	-0.627	7.672	1.232
Lithuania	1/1/99	22.11	25.92	0.111	0.109	0.174	-0.266	8.819	1.436**
Poland	1/1/93	18.42	32.97	-0.067	0.020	0.111	-0.538	6.777	1.112
Romania	1/1/97	31.34	38.65	0.105	0.080	0.212	-0.255	5.437	1.273*
Russia	2/1/95	27.39	40.56	-0.063	-0.071	0.152	-0.516	8.757	1.102
Slovak Rep.	1/1/02	24.09	30.22	-0.044	0.021	0.120	-0.161	7.263	0.920
Slovenia	1/1/97	11.88	23.95	-0.007	-0.001	0.279	-0.458	10.940	1.136
Turkey	1/1/91	22.21	41.33	-0.009	0.012	0.082	-0.357	4.813	1.034
Ukraine*	1/1/06	7.15	35.14	0.050	0.174	0.179	-0.585	6.266	1.403**
Own CEE	1/1/95	22.24	34.48	-0.041	-0.042	0.157	-0.789	7.780	1.078
MSCI CEE	1/1/90	18.31	34.32	-0.068	-0.056	0.166	-0.903	10.080	1.045
MSCI EM	1/1/90	14.29	24.08	0.017	-0.043	0.184	-0.863	9.944	1.128
MSCI FM*	6/1/02	7.54	17.67	0.132	0.207	0.195	-1.791	13.211	1.493***

* Note that the starting dates of Ukraine and MSCI FM for the calculations are later than January 2002.

Table 3: Comparison of Tailor-Made Indices with Indices of MSCI, Datastream, and S&P

This Table reports for each country the beta and correlation of the weekly total excess dollar returns on our tailor-made indices with the local and CEE market index returns provided by MSCI, Datastream, and S&P, respectively. The column Starting Date reports the starting year and month. The final three columns also report return correlations among the different index providers. We test the null hypothesis of β (ρ) being equal to 1, where we use a simple t-test for the regression coefficient and Z-test for the correlation coefficient based on a Fisher transformation $[z = (1/2)\ln((1+\rho)/(1-\rho))]$ for which the asymptotic standard error is $1/\sqrt{T-3}$. Since for the null $\rho = 1$ the Fisher transformation is not valid, we use $\rho = 1 \approx 0.99$ as an approximation. The numbers in brackets record the p-values for different tests.

	MSCI			Datastream			S&P			Correlation		
Country	Starting Date	β	ρ	Starting Date	β	ρ	Starting Date	β	ρ	MSCI/ DS	MSCI/ S&P	DS/ S&P
Bulgaria	5/05	0.67	0.82	10/00	0.74	0.88	12/95	0.60	0.65	0.75	0.69	0.63
	-	(0.00)	(0.00)	-	(0.00)	(0.00)	-	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Croatia	5/02	0.63	0.67	-	-	-	4/98	0.34	0.35	-	0.46	-
	-	(0.00)	(0.00)	-	-	-	-	(0.00)	(0.00)	-	(0.00)	-
Czech Rep.	12/94	0.97	0.96	11/93	1.02	0.94	12/94	0.94	0.95	0.95	0.97	0.94
	-	(0.14)	(0.00)	-	(0.21)	(0.00)	-	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Estonia	5/02	0.76	0.87	-	-	-	1/98	0.49	0.59	-	0.63	-
	-	(0.00)	(0.00)	-	-	-	-	(0.00)	(0.00)	-	(0.00)	-
Hungary	12/94	0.94	0.97	6/91	1.02	0.93	12/96	0.95	0.97	0.94	0.99	0.94
	-	(0.00)	(0.00)	-	(0.55)	(0.00)	-	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Latvia	-	-	-	-	-	-	1/98	0.38	0.37	-	-	-
	-	-	-	-	-	-	-	(0.00)	(0.00)	-	-	-
Lithuania	7/08	0.71	0.79	-	-	-	12/95	0.78	0.87	-	0.89	-
	-	(0.00)	(0.00)	-	-	-	-	(0.00)	(0.00)	-	(0.00)	-
Poland	12/92	0.91	0.93	3/94	0.98	0.94	6/95	0.94	0.94	0.98	0.98	0.97
	-	(0.00)	(0.00)	-	(0.26)	(0.00)	-	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Table 3: Comparison of Tailor-Made Indices with Indices of MSCI, Datastream, and S&P (continued)

	MSCI			Datastream			S&P			Correlation		
Country	Starting Date	β	ρ	Starting Date	β	ρ	Starting Date	β	ρ	MSCI/ DS	MSCI/ S&P	DS/ S&P
Romania	11/05	0.91	0.94	12/96	0.99	0.99	1/98	0.64	0.68	0.93	0.70	0.67
	-	(0.20)	(0.00)	-	(0.49)	(0.04)	-	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Russia	12/94	0.91	0.95	1/98	0.61	0.69	12/95	0.78	0.82	0.79	0.90	0.92
	-	(0.00)	(0.00)	-	(0.08)	(0.00)	-	(0.07)	(0.00)	(0.00)	(0.00)	(0.00)
Slovak Rep.	-	-	-	-	-	-	1/97	0.19	0.20	-	-	-
	-	-	-	-	-	-	-	(0.00)	(0.00)	-	-	-
Slovenia	5/02	0.80	0.82	12/98	1.06	0.96	9/02	0.48	0.46	0.85	0.43	0.49
	-	(0.01)	(0.00)	-	(0.08)	(0.00)	-	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Turkey	12/87	0.94	0.85	1/88	0.95	0.86	6/95	0.92	0.85	0.98	0.98	0.99
	-	(0.02)	(0.00)	-	(0.06)	(0.00)	-	(0.00)	(0.00)	(0.00)	(0.00)	(0.17)
Ukraine	5/06	0.16	0.21	-	-	-	1/98	0.10	0.14	-	0.74	-
	-	(0.00)	(0.00)	-	-	-	-	(0.00)	(0.00)	-	(0.00)	-
Average	-	0.78	0.81	-	0.92	0.90	-	0.61	0.63	0.90	0.78	0.82
CEE Index	1/88	0.95	0.98	1/94	1.08	0.97	1/06	1.10	0.91	0.98	0.91	0.92
	-	(0.00)	(0.00)	-	(0.00)	(0.00)	-	(0.04)	(0.00)	(0.00)	(0.00)	(0.00)

Table 4: Tracking Errors of Tailor-Made Indices, Free-Float Adjusted Indices, and Indices of MSCI, Datastream, and S&P

This Table reports annualized tracking errors (in percent) for our tailor-made indices, free-float adjusted versions of our indices, and indices of MSCI, Datastream, and S&P. For indices a and b, the tracking error is defined as $\sqrt{52}\sqrt{\frac{1}{T}\sum_{t=1}^{T}(r_{at}-r_{bt})^2}$. In the Index vs. Free Float columns, we compare our original tailor-made index (Original) to a tailor-made index that only uses stocks for which the free-float adjusted information is available, but weights them using the full market capitalizations rescaled to make them sum to 100% (FF1) and to a tailor-made index that uses these stocks weighted by their actual float-adjusted market capitalizations (FF2). In the Index vs. Provider columns, we compare our tailor-made index (Index) to indices of MSCI, Datastream and S&P. In the Free Float vs. Provider columns, we compare the free-float adjusted index (FF2) with the commercial indices. In the Provider vs. Provider columns, we compare the provider indices with each other.

Country	Original vs. Free Float			Original vs. Provider			Free Float vs. Provider			Provider vs. Provider		
	Original/FF1	Original/FF2	FF1/FF2	Original/MSCI	Original/DS	Original/S&P	FF2/MSCI	FF2/DS	FF2/S&P	MSCI/DS	MSCI/S&P	DS/S&P
Bulgaria	16.46	16.68	12.57	18.72	15.13	23.45	19.04	17.02	23.46	23.16	24.66	26.68
Croatia	15.31	17.73	9.04	22.33	-	28.57	16.98	-	29.37	-	26.21	-
Czech Rep.	1.95	4.54	4.37	8.02	9.30	7.91	8.72	9.99	8.79	6.13	3.66	6.64
Estonia	0.31	7.52	7.50	15.70	-	27.62	15.69	-	28.49	-	27.38	-
Hungary	0.74	5.26	5.24	8.51	13.07	8.67	7.96	14.80	8.03	14.60	1.38	14.53
Latvia	5.38	11.12	10.50	-	-	21.94	-	-	22.4	-	-	-
Lithuania	2.89	12.58	12.78	23.73	-	18.75	25.83	-	19.47	-	17.60	-
Poland	8.67	9.39	3.41	10.36	9.44	10.11	5.95	4.45	6.50	5.31	6.04	6.04
Romania	7.96	16.42	14.80	14.24	6.35	32.87	12.82	14.96	32.46	15.20	31.88	33.00
Russia	2.65	6.06	5.79	12.29	15.94	11.27	13.97	17.50	12.96	11.57	10.30	13.33
Slovak Rep.	16.37	22.47	19.52	-	-	39.84	-	-	40.65	-	-	-
Slovenia	5.89	6.40	2.34	12.17	5.64	23.41	11.58	5.63	23.91	11.30	24.94	22.59
Turkey	1.34	4.22	4.47	6.28	3.62	5.01	8.36	5.59	6.81	5.33	4.29	4.06
Ukraine	15.51	19.87	17.27	30.17	-	29.42	33.83	-	35.15	-	19.81	-
Average	7.25	11.45	9.26	15.21	9.81	20.63	15.06	11.24	21.32	11.58	16.51	15.86
CEE Index	2.14	5.99	5.59	7.14	9.56	17.19	9.32	11.05	18.79	8.28	17.40	13.90

Table 5: Equity Market Development Indicators in 2010

This Table shows the ratio of total market capitalization over GDP; two market liquidity measures, namely (1) turnover, calculated as the ratio of total dollar trading volume per year over the end-of-year market capitalization, and (2) the average percentage of non-zero daily returns, calculated as the yearly average of the value-weighted share of non-zero daily returns (in local currency), and two measures of firm and industry concentration, namely (1) the Herfindahl index and (2) the share of the largest 3 firms (industries). We use FTSE's level-2 classification (10 industries) to calculate the industry measures. All indicators are calculated at the daily frequency, and averaged over the year 2010. The column "Ordinal Rank" ranks the countries from most to least developed, using the aggregated ordinal values of the 5 different measures. The final column reports whether MSCI classifies the market as 'Emerging' or 'Frontier'.

Country	Mcap/ GDP	Liquidity		Concentration				Ordinal Rank	MSCI Classification
		Turn-over	Non-zero returns	Firm HHI	Firm C3	Industry HHI	Industry C3		
Bulgaria	0.075	0.058	0.656	0.029	0.250	0.145	0.707	9	Frontier
Croatia	0.142	0.063	0.900	0.304	0.871	0.293	0.917	11	Frontier
Czech Rep.	0.214	0.494	0.965	0.270	0.900	0.305	0.900	6	Emerging
Estonia	0.093	0.312	0.809	0.101	0.598	0.350	0.882	10	Frontier
Hungary	0.216	1.073	0.954	0.203	0.750	0.161	0.765	3	Emerging
Kazakhstan	0.055	0.007	0.645	0.251	0.881	0.394	1.000	16	Frontier
Latvia	0.035	0.027	0.619	0.140	0.764	0.335	0.890	14	Emerging
Lithuania	0.124	0.069	0.896	0.055	0.380	0.183	0.700	6	Frontier
Poland	0.320	0.372	0.805	0.043	0.309	0.222	0.688	4	Emerging
Romania	0.083	0.138	0.816	0.210	0.684	0.328	0.930	12	Frontier
Russia	0.588	0.813	0.913	0.050	0.331	0.198	0.776	1	Emerging
Serbia	0.049	0.077	0.699	0.071	0.484	0.314	0.898	13	Frontier
Slovak Rep.*	0.029	0.279	0.244	0.586	0.978	0.672	0.799	15	Emerging
Slovenia	0.188	0.087	0.846	0.117	0.523	0.109	0.650	5	Frontier
Turkey	0.386	1.368	0.830	0.029	0.215	0.222	0.729	2	Emerging
Ukraine	0.094	0.097	0.782	0.099	0.694	0.206	0.843	8	Frontier
Germany	0.433	1.14	-	-	-	0.139	0.534	-	Developed
US	1.182	1.76	-	-	-	0.125	0.468	-	Developed

* Note that for the Slovak Republic the values reported pertain to 2009.

Table 6: Market Development: Panel Regressions

This Table reports estimation results from multivariate panel regressions of one of the 5 market development indicators (market cap over GDP, turnover, percentage non-zero returns, and Herfindahl measures of firm and industry concentration) on 9 candidate explanatory variables . Our set includes one economic openness measure (ratio of imports plus exports over GDP), three institutional and political reform measures (EBRD transition indicator, Political Constraints measure of Henisz (2000) and a dummy for EU accession announcement), three capital controls and liberalization measures (Financial openness measure of Chinn and Ito (2008), dummies for official equity market liberalization and first sign of liberalization from Bekaert et al. (2005)) and, lastly, two market specific laws and reforms (dummies for introduction of first prosecution of insider trading law from Bekaert et al. (2005) and a dummy for introduction of electronic trading system (Jain (2005))). Panel A reports estimation results from panel regressions of each of our market development indicators on all determinants of market development without and with country fixed effects. Panel B reports estimation results for the best multivariate model without and with country fixed effects. Starting with all determinants of market development, we remove all insignificant regressors (if the p-value is above 10%) if their joint F-test is insignificant at a 10% significance level. In case it is significant, we only remove the regressor with lowest absolute t-statistic and run a new model without this regressor. We repeat all previous steps until we are left with only significant regressors. Note that for the turnover ratio neither of the regressors turns out significant. All regressions include country fixed effects and standard errors clustered at country level. Stars (***,**, *) indicate significance at the 1%, 5% or 10% significance level.

Panel A: Multivariate panel regressions

	MCAP/GDP	TO	NONZERO	FIRM HHI	SECTOR HHI	MCAP/GDP	TO	NONZERO	FIRM HHI	SECTOR HHI
Institutional and Political Reforms										
EBRD Transition Indicator	-0.106	-0.128	0.099	-0.087	-0.146	-0.013	2.665	0.249***	-0.333***	-0.528***
	(0.141)	(0.911)	(0.104)	(0.148)	(0.163)	(0.078)	(2.270)	(0.073)	(0.104)	(0.127)
Political Constraint Index	0.042	-7.073*	-0.111	-0.053	-0.214*	0.368***	-7.440*	0.041	-0.068	-0.190
	(0.126)	(3.417)	(0.092)	(0.132)	(0.116)	(0.088)	(3.703)	(0.032)	(0.079)	(0.115)
EU Accession	0.021	-0.366	-0.027	-0.050	-0.015	0.026	-0.694	0.001	-0.005	0.025
	(0.045)	(0.247)	(0.050)	(0.064)	(0.084)	(0.023)	(0.477)	(0.020)	(0.033)	(0.040)
Capital Controls and Liberalization										
Financial Openness	0.006	-0.147	0.017	0.005	-0.012	0.020	-0.448	-0.007	0.009	0.008
	(0.018)	(0.219)	(0.024)	(0.016)	(0.027)	(0.016)	(0.488)	(0.015)	(0.031)	(0.029)
Official Liberalization	0.005	0.069	0.023	-0.043	-0.014	-0.010	0.376	0.041*	-0.008	0.017
	(0.031)	(0.356)	(0.030)	(0.045)	(0.047)	(0.022)	(0.369)	(0.021)	(0.034)	(0.045)
First Sign of Liberalization	0.086	-1.375	-0.016	-0.099	-0.256***	0.047	-1.931	-0.090*	-0.163***	-0.236***
	(0.068)	(1.320)	(0.058)	(0.066)	(0.065)	(0.032)	(1.991)	(0.049)	(0.050)	(0.046)
Market Specific Laws and Reforms										
Insider Trading Law	0.101	0.682	0.158**	-0.018	-0.145*	0.011	-1.206	0.014	0.200*	0.103
	(0.069)	(0.485)	(0.058)	(0.060)	(0.076)	(0.083)	(1.710)	(0.072)	(0.096)	(0.106)
Electronic Trading System	0.075	0.964	0.036	0.031	0.027	0.013	-0.764	0.022	0.026	-0.021
	(0.044)	(0.780)	(0.047)	(0.036)	(0.050)	(0.034)	(0.709)	(0.039)	(0.049)	(0.034)
Economic Openness										
Trade/GDP	-0.047	-0.243	-0.110	0.197***	0.097	0.157*	1.144	0.020	0.077	-0.008
	(0.071)	(0.567)	(0.091)	(0.063)	(0.097)	(0.077)	(1.052)	(0.094)	(0.075)	(0.099)
Constant	0.300	6.413	0.424	0.523	1.278**	-0.293	-0.939	-0.164	1.365***	2.496***
	(0.344)	(4.557)	(0.308)	(0.390)	(0.525)	(0.239)	(3.645)	(0.200)	(0.293)	(0.356)
Country fixed effects	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
△GDP per Capita	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
△GDP Deflator	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.209	0.182	0.268	0.237	0.260	0.686	0.319	0.663	0.592	0.652
Observations	184	184	184	184	184	184	184	184	184	184

Table 6: Market Development: Panel Regressions (continued)

Panel B: Best Multivariate Model

	MCAP/GDP	TO	NONZERO	FIRM HHI	SECTOR HHI	MCAP/GDP	TO	NONZERO	FIRM HHI	SECTOR HHI
Institutional and Political Reforms										
EBRD	-	-	-	-0.165**	-	-	-	0.265***	-0.283**	-0.421***
	-	-	-	(0.075)	-	-	-	(0.050)	(0.113)	(0.072)
Political Constraint	-	-6.225*	-	-	-0.240**	0.371***	-5.214**	-	-	-0.194**
	-	(3.290)	-	-	(0.097)	(0.095)	(1.822)	-	-	(0.080)
EU Accession	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Capital Controls and Liberalization										
Financial Openness	-	-	-	-	-	0.029***	-	-	-	-
	-	-	-	-	-	(0.009)	-	-	-	-
Official Liberalization	-	-	-	-	-	-	-	0.045**	-	-
	-	-	-	-	-	-	-	(0.015)	-	-
First Sign of Liberalization	0.078***	-	-	-0.102*	-0.264***	0.052**	-	-0.088**	-0.171***	-0.238***
	(0.020)	-	-	(0.053)	(0.049)	(0.017)	-	(0.035)	(0.051)	(0.040)
Market Specific Laws and Reforms										
Insider Trading Law	-	-	0.174***		-0.162***	-	-	-	0.236**	-
	-	-	(0.030)		(0.055)	-	-	-	(0.106)	-
Electronic Trading System	0.089**	-	-	-	-	-	-	-	-	-
	(0.032)	-	-	-	-	-	-	-	-	-
Economic Openness										
Trade/GDP	-	-	-	0.228***	-	0.162**	-	-	-	-
	-	-	-	(0.075)	-	(0.072)	-	-	-	-
Constant	-0.012	5.116*	0.618***	0.658**	0.865***	-0.349***	4.401***	-0.160	1.211***	2.221***
	(0.025)	(2.560)	(0.009)	(0.237)	(0.107)	(0.117)	(1.290)	(0.158)	(0.320)	(0.227)
Country fixed effects	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
$\triangle$GDP per Capita	Yes	No	No	No	No	Yes	No	No	No	No
$\triangle$GDP Deflator	No	No	No	No	No	No	No	No	Yes	Yes
R^2	0.119	0.125	0.162	0.175	0.199	0.679	0.265	0.659	0.579	0.645
Observations	184	184	184	184	184	184	184	184	184	184

Table 7: Correlations, Betas and Idiosyncratic Volatilities

This Table reports correlation coefficients (ρ), regression coefficients (β), annualized idiosyncratic volatilities ($\sigma_{i,t}$), and their respective trends (trend) for weekly dollar returns of tailor-made country indices and the CEE index with respect to the benchmark region indices of MSCI, all in excess of the 3-month T-Bill rate. The MSCI benchmark regions are the World, Europe, Emerging Markets, and Russia. Bold numbers stand for significance at the 5% level for correlation and regression coefficients. Idiosyncratic volatilities are calculated based on the residuals from regressions on the benchmarks. We conduct Bunzel and Vogelsang (2005) trend tests using quarterly non-overlapping correlations, betas, and idiosyncratic volatilities (that is, using 13 weekly observations within the quarter) and present the respective annualized trend coefficients. The Bunzel and Vogelsang (2005) test uses a Daniell kernel to maximize the power of this test in small samples. Starts (**, *) indicate significance at the 5% and 10% significance level.

Country	World						Europe					
	ρ	trend	β	trend	$\sigma_{i,t}$	trend	ρ	trend	β	trend	$\sigma_{i,t}$	trend
Bulgaria	__0.23__	__0.078__**	__0.52__	__0.130__*	__0.40__	-0.051	__0.26__	__0.074__**	__0.47__	0.050	__0.40__	-0.052
Croatia	__0.32__	0.005	__0.53__	-0.004	__0.27__	-0.007	__0.35__	0.010	__0.48__	-0.004	__0.27__	-0.007
Czech Rep.	__0.48__	__0.042__**	__0.84__	__0.075__**	__0.25__	0.000	__0.54__	__0.041__**	__0.79__	__0.054__**	__0.24__	-0.001
Estonia	__0.26__	__0.035__**	__0.57__	__0.071__**	__0.37__	-0.022	__0.30__	__0.034__**	__0.54__	__0.037__*	__0.37__	-0.023
Hungary	__0.53__	__0.031__**	__1.19__	__0.048__*	__0.30__	-0.002	__0.56__	__0.036__**	__1.05__	__0.047__**	__0.30__	-0.003
Latvia	__0.21__	__0.035__**	__0.39__	0.034	__0.33__	-0.005	__0.24__	__0.042__**	0.37	0.033	__0.32__	-0.004
Lithuania	__0.30__	__0.034__**	__0.43__	__0.043__**	__0.24__	0.001	__0.34__	__0.040__**	__0.40__	0.043	__0.24__	0.001
Poland	__0.42__	__0.037__**	__1.09__	__0.034__*	__0.38__	-0.020	__0.45__	__0.040__**	__0.97__	0.024	__0.37__	-0.022
Romania	__0.23__	__0.067__*	__0.68__	__0.139__**	__0.50__	-0.033	__0.25__	__0.074__**	__0.60__	__0.116__**	__0.49__	-0.034
Russia	__0.37__	__0.046__**	__1.36__	__0.106__*	__0.57__	__-0.031__*	__0.37__	__0.049__**	1.14	__0.075__*	__0.57__	__-0.033__*
Slovak Rep.	__0.33__	0.000	__0.53__	0.058	__0.28__	0.019	__0.35__	0.006	__0.46__	0.048	__0.28__	0.018
Slovenia	__0.33__	__0.037__**	__0.46__	__0.046__**	__0.23__	-0.007	__0.40__	__0.033__**	__0.46__	0.021	__0.23__	-0.007
Turkey	__0.28__	__0.038__**	__1.10__	__0.135__**	__0.59__	__-0.027__*	__0.28__	__0.033__**	__0.89__	__0.058__*	__0.59__	__-0.029__*
Ukraine	0.04	__0.142__**	0.08	0.284	__0.35__	-0.010	0.00	__0.114__*	0.01	0.129	__0.35__	-0.009
Average (all)	0.31	0.045	0.70	0.086	0.36	-0.011	0.24	0.034	0.52	0.066	0.37	-0.011
Average (frontier)	0.24	0.057	0.47	0.101	0.34	-0.018	0.18	0.043	0.33	0.080	0.34	-0.016
Average(emerging)	0.37	0.033	0.93	0.070	0.39	-0.002	0.30	0.025	0.71	0.053	0.40	-0.005
CEE	__0.46__	__0.050__**	__1.23__	__0.071__*	__0.39__	-0.022	__0.45__	__0.051__**	__1.00__	0.044	__0.40__	-0.024
Cross-listed	__0.43__	__0.037__**	__1.06__	__0.065__**	__0.38__	-0.007	__0.42__	__0.041__**	__0.86__	__0.053__**	__0.38__	-0.008
Home-only	__0.41__	__0.043__**	__0.69__	__0.060__**	__0.26__	-0.011	__0.40__	__0.041__**	__0.56__	__0.030__*	__0.26__	-0.011
Large stocks	__0.43__	__0.041__**	__0.97__	__0.069__**	__0.35__	-0.008	__0.42__	__0.041__**	__0.79__	__0.046__**	__0.35__	-0.009
Small stocks	__0.30__	__0.035__**	__0.51__	0.029	__0.27__	-0.005	__0.31__	__0.036__**	__0.44__	0.019	__0.27__	-0.006
Liquid stocks	__0.50__	__0.033__**	__1.08__	__0.062__**	__0.32__	-0.003	__0.49__	__0.034__**	__0.89__	0.031	__0.33__	-0.003
Illiquid stocks	__0.20__	__0.026__**	__0.35__	0.042	__0.28__	-0.009	__0.20__	__0.024__**	__0.28__	0.018	__0.28__	-0.009

Table 7: Correlations, betas and idiosyncratic volatilities (continued)

Country	Emerging						Russia					
	ρ	trend	β	trend	$\sigma_{i,t}$	trend	ρ	trend	β	trend	$\sigma_{i,t}$	trend
Bulgaria	**0.24**	**0.077****	**0.41**	0.120	**0.40**	-0.049	**0.30**	0.045	**0.30**	0.015	**0.39**	-0.048
Croatia	**0.35**	-0.005	**0.42**	-0.032	**0.27**	-0.007	**0.28**	0.011	**0.15**	0.011	**0.28**	-0.007
Czech Rep.	**0.56**	**0.035****	**0.71**	**0.039****	**0.24**	0.000	**0.41**	**0.036****	**0.21**	**0.038****	**0.26**	-0.002
Estonia	**0.30**	**0.030****	**0.48**	**0.037****	**0.37**	-0.021	**0.33**	**0.028***	**0.24**	**0.023***	**0.36**	-0.020
Hungary	**0.55**	**0.036****	**0.89**	**0.047****	**0.30**	-0.003	**0.46**	**0.042****	**0.30**	**0.054****	**0.32**	-0.004
Latvia	**0.22**	**0.032***	**0.32**	0.017	**0.33**	-0.004	**0.14**	**0.045***	**0.10**	0.025	**0.33**	-0.003
Lithuania	**0.36**	**0.031***	**0.39**	**0.039****	**0.24**	0.002	**0.26**	**0.038****	**0.14**	**0.032****	**0.25**	0.000
Poland	**0.49**	**0.037****	**0.92**	0.016	**0.36**	-0.021	**0.43**	**0.043****	**0.27**	**0.047****	**0.31**	-0.010
Romania	**0.32**	0.059	**0.68**	**0.090***	**0.48**	-0.033	**0.24**	0.059	**0.23**	0.044	**0.49**	-0.030
Russia	**0.47**	**0.045****	**1.25**	0.065	**0.54**	**-0.032***	-	-	-	-	-	-
Slovak Rep.	**0.24**	0.011	**0.29**	0.036	**0.29**	0.020	**0.18**	0.011	**0.13**	0.028	**0.29**	0.020
Slovenia	**0.38**	**0.032***	**0.40**	**0.029***	**0.23**	-0.007	**0.30**	0.024	**0.14**	**0.015***	**0.24**	-0.007
Turkey	**0.34**	**0.044****	**0.96**	**0.088****	**0.58**	**-0.029***	**0.34**	**0.040****	**0.34**	0.043	**0.52**	**-0.026***
Ukraine	0.01	0.092	0.01	0.143	**0.35**	-0.007	0.04	0.095	0.03	0.105	**0.35**	-0.004
Average	0.34	0.039	0.58	0.053	0.36	-0.011	0.29	0.037	0.20	0.033	0.34	-0.009
Average (frontier)	0.28	0.045	0.40	0.061	0.33	-0.018	0.25	0.043	0.18	0.035	0.34	-0.017
Average(emerging)	0.41	0.034	0.76	0.044	0.38	-0.002	0.33	0.036	0.23	0.039	0.34	0.000
CEE	**0.56**	**0.053****	**1.09**	**0.050****	**0.37**	-0.025	**0.54**	0.060	**0.44**	**0.056****	**0.37**	0.28
Cross-listed	**0.60**	**0.032****	**1.09**	**0.033****	**0.34**	-0.009	**0.52**	**0.040****	**0.40**	**0.049****	**0.36**	-0.011
Home-only	**0.54**	**0.035****	**0.67**	0.015	**0.24**	-0.011	**0.37**	**0.045****	**0.20**	**0.033****	**0.27**	-0.011
Large stocks	**0.60**	**0.033****	**0.99**	**0.029****	**0.31**	-0.011	**0.50**	**0.045****	**0.35**	**0.046****	**0.33**	-0.012
Small stocks	**0.42**	**0.024***	**0.52**	0.000	**0.26**	-0.004	**0.30**	**0.035****	**0.16**	**0.031***	**0.28**	-0.004
Liquid stocks	**0.66**	**0.027****	**1.07**	**0.028****	**0.28**	-0.004	**0.61**	**0.034****	**0.42**	**0.048****	**0.30**	-0.004
Illiquid stocks	**0.28**	**0.022****	**0.35**	0.008	**0.28**	-0.009	**0.23**	**0.027****	**0.12**	**0.021***	**0.28**	0.66

Table 8: Correlation decomposition

This Table shows a decomposition of correlation coefficients for weekly dollar returns of tailor-made country indices and the CEE index with respect to the benchmark region indices of MSCI, all in excess of the 3-month T-Bill rate. The MSCI benchmark regions are the World, Europe, Emerging Markets, and Russia. For each benchmark, we calculate correlations over the last 10 years (ρ_{10}), 2 years (ρ_2), and 1-year ahead (ρ_{+1}) based on the linear trend model from Table 7. Note that if the trend coefficient is not significant we use the correlation for the whole sample period (in italics). In the next for columns, we form ratios of the 2-year over the 10-year correlation as well as a model-implied correlation over the 10-year correlation for each benchmark respectively. For the model-implied correlation, we decompose the correlation of a CEE market i with a benchmark b into three main components: the market's beta with respect to the benchmark (β_i^b), the benchmark's return volatility (σ_b^2), as well as country-specific ('idiosyncratic') volatility (σ_i^2) (see also Bekaert et al. (2009)): $\rho_{t_\beta,t_b,t_i} = \beta_i^b \sigma_b / \sqrt{\left(\left(\beta_i^b\right)^2 \sigma_b^2 + \sigma_i^2\right)}$, where the subscripts indicate the calculation period for beta, the benchmark volatility, and the idiosyncratic volatility.

Country	World							Europe						
	ρ_{10}	ρ_2	ρ_{+1}	$\frac{\rho_2}{\rho_{10}}$	$\frac{\rho_{2,10,10}}{\rho_{10}}$	$\frac{\rho_{10,2,10}}{\rho_{10}}$	$\frac{\rho_{10,10,2}}{\rho_{10}}$	ρ_{10}	ρ_2	ρ_{+1}	$\frac{\rho_2}{\rho_{10}}$	$\frac{\rho_{2,10,10}}{\rho_{10}}$	$\frac{\rho_{10,2,10}}{\rho_{10}}$	$\frac{\rho_{10,10,2}}{\rho_{10}}$
Bulgaria	0.23	0.55	0.69	2.38	1.42	0.96	1.84	0.26	0.58	0.72	2.28	1.31	0.997	1.84
Croatia	0.35	0.20	*0.32*	0.58	0.69	0.97	0.89	0.39	0.25	*0.35*	0.63	0.71	1.004	0.88
Czech Rep.	0.57	0.69	0.74	1.21	0.96	0.97	1.27	0.61	0.74	0.79	1.21	0.93	1.003	1.26
Estonia	0.45	0.48	0.56	1.07	1.21	0.97	0.90	0.49	0.51	0.63	1.04	1.14	1.004	0.90
Hungary	0.64	0.80	0.74	1.24	1.20	0.98	1.06	0.67	0.84	0.83	1.25	1.17	1.003	1.09
Latvia	0.23	0.18	0.43	0.78	0.79	0.96	1.02	0.27	0.24	0.54	0.89	0.86	1.005	1.02
Lithuania	0.35	0.49	0.42	1.40	1.36	0.97	1.07	0.40	0.54	0.53	1.35	1.26	1.004	1.08
Poland	0.62	0.75	0.83	1.21	1.11	0.98	1.13	0.64	0.79	0.89	1.24	1.09	1.003	1.15
Romania	0.42	0.70	0.74	1.68	1.40	0.97	1.30	0.45	0.73	0.82	1.63	1.32	1.004	1.31
Russia	0.62	0.83	0.85	1.33	1.08	0.98	1.29	0.63	0.83	0.87	1.32	1.05	1.003	1.28
Slovak Rep.	0.33	0.43	*0.33*	1.32	1.74	0.97	0.73	0.34	0.44	*0.35*	1.30	1.65	1.005	0.74
Slovenia	0.44	0.57	0.58	1.29	1.07	0.97	1.24	0.48	0.62	0.63	1.27	1.03	1.004	1.24
Turkey	0.54	0.60	0.70	1.11	0.82	0.97	1.31	0.53	0.61	0.68	1.17	0.82	1.004	1.34
Ukraine	-	0.31	0.56	-	-	-	-	-	0.20	0.42	-	-	-	-
CEE	0.69	0.86	0.91	1.86	1.04	0.98	1.22	0.69	0.86	0.93	1.92	1.02	1.003	1.22
Frontier	0.37	0.47	0.53	1.40	1.19	0.97	1.20	0.41	0.49	0.58	1.37	1.13	1.00	1.21
Emerging	0.51	0.61	0.65	1.17	1.10	0.97	1.12	0.53	0.64	0.70	1.19	1.08	1.00	1.13
Cross-listed	0.55	0.60	0.75	1.09	1.01	0.97	1.10	0.55	0.54	0.75	1.34	0.91	1.004	1.07
Home-only	0.52	0.64	0.62	1.22	1.16	0.97	1.08	0.52	0.58	0.65	1.38	1.07	1.004	1.05
Large stocks	0.57	0.62	0.75	1.09	1.03	0.97	1.08	0.56	0.56	0.76	0.99	0.94	1.004	1.05
Small stocks	0.40	0.63	0.61	1.58	1.35	0.97	1.24	0.42	0.60	0.64	1.44	1.22	1.004	1.20
Liquid stocks	0.56	0.62	0.72	1.11	1.04	0.97	1.09	0.56	0.56	0.73	1.29	0.94	1.004	1.05
Illiquid stocks	0.24	0.36	0.44	1.51	1.52	0.96	1.03	0.23	0.32	0.46	1.97	1.35	1.005	1.01

Table 8: Correlation decomposition (continued)

Country	Emerging							Russia						
	ρ_{10}	ρ_2	ρ_{+1}	$\frac{\rho_2}{\rho_{10}}$	$\frac{\rho_{2,10,10}}{\rho_{10}}$	$\frac{\rho_{10,2,10}}{\rho_{10}}$	$\frac{\rho_{10,10,2}}{\rho_{10}}$	ρ_{10}	ρ_2	ρ_{+1}	$\frac{\rho_2}{\rho_{10}}$	$\frac{\rho_{2,10,10}}{\rho_{10}}$	$\frac{\rho_{10,2,10}}{\rho_{10}}$	$\frac{\rho_{10,10,2}}{\rho_{10}}$
Bulgaria	0.24	0.48	0.63	2.00	1.38	0.83	1.75	0.30	0.50	*0.51*	1.67	1.15	0.85	1.69
Croatia	0.36	0.14	*0.35*	0.39	0.55	0.84	0.87	0.32	0.21	*0.28*	0.65	0.86	0.86	0.89
Czech Rep.	0.63	0.68	0.73	1.07	0.98	0.88	1.19	0.59	0.63	0.70	1.06	0.96	0.89	1.20
Estonia	0.51	0.42	0.56	0.82	1.10	0.86	0.85	0.44	0.47	0.49	1.07	1.33	0.87	0.90
Hungary	0.66	0.80	0.82	1.21	1.25	0.89	1.05	0.62	0.79	0.93	1.28	1.30	0.89	1.07
Latvia	0.26	0.15	0.42	0.57	0.68	0.84	1.01	0.22	0.10	0.48	0.46	0.53	0.85	1.01
Lithuania	0.43	0.43	0.43	1.01	1.16	0.85	1.00	0.37	0.47	0.47	1.28	1.39	0.86	1.05
Poland	0.69	0.76	0.89	1.11	1.12	0.90	1.08	0.63	0.71	0.92	1.12	1.13	0.90	1.08
Romania	0.50	0.71	*0.32*	1.43	1.34	0.86	1.24	0.45	0.72	*0.24*	1.59	1.44	0.87	1.29
Russia	0.74	0.89	0.95	1.19	1.07	0.91	1.19	-	-	-	1.02	-	-	-
Slovak Rep.	0.23	0.38	*0.24*	1.64	2.45	0.83	0.73	0.16	0.35	*0.18*	2.10	3.15	0.85	0.72
Slovenia	0.51	0.55	0.51	1.08	1.05	0.86	1.17	0.46	0.52	*0.30*	1.13	1.07	0.87	1.19
Turkey	0.64	0.68	0.81	1.06	0.91	0.89	1.24	0.50	0.53	0.87	1.06	0.87	0.88	1.31
Ukraine	-	0.17	0.33	-	-	-	-	-	0.17	0.30	-	-	-	-
CEE	0.81	0.92	1.03	1.13	1.05	0.93	1.14	0.92	0.95	*0.54*	1.03	1.01	0.97	1.04
Frontier	0.42	0.41	0.49	1.12	1.10	0.85	1.15	0.39	0.44	0.46	1.23	1.21	0.86	1.17
Emerging	0.55	0.62	0.70	1.12	1.21	0.88	1.07	0.52	0.58	0.75	1.16	1.28	0.89	1.06
Cross-listed	0.74	0.66	0.83	0.89	0.99	0.91	0.99	0.81	0.66	0.94	0.82	0.95	0.94	0.95
Home-only	0.68	0.66	0.67	0.97	1.08	0.89	0.99	0.58	0.61	0.67	1.05	1.14	0.89	1.03
Large stocks	0.75	0.67	0.83	0.89	1.00	0.91	0.98	0.80	0.66	0.93	0.82	0.96	0.93	0.94
Small stocks	0.48	0.65	0.62	1.36	1.31	0.86	1.20	0.38	0.56	0.61	1.47	1.42	0.86	1.19
Liquid stocks	0.75	0.68	0.80	0.91	1.01	0.91	0.99	0.82	0.68	0.92	0.83	0.97	0.94	0.94
Illiquid stocks	0.29	0.41	0.48	1.40	1.57	0.84	1.03	0.27	0.35	0.46	1.31	1.49	0.85	1.01

Table 9: Hurdle Rates

This Table reports correlations between weekly returns on the respective country indices and those on the MSCI World index, the ratios of the return volatilities on the respective country indices and MSCI world, as well as country-specific hurdle rates, again with respect to the MSCI World index. The hurdle rate is the lowest possible expected (excess) return for market i that must be earned for investors with a 100 percent investment in the benchmark to improve their Sharpe Ratio when they invest in market i, given a specific expected (excess) return for the benchmark market. The hurdle rate is defined as $HR_i^b = \rho_{i,b}(E\left[r_b\right] - r_f^b)(\sigma_i/\sigma_b) = \beta_{i,b}(E[r_b] - r_f^b)$ with $E\left[r_b\right] - r_f^b = 5\%$. We calculate hurdle rates for the whole sample period (HR), i.e. over the the period 2002 to mid 2011, and for the last 2 (HR2) and 5 (HR5) years based on betas from regressions of the returns on the respective country indices on MSCI World index returns (estimated over the full sample, last 2 and 5 years, respectively). The last forward-looking hurdle rate (FHR) is based on a 1-year forward looking beta derived from the linear trend model in Table 7. Note that if trend coefficients are not significant, we use a full sample beta (in italics).

Country	World					
	ρ	$\frac{\sigma_i}{\sigma_w}$	HR	HR5	HR2	FHR
Bulgaria	0.23	2.26	2.60	3.88	3.45	4.95
Croatia	0.35	1.42	2.50	2.76	1.77	*2.63*
Czech Rep.	0.58	1.66	4.85	5.38	4.69	6.76
Estonia	0.45	1.49	3.33	4.12	4.10	4.62
Hungary	0.65	1.98	6.42	7.91	8.61	7.37
Latvia	0.29	1.41	2.08	2.71	2.18	1.95
Lithuania	0.35	1.42	2.51	3.37	3.22	2.62
Poland	0.64	1.81	5.75	6.54	6.97	7.16
Romania	0.43	2.12	4.59	6.74	6.99	8.05
Russia	0.64	2.23	7.13	8.53	7.57	9.96
Slovak Rep.	0.33	1.66	2.73	2.85	4.57	*2.65*
Slovenia	0.46	1.32	3.05	3.90	3.17	3.62
Turkey	0.54	2.27	6.15	7.43	5.45	10.48
CEE	0.70	1.89	6.63	7.86	7.07	8.59
US	0.94	0.99	4.69			-
Frontier	0.38	1.67	3.09	4.13	3.78	4.41
Emerging	0.52	1.86	5.02	5.91	5.72	6.62
Cross-listed	0.55	2.09	5.79	7.18	5.88	7.64
Home-only	0.52	1.36	3.55	4.55	4.43	5.56
Large Stocks	0.57	1.87	5.27	6.53	5.52	7.35
Small Stocks	0.40	1.37	2.73	2.79	4.01	3.84
Liquid stocks	0.56	2.05	5.78	7.25	6.17	7.55
Illiquid stocks	0.24	1.48	1.76	1.92	2.77	1.74

Table 10: Decomposition of Index Returns into Country and Industry Effects

This Table shows the volatility of the components of the value-weighted weekly country and industry index returns in excess of the CEE market from 1995 until mid 2011. We estimate weekly cross-sectional regressions based on a Heston and Rouwenhorst (1994) model for each return i of country k and industry j: $r_i = \alpha + \beta_1 I_{i1} + \beta_2 I_{i2} + ... + \beta_{10} I_{i10} + \gamma_1 C_{i1} + \gamma_2 C_{i2} + ... + \gamma_{14} C_{i14} + \varepsilon_i$, with industry dummies (I) and country dummies C subject to the constraint that the value-weighted industry and country effects sum to zero. The cross-sectional regressions yield time series of coefficients. The value-weighted country index of country k can be decomposed into a common effect to all countries ($\hat{\alpha}$), a pure country effect ($\hat{\gamma_k}$) , and the value-weighted sum of 10 industry effects ($\sum_{j=1}^{10} \theta_{j,k} \hat{\beta}_j I_{ij}$). The value-weighted industry index of industry j can be decomposed into a common effect to all industries ($\hat{\alpha}$), a pure industry effect ($\hat{\beta_j}$) and the value-weighted sum of 14 country effects ($\sum_{k=1}^{14} \phi_{j,k} \hat{\gamma}_k C_{ik}$). Note that the estimate of α represents the return on the value-weighted CEE index. For each country (industry), we report the annualized volatilities of the value-weighted country (industry) return in excess of the value-weighted CEE index, the pure country (industry) effect and the value-weighted sum of industry (country) effects.

Country	Excess Country Volatility	Volatility of γ_k	Volatility of $\sum_{j=1}^{10} \theta_{j,k} \hat{\beta}_j I_{ij}$
Bulgaria	33.87	25.69	5.13
Croatia	32.03	29.76	6.33
Czech Rep.	27.55	27.89	7.26
Estonia	36.82	33.48	5.87
Hungary	28.17	28.14	5.55
Latvia	32.19	27.26	4.86
Lithuania	29.53	24.52	5.80
Poland	29.60	29.04	5.63
Romania	45.91	42.99	5.67
Russia	35.28	35.56	6.94
Slovak Rep.	36.22	29.04	4.43
Slovenia	43.48	40.21	6.00
Turkey	26.39	26.87	5.60
Ukraine	54.90	30.49	5.03
Average	35.14	30.78	5.72
Industry	Excess Industry Volatility	Volatility of β_j	Volatility of $\sum_{k=1}^{14} \phi_{j,k} \hat{\gamma}_k C_{ik}$
Oil & Gas	19.65	14.97	16.45
Basic Materials	19.39	11.10	15.40
Industrials	18.85	15.17	15.95
Consumer Goods	15.34	7.97	14.01
Health Care	26.07	17.28	20.49
Consumer Service	18.36	12.03	14.11
Telecommunications	26.09	19.83	24.46
Utilities	23.45	16.31	17.27
Financials	16.49	9.32	14.07
Technology	31.24	25.02	18.67
Average	21.49	14.90	17.09

Table 11: Cross-Sectional Strategies

This Table reports performance statistics for different characteristics based portfolios. Starting from the first quarter of 1996 until mid 2011, we build portfolios for 2090 liquid stocks in 14 CEE countries based on the following characteristics: 1-quarter lagged size (market capitalization), dividend yield, price earning ratio, and market to book ratio; t-12 to t-1 and t-6 to t-1 months momentum; 1-quarter lagged volatility, low local and global beta (measured over the previous year), and illiquidity (zero returns measure). For each quarter, we rank stocks based on the respective characteristic and construct value-weighted returns for selected stocks in the 25th (L) and 75th quartile (H) as well the H-L /L-H respectively. Based on monthly returns in excess of the 3-month T-bill rate, we calculate means, volatility, and alphas from univariate regressions of the portfolio returns on our own CEE index, MSCI EM index, MSCI Europe index, MSCI World index as well as multivariate regressions on the CEE, Europe (EU), and World (W) indices and on the global Fama-French factors + momentum (Global FF+Mom). We form correlations $\rho_{i,w}$, variance ratios (σ_i/σ_w) and hurdle rates (HR) with respect to the MSCI World index. The last column reports the average liquidity within each portfolio (%NZR). Panel A reports unrestricted portfolios, while Panel B and Panel C report industry and country neutral portfolios. Bold numbers indicate significance at the 5% significance level. Note that for the dividend yield, price-earnings ratio and book-to-market ratio we do not have data for all 2090 stocks but only for 99.7%, 87.1%, and 74% of the original sample, respectively.

Panel A: Unrestricted

Characteristic				(Annualized) alpha with respect to:						Hurdle Rate vis-à-vis World			Liquid
		μ	σ	CEE	EM	Europe	World	CEE-EU-W	Global FF+Mom	$\rho_{i,w}$	$\frac{\sigma_i}{\sigma_w}$	HR	%NZR
Size	L	24.63	32.7	**18.48**	**20.09**	**21.34**	**22.51**	**18.07**	**23.18**	0.47	2.03	4.77	64.3%
(1 quarter lagged)	H	15.91	38.6	**3.24**	9.60	11.26	12.69	**3.17**	11.07	0.61	2.40	7.28	84.2%
	L-H	8.72	33.23	**15.25**	10.50	10.09	9.81	**14.90**	12.12	-0.24	2.06	-	-
dividend yield	L	9.0	32.3	2.86	3.36	4.32	6.01	2.31	-2.67	0.66	2.01	6.67	83.5%
(1 quarter lagged)	H	22.5	37.9	**11.42**	**16.48**	**17.73**	**19.44**	**10.58**	**16.28**	0.60	2.36	7.02	82.2%
	H-L	13.57	30.74	8.56	13.11	13.41	13.42	8.28	**18.95**	0.04	1.91	-	-
P/E	L	29.8	38.7	**19.31**	**23.82**	**25.30**	**26.77**	**19.07**	**18.01**	0.57	2.41	6.90	82.5%
(1 quarter lagged)	H	6.2	40.2	-5.29	0.12	1.74	3.13	-5.31	4.13	0.56	2.50	6.98	79.8%
	L-H	23.61	30.57	**24.60**	**23.70**	**23.55**	**23.64**	**24.39**	13.87	-0.01	1.90	-	-
Market to Book	L	23.2	38.0	14.71	**16.64**	18.99	**20.26**	15.01	12.42	0.55	2.36	6.52	76.5%
(1 quarter lagged)	H	1.8	42.1	**-10.67**	-4.01	-2.82	-1.41	**-10.72**	2.11	0.55	2.62	7.16	83.8%
	L-H	21.40	39.02	**25.38**	20.65	21.81	21.67	**25.74**	10.31	-0.05	2.42	-	-
Momentum	L	20.2	50.0	6.11	12.56	14.99	16.31	7.24	**25.43**	0.56	3.10	8.67	78.4%
(t-12 to t-1)	H	14.7	40.6	2.82	8.84	10.13	11.66	2.32	6.90	0.55	2.52	6.97	83.0%
	H-L	-5.42	37.45	-3.29	-3.72	-4.87	-4.65	-4.92	**-18.53**	-0.15	2.33	-	-
Momentum	L	12.0	51.3	-2.50	4.38	6.34	7.99	-2.14	12.29	0.56	3.19	8.98	78.9%
(t-6 to t-1)	H	16.4	37.6	5.70	10.50	11.95	13.40	5.44	10.53	0.58	2.34	6.78	82.1%
	H-L	4.43	36.15	8.20	6.12	5.61	5.41	7.59	-1.76	-0.20	2.25	-	-
Volatility	L	19.7	28.5	**12.70**	**14.90**	**16.33**	**17.47**	**12.39**	**11.22**	0.56	1.77	4.96	83.2%
(t-3 to t)	H	6.5	48.5	-6.54	-0.98	1.05	2.73	-6.36	7.29	0.57	3.01	8.63	76.2%
	L-H	13.1	37.0	**19.24**	**15.87**	**15.28**	14.74	**18.75**	3.94	-0.32	2.30	-	-

Table 11 continued...

Panel A: Unrestricted

Characteristic				(Annualized) alpha with respect to:						Hurdle Rate vis-à-vis World			Liquid
		μ	σ	CEE	EM	Europe	World	CEE-EU-W	Global FF+Mom	$\rho_{i,w}$	$\frac{\sigma_i}{\sigma_w}$	HR	%NZR
low local beta	L	10.0	21.8	6.40	7.11	7.73	8.65	5.69	3.58	0.45	1.35	3.04	70.7%
(1 year lagged)	H	13.9	49.6	-0.69	6.12	8.28	9.87	-0.10	14.99	0.59	3.08	9.09	84.5%
	L-H	-3.9	45.1	7.09	1.00	-0.55	-1.22	5.79	-11.41	-0.43	2.80	-	-
low world beta	L	14.1	29.5	7.61	10.10	10.71	11.98	6.88	9.99	0.52	1.83	4.81	70.6%
(1 year lagged)	H	18.4	42.3	6.79	11.08	13.34	14.84	7.17	13.05	0.61	2.63	8.04	85.7%
	L-H	-4.3	32.9	0.82	-0.98	-2.63	-2.86	-0.29	-3.06	-0.32	2.05	-	-
Illiquidity	L	18.5	35.7	8.37	**12.11**	13.78	**15.28**	8.37	8.90	0.66	2.22	7.29	90.2%
(1 year lagged)	H	22.8	32.4	**15.59**	**19.26**	**20.46**	**21.29**	**15.01**	**14.20**	0.34	2.01	3.44	45.9%
	H-L	4.3	28.9	7.22	7.15	6.68	6.01	6.64	5.30	-0.43	1.80	-	-

Table 11 continued...

This Table reports performance statistics for different characteristics based portfolios. Starting from the first quarter of 1996 until mid 2011, we build portfolios for 2090 liquid stocks in 14 CEE countries based on the following characteristics: 1-quarter lagged size (market capitalization), dividend yield, price earning ratio, and market to book ratio; t-12 to t-1 and t-6 to t-1 months momentum; 1-quarter lagged volatility, low local and global beta (measured over the previous year), and illiquidity (zero returns measure). For each quarter, we rank stocks based on the respective characteristic and construct value-weighted returns for selected stocks in the 25th (L) and 75th quartile (H) as well the H-L /L-H respectively. Based on monthly returns in excess of the 3-month T-bill rate, we calculate means, volatility, and alphas from univariate regressions of the portfolio returns on our own CEE index, MSCI EM index, MSCI Europe index, MSCI World index as well as multivariate regressions on the CEE, Europe (EU), and World (W) indices and on the global Fama-French factors + momentum (Global FF+Mom). We form correlations $\rho_{i,w}$, variance ratios (σ_i/σ_w) and hurdle rates (HR) with respect to the MSCI World index. The last column reports the average liquidity within each portfolio (%NZR). Panel A reports unrestricted portfolios, while Panel B and Panel C report industry and country neutral portfolios. Bold numbers indicate significance at the 5% significance level. Note that for the dividend yield, price-earnings ratio and book-to-market ratio we do not have data for all 2090 stocks but only for 99.7%, 87.1%, and 74% of the original sample, respectively.

Panel B: Restricted to have same industry structure

Characteristic				(Annualized) alpha with respect to:						Hurdle Rate vis-à-vis World			Liquid
		μ	σ	CEE	EM	Europe	World	CEE-EU-W	Global FF+Mom	$\rho_{i,w}$	$\frac{\sigma_i}{\sigma_w}$	HR	%NZR
Size	L	26.33	30.4	**19.18**	**21.50**	**22.57**	**23.81**	**19.10**	**21.70**	0.61	1.89	5.72	62.1%
(1 quarter lagged)	H	22.83	38.7	**10.36**	**16.45**	**18.09**	**19.59**	**10.18**	**17.10**	0.61	2.40	7.35	85.0%
	L-H	3.50	26.07	8.82	5.05	4.48	4.22	**8.92**	4.60	-0.20	1.62	-	-
dividend yield	L	17.8	28.5	12.28	**13.11**	**14.03**	**15.39**	**11.87**	6.50	0.62	1.77	5.47	79.9%
(1 quarter lagged)	H	29.8	40.5	**18.15**	**23.52**	**25.16**	**26.73**	**17.64**	**23.70**	0.56	2.51	7.06	80.5%
	H-L	12.02	32.72	5.86	10.41	11.12	11.33	5.77	**17.20**	0.16	2.03	-	-
P/E	L	31.9	33.8	**23.52**	**26.62**	**27.76**	**29.20**	**22.99**	**23.14**	0.58	2.10	6.05	77.9%
(1 quarter lagged)	H	12.9	38.8	1.59	7.22	8.51	9.91	1.35	11.06	0.56	2.41	6.71	79.6%
	L-H	18.99	28.33	**21.93**	**19.39**	**19.24**	**19.28**	**21.64**	12.09	-0.08	1.76	-	-
Market to Book	L	30.8	35.8	**21.93**	**24.89**	**26.83**	**28.03**	**22.22**	**25.76**	0.57	2.22	6.34	79.0%
(1 quarter lagged)	H	9.1	38.3	-1.69	3.47	4.50	6.00	-1.98	6.29	0.58	2.38	6.95	87.2%
	L-H	21.77	28.85	**23.62**	**21.42**	**22.33**	**22.03**	**24.21**	**19.46**	-0.07	1.79	-	-
Momentum	L	28.3	47.1	**15.37**	**21.75**	**23.34**	**24.85**	**15.42**	**28.97**	0.53	2.92	7.76	83.5%
(t-12 to t-1)	H	17.1	36.1	6.73	11.47	12.82	14.19	6.59	10.10	0.58	2.24	6.56	85.4%
	H-L	-11.20	28.68	-8.64	-10.28	-10.52	-10.67	-8.83	**-18.87**	-0.14	1.78	-	-
Momentum	L	13.8	32.3	4.82	8.57	9.63	11.07	4.29	7.03	0.61	2.01	6.09	83.3%
(t-6 to t-1)	H	21.8	44.3	8.75	**15.17**	16.85	**18.32**	8.95	**22.76**	0.57	2.75	7.85	80.7%
	H-L	8.03	27.57	3.92	6.59	7.22	7.25	4.66	**15.74**	0.21	1.71	-	-
Volatility	L	20.3	28.2	**12.70**	**15.57**	**16.78**	**18.02**	**12.19**	10.49	0.59	1.75	5.21	79.8%
(t-3 to t)	H	23.2	46.2	10.85	16.21	18.00	**19.58**	11.11	**23.43**	0.58	2.86	8.24	76.7%
	L-H	-2.9	33.6	1.85	-0.65	-1.22	-1.55	1.08	-12.94	-0.29	2.09	-	-

Table 11 continued...

Panel B: Restricted to have same industry structure

Characteristic				(Annualized) alpha with respect to:						Hurdle Rate vis-à-vis World			Liquid
		μ	σ	CEE	EM	Europe	World	CEE-EU-W	Global FF+Mom	$\rho_{i,w}$	$\frac{\sigma_i}{\sigma_w}$	HR	%NZR
low local beta	L	10.9	21.1	7.36	8.04	8.60	9.45	6.91	3.46	0.48	1.31	3.16	69.4%
(1 year lagged)	H	28.2	47.1	**14.20**	**21.04**	**22.65**	**24.44**	**13.93**	**25.57**	0.59	2.93	8.59	84.4%
	L-H	-17.4	42.1	-6.84	-13.00	-14.05	-14.98	-7.02	**-22.11**	-0.42	2.61	-	-
low world beta	L	15.8	26.4	9.87	12.05	**12.69**	**13.79**	9.48	10.64	0.55	1.63	4.52	69.3%
(1 year lagged)	H	20.7	39.4	**9.35**	**13.96**	**15.80**	**17.19**	**9.93**	**17.60**	0.64	2.44	7.84	85.2%
	L-H	-4.9	30.5	0.52	-1.92	-3.11	-3.40	-0.45	-6.96	-0.35	1.89	-	-
Illiquidity	L	18.5	34.3	**8.57**	**12.31**	13.78	**15.31**	**8.42**	10.81	0.67	2.13	7.14	89.9%
(1 year lagged)	H	26.5	26.9	**19.97**	**22.98**	**24.19**	**24.88**	**20.03**	**21.68**	0.44	1.67	3.68	46.5%
	H-L	8.1	23.3	**11.40**	**10.67**	**10.41**	**9.58**	**11.61**	**10.86**	-0.48	1.45	-	-

Table 11 continued...

This Table reports performance statistics for different characteristics based portfolios. Starting from the first quarter of 1996 until mid 2011, we build portfolios for 2090 liquid stocks in 14 CEE countries based on the following characteristics: 1-quarter lagged size (market capitalization), dividend yield, price earning ratio, and market to book ratio; t-12 to t-1 and t-6 to t-1 months momentum; 1-quarter lagged volatility, low local and global beta (measured over the previous year), and illiquidity (zero returns measure). For each quarter, we rank stocks based on the respective characteristic and construct value-weighted returns for selected stocks in the 25th (L) and 75th quartile (H) as well the H-L /L-H respectively. Based on monthly returns in excess of the 3-month T-bill rate, we calculate means, volatility, and alphas from univariate regressions of the portfolio returns on our own CEE index, MSCI EM index, MSCI Europe index, MSCI World index as well as multivariate regressions on the CEE, Europe (EU), and World (W) indices and on the global Fama-French factors + momentum (Global FF+Mom). We form correlations $\rho_{i,w}$, variance ratios (σ_i/σ_w) and hurdle rates (HR) with respect to the MSCI World index. The last column reports the average liquidity within each portfolio (%NZR). Panel A reports unrestricted portfolios, while Panel B and Panel C report industry and country neutral portfolios. Bold numbers indicate significance at the 5% significance level. Note that for the dividend yield, price-earnings ratio and book-to-market ratio we do not have data for all 2090 stocks but only for 99.7%, 87.1%, and 74% of the original sample, respectively.

Panel C: Restricted to have same country structure

Characteristic				(Annualized) alpha with respect to:						Hurdle Rate vis-à-vis World			Liquid
		μ	σ	CEE	EM	Europe	World	CEE-EU-W	Global FF+Mom	$\rho_{i,w}$	$\frac{\sigma_i}{\sigma_w}$	HR	%NZR
Size	L	34.29	37.8	**24.88**	**28.99**	**30.22**	**31.50**	**24.88**	**32.32**	0.54	2.35	6.299	59.4%
(1 quarter lagged)	H	23.57	37.9	**11.21**	**17.32**	**18.96**	**20.40**	**11.07**	**18.48**	0.61	2.35	7.169	84.6%
	L-H	10.72	25.90	**13.68**	11.67	11.26	11.10	**13.81**	**13.83**	-0.11	1.61	-	-
dividend yield	L	25.2	39.5	**13.32**	**18.98**	**20.56**	**21.99**	**13.27**	16.86	0.58	2.45	7.162	77.7%
(1 quarter lagged)	H	27.3	39.4	**16.27**	**21.07**	**22.50**	**24.14**	**15.75**	**19.44**	0.59	2.45	7.255	81.7%
	H-L	2.19	22.06	2.95	2.08	1.93	2.15	2.48	2.58	0.01	1.37	-	-
P/E	L	30.4	41.0	**18.58**	**24.17**	**25.58**	**27.21**	**17.98**	**22.26**	0.56	2.54	7.157	80.0%
(1 quarter lagged)	H	15.8	36.9	5.03	10.01	11.66	12.90	5.22	12.35	0.58	2.29	6.635	81.5%
	L-H	14.55	20.71	**13.55**	**14.16**	**13.92**	**14.31**	**12.76**	9.90	0.08	1.29	-	-
Market to Book	L	34.4	41.9	**22.66**	**27.92**	**29.73**	**31.20**	**22.57**	**28.27**	0.56	2.60	7.252	74.5%
(1 quarter lagged)	H	17.1	37.3	6.66	11.55	12.93	14.28	6.41	12.34	0.55	2.32	6.412	85.0%
	L-H	17.30	24.14	**16.00**	**16.36**	**16.80**	**16.92**	**16.16**	**15.93**	0.11	1.50	-	-
Momentum	L	19.8	43.6	7.36	13.21	14.98	**16.37**	7.76	16.66	0.57	2.71	7.733	77.9%
(t-12 to t-1)	H	20.7	38.0	**9.66**	**15.10**	**16.34**	**17.86**	**8.97**	13.43	0.55	2.36	6.546	80.7%
	H-L	0.96	28.23	2.30	1.89	1.36	1.49	1.22	-3.23	-0.14	1.75	-	-
Momentum	L	34.7	40.1	**23.29**	**28.62**	**29.87**	**31.58**	**22.39**	**25.46**	0.56	2.49	7.035	83.4%
(t-6 to t-1)	H	16.4	38.6	4.29	10.40	12.20	13.42	4.52	**14.66**	0.56	2.40	6.765	80.8%
	H-L	-18.26	25.74	**-19.00**	**-18.22**	**-17.67**	**-18.16**	**-17.87**	**-10.80**	-0.03	1.60	-	-
Volatility	L	25.6	36.0	**14.85**	**20.11**	**21.53**	**22.79**	**14.78**	**19.72**	0.57	2.24	6.357	78.9%
(t-3 to t)	H	17.7	41.6	7.03	11.14	12.99	14.59	6.58	12.89	0.55	2.58	7.088	73.6%
	L-H	7.9	28.6	7.82	8.97	8.54	8.20	8.20	6.83	-0.08	1.78	-	-

Table 11 continued...

Panel C: Restricted to have same country structure

Characteristic				(Annualized) alpha with respect to:						Hurdle Rate vis-à-vis World			Liquid
		μ	σ	CEE	EM	Europe	World	CEE-EU-W	Global FF+Mom	$\rho_{i,w}$	$\frac{\sigma_i}{\sigma_w}$	HR	%NZR
low local beta	L	21.6	29.7	**14.04**	**17.65**	**18.55**	**19.66**	**13.38**	**18.25**	0.48	1.84	4.441	66.9%
(1 year lagged)	H	22.2	40.5	**9.66**	**15.69**	**17.31**	**18.82**	**9.64**	**19.06**	0.61	2.51	7.627	84.9%
	L-H	-0.6	27.1	4.38	1.97	1.24	0.84	3.75	-0.81	-0.38	1.68	-	-
low world beta	L	18.9	30.0	**10.70**	**14.50**	**15.45**	**16.60**	**10.40**	**15.56**	0.56	1.86	5.222	66.8%
(1 year lagged)	H	20.5	40.4	8.84	**13.91**	15.44	**17.12**	**8.45**	15.28	0.61	2.51	7.652	84.3%
	L-H	-1.6	23.5	1.86	0.59	0.02	-0.51	1.95	0.28	-0.33	1.46	-	-
Illiquidity	L	21.9	38.7	**9.58**	**15.42**	**17.18**	**18.65**	**9.47**	**17.33**	0.61	2.40	7.309	88.2%
(1 year lagged)	H	31.1	37.8	**21.44**	**26.21**	**27.43**	**28.70**	**20.86**	**25.75**	0.47	2.35	5.510	42.3%
	H-L	9.3	25.4	**11.87**	10.79	10.25	10.05	11.39	8.42	-0.23	1.58	-	-

Table 12: Comparison with free-floating stocks: Cross-Sectional Strategies

This Table reports performance statistics for different characteristics based portfolios for the original sample and free-float samples in 14 CEE countries for the overlapping period. Starting from the first quarter of 2003, we build portfolios on the full sample of 2,090 stocks (Original) and on a sample of 1,264 stocks for which free-float data is available, either using (rescaled) market weights as before (FF1) or using free-float market weights (FF2). We use the following characteristics: 1-quarter lagged size (market capitalization), dividend yield, price earning ratio, and market to book ratio; t-12 to t-1 and t-6 to t-1 months momentum; 1-quarter lagged volatility, low local and global beta (measured over the previous year), and illiquidity (zero returns measure). For each quarter, we rank stocks based on the respective characteristic from the previous period (from 1-quarter to 1-year) and construct value-weighted returns for selected stocks in the 25th (L) and 75th quartile (H) as well the H-L /L-H respectively. Based on monthly returns in excess of the 3-month T-bill rate, we calculate alphas from multivariate regressions on the CEE, Europe (EU), and World (W) indices and on the global Fama-French factors + momentum (Global FF+Mom). The Original column reports alphas for the original sample, the FF1 column for the free-float stocks with rescaled original market weights, and the FF2 column for the free-float stocks with free-float market weights. Bold numbers indicate significance at the 5% significance level. Note that for the dividend yield, price-earnings ratio and book-to-market ratio we do not have data for all 2090 (1264) stocks but only for 99.7%, 87.1%, and 74% of the original sample, respectively.

Characteristic		(Annualized) alpha with respect to:					
		CEE-EU-World			Global FF+Mom		
		Original	FF1	FF2	Original	FF1	FF2
Size	L	**33.05**	**26.28**	10.39	**33.25**	**24.45**	15.78
(1 quarter lagged)	H	1.59	1.24	1.85	6.50	6.35	7.22
	L-H	**31.46**	**25.04**	8.53	**26.75**	**18.11**	8.56
dividend yield	L	2.33	0.97	-2.17	-0.19	-2.13	-5.87
(1 quarter lagged)	H	**6.54**	**8.03**	**6.89**	10.17	**11.19**	10.00
	H-L	4.20	7.05	9.07	10.37	13.32	15.87
P/E	L	9.85	**10.62**	7.38	14.25	14.63	11.77
(1 quarter lagged)	H	3.08	1.08	4.00	3.88	2.19	5.67
	L-H	6.78	9.53	3.38	10.37	12.44	6.10
Market to Book	L	**14.59**	**14.39**	**14.40**	**19.61**	**19.49**	**20.08**
(1 quarter lagged)	H	-6.44	-7.50	-6.80	-3.09	-4.35	-4.35
	L-H	**21.03**	**21.88**	**21.20**	**22.70**	**23.83**	**24.43**
Momentum	L	15.50	8.55	9.24	**21.40**	**14.64**	**14.59**
(t-12 to t-1)	H	-2.40	-3.89	0.34	1.65	-0.56	3.35
	H-L	-17.90	-12.44	-8.90	**-19.75**	**-15.20**	-11.24
Momentum	L	-0.83	-0.26	-0.41	4.90	5.59	6.45
(t-6 to t-1)	H	3.99	-1.56	-1.32	6.84	1.39	1.46
	H-L	4.82	-1.30	-0.91	1.93	-4.21	-4.99
Volatility	L	**11.43**	**9.98**	**12.10**	**12.43**	**10.06**	12.23
(t-3 to t)	H	-15.01	-8.03	-9.49	-4.60	-0.45	-1.07
	L-H	**26.45**	**18.01**	**21.59**	17.03	10.51	13.30

Table 12 continued...

Characteristic		(Annualized) alpha with respect to:					
		CEE-EU-World			Global FF+Mom		
		Original	FF1	FF2	Original	FF1	FF2
low local beta	L	9.35	3.91	4.33	8.14	2.70	3.16
(1 year lagged)	H	0.89	-3.27	-2.72	7.44	3.21	4.21
	L-H	8.46	7.18	7.05	0.70	-0.51	-1.05
low world beta	L	9.21	6.79	6.21	8.52	4.16	3.31
(1 year lagged)	H	2.33	5.41	3.73	8.75	11.30	10.56
	L-H	6.88	1.38	2.48	-0.22	-7.14	-7.25
Illiquidity	L	1.81	1.70	2.07	7.37	7.58	8.35
(1 year lagged)	H	**15.14**	12.73	**14.46**	**18.47**	14.77	**17.23**
	H-L	13.32	11.03	12.39	11.10	7.19	8.88

Table 13: Parametric Portfolios with 6 Characteristics

This Table reports estimation results and descriptives (Panel A) as well as performance statistics (Panel B) for (1) our benchmark CEE index and (2) a parametric portfolio policy that is based on six characteristics: size (me) from the previous quarter, market to book ratio (mtbv) from the previous quarter, and momentum for t-12 to t-1 (mom), volatility of daily returns over the previous quarter (vol), percentage of zero (price) returns in local currency over the previous year (illiq), betas from regressions of weekly returns on the value-weighted CEE index (85% threshold) over the previous year (beta). The sample includes monthly returns for 2,090 liquid stocks in 14 CEE countries over the period 1996 until mid 2011. We report results for a relative risk aversion of 5. The first seven columns of Panel A report the estimated coefficients of policies including 3 and 6 characteristics. We also report bootstrapped standard errors in parentheses (1000 replications of draws with replacement from returns sand characteristics series), the percentage of simulated thetas that have the same sign as the estimated one, as well as the simulated thetas' top/bottom deciles. The next column report the average maximum portfolio weight. The last seven columns report the average weighted normalized characteristics of the portfolio $\sum_{i=1}^{N_t} w_{i,t}\hat{x}_{i,t}$. The first two columns in Panel B report the annualized mean and volatility of the monthly portfolio returns in excess of the 3-month T-bill rate. The next columns report alphas from univariate regressions of the portfolio returns on our own CEE index (85% market cap. threshold), MSCI EM index, MSCI Europe index, MSCI World index as well as multivariate regressions on the latter three indices and on the global Fama-French factors + momentum. Bold numbers indicate significance at the 5% significance level. The next two columns report the (annualized) Sharpe Ratio and and (annualized) Information Ratio calculated as the alpha from the regression on our own CEE index (85% threshold) divided by the standard deviations of the residuals from this regression. We form correlations, variance ratios and hurdle rates with respect to the MSCI World index.

Panel A: Estimates and Portfolio Characteristics

	θ_{me}	θ_{mtb}	θ_{mom}	θ_{vol}	θ_{illiq}	θ_{beta}	max w_i (%)	*me*	*mtb*	*mom*	*vol*	*illiq*	*beta*
CEE VW							16.992	1.266	0.156	0.213	-0.091	-0.045	0.496
CEE PW - 3 char.	-3.113	-2.116	1.257				10.241	-0.233	-0.396	0.227			
Std.	(1.818)	(1.709)	(1.396)										
Prob	0.083	0.025	0.120										
10th percentile	-4.825	-5.261	-0.162										
90th percentile	-0.203	-0.963	3.367										
CEE PW - 6 char.	-2.854	-3.684	1.969	1.409	1.503	1.030	8.418	-0.195	-0.416	0.325	0.414	0.327	0.230
Std.	(2.233)	(2.133)	(1.506)	(1.497)	(2.254)	(1.056)							
Prob	(0.128)	(0.005)	(0.053)	(0.204)	(0.119)	(0.110)							
10th percentile	-5.370	-7.627	0.571	-0.705	-0.232	-0.049							
90th percentile	0.291	-2.157	4.302	3.097	5.450	2.626							

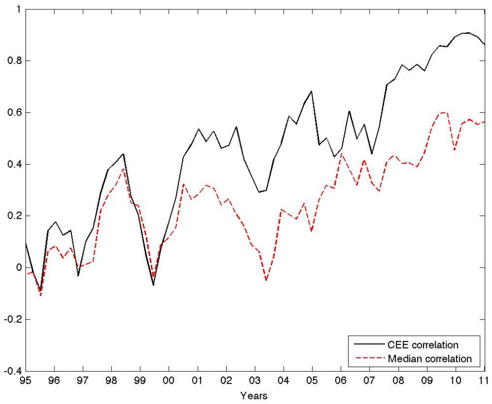
Panel B: Performance Statistics

			(Annualized) alpha with respect to:						Sharpe	Information	Hurdle Rate vis-à-vis World		
	Mean (y)	Vol (y)	CEE	EM	Europe	World	CEE-EU-W	Global FF + Mom	Ratio	Ratio (CEE)	ρ	$\frac{\sigma_i}{\sigma_w}$	HR
CEE VW	15.33	37.09	3.75	8.97	10.73	12.13	3.87	11.30	0.41	0.65	0.63	2.30	7.24
CEE PW - 3 char.	23.29	32.50	**13.85**	**17.45**	**18.98**	**20.32**	**13.97**	**19.26**	0.72	1.86	0.66	2.02	6.71
CEE PW - 6 char.	25.31	34.63	**15.27**	**19.25**	**20.82**	**22.19**	**15.47**	**22.28**	0.73	1.91	0.66	2.15	7.05

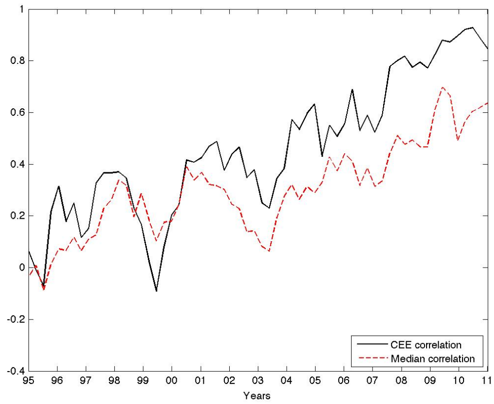
Figure 1: The Dynamics of Correlations

The Figures show 4-quarter moving window return correlations of our tailor-made CEE index with returns on 4 benchmarks: MSCI World, MSCI Europe, MSCI Emerging Markets, and MSCI Russia. We also plot at each point in time the (4-quarter moving) median of quarterly return correlations of the individual country indices with each of the 4 benchmarks. All returns are expressed in US dollar and in excess of the 3-month T-Bill rate.

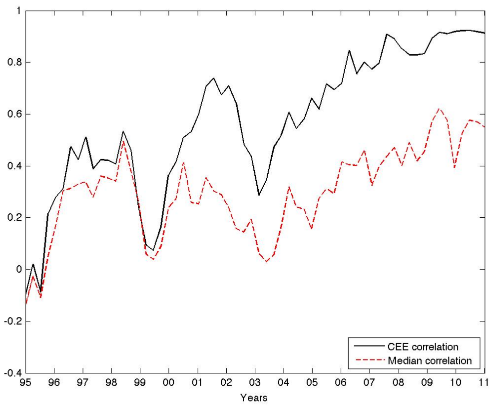
(a) World



(b) Europe



(c) Emerging Markets



(d) Russia

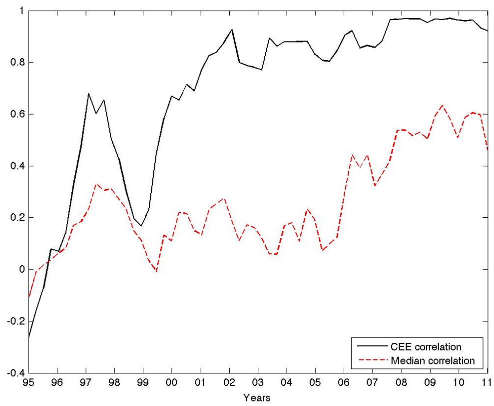
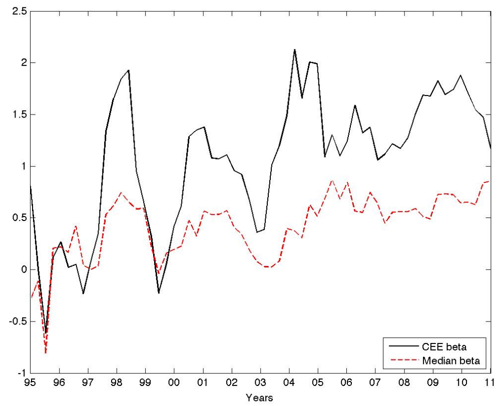


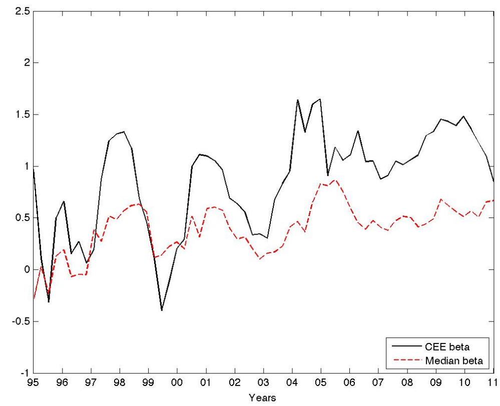
Figure 2: The Dynamics of Betas

The Figures show 4-quarter moving averages of quarterly betas (measured over the previous 52 weeks) of our tailor-made CEE index with 4 benchmarks: MSCI World, MSCI Europe, MSCI Emerging Markets, and MSCI Russia. We also plot at each point in time the (4-quarter moving) median of the quarterly betas of the individual country indices with each of the 4 benchmarks. Betas estimates are based on weekly US dollar returns in excess of the 3-month T-Bill rate.

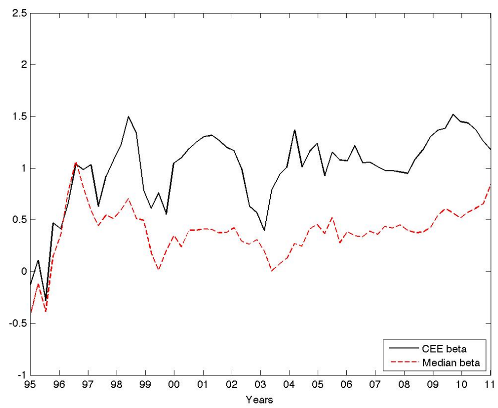
(a) World



(b) Europe



(c) Emerging Markets



(d) Russia

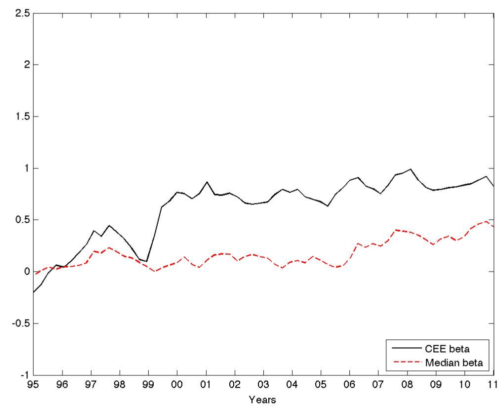
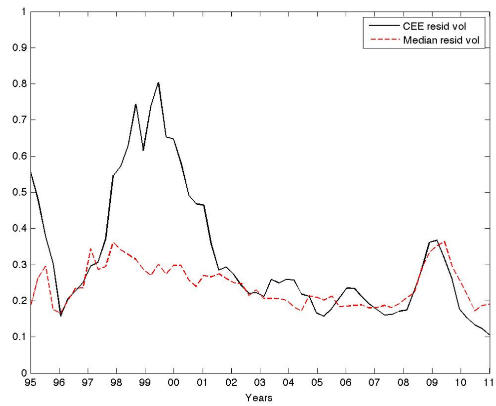


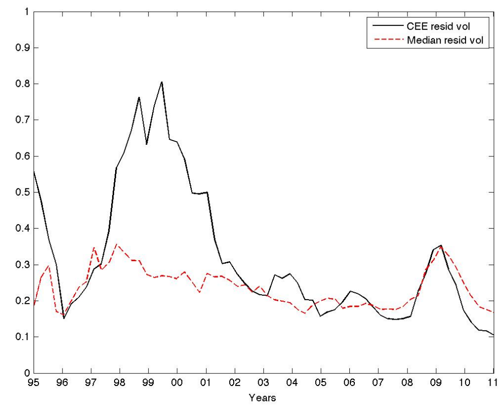
Figure 3: The Dynamics of Residual Volatilities

The Figures show 4-quarter moving averages of quarterly (annualized) market-specific returns volatilities for the CEE index as well as the median estimate across all markets. The annualized market-specific volatilities are calculated as $\sqrt{52}$ times the market-specific weekly volatility, which is in turn calculated as the volatility of the residuals from a regression of weekly excess US dollar returns over the past quarter on a specific market index on a constant and the excess US dollar return on one of 4 benchmark returns. The benchmark are: MSCI World, MSCI Europe, MSCI Emerging Markets, and MSCI Russia.

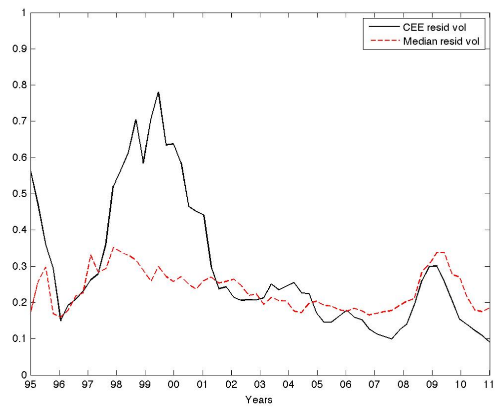
(a) World



(b) Europe



(c) Emerging Markets



(d) Russia

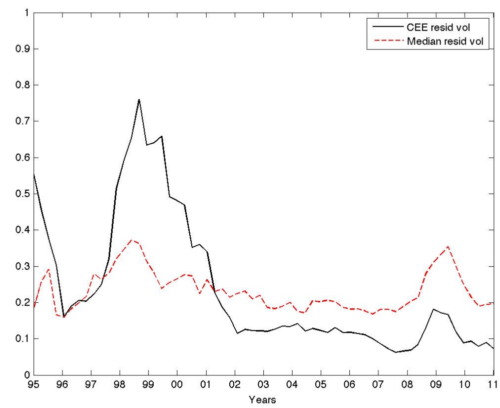


Figure 4: Hurdle Rates over Time

The Figures show hurdle rates of weekly dollar returns of CEE country indices and the CEE index with respect to weekly dollar returns of MSCI World index. Hurdle rates are calculated for each quarter over a one year period. For each quarter, the figure shows the median country's hurdle rate as well as the hurdle rate of the CEE index with the world. The hurdle rate is the lowest possible expected (excess) return for market i that must be earned for investors with a 100 percent investment in the benchmark to improve their Sharpe ratio when they invest in market i, given a specific expected (excess) return for the benchmark market. The hurdle rate is defined as $HR_i^b = \rho_{i,b}[E\,[r_b] - r_f^b](\sigma_i/\sigma_b) = \beta_{i,b}[E[r_b] - r_f^b]$ with $E\,[r_b] - r_f^b = 5\%$.

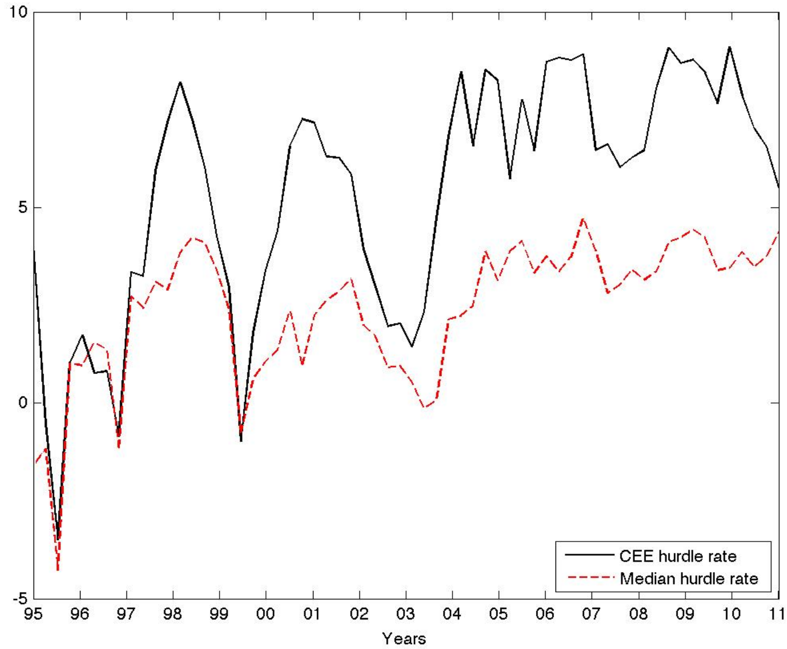


Figure 5: Hurdle Rates across Countries

The Figures show hurdle rates of weekly dollar returns of CEE country indices with respect to weekly dollar returns of MSCI World index for the period 2002 to mid 2011. The hurdle rate is the lowest possible expected (excess) return for market i that must be earned for investors with a 100 percent investment in the benchmark to improve their Sharpe ratio when they invest in market i, given a specific expected (excess) return for the benchmark market. The hurdle rate is defined as $HR_i^b = \rho_{i,b}(E\left[r_b\right] - r_f^b)(\sigma_i/\sigma_b) = \beta_{i,b}(E[r_b] - r_f^b]$ with $E\left[r_b\right] - r_f^b = 5\%$.

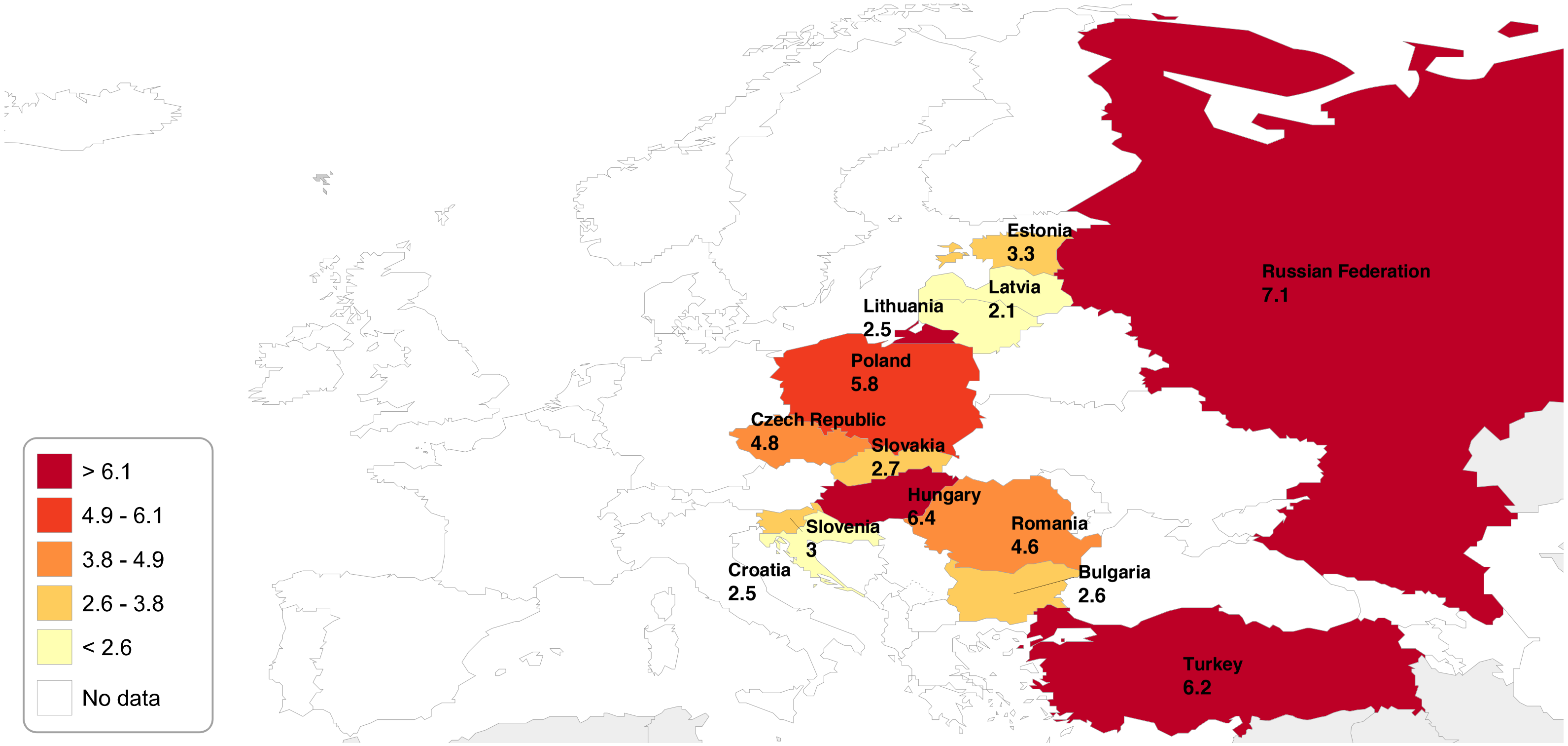


Figure 6: Industry and Country Effects

The Figure shows industry and country effects of 2090 weekly stocks returns from all 14 CEE countries. We estimate weekly cross-sectional regressions based on a Heston and Rouwenhorst (1994) model for each return i of country k and industry j: $r_i = \alpha + \beta_1 I_{i1} + \beta_2 I_{i2} + ... + \beta_{10} I_{i10} + \gamma_1 C_{i1} + \gamma_2 C_{i2} + ... + \gamma_{14} C_{i14} + \varepsilon_i$, with industry dummies (I) and country dummies C subject to the constraint that the value-weighted industry and country effects sum up to zero. The cross-sectional regressions yield time series of coefficients. We decompose the R-squared of each regression in a component explained by industry and country effects jointly and individually. In other words, we calculate the variance of the model setting the constant and either the industry or country effect coefficients to zero and divide it by the variance of weekly returns. We take a 1-year moving average of the resulting components.

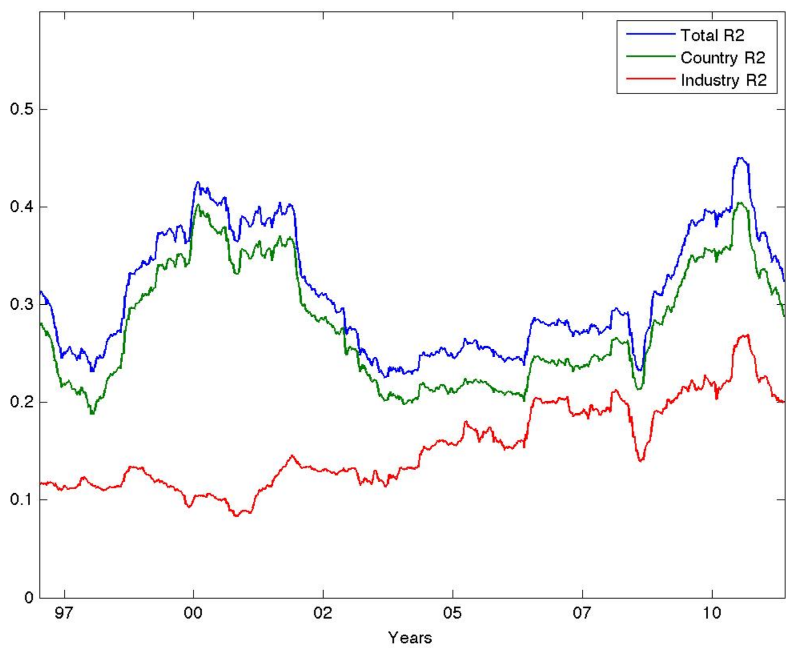
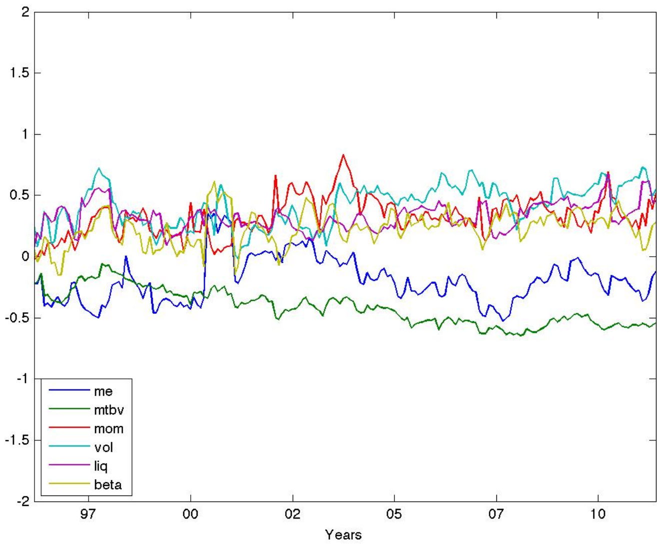


Figure 7: Portfolio characteristics over time, $\gamma = 5$

The Figure displays weighted normalized characteristics, $\sum_{i=1}^{N_t} w_{i,t}\hat{x}_{i,t}$, of the optimal portfolio policy with short sale constraints over time for six characteristics: size (*me*) from the previous quarter, market to book ratio (*mtb*) from the previous quarter, and momentum for t-12 to t-1 (*mom*), volatility of daily returns over the previous quarter (*vol*), percentage of zero (price) returns in local currency over the previous year (*illiq*), betas from regressions of weekly returns on the value-weighted CEE index (85% threshold) over the previous year (*beta*). The sample includes monthly returns for 2,090 liquid stocks in 14 CEE countries over the period 1996 until mid 2011. We report results for a relative risk aversion of 5.



A Variable Definitions

Table A.1: Variable Definitions

Variable	Definition
EBRD Transition Indicator	The EBRD Transition Indicator assesses the progress in transition through a set of transition indicators. Progress is measured against the standards of industrialized market economies, while recognizing that there is neither a "pure" market economy nor a unique end-point for transition. The measurement scale for the indicators ranges from 1 to 4+ (coded as 4.3), where 1 represents little or no change from a rigid centrally planned economy and 4+ represents the standards of an industrialized market economy. The reform scores reflect the assessments of EBRD country economists using the criteria described in the methodological notes. The assessment areas are: large scale privatization, small scale privatization, governance and enterprise restructuring, price liberalization, trade and foreign exchange system, competition policy. For the analysis, we calculate an average score of the 6 area scores. Source: EBRD.
Political Constraint Index	The political constraint index is an objective measure of political risk that directly measures the feasibility of policy change based on the a country's political and regulatory structures. The index is based on simple spatial model of political interaction that measures the intensity of constraints a political actor or his replacement faces in his or her choice of future policies. In particular, it identifies the number of independent branches of government (executive, lower and upper legislative chambers, judiciary and sub-federal institutions) with veto power over policy change in each country in every year. This initial measure is then modified to account for the extent of alignment across branches and the heterogeneity or homogeneity of the preferences within each branch. Such alignment increases the feasibility of policy change and thus reduces the level of political constraints. The higher the political constraint index, the more politically constraint a country is and the lower the political risk is (0 to 0.90). A country with no checks and balances would have no constraints on leading politicians, making a veto on key decisions difficult and resembling a totalitarian system (e.g., China has an index of 0). Source: Henisz (2000).
EU Accession	Dummy variable that takes the value of one following the official announcement date of European Union Accession. Source: national websites.

Table A.1 continued...

Variable	Definition
Financial Openness	Index that measures a country's degree of capital account openness (KAOPEN). The measure is based on binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). In order to measure financial openness the values of the binary variables are reversed, such that the variables are equal to one when the capital account restrictions are non-existent. Then an index of capital "openness" is constructed based on the first standardized principal component of four measures of financial openness. The index takes on higher values the more open the country is to cross-border capital transactions. By construction, the series has a mean of zero. The index has a value of 2.44 for the "most financially open" countries and a value of -1.86 for the "least financial open" countries. Source:Chinn and Ito (2006) and Chinn and Ito (2008).
Official Liberalization	Corresponding to a date of formal regulatory change after which foreign investors officially have the opportunity to invest in domestic equity securities. Official Liberalization dates are based on Bekaert and Harvey (2004), A Chronology of Important Financial, Economic and Political Events in Emerging Markets, `http://people.duke.edu/~charvey/Country_risk/chronology/chronology_index.htm`. This chronology is based on over 50 different source materials. If dates have not been updated or were not available, we added dates for these countries based on information on the official websites of the respective country. For the remaining countries, fully segmented countries are assumed to have an indicator value of zero, and fully liberalized countries are assumed to have an indicator value of one.
First Sign of Liberalization	"First Sign" equity market liberalization dates denote the year associated with the earliest of three dates: Official Liberalization, first American Depositary Receipt (ADR) announcement and first country fund launch. The First Sign indicator takes a value of one on and after the First Sign year, and zero otherwise. First Sign of Liberalization are based on Bekaert and Harvey (2004), A Chronology of Important Financial, Economic and Political Events in Emerging Markets, `http://people.duke.edu/~charvey/Country_risk/chronology/chronology_index.htm`.. This chronology is based on over 50 different source materials. If dates have not been updated or were not available, we added dates for these countries based on information on the official websites of the respective country. As with the Official Liberalization indicator, fully segmented countries are assumed to have an indicator value of zero, and fully liberalized countries are assumed to have an indicator value of one.

Table A.1 continued...

Variable	Definition
Insider Trading Law	Dummy variable that takes the value of one following the introduction of an insider trading law. Source: Bekaert and Harvey (2004), A Chronology of Important Financial, Economic and Political Events in Emerging Markets, `http://people.duke.edu/~charvey/Country_risk/chronology/chronology_index.htm`. This chronology is based on over 50 different source materials. If dates have not been updated or were not available, we added dates for these countries based on information on the official websites of the respective country.
Electronic Trading System	Dummy variable that takes the value of one following the introduction of an insider trading law. Source: Jain (2005) and updates based on national websites.
Trade/GDP	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product. Imports (Exports) of goods and services represent the value of all goods and other market services received from (provided to) the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments. Source: World Bank.
ΔGDP per Capita	Annual growth of per capita gross domestic product. Source: World Bank.
ΔGDP Deflator	Annual growth of the gross domestic product implicit deflator. Source: World Bank.

B Portfolio Creation

To construct monthly portfolios, we select from all liquid 2,090 stocks of 14 CEE countries starting from the first quarter of 1996 until mid 2011. We start the selection in 1996 in order to be able to cover at least 3 countries and sort on 1-year lagged characteristics. Each quarter, we rebalance the portfolio based on the following characteristics: (i) size based on market capitalization lagged by 1 quarter, (ii) value based on dividend yield (only for 99.7% of all stocks), price earnings ratio (only for 87.1% of all stocks), market to book ratio (only for 74% of all stocks), all lagged by 1 quarter, (iii) momentum based on price return in U.S. dollars for periods from t-12 until t-1 and t-6 until t-1, (iv) volatility of all liquid stocks over the previous quarter (from t-3 until t), (v) betas of regressions of weekly returns on the MSCI World index (global) or the value-weighted CEE index (local) over the previous year, and (vi) illiquidity measured as the percentage of zero (price) returns in local currency for each stock over the previous year.

Based on their rankings, we sort stocks into the top and bottom quartiles and create daily value-weighted indices from which we construct monthly returns. Additionally, we calculate value-weighted daily liquidity indicators measured as the percentage of non-zero returns across stocks in a quartile over time. We rebalance the portfolios on a quarterly basis.

When we restrict portfolios to have the same industry structure, we, first, compute industry weights over time and then split stocks into 10 industries and calculate daily value-weighted industry indices of the top and bottom quartiles for firms in each industry. For each quartile, we combine the industry weights and industry indices into an industry-neutral index. Note that an industry is only considered if it has at least 4 firms which correspond to 4 quartiles, otherwise it is excluded for the respective quarter. Again, we rebalance portfolios on a quarterly basis and calculate the value-weighted percentage of non-zero returns.

When we restrict portfolios to have the same country structure, we, first, compute country weights over time and then split stocks into 14 countries and calculate daily value-weighted country indices of the top and bottom quartiles for firms in each country. For each quartile, we combine the country weights and country indices into a country-neutral index. Note that a country is only considered if it has at least 4 firms which correspond to 4 quartiles, otherwise it is excluded for the respective quarter. Again, we rebalance portfolios on a quarterly basis and calculate the value-weighted percentage of non-zero returns.

C Derivation of Parametric Portfolio Model

As outlined in section 5.2, our investor maximizes the following objective function with respect to θ:

$$E\left[r_{p,t+1} - r_{b,t+1}\right] - \frac{\gamma}{2} Var\left[r_{p,t+1} - r_{b,t+1}\right] \tag{A.1}$$

While equation A.1 looks like a mean-variance utility function, the return is the alpha over the benchmark portfolio and the risk is measured relative to the benchmark. In other words, this is a standard tracking error problem. In order to derive the optimal weights we define portfolio weights as follows:

$$w_t = \begin{bmatrix} w_{1t} & w_{2t} & ... & w_{Nt} \end{bmatrix}' ,$$

where w_t is an $(N_t \times 1)$ vector of weights with $i = 1, ..., N$ stocks. We decompose the weights into benchmark weights and an active component that over- or underweights stocks:

$$w_t = w_{bt} + sc_t,$$

where w_{bt} is a $(N_t \times 1)$ vector of stocks' benchmark weights, and sc_t is a $(N_t \times 1)$ vector of scores that is defined as:

$$sc_{i,t} = \tfrac{1}{N_t}\theta' x_{i,t} \text{ for each stock and } sc_t = (\theta' x_t)' \text{ for all stocks,}$$

where $x_{i,t}$ is a (k $\times$ 1) vector of characteristics of stock i based on observable firm characteristics z ($z = 1, ..., \mathrm{k}$), x_t is a (k $\times$ N_t) vector of k characteristics for all N_t stocks, and θ is a time and stock invariant (k $\times$ 1) vector of parameters.

Based on the assumptions above, we define the portfolio and benchmarks returns for the $(N_t \times 1)$vector of returns R_t:

$$r_{p,t+1} = w_t' R_{t+1} = (w_{bt} + sc_t)' R_{t+1},$$

$$r_{b,t+1} = w_{bt}' R_{t+1},$$

We also define the average of the cross-product of characteristics with returns: $\overline{xR} = \frac{1}{T}\sum_{t=0}^{T-1} x_t R_{t+1}$. We derive the optimal θ by taking the FOC of the sample analog of equation A.1 (setting $N_t = 1$, w.l.o.g):

$$\underset{\theta}{\text{Max}}\, U = E\left[r_{p,t+1} - r_{b,t+1}\right] - \frac{\gamma}{2} Var\left[r_{p,t+1} - r_{b,t+1}\right]$$

Given that $r_{p,t+1} - r_{b,t+1} = \theta' x_{i,t}$ and taking sample analogs, we get:

$$\underset{\theta}{\text{Max}}\, U == \frac{1}{T}\sum_{t=0}^{T-1} \theta' x_t R_{t+1} - \frac{\gamma}{2}\frac{1}{T}\sum_{t=0}^{T-1} \left(\theta' x_t R_{t+1} - \frac{1}{T}\sum_{t=0}^{T-1} \theta' x_t R_{t+1}\right)^2$$

FOC:

$$\frac{\partial U}{\partial \theta'} = \overline{xR} - \frac{\gamma}{T}\sum_{t=0}^{T-1}\theta'(x_t R_{t+1} - \overline{xR})(x_t R_{t+1} - \overline{xR})' = 0$$

$$\overline{xR} - \frac{\gamma}{T}\sum_{t=0}^{T-1}(x_t R_{t+1} - \overline{xR})(x_t R_{t+1} - \overline{xR})'\theta = 0$$

$$\Rightarrow \theta = \frac{1}{\gamma}\left[\frac{1}{T}\sum_{t=0}^{T-1}(x_t R_{t+1} - \overline{x'R})(x_t R_{t+1} - \overline{xR})'\right]^{-1}\overline{xR}$$

Q.E.D.