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Factor Investing and Macroeconomic Risk

A panel-data study of stock returns across developed and emerging markets

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Abstract

This thesis examines the influence of macroeconomic risk on simple investment strategies related to the well-known risk factors size, value and momentum. Based on a sample of 25,224 stocks from 10 different countries, quarterly returns between 1999 and 2016 have been analyzed with fixed-effect regression models. Generally, indicators of macroeconomic risk were jointly significant for value-weighted market portfolios but not for factor-mimicking portfolios. In particular, the explanation power of macroeconomic indicators for value excess returns was low. However, development risk in emerging markets had a significant impact on value and size sensitivity to macroeconomic risk. Country idiosyncrasy from fixed effects could be found for size and value bot not for momentum excess returns. Moreover, higher current-account deficits and sovereign spreads supported the size factor surprisingly. Finally, international momentum investments were particularly affected during the financial crisis 2007-9 and by changes in oil prices.

Keywords: Factor Investing, Macroeconomic Risk, APT, CAPM
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All errors remain my own.

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Abbreviations

APT	*Arbitrage Pricing Theory*
CAPM	*Capital Asset Pricing Model*
CHE	*ISO* 3166 *International Country Code for Switzerland*
DM	*Developed Market(s)*
EM	*Emerging Market(s)*
FMP	*Factor Mimicking Portfolio*
GDP	*Gross Domestic Product*
IP	*Industrial Production*
LQ(.)	*Long Quantile*
MC	*Market Capitalization*
MP	*Market Portfolio*
MRP	*Market Risk Premium (i.e. excess returns)*
MPT	*Modern Portfolio Theory*
MOM	*Momentum Factor Mimicking Portfolio*
MSCI	*Morgan Stanley Capital International*
NGO	*Non − Governmental Organization*
PTBV	*Price − To − Book Value*
SQ(.)	*Short Quantile*
SS	*Sovereign Spread*
SZE	*Size Factor Mimicking Portfolio*
TS	*Term Spread*
USD	*United States (U.S.) dollar*
VAL	*Value Factor Mimicking Portfolio*
YTM	*Yield − To − Maturity*
ZC	*Zero − Cost*

1 Introduction

(a) Motivation

A main question in financial economics is what constitutes returns on investments in financial securities. Previous research around and subsequent to its major theoretical concepts – the Modern Portfolio Theory (MPT) by Harry Markowitz – are well founded on a common ground: return originates from taking risk. In other words, exposure to certain sources of risk (i.e. *risk factors*) should reward the investor with a *risk premium* above the return from risk-free investments. This is because fluctuations in such risk factors impact the asset's fair market value, e.g. the discounted cashflow-stream from a firm's dividends. The Capital Asset Pricing Model (CAPM) and the Arbitrage Pricing Theory (APT) have consolidated scholars' and practicians' view on the risk-return relationship. In related models, first the market portfolio and then common risk factors have been introduced as explanatory variables in regressions on stocks's excess returns. Financial economists have suggested and analyzed a plethora of such common risk factors. This paper seeks to find more insights into the relationship between two major groups of well-established sources of risk: *macroeconomic* indicators and *characteristics-based* factors. Specifically, the research question at hand is if macroeconomic risk can explain returns on modern factor-related investment strategies in international stock returns. The author applies the tools provided by *Factor Investing* theory, i.e. return analysis of simple zero-cost *factor-mimicking portfolios* structured as investable assets. Such have been suggested, for example, by the leading factor-investing theorists Bender et al. (2013) or Bender & Wang (2015).

Different economists have suggested that characteristics-based risk factors finally reflect macroeconomic risk. If this is true, factor-related strategies should yield returns that correlate with changes in macroeconomic indicators. This seems intuitive since changes in the macroeconomic or economic-policy environment affect cashflows and therefore the absolute and relative valuation of a company's equity. In actual fact, previous research has found significant correlations between both macroeconomic and characteristics-based risk factors. For example, Liew & Vassalou (2000) and Vassalou (2003) found a positive correlation between industrial production and both small-cap and value stocks. Controversial results have been suggested for the correlation between momentum stock gains and different macroeconomic indicators by Liu & Zhang (2008) and Bergbrant & Kelly (2016). Nevertheless, there have been only few cross-country comparisons on that specific relationship; in particular, lacking the inclusion of emerging-market data and to the best of the author's knowledge the Factor Investing-approach.

This thesis contributes to previous literature with a broader dataset of stock-market data, including prices, market capitalization and price-to-book values for 25,224 stocks from 10 developed and emerging countries. The econometric analysis of the cross-country stock panel was implemented with two stages and three different specifications of fixed-effect regression models. This study found that, in general, macroeconomic risk cannot explain the excess returns of factor-related investments better than of a value-weighted market benchmark. In particular, model performance was low for the value factor. However, the difference in economic development between markets had a decisive impact on both excess returns and sensitivity to macroeconomic risk. In contrast, momentum excess returns were more pervasive across countries and less country-idiosyncratic. Moreover, size excess returns seemed dependent on the country's economic competitiveness via current-account balance and sovereign spread. Finally, momentum-related investments were negatively exposed to financial turmoil and higher oil prices.

The relevance of this contribution to theoretical and practical portfolio choice is manifold. (1) The replication of characteristics-based factors is following the growing trend of Factor Investing instead of the classic Fama-French models. In this way, the thesis tests whether factor-related investments most similar to specialized fund products in today's investment industry are exposed to macroeconomic risk or not. (2) Macroeconomic risk is *systematic*, meaning a source of risk to which the investor is inevitably exposed and which cannot be fully diversified. Insights into how characteristics-based risk factors are driven by macroeconomic risk could give portfolio managers better insights into their effective strategy and risk management. (3) New findings can resolve ambiguities in previous literature and compensate for its current deficiencies.

(b) Structure

In chapter 2, the previous literature in relevant fields of asset-pricing theory and their findings for both macroeconomic risk and characteristics-based risk factors will be discussed. Chapter 3 of the thesis will explore origin, structure and descriptive statistics of the dataset. Subsequently, research questions will be derived in chapter 4. In chapter 5, the construction of factor-mimicking portfolios and the econometric methods will be illustrated. The results are presented in chapter 6. Additionally, slight but decisive modifications in calculations are examined in the robustness tests of chapter 7. Chapter 8 provides a summary of the findings, their critical evaluation and suggestions for further research. Finally, the appendix provides further mathematical concepts as well as the majority of figures and tables referred to in the main text.

2 Literature Review: The Emergence of Factor Investing

The aim of this thesis is to understand whether returns from real-world investment strategies based on Factor Investing are sensitive to macroeconomic risk. For this purpose, the following chapter will explore fundamental ideas in financial economics on risk and return of financial investments. It will clarify (1) the foundations of Factor Investing, (2) foregoing theories and (3) which characteristics-based risk factors are at the core of Factor Investing. Finally, findings and indications from previous literature with respect to the research questions will be discussed.

(a) Definitions

Two important assumptions about the sources of risk are that (1) the stocks of different companies differ in exposure to a particular risk factor (i.e. have different factor sensitivities) and (2) both groups of risk factors represent *systematic* risk that cannot be diversified fully by investments across all global equity markets.

Macroeconomic risk is volatility in the economic and political framework around a country's financial markets. It materializes as (positive or negative) changes in the cashflows to the owners of domestic financial assets, e.g. stocks. Hence, the investors process these changes in their investment decisions, which creates fluctuations in the market price of a stock.

In contrast, *characteristics-based* risk factors differ fundamentally from macroeconomic risk. Exposure to them depends on company characteristics. They arise from investors's risk-return assessments for particular stocks, meaning their absolute or relative valuation. Hence, firm or stock characteristics reflect different sources of risk. Exploiting different stock or firm characteristics for portfolio construction allows to replicate the underlying risk factor (i.e. factor-mimicking portfolios)[1]. The most famous example is likely the *value* factor approximation, e.g. in Fama & French (1992). They found a consistent outperformance of firms with high book-to-market values against those with conversely low values. The observation that stock returns could be explained with exposure to those risk factors gave finally rise to the theory and practice of Factor Investing.

[1] Consequently, practitioners find it often convenient to refer to such factor portfolios simply as *trading rules*.

(b) Modern Portfolio Theory

The starting point of today's asset pricing theory is the work by Markowitz (1952). His *Modern Portfolio Theory* (MPT) offered the first tangible risk-return framework. His portfolio-choice universe included risky and risk-free[2] assets as well as rational unconstrained investors maximizing the expected return of their portfolios. This investor would compare the historical excess returns above risk-free returns (i.e. risk premia) of a financial asset against their riskiness (i.e. the volatility of historical returns). Then, he will increase the portfolio weight of an asset with a higher ratio of excess return over volatility. For every observed level of volatility, the investor would therefore choose the asset with the highest excess return for his most efficient portfolio choice (hence following the so-called *Efficient Frontier*).

Markowitz formalized this linear allocation problem as the *Capital Allocation Line*, which defines the expected portfolio return as follows:

$$E(R_P) = r_f + \sigma_P \frac{E(R_T) - r_f}{\sigma_T} \tag{1}$$

where r_f is the risk-free rate, $E(R_P)$ the expected return of the investor's portfolio, $E(R_T)$ the expected return on the optimal *tangency portfolio* on the tangency point between Capital Allocation Line and Efficient Frontier (see figure left illustration of figure 1 on page 12), σ_P the volatility of the investor's portfolio, σ_T the volatility of the tangency portfolio.

Consequently, MPT brought important implications for the upcoming Factor Investing Theory: (1) Higher risk exposure should compensate investors with returns above those of lower risk, igniting the idea of the risk premium. (2) With the means of diversification it is possible to lower portfolio risk and increase the investment's efficiency ratio.

(c) Capital Asset Pricing Model (CAPM)

Given that every investor is rational and has the same possibilities to evaluate historical returns and volatility measures in the entire asset universe (i.e. all investors share the same expectations), the only efficient portfolio choice for risky assets is the *market portfolio*[3].

Hence, Sharpe (1964), Lintner (1965) and Mossin (1966) presented new asset-pricing models

[2] Usually, researchers refer to the interval return (yield-to-maturity) of a short-term government bond, such as the U.S. treasury bill

[3] The market portfolio is a hypothetical portfolio of all tradeable assets within an economy. The share of every asset is representative for its size relative to the size of all other assets, e.g. for stocks the market capitalization (market value of equity) over the total capitalization of all other stocks in the economy. Simultaneously, it is the aggregate of all investors's portfolios.

with this implication: The return of a financial asset is driven by the return of the market itself, and so is the risk. The final outcome of this idea led into the *Capital Asset Pricing Model* (CAMP), which is probably the central theory of modern asset pricing.

The relationship between expected return on any asset and the market portfolio can be written as follows:

$$E(R_{i,t}) = r_{f,t} + \alpha_{i,t} + \beta_i \cdot (E(R_{M,t}) - r_{f,t}) + \epsilon_{i,t} \tag{2}$$

where $E(R_{i,t})$ is the expected return of the security i in period t, $r_{f,t}$ is the risk-free return, $\alpha_{i,t}$ is the arbitrage return, β_i the exposure of asset i to the market portfolio, $(E(R_{M,t}) - r_{f,t})$ the expected excess return of the market portfolio, and $\epsilon_{i,t}$ the residual return of asset i in quarter t.

Hence, the market exposure of a stock originates from the *factor sensitivity* represented by the term β_i.

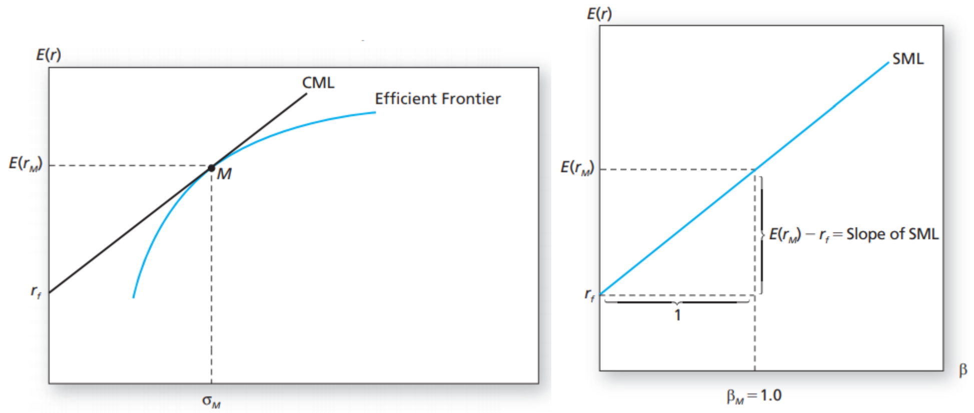
$$\beta_i = \frac{\sigma_{R_i,R_M}}{\sigma^2_{R_M}} \tag{3}$$

where R_i is the return of an individual financial security and R_M the return of the market portfolio. σ_{R_i} denotes the volatility (i.e. standard deviation) of stock i's returns.

Another important implication is that the arbitrage return $\alpha_{i,t}$ is expected to be zero on average over all the market participants (i.e. *no-arbitrage condition*). This maxim holds that it should not be possible to generate return consistently without exposing to market risk. This, however, would be the case if $\alpha_{i,t} \neq 0$. This rigorous relationship between market risk, β_i, and return in the CAPM is depicted in the *Security Market Line* (see figure below).

In summary, the CAPM formalized the following insights for the further development of asset-pricing theory towards Factor Investing: (1) Any investor must discriminate between two sources of risk, diversifiable *idiosyncratic* risk and non-diversifiable *systematic* risk. (2) The risk premium earned on a risky investment is driven by systematic risk and the respective exposure to it. (3) Any discrepancy between risk exposure and expected return constitutes an arbitrage opportunity and should prove unsustainable in an information-efficient market.

Figure 1: Capital Market Line (left) and Security Market Line (right) according to CAPM



The Capital Market Line (CML, left image) depicts the relationship between the expected return $E(r)$ on the vertical and risk on the horizontal axis, measured in standard deviation and labeled as σ_M for the market portfolio. For the Security Market Line (SML, right image), risk is restricted to the market exposure β_M. Source: Bodie et al. (2014); p. 292, 298.

(d) Arbitrage Pricing Theory (ATP)

The idea that the sources of financial returns can be reduced to systematic risk factors was intriguing given increasing availability of company data in the developed world. Hence, the next link was a broader conception of the CAPM, the so-called *Arbitrage Pricing Theory* (APT). The idea and theoretical conception were introduced by Ross (1976).

The first return models suggested under ATP were multivariate and referred to *exogenous* risk factor such as macroeconomic risk factors (see Chen et al. (1986), described below) instead of *endogenous*[4] market risk. In contrast to the CAPM, the APT is less rigid in its assumptions and conclusions. In APT, investors can hold portfolios different from the market portfolio derived from different expectations. Hence, only well-diversified portfolios eliminating idiosyncratic risk of single stocks must comply with the no-arbitrage condition (see figure 2).

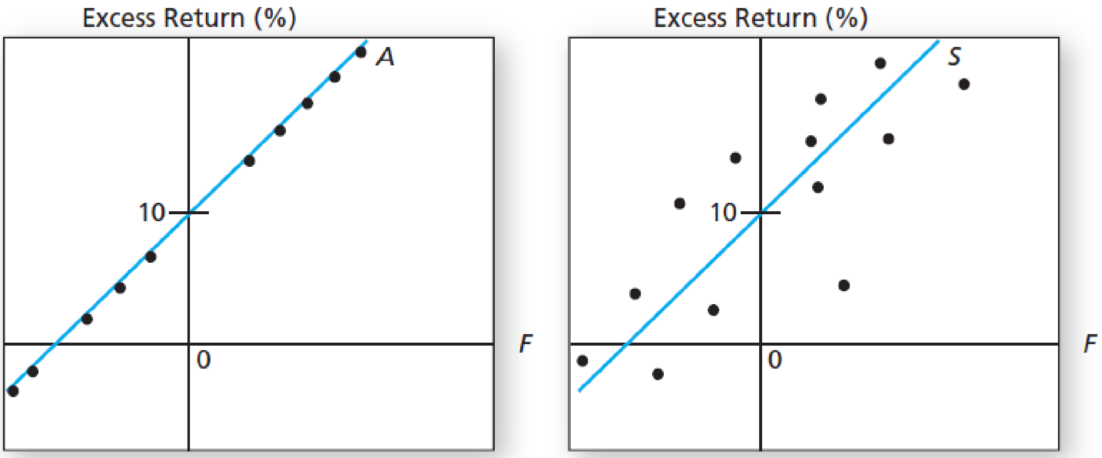
The multivariate factor model is captured in an equation similar to:

$$E(R_{i,t}) = \alpha_{i,t} + \delta_j \cdot E(\tilde{F}_{j,t}) + \delta_k \cdot E(\tilde{F}_{k,t}) + \epsilon_{i,t} \quad (4)$$

where $E(R_{i,t})$ is the expected return of security i in period t, $E(\tilde{F}_{j,t})$ is the expected change in a common risk factor F_j at time t (by assumption $E(\tilde{F}_{j,t}) = 0$), δ_j is the sensitivity or risk exposure of security i towards common risk factor j and $\epsilon_{i,t}$ for the residual return of

[4] The *endogeneity* of market risk arises from the fact it is the weighted aggregate of single volatilities in all associated stocks. Hence, market risk can be explained *within the model*. In contrast, the volatility of stock returns is expected not to influence changes in the exogenous risk factors.

Figure 2: Security Market Line (SML) according to CAPM (left) and APT (right)



The horizontal line denotes the sensitivity to single or multiple systematic risk factors F (e.g. market portfolio). A and S can denote single stocks in CAPM (left) and APT (right), respectively. According to APT, the pricing of a single stock against the SML does not imply the existence of an arbitrage opportunity. Only diversified portfolios, whose exposure to the systematic risk factors can be determined specifically, must rule out arbitrage and hence lie on the SML. Source: Bodie et al. (2014); p. 330.

security i at time t. The subscript k denotes another common risk factor.

Beyond the academic impact of APT, its asset-pricing models have transformed investment management. It was then conceivable to define a set of common risk factors, to which exposure of a portfolio can be fine-tuned for a specific investment strategy or neutralization (i.e. hedging).

i Macroeconomic Risk Factors

An important contribution to APT was a well-known paper by Chen et al. (1986), in which the influence of the following macroeconomic factors on stock returns were analyzed:

1. Industrial production
2. Expected inflation[5]
3. Unexpected inflation
4. Spread of long-term corporate bonds over long-term treasuries
5. Spread of long-term over short-term treasuries

[5] Expected and unexpected inflation have been defined, for example by Fama and Gibbons in *A comparison of inflation forecasts* (1984), as the serially correlated and uncorrelated parts of a first-order random walk MA(1) model.

Chen et al. (1986) employed the so-called Fama & MacBeth (1973) factor regressions to derive long-run risk premia of U.S. stock returns on the above-mentioned macroeconomic factors. In accord with following research, especially industrial production and the default-risk premium on corporate bonds were found to be significantly correlated with stock returns. These results could later be partially confirmed for international stock returns by Bodurtha et al. (1989). A methodological revision by Shanken & Weinstein (2006), however, dismissed most macroeconomic factors as lacking explanatory power, except for industrial-production growth. The significance of this contribution was the further elaboration of the idea that systematic risk factors, affecting stock returns in an entire economy, constitute material risk exposure that an investor cannot diversify. However, the results could not substantiate the hypothesis that market risk as in CAPM is fully driven by macroeconomic factors. Nevertheless, the paper initiated further research into the relationship between financial returns and macroeconomic innovation.

ii Characteristics-Based Risk Factors

The next extension of the APT idea and last missing link to Factor Investing was the three-factor model by Fama & French (1993), in which the market exposure of U.S. stocks could be sufficiently explained with risk factors of fundamental firm characteristics: *size* and *value*. This article was also the academic breakthrough of zero-cost, market capitalization-weighted *factor-mimicking portfolios* (FMPs) to reflect characteristics-based risk factors. An important auxiliary was later added by Carhart (1997), who published a four-factor model with the so-called *momentum* factor included.

Characteristics-based factors refer to valuation or price characteristics of a stock reflecting underlying fundamental risk. FMPs tracking this risk are usually formed by sorting stocks into different quantiles of a specific characteristic (e.g. relation between book value and market capitalization) across a market's stocks, as done by Fama & French (1992, 1993) or Carhart (1997)[6]. For example, the FMP for the so-called *value* risk factor (see below in this section) is formed by sorting stocks into a bottom- and top-30% percentile and a middle-40% percentile, according e.g. to their price-to-book value. Within those different layers, the stocks can be weighted according to their relative market capitalization (i.e. value-weighted) or equally-weighted. Cazalet & Roncalli (2014) illustrated the value-weighted mechanism as follows:

The layers themselves are then used to determine which stocks should constitute long positions, short positions or are excluded from the portfolio. As FMPs are zero-cost

[6] The Fama-French methodology for the sorting of zero-cost FMPs is accurately described in section 3.1.1. of Cazalet & Roncalli (2014)

Figure 3: Portfolio Weighting for FMP Construction in Factor Investing

$$w_i \propto \begin{cases} -ME_i & \text{if } R_i < Q_1 \\ +ME_i & \text{if } R_i > Q_2 \end{cases}$$

w_i is the portfolio weight (in dollar terms) for the underlying firm of stock i, ME_i the market value of the company's equity (i.e. market capitalization), R_i the ratio realization for a particular risk factor and Q_1 (Q_2) for the respective percentile from the distribution of ratios across companies

portfolios, the long layer and the short layer finally sum up to a net investment of zero. Fama & French concluded this portfolio construction with holding the intersections between the sub-samples of different FMP layers equal[7], so that for example a value FMP is not tiled towards another one (e.g. size FMP).

The above-mentioned factors that have their firm place in asset-pricing literature are interpreted and explained as follows:

Size: The size factor refers to the long-term outperformance of firms with a low market capitalization over such with high market capitalization, as originally observed by Banz (1981) and Reinganum (1981). According to them, the growth and innovation opportunities allow them to win market shares from saturated large-cap firms. Recent studies, though, challenge its existence in longer time series, e.g. Fama & French (2012). It seems with hindsight that the growth potential of publicly traded small-caps comes from other risk factors, as found for value by Loughran (1997) or by Chen et al. (2002) for momentum. Nevertheless, the higher sensitivity of small-cap stocks to other characteristics-based risk factors, as found by Fama & French (2012) or Atanasov & Nitschka (2014), makes it still a relevant object of analysis in Factor Investing.

Value: Value stocks are defined as having a high book value (i.e. net asset value) relative to its market capitalization. One of the first discoveries of this risk factor was in the famous investment advice book *Security Analysis* by Graham & Dodd (1934). In long return time series, they beat their counter-parts, which are called *growth* or *glamour* stocks. While growth stocks attract investors by a high growth rate of expected future cash flows, value stocks are mostly well-established and positioned firms with high accumulations of fixed assets and low investment opportunities. During recessions such firms are expected to perform particularly bad since they are burdened with a high load of unproductive expensive assets, as put forward in the production-based pricing framework by Cochrane (1991). Similarly, Bansal et al. (2005) concluded with the rationalistic theory of *long-run consumption risk* that value stocks are especially exposed to drops in operating income. This resonates with Chen et al. (2006), who found the value premium to be connected to

[7] A mathematical illustration of the equalization methodology is outlined in formulas 15 and 16 of the appendix section 9.9

long-run dividend growth. Moreover, the beta exposure of value stocks has been shown to increase during troughs e.g. by Zhang (2005). At the same time, behavioral theories tried to explain the value premium with *overreaction* to high cash flows in growth stocks (Lakonishok et al. (1994)), or by loss aversion and mental accounting as by Barberis & Huang (2001)[8]. Further research has shown that the value premium is mostly linked to the profitability of the firm with respect to their operational income and to their investment activities (e.g. Fama & French (2014)).

An important extension of the previous three-factor model has been made by Carhart (1997). The asset-pricing formula comprising all mentioned risk factors in *four-factor model* has been defined as follows:

$$R_t = \alpha_t + \beta_{MKT} \cdot MKT_t + \beta_{SMB} \cdot SMB_t + \beta_{HML} \cdot HML_t + \beta_{WML} \cdot WML_t + \epsilon_t \quad (5)$$

where R_t stands for any asset's return at time t, MKT for the market portfolio, SMB for the size factor-mimicking portfolio 'small-minus-big', HML for the FMP 'high-minus-low' and WML for the momentum factor 'winners-minus-losers'. The term β stands for the asset's sensitivity to any risk factor. Finally, ϵ_t denotes the residual return at time t.

Momentum: First described by Jegadeesh & Titman (1993), the momentum factor describes the pricing anomaly that well-performing stocks tend to continue with their out-performance over weak stocks in the short-term future. The behavioral explanation by Barberis & Huang (2001) says that *loss aversion* causes the common trading lapse to close winning positions immediately while keeping drawdowns overly long in the portfolio. Assuming that investors become aware of such mispricings over time, they would then invest in stocks according to their recent performance and enhance a positive-feedback loop (Ang (2014)). As a consequence, the momentum factor should be considered especially immune to regional idiosyncrasies. Moreover, Daniel & Moskowitz (2016) found a particular vulnerability of momentum investments to market crashes, implying that market interventions would support the prices of recent under-performers. Another relevant finding by Chui et al. (2010) as well as Fama & French (2012) is that momentum has been completely dysfunctional in the Japanese stock market. Chui et al. suggested that collectivist societal traits in Japanese culture lead to behavioral implications including short-termism. This hypothesis would speak strongly in favor of a psychological basis for the momentum factor, but has also been contested among others by Fama & French.

The explanation power of characteristics-based FMPs could be shown in numerous studies, primarily for U.S. equity. Most importantly for the context of this study, these findings

[8] Barberis and Huang imply, similarly to the overreaction hypothesis, that "dismal prior performance" makes investors irrationally averse to value stocks.

could be extended to and largely confirmed on the international level: for example, for 13 developed markets by Fama & French (1998) [9], 31 emerging markets by Rouwenhorst (1999) and 23 developed markets by Fama & French (2012). Fama & French (2012) and Atanasov & Nitschka (2014) re-confirmed as well the interdependency between value and size premia, meaning that excess returns from the value factor decreased by firm size. The first relevant research on FMPs in emerging-market returns was brought forward by Karolyi et al. (2006), who found global market risk and the momentum factor to be especially powerful at explaining returns over an international sample. Conversely, the size and cashflow-based value factor did not yield significant results in emerging markets as part of an international sample. On a single-country level, however, the classic four-factor model was found to yield risk premia on the value and momentum factor in 18 emerging markets by Cakici et al. (2012)[10].

Other risk factors and market anomalies are the *low-beta anomaly*, as described by Black (1993) and the concluding betting-against-beta strategy by Frazzini and Pedersen (2014). They could show that leverage and margin constraints drive investors to increase portfolio risk via long positions in high market-beta stocks. This lowers the prices of low-beta securities relatively against high-beta stocks, and gives them a higher return potential. Another factor discovered by Amihud (2000) is the liquidity or rather *illiquidity* premium, referring to the usual price risk in illiquid markets. The less investors are ready to buy or sell in a market, the stronger will the market price react to exogenous shocks. Hence, investors want to be compensated for this risk.

(e) Factor Investing

i Occurrence

Factor Investing seeks to build real-world investment strategies offering exposure to characteristics-based risk factors. Its actual breakthrough came with the analysis of the Norwegian Sovereign Wealth Fund's long-term returns by Ang et al. (2009). Designed as a large-scale performance-attribution analysis, they found that despite of elaborate diversification efforts the fund's performance against the market benchmark could be explained by characteristics-based risk factors. The Sovereign Wealth Fund's portfolio managers could not generate α-returns over the exposure to those risk factors. Exposure to both *value* and *size* factors were found to destroy (partial correlation -0.56) or to support (partial correlation $+0.41$) equity performance. Also, default-risk premia on investment-grade corporate bonds and the term spread affected fixed-income returns in

[9] Only concerning the long-term premium of value stocks over their counterpart of growth stocks

[10] Except for the momentum returns in Eastern European markets

different directions.

The main conclusions from Ang et al. (2009) for the perception of risk and return of financial assets, especially for practitioners, were twofold:

1. Characteristics-based risk factors are the supreme systematic risk factors, visible in numerous asset classes. Hence, allocation strategies across regions or asset classes cannot diversify the exposure to those.
2. Since a significant part of α-returns of the Norwegian Sovereign Wealth Fund could be explained with exposure to those common factors, the net performance by active managers after fees is fundamentally questioned.

The importance of Factor Investing became evident through the strong increase in fund products giving exposure to characteristics-based risk factors[11]. One must distinguish between fund products that actually constitute FMPs on one side and so-called *smart beta* or *strategic beta* funds on the other. The latter terms are mostly used for long-only funds with deviations from the market benchmark[12] of single stocks to increase exposure to a characteristics-based risk factor.

ii Methodology

According to the principles of Factor Investing, there must be transparent rule-based concept for forming FMPs. The basic approach found in Fama & French (1992, 1993), Carhart (1997), Ang et al. (2009) and Fama & French (2012) proposes value-weighted zero-cost portfolios, as already outlined in section 2.(d). The particular allocation rules for all FMPs that have been applied in this thesis are summarized in table 10.

The approach to FMP construction in Factor Investing differs decisively from Fama & French. First, FMPs in Factor Investing are treated and built as investable assets. Conversely, Fama & French used them as rigorous replications to the underlying risk factors. They used FMPs as explanatory variables in cross-sectional returns. This leads to the second important difference in the handling of FMPs. In contrast to the cross-section analysis by Fama & French and its purpose to analyze the impact of one factor while holding others equal (see appendix section 9), the Factor-Investing treatment of FMPs does not correct for their exposure to other characteristics-based risk factors.

[11] 'The Rise of Smart Beta' (06/07/2013). The Economist [`https://www.economist.com/news/finance-and-economics/21580518-terrible-name-interesting-trend-rise-smart-beta`] (accessed on 19/03/2018).

[12] Deviations from the market, i.e. over- or underweighting of single stocks according to the rules for replicating a characteristics-based risk factor, are mostly called *tilts* by practitioners.

(f) Macroeconomic Spillovers on Factor Strategies

The aim of this thesis is two find new insights into the relationship between characteristics-based risk factors in stocks and the impact from macroeconomic risk on them. The following section will therefore discuss the various measures for different sources of macroeconomic risk, and previous findings related to their effect on stock prices. The most important findings of previous research have been summarized in table 2.

Although a plethora of research has scrutinized characteristics-based risk factors and spillovers from macroeconomic risk, their results are often conflicting. Among those that analyzed the effect of macroeconomic-risk exposure on characteristics-based factors in stock prices, the primary method has so far been orthogonalization of cross-sectional stock returns or constructing FMPs according to the Fama-French methodology (both in contrast to investable FMPs in Factor-Investing theory).

Most similar to this thesis has been the panel-data analysis by Bergbrant & Kelly (2016). They analyzed the returns of Fama-French FMPs (local and global portfolios) for size, value and momentum with respect to forecasts in macroeconomic indicators within and across 20 developed markets. They found very contrary results to previous research, with momentum (negatively) and value (positively) weakly related to changes in GDP forecasts on an international level. Equally critical are the recent insights by Boons (2016)[13], who found the risk premia on macroeconomic factors unrelated to the characteristics-based factors value and size.

i Growth Risk

The most important measure for macroeconomic risk concerns the value of an economy's output. Related indicators have therefore been at the core of previous studies of FMP returns and macroeconomic risk. A popular measure in that respect is the growth of industrial production, as the most tangible measure for the productivity of an economy. Also, growth of the gross domestic product (GDP) per capita is commonly used. However, most studies use industrial production due to its ability to forecast GDP, e.g. according to Chen et al. (1986) and Fama & French (1993).

Several researchers have found a positive correlation of changes in industrial production with risk factors for U.S. stock data, e.g. Liu & Zhang (2008) for cross-sectional momentum returns or with value in Vassalou (2003), Hahn & Lee (2006) and Petkova (2006).

[13] This result deserves particular attention as Boons demonstrated that his set of macroeconomic indicators has predictive power for volatility in the business cycle.

Furthermore, Liew & Vassalou (2000) demonstrated forecasting abilities of size and value FMPs for changes in growth expectations. Just as Aretz et al. (2010), who found the size factor to gain from expected industrial-production growth, they constructed FMPs tracking unexpected changes in growth expectations[14]. Their findings suggest that industrial production as a precedent indicator for the real economic development reflects macroeconomic risk that investors can expose to via investing in small-cap or value stocks. This risk source can be described as *growth risk*. The intuition behind is that small-camp companies and dividend-pouring value stocks benefit from economic growth in the long run more than their counterparts. As outlined in section 2, this would be in line with the usual explanations for the occurrence of these risk factors. Especially for value stocks, though, this relationship becomes more complicated by the findings about its disparate nature between the *profitability* and *investment* factor, e.g. Fama & French (2014). As for Momentum, only Liu & Zhang (2008) found a positive correlation with momentum FMP returns, following the methodology of Liew & Vassalou (2000). The idea that momentum reflects improving fundamental conditions would challenge the common perception of momentum as a behavioral market anomaly.

The mentioned findings got fundamentally contested from several sides. Bergbrant & Kelly (2016) and Griffin et al. (2003) showed with their approach, using GDP forecasts, that momentum is either unrelated to macroeconomic risk or negatively correlated. Chen et al. (2006) similarly find value returns in the U.S. to act as a hedge against drops in real consumption growth. Also, Aretz et al. (2010) found value stocks to be a hedge against negative changes in expected industrial-production growth when holding size and momentum differences between them constant.

ii Inflation Risk

Inflation risk means spillover effects from volatility in the consumer-price level of an economy on the stock market. Higher inflation reduces the real purchasing power of the cashflows received from equity investments. Hence, inflation risk is crucial to stockholders.

The effect of inflation on stock returns in general has, for example, been analyzed by Chen et al. (1986). They found overall inflation to be fairly unrelated to stock-price moves whereas changes in unexpected inflation would have a strongly negative impact (unless during regimes of high inflation volatility). This implies, in line with the efficient market

[14] The reasoning behind this approach is that stocks with higher sensitivity to realized changes in industrial production uncover the filtered part of *unexpected* changes in economic growth. This, however, is based on the assumption that only unexpected changes can cause volatility in stock prices, as current prices already reflect the common expectations about future economic growth. Hence, the approach is based on the efficient-market hypothesis formulated by Fama (1970).

hypothesis, that expected inflation is efficiently priced in the market risk by investors. Nevertheless, extreme hyper-inflation was found to have a negative impact on stock prices, e.g. coined *disaster risk* by Barro & Ursua (2008). Also, Kelly (2003) found size FMP returns to be negatively correlated with inflation.

So far, there is has not been any established theory for relationships between inflation and specific characteristics-based factors. However, it is reasonable to assume that especially value returns should be vulnerable to inflation risk as it has been found strongly dependent on long-run consumption (Bansal et al. (2005)) and on the lower purchasing power from dividend streams to investors (Chen et al. (2006)).

iii Default Risk

A popular approximation for the risk of firms becoming unable to pay out cashflows to their shareholders is their *default risk* relative to their local government. It is therefore mostly referred to as an indicator for corporate stability. The common measure in literature has been probabilities of survival, derived from the pricing of corporate bonds (see e.g. Vassalou (2003) or Aretz et al. (2010)). The inverse impact of default risk on characteristics-based factors could be shown by Vassalou & Xing (2004), Hahn & Lee (2006) and Petkova (2006). Overall, the size factor had a strong negative exposure to rise in default risk while value stocks offered a weak hedge or insensitivity (referring to the later two sources). These findings can be brought in line with Factor-Investing theory. As small-cap stocks are expected to be more dependent on their home market, the opposite should hold true for value stocks with a strong asset and diversified revenue base. In a U.S. panel including various macroeconomic indicators, Aretz et al. (2010) found that value returns are not sensitive to default risk when holding term-structure risk constant. Instead, they found as the first in the literature momentum returns to deliver risk premia on default risk. This can to some extent be reconciled with the composite view on momentum returns in Ang (2014) and Daniel & Moskowitz (2016), who stated that those are especially exposed to the risk of extreme market turmoils.

iv Term-Structure Risk

Another important macroeconomic indicator is the so-called *term spread* between the yields of long- and short-maturity sovereign bonds of a country:

$$YTM^A_{T=1} - YTM^A_{T=2} = TS^A \tag{6}$$

where YTM denotes a sovereign bond's yield-to-maturity, A denotes the country with sovereign bonds of two different maturities (1 for long, 2 for short), and the resulting term spread of country A.

The width of the term spread indicates how strongly the market associates credit risk to time outstanding. A small term spread is usually associated to a business-cycle peak (e.g. Hahn & Lee (2006)), where long-term interest rates are comparably low against short-term rates. This implies that the time-dependent risk premium on higher maturity has reached its lowest point. With an economic downturn, the time-risk premium would increase again. Consequently, the term spread is thought to reach its climax at the trough of the business cycle.

Aretz et al. (2010) find that term-structure risk is captured in both value (positively correlated) and momentum (negatively correlated) returns of U.S. data. These findings appeared in both cross-sectional returns as well as long-short FMPs. No distinct relationship could be found for size cross-sectional returns or FMPs. In agreement with this, Hahn & Lee (2006) and Petkova (2006) found a positive correlation between value cross-sectional returns and increases in the term spread. According to them, their findings confirmed a familiar notion that growth stocks have a high duration risk while naturally the opposite is then expected for value stocks. Consequently, this implies that long-term financing costs affect growth firms stronger than value counterparts. This is in congruence with the general idea of value firms to be well-established market players with high-quality debt collateral (as measured by their high book values).

v Sovereign Risk

Sovereign risk can be defined as the aggregate risk that the government of a country, or entities backed by them, find themselves unable or politically unwilling to comply with their debt obligations. In an information-efficient market, one would therefore expect this risk to be priced in affected debt instruments (in this case sovereign bonds such as U.S. Treasuries). As this implies that the yield-to-maturity on a sovereign bond should bear a measurable risk premium for exposure to this source of risk, the so-called **sovereign spread** has become the most popular indicator for sovereign risk:

$$YTM_T^A - YTM_T^B = SS_A \tag{7}$$

where YTM is the yield-to-maturity for maturity T on the sovereign bonds of countries A and B. Hence, the sovereign spread SS_A gives the absolute sovereign risk of country A over B in percentage points or basis points.

More elaborate deductions of sovereign risk from bond spreads have been suggested, for example, by Bekaert & Hodrick (2017). They are also the foundation for the country-risk premia calculated and published by the well-known corporate-finance researcher Aswath Damodaran [15]. A comprehensive model on sovereign-risk premia and related dynamics in stock returns has been suggested by Pastor & Veronesi (2012). However, it was already years before that Diamonte et al. (1996) demonstrated its relevance in international stock markets (with a significantly higher risk sensitivity in emerging markets). Zinna (2014) showed that sovereign spreads in emerging markets were much more country-dependent than corporate spreads during times of high risk and low global market liquidity.

Previous studies on the relationship between characteristics-based risk factors and sovereign risk in the sphere of Factor Investing are scarce. Erb et al. (1996) as well as Ferson & Harvey (1997)[16] found value in sorted cross-sectional stock returns positively correlated with upgrades in country-risk ratings, including debt quality of sovereign bonds.

vi Further Sources of Macroeconomic Risk

There are more macroeconomic indicators that are suggested for the inclusion in the data analysis of this thesis, among which are *current-account balance*, *short-term rates* and *monetary supply*.

The current-account balance gives the most observed indicator for the competitiveness of an economy within international trade. Consequently, it is also considered in the public debate when assessing the performance of stock markets, as large blue-chip companies with diverse revenue markets are expected to be heavily dependent on exports. Erb et al. (1996) found that economic-policy risk (including current-account balance) can explain variations in future value returns by about 25%.

The liquidity provided by monetary supply has so far been neglected in the analysis of cross-sectional returns. Also, there is no established theory on a possible relationship between characteristics-based risk factors and the risk in monetary policy. A more common measure for the availability of capital are short-term rates.

[15] A complete overview of country-risk premia calculated by Damodaran can be found here: `http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ctryprem.html` (accessed on 23/03/2018)

[16] However, Ferson & Harvey adjusted their definition of value stocks to country-specific definitions. In fact, robustness tests showed that significant results can otherwise not be found.

vii Development Risk

As this thesis represents a comparative analysis of developed and emerging markets, some analysis must be dedicated to fundamental differences between them. The most extensive analysis of risk in emerging markets so far can be found in Karolyi (2015). He mainly refers to six groups of major risk where developing markets differ from fully developed markets:

- **Market-capacity constraints**: The accessibility of domestic capital markets for the external funding of domestic firms. The more difficult it is to acquire external funds, the more risky is the sustainability of future cash flows of potentially profitable firms.
- **Operation inefficiencies**: The efficiency and liquidity of domestic capital markets. This affects the costs to raise external funds for domestic firms.
- **Foreign accessibility restrictions**: As homogeneity in the investor community of one market constitutes a cluster risk, domestic financial assets should ideally be available for a wider range of international investors (leading to the so-called *risk-sharing effect*). This is impeded, for example, by legal obstacles to foreign direct investment.
- **Corporate governance**: The quality of corporate (i.e. self-regulatory) protection of asset claims against company values from squandering behavior by the management. The company's failure to disclose its managerial performance will lead to over- or under-rated asset prices, and hence to suboptimal investment decisions by their shareholders.
- **Legal protection**: The quality of state-guaranteed protection of investors's asset claims, in particular from different domestic stakeholders. The possibility that rightful claims are not being enforced is another substantial risk with respect to future cashflows.
- **Political instability**: The variability of economic and financial policies by the government in one specific market. Changes in public spending, taxation or business-relevant regulations constitute another source of uncertainty about future cash flows to investors.

In a cross-country regression analysis over 56 countries among global institutional investors, Karolyi (2015) found for 2012 that common factors assembled by principal component analysis, especially indicators of corporate opacity, political instability, market capacity constraints and to a lesser extent limits to legal protection, significantly explain excess holdings[17]. This means that higher country risk determines the under-weighting of this country's assets by global investors.

Moreover, Chari & Henry (2004) and Hou et al. (2011) engaged in pioneer work proving that liberalizations of stock markets have an enhancing effect on returns in emerging markets. The findings were explained with a more heterogeneous investor community that is able to share the before inevitable risk within a specific market. In other words, what has been systematic risk in a *segmented* market can be diversified in a globally *integrated* market after liberalizations, hence proving the risk-sharing effect. Therefore, emerging markets imply regional idiosyncratic risks for which investors require compensation.

These aspects of risk that correlate with the economic development of an economy must be considered in the cross-country variance of stock returns. Although some of them should be correlated to common macroeconomic indicators, the author expects profound differences in time-invariant country-fixed effects between emerging and developed market.

[17] Excess holdings were defined as a surplus share of country-specific assets in the portfolio of the global investor above the share in cross-country market capitalization.

3 Data Overview

The following chapter gives an overview on the data that have been harvested for this study. It consists of a section each for the stock prices (a), later used used in chapter 5 for the construction of FMPs, the macroeconomic indicators (b) and the descriptive analysis of the stock market data (c).

(a) Stock-Market Data

The stock-market data have been collected from two different groups of countries: emerging and developed markets. The main provider of equity indices and benchmarks, Morgan Stanley Capital International (MSCI)[18], applies the following income-dependent definition by the World Bank's Atlas method[19], where

1. emerging markets are *upper-middle-income economies* of a GNI per capita between 3,956$ and 12,235$,
2. and developed markets are *high-income economies* of a GNI per capita equal to or higher than 12,235$

per latest calculations in 2016[20].

In order to work with a geographically diversified group of countries, the markets displayed in table 1 were selected by the author.

Table 1: Overview on country selection

Developed	**Emerging**
Australia	Brazil
Germany	China
Japan	India
United Kingdom	Russia
United States	South Africa

The stock-market data have been retrieved from common-equity quotes available on Thomson Reuters Datastream and Thomson Reuters Eikon. Monthly quotes of adjusted stock prices, market values and price-to-book values have been gathered for all countries from 1 January 1995 to 1 January 2017. The stock prices include stock splits as well as dividends.

[18] `https://www.msci.com/market-cap-weighted-indexes` (accessed on 04/09/2017)
[19] https://datahelpdesk.worldbank.org/knowledgebase/articles/378834-how-does-the-world-bank-classify-countries (accessed on 09/02/2018)
[20] `https://datahelpdesk.worldbank.org/knowledgebase/articles/906519` (accessed on 09/02/2018)

The different data categories are necessary for the construction of the following factor-mimicking portfolios (further explained in section 5.(a) and table 10):

1. The adjusted prices are used for the calculations of arithmetic returns across all FMPs. Moreover, the historic 6-month returns are taken for momentum FMP (MOM) construction with the top-30% regarded as winner stocks and the bottom 30-% as loser stocks.
2. Market value (i.e. market capitalization) is needed to construct a size FMP (SZE), discriminating between small and big along the median market value within one market. Moreover, it is used to create a relative value-weighting of each stock across all the proposed FMPs
3. Price-to-book values (i.e. market value over common-equity value) is used for the allocation in the value FMP (VAL), where the bottom-30% realizations are considered value stocks and the opposite (top-30%) growth stocks.

i Filters

The author has largely followed the previous literature (e.g. Griffin et al. (2010)) on the analysis of factor-mimicking portfolios with respect to filters on the stock-market dataset. Also in line with Aretz et al. (2010) or Cakici et al. (2013), all stock prices have been re-calculated into USD, using the closing price of each currency pair at the end of the month.

Only common equity was allowed to enter the dataset, so that preferred stocks of the same company or exchange-traded funds were excluded. Moreover, cross-listings and double-listing as well as different securities of common equity were eliminated by choosing only primary and major listings (as opposed to secondary and minor listings). Finally, stocks associated to a country without being listed at a domestic exchange were also excluded.

For the calculation of meaningful FMP returns, two important filters have been applied to the stock selection.

1. A major concern in stock-market analysis is the abundance of highly illiquid *micro* stocks that do not deliver meaningful information. While Cakici et al. (2013) excluded stocks reaching a stock price lower than 1 USD over the period, this study applied a more cautious approach. For FMP calculations, only stocks with a historic average of

at least 1.5 USD were considered. This ensured that, especially in emerging markets with a comparatively weak currency, the impact was limited.

2. A usual method to avoid distortions by outlier returns is the exclusion or capping of returns. For this analysis the top and bottom 0.1%-percentile of returns has been excluded.

(b) Indicators for Macroeconomic Risk

The indicators approximating macroeconomic risk can be associated to intuitive sources of risk, such as *growth risk*, *development risk*, *inflation risk*, *sovereign risk* or *default risk* among others. All macroeconomic indicators have been retrieved from Thomson Reuters Datastream, with several country gaps being filled through the Federal Reserve (Fed) St. Louis Databank. The USD LIBOR interest rate, used as risk-free rate, has also been taken from the second source. The lending-rate series were retrieved from the International Monetary Fund (IMF) International Financial Statistics. Unfortunately, several parts of time series (especially short-term interest rates in emerging markets) where either not available or not existent for the chosen time frame. All interest-based, GDP-based indicators, industrial production and inflation are seasonally adjusted.

Considering the previous research on the impact of macroeconomic risk on characteristics-based factors, the following indicators for macroeconomic risk have been collected:

1. Relative changes in industrial production ($\frac{\Delta IP_{i,t}}{IP_{i,t-1}} = ip_{i,t}$), quarterly data. Industrial production is supposed to be a direct proxy for expected economic growth and hence future cashflows[21].

2. The inflation rate as a relative change of the consumer price indices ($\frac{\Delta CPI_{i,t}}{CPI_{i,t-1}} = i_{i,t}$), monthly data

3. Absolute changes in the prime lending rate have been used as a substitute indicator for default risk, quarterly data

   $$L_{i,t} - L_{i,t-1} = \lambda_{i,t}$$

4. Absolute changes in the term spread between yield-to-maturities of the 10-year government bond over the 2-year government bond of the same country i in percentage points, monthly data

[21] Both Vassalou (2003) and Aretz et al. (2010) argue that taking realized changes in an indicators such as GDP or industrial production could lead to errors-in-variable problems since they do not actually reflect the changes in expectations about future economic growth.

$$R_{i,t}^{T=10Y} - R_{i,t}^{T=2Y} - (R_{i,t-1}^{T=10Y} - R_{i,t-1}^{T=2Y}) = TS_{i,t} - TS_{i,t-1} = ts_{i,t}$$

5. Absolute changes in the sovereign spread between yield-to-maturities of one 10-year government bond over the high-quality 10-year government bond[22] in percentage points, monthly data

$$R_{i,t}^{T=10Y} - R_{CHE,t}^{T=10Y} - (R_{i,t-1}^{T=10Y} - R_{CHE,t-1}^{T=10Y}) = SS_{i,t} - SS_{i,t-1} = ss_{i,t}$$

6. Absolute changes in the current-account balance as a percentage of the gross domestic product ($\frac{CA_{i,t}}{GDP_{i,t}} - \frac{CA_{i,t-1}}{GDP_{i,t-1}} = ca_{i,t}$), quarterly data

Moreover, two more categories of **dummy variables** will be tested

7. Crisis dummy: Previous research on characteristics-based risk factors has developed different theories for the development of various FMPs during recessions or depressions. Consequently, a dummy variable for the global financial crisis of 2007-2008 identical for every country has been introduced. The dummy variable assigns a value of 1 for the four quarters from mid-2007 to mid-2008, and 0 to all others.
8. Country dummy: Country-fixed effects will be tested with inclusive dummy variables. For the panel-data analysis, a dummy variable assigning the value 1 for every single country has been introduced. In order to avoid the dummy-variable trap, observations from Australia were omitted from the econometric analysis.
9. *EM dummy*: A further country variables has been created, assigning 1 to every observation that stems from a country classified as emerging market.

Finally, the set of indicators is closed with relevant **control variables**.

10. Relative changes in gross domestic product ($\frac{\Delta Y_{i,t}}{Y_{,t-1}} = y_{i,t}$) per capita in quarterly real prices. The series is supposed to highlight the predictive power of the industrial-production series
11. Absolute changes[23] in the short-term interest-rate level ($YTM_{i,t}^{T=2Y} - YTM_{i,t-1}^{T=2Y} = r_{i,t}$) measured by yield-to-maturity on a 2-year government bond, monthly data
12. Relative changes in monetary supply ($\frac{\Delta M1_{i,t}}{M1_{i,t-1}} = m1_{i,t}$) quantified by the national M1 money supply, quarterly data

[22] Although asset-pricing literature often refers to the 10-year U.S. Treasury yield as risk-free interest rate, the corresponding yield of the Swiss (CHE) government bond (*Eidgenosse*) has been used for the calculation of the risk spread. This is not only because the United States is one of the countries to be analyzed in this thesis. The Swiss government is also a more reasonable choice with respect to the excellent debt situation of the Swiss government and the strength of its economy.

13. Relative changes in the OPEC Oil Basket price ($\frac{\Delta OP_{i,t}}{OP_{i,t}} = op_{i,t}$), monthly data

Table 5 shows the quarterly mean changes and standard deviations in all macroeconomic indicators that realize different values across the observed countries.

(c) Descriptive Statistics

i Overview of international stock-market data

As can be seen in table 3, the international stock markets reveal a pattern congruent with the notion of higher volatility implying higher returns. Nevertheless, the risk-return-relationship was more efficient across emerging markets than in developed markets. Direct comparisons should be approached with caution though: As can be seen easily, the final number of used stock returns and the market capitalization of those differs vastly among countries. In the first place, stock-market data are a lot scarcer in emerging markets.

The Shapiro-Wilk test is an established test in financial economics to check the null hypothesis of a return series being approximately normally distributed. Apart Japan and South Africa, global stock returns have shown to resemble normal distribution.

ii Correlation of international FMP returns

Tables 6, 7, 8 and 9 depict the correlation matrices of the four different FMP returns across all 10 countries.

In general, correlation levels were at least moderately and significantly positive. The highest correlation coefficients are found among developed markets, which confirms the common view that their financial markets are internationally integrated to a higher degree than those of emerging markets, e.g. Bekaert et al. (2009). The fact that correlation coefficients for market-portfolio returns are slightly higher than for other FMP returns also coincides with the mentioned source[24]. As they are only few recognizable deviations from the pattern of size and significance of correlation coefficients, FMP returns may be considered as largely reliable for further analysis.

An outlier with regard to these patterns are FMP returns in China. Their correlation coefficients are often insignificantly or weakly correlated to other FMP returns. This holds

[24] More precisely, Bekaert et al. (2009) found the stock returns of large growth stocks to be correlated more strongly across international markets than small value stocks.

true especially for VAL and MOM returns. A similar observation with yet significant coefficients can be made for Japanese stock returns.

Furthermore, Rouwenhorst (1999) found extremely low correlation for factor premia among all of the 31 observed emerging markets during 1982 to 1997. The contrast could arise from various factors, such as different sample with respect to date and geography. However, it is also possible that the difference exhibits another proof for the significance for market liberalization in the meantime.

iii International FMP Returns Comparison

Although this thesis does not seek to elicit long-term factor premia, a few notable differences in FMP returns can be seen from table 4. It shows the mean returns and standard deviations of the quarterly returns from June 1999 to December 2016, which have finally been used for the data analysis in 5.

Although the height of returns differ vastly across countries, volatilities seem consistently lower for size and value FMP returns that for market and momentum returns. Moreover, value and momentum returns in emerging markets tend to go in different directions when compared to market returns[25]. While size did not yield positive returns in developed markets, the same was true for momentum in emerging markets. In general, returns and volatility were higher in emerging markets (which is in line with the basic notion of the risk-return relationship in financial economics). However, the most efficient investments were possible in value returns while momentum constituted the most inefficient strategy.

Finally, an overview of FMP returns for each country are depicted in figures 4 to 8.

[25] A similar divergence between the value and momentum factors has been found by Asness et al. (2013)

4 Research questions

The theoretical basis makes it possible to derive testable hypotheses for the sensitivity of FMP excess returns to macroeconomic risk. The research questions will be tested for all characteristics-based factors across all countries by regressing FMP excess returns in two fixed-effect models on generic and particular changes in macroeconomic indicators. The research hypotheses refer primarily to the second-stage regression models explained in section 5.(b).

In summary, the following relationships between characteristics-based risk factors and macroeconomic risk should be expected:

- H.1 The coefficients of changes in the explanatory variables are jointly significant for the excess returns of value-weighted market portfolios (MRP).
- H.2.a The coefficients of changes in the explanatory variables are jointly significant for the excess returns of value-weighted size FMPs (SZE).
- H.2.b Specifically, one should expect a positive influence from changes in industrial production, negative from a higher lending rate and immunity to the term spread.
- H.3.a Jointly significant coefficients of changes in the macroeconomic indicators for the excess returns of the value FMPs (VAL).
- H.3.b From previous research, a positive coefficient of industrial production and the term spread with no significance of inflation on VAL excess returns must be expected. Moreover, the excess returns during the financial crisis should be significantly lower.
- H.4.a Jointly ***in***significant coefficients of changes in the macroeconomic indicators for the excess returns of the momentum FMPs (MOM).
- H.4.b Important previous findings should confirm significantly lower MOM excess returns during the financial crisis and a negative correlation to inflation.
- H.5 For the excess returns of all FMPs but MOM, the consideration of development risk implies significantly higher excess returns in emerging markets than in developed markets.
- H.6 For all FMPs but MOM, there should be country-fixed effects to contribute to the respective excess returns as an indication of country-specific risk. This hypothesis reflects the possibility of unobserved macro-effects being significant for explaining market, size and value returns.

5 Econometric Analysis

The following chapter intends to explain the econometric approach to the analysis of the data described in chapter 3 for testing the research hypotheses derived in chapter 4. The chapter consists of a section (a) illustrating the construction of FMP returns as the dependent variables for the regressions models outlined in section (b).

(a) Construction of Factor-Mimicking Portfolios

The following characteristics-based risk factors have been considered for the construction of factor-mimicking portfolios, individually for each country, from monthly returns in the stock-market dataset:

1. *Market Portfolio (MP)*
2. *Size (SZE)*
3. *Value (VAL)*
4. *Momentum (MOM)*

The factor-mimicking portfolios have been calculated with monthly stock returns from the given cross-country equity sample, and later transformed into quarterly returns to be congruent with the quarterly changes in several macroeconomic indicators (as described in section 3 (b)). As a result of the below-explained construction rules, the final time scope of return series included 70 quarterly observations from 30 June 1999 to 31 December 2016. Consequently, 40 FMPs have been calculated in total for 10 different countries. Other characteristics-based factors have to be omitted due to restrictions.[26]

The selection rules for sorting stocks into the different layers of a zero-cost FMP are taken from main predecessors, such as Fama & French (1992, 1993, 2012), Hou et al. (2011), Bekaert et al. (2009) or Cakici et al. (2013). The subsequent part 3.(a).i explains the mathematical foundations of how FMPs have been constructed. The market portfolio, in contrast, is simply a portfolio with each stock weighted by its relative market capitalization and monthly re-balancing.

Furthermore, specific rules for the construction of some FMPs had to be considered from previous literature:

[26]The *quality* or *profitability* factor cannot be considered due to data deficiencies in numerous emerging markets. Furthermore, analysis of the *low-beta* anomaly would require long return series for reliable correlation figures that cannot be guaranteed with the given data sources.

1. According to Carhart (1997) and later others such as Fama & French (2012), the time frame of previous returns for replicating the momentum factor is commonly 6 or 12 months. In most studies and practical implementations such as factor indices by MSCI[27] reveal a preference to a 6-month solution. Consequently, the sorting of the MOM portfolios has been implemented on the cumulative 6-month return with re-balancing each consecutive month.

2. Following the example of Fama & French (1992, 1993, 2012), Chen et al. (2006) and others, the VAL portfolios are re-balanced annually each mid-year of the sample period. This has been introduced to make sure that the investor is aware of a listed firm's book value, which can be ensured by the end of U.S. reporting period.

Finally, as financial economists is naturally interested in the risky part of an asset's returns, the risk-free rate has been deducted from all FMP returns. As a consequence, they have gone into the panel-data regression models as dependent variable in excess returns. This is congruent with the usual approach in financial economics, as outlined in section 2.(b).

i Mechanism

The *zero-cost* (ZC) or *dollar-neutral* factor-mimicking portfolio invests in two layers of off-setting amounts: the long layer includes buy positions on all preferable stocks whereas the short layer consists of sell positions on all inferior stocks within the same market. As both layer finally sum up to zero, so do the weights of all stocks in the portfolio. To which layer a stock is allocated depends on whether the observed characteristic in question for this stock falls within a pre-defined percentile range beyond the long-quantile (LQ) or short-quantile (SQ). Table 10 shows under which circumstances a stock qualifies for a long or short position. All shares that qualify for neither of them will be ignored as the neutral part (i.e. receive the portfolio weight zero). In order to remain in a rule-based passive investment approach, following the literature such as Fama & French (1992, 1993, 2012), the relative portfolio weight of one security in either layer is its share in the total market capitalization of all firms in the layer (value-weighted approach). An alternative way, e.g. according to Bender et al. (2013), would be the equal-weight approach.

The relative weight in the zero-cost factor mimicking portfolio is defined as:

[27] `https://www.msci.com/eqb/methodology/meth_docs/MSCI_Momentum_Indices_Methodology.pdf` (accessed on 02/04/2018)

$$w^{+}_{i,FMP} = \frac{MC_i}{\sum_l^L MC_l} \qquad for\ \forall l\ R_l \geq LQ(R) \tag{8}$$

$$w^{-}_{i,FMP} = \frac{MC_i}{\sum_s^S MC_s} \qquad for\ \forall s\ R_s \leq SQ(R) \tag{9}$$

where for each stock i w^{+} denotes the relative FMP weight of a long position in the long layer, w^{-} the relative weight of a short position in the short layer, MC the market capitalization of the stock in one position, L the number of all FMP long positions, and S the number of all FMP short positions.

Further, the layers of long and short positions in a zero-cost MFP can be illustrated as follows:

$$0 = \sum_l^L w^{+}_{l,FMP} \cdot MC_l - \sum_s^S w^{-}_{s,FMP} \cdot MC_s \tag{10}$$

Consequently, the quarterly excess return of each FMP portfolio is the weighted sum of all stocks from one country:

$$r_{FMP} - r_f = \sum_l^L w^{+}_{l,FMP} \cdot r_l - \sum_s^S w^{-}_{s,FMP} \cdot r_s - r_f \tag{11}$$

where r_l and r_s denote the arithmetic quarterly single-stock returns of the respective positions in the long or short layer and where r_f is the risk-free rate.

(b) Two-Stage Panel-Data Analysis

i Methodology

The analysis of the empirical panel data on country and factor levels will be conducted with fixed-effect regression models in two stages:

1. Country Panel: fixed-effect regressions including all FMP and each country (i.e. total 10 regressions for 10 different countries)
2. Factor Panel: FMP-specific fixed-effect regressions spanning over all countries (i.e. 4 regressions for four different FMPs)

The purpose of the first stage is the derivation of FMP factor sensitivities to macroeconomic indicators in one country. This makes it possible to compare the significance of different macroeconomic indicators, controlled for interdependencies between the country's FMP returns. Subsequently, the second stage will shift the perspective from countries to characteristics-based factors. Hence, the regressions models in the second stage yield factor sensitivities that apply to all countries and give a more aggregate picture of macroeconomic spillovers. As both steps are implemented with fixed-effect regressions, they allow for the quantification of country-specific and factor-specific variation in the FMP returns. This is beneficial as it enables valuable insights into unobserved drivers of excess returns. Finally, the fixed-effect model is the most adequate for these kinds of panels from a methodological point of view[28].

The estimation of the fixed-effect coefficients, besides those of explanatory and control variables, has been implemented via direct estimation of dummies for each fixed-effect. This implies a set of FMP-specific dummy variables for first-stage regressions and of country-specific dummy variables in the second-stage regressions. However, these sets of dummy variables are inclusive in the sense that the value 1 is realized once for every observation in the panel. This creates the problem of the *dummy-variable trap* when multicollinearity between different variables makes the regression estimation of ceteris-paribus effects impossible. Accordingly, the fixed effects MRP (first-stage) and and Australia (second-stage) will be removed. These leaves the reader with the following interpretation of the entity-dummy coefficients: (1) the complete fixed effect is caught in the constant term of the regression model plus the coefficient dummy coefficient. (2) Each dummy coefficient should hence be considered as the relative fixed-effect difference to the omitted fixed effect.

The regression models in each step will be calculated with three different implementations for robustness checks:

I. Explanatory variables only

II. Explanatory and entity-dummy variables

III. Complete set of explanatory, dummy and control variables

The complex structure of cross-section panel-data analysis is, exemplifying step 2, depicted in table 11. The panel can be considered strongly but not fully balanced with 278 missing values among 13,022 macroeconomic data points.

Readers might be reminded of the famous Fama-MacBeth regression methodology proposed by Fama & MacBeth (1973). The Fama-MacBeth also incorporates a two-stage approach, which yields factor sensitivities individually for every portfolio by time-series regressions and then regresses the factor sensitivities on the returns in a panel to yield portfolio risk

[28] The alternative method of random-effect regressions should be considered only if the number of observations for each cluster of effects is considerably different.

premia. In spite of the similarity between both approaches, the brevity of the available data series makes them inapt for the derivation of significant long-term risk premia.

ii Stage 1: Country-specific fixed-effect regressions

In the first step, the FMP returns are integrated in one fixed-effect regressions for each out of N countries. The regression model is defines as follows:

$$r^e_{j,t} = \alpha_j + \delta F_{j,t} + \beta M_{j,t} + \gamma C_{j,t} + u_{j,t} \tag{12}$$

where $r^e_{j,t}$ is excess return, $t \in \{1, 2, \ldots, T\}$ denotes one quarterly observation in the series of T quarters, $j \in \{1, 2, \ldots, Y\}$ stands for one out of Y different characteristics-based risk factors. $M_{j,t}$ is a time-variant matrix of the quarterly changes in k explanatory variables with a vector β of resulting factor sensitivities. Analogously, $C_{j,t}$ is a time-variant matrix with the quarterly changes in p different control variables and according regressions coefficients in vector γ. The factor-fixed effect of each regression is captured in the constant term α_j and the δ-coefficients of the factor-specific dummy variables in the matrix $F_{j,t}$.

As the first-stage regressions are implemented all four FMPs for every country, all 10 regression models are run on a $4 \cdot 70 = 280$-observation panel.

iii Stage 2: Factor-specific fixed-effect regressions

The fixed-effect regression model of the second stage is run individually for each out of Y characteristics-based risk factors with according FMPs over all countries. An important supplement to the first-stage model is that the second-stage models introduce *interaction variables* of all explanatory variables with an emerging-market dummy variable $EM_{i,t}$.

The second-stage regression model is defined as in equation (13):

$$r^e_{i,t} = \alpha_i + \omega D_{i,t} + \beta M_{i,t} + \theta I_{i,t} + \gamma C_{i,t} + \epsilon_{i,t} \tag{13}$$

where $r^e_{j,t}$ is excess return, $t \in \{1, 2, \ldots, T\}$ denotes one quarterly observation in the series of T quarters, $i \in \{1, 2, \ldots, N\}$ stands for one out of N different countries. The explanatory and control variables are represented with identical matrices as in equation (12). Their respective factor sensitivities are included in the vectors β and γ, respectively. The additional interaction variables are reflected in matrix I and their respective factor sensitivities in vector θ. The fixed effect in FMP excess returns for each country of the panel is captured in the constant term α_i plus the coefficient ω_i for the matrix $D_{i,t}$ containing the country-specific dummy variables.

The set of EM-specific interaction variables is defined as follows:

$$I_{i,t} = M_{i,t} \cdot EM_{i,t} \tag{14}$$

where EM_{it} is a vector specifying the value 1 for every observation from an emerging market, and 0 otherwise.

As the second-stage regressions are implemented for each FMP across all 10 countries, four regressions would be run on a $10 \cdot 70 = 700$-observation panel[29] for the dependent variable.

Besides the three implementations outlined in part 5.(b).i, two additional specifications have been calculated for the second-stage regressions. (1) The third implementation has been repeated with the $EM_{i,t}$ dummy variable $C_{i,t}$ instead of the set of country-dummy variables. (2) In line with the robustness checks of Aretz et al. (2010), the third implementation has been repeated with the inclusion of the market-risk premia as a further explanatory variable.

[29]Since the second-stage panel is unbalanced, the effective size is 524 observations for each country-specific regression. The number of observations in the case of first-stage regressions differed from country to country.

6 Results

The following chapter gives a comprehensive overview on the regression results targeted in chapter 5. It includes the descriptive presentation of the main coefficients and their statistical significance. The chapter is structured in the following way: First, the results are presented for the first-stage (section (a)) and second-stage (section (b)) regression models.

(a) First-Stage Regressions

The coefficient estimates for all three implementations of the first-stage regressions models can be found in tables 12 (explanatory variables) and 13 (constant term, factor dummies and control variables).

The explanation power of the country-specific regression models are relatively low. While the lowest R^2 equals 2.37% for the first implementation of the model for U.S. stocks, the highest value could be attained in the third implementation of the Indian model with 11.97%. It is possible to see across all regressions that the marginal contribution to explanation power is on average higher for the second than for the third implementation. This is supported by the striking significance of the factor-dummy coefficients.

The explanatory variables yielded different results across all countries, even though most coefficients – as the low explanation power of the models would suggest – received insignificant results. The most important findings by explanatory variables are:

- Industrial Production: Most intuitive *and* significant results can be seen for emerging markets. Their coefficients were in general more positive and brought higher t-values. In India (0.563^{***}), Russia (0.088^{**}) and South Africa (0.442^{*}), the coefficients were significant on the common 1%, 5% or 10% levels for the third implementation. In DM countries, conversely, most coefficients were insignificantly negative.
- Sovereign Spread: Again, emerging markets brought more significant results than in developed markets. The strongest results were found in India (0.069^{***}), Brazil (-0.027^{***}) and China (-0.093^{**}) for the third implementation. No significant results could be found for DM regressions. According to initial expectations, most coefficients had a negative sign. However, in four countries the sign changed once the regression included the set of control variables.
- Term Spread: In six countries, the coefficient yielded significant results. Remarkably, they turned significant once the control variables were integrated. In all these markets,

the coefficient had a negative sign. The 1%-significance coefficients can be attributed to Australia (-0.065^{***}) and Russia (-0.066^{***}).

- Lending Rate: Irrespective of the implementation level, this indicator yielded almost no significant results. Only in Japan (-0.351^{**}) a 1-percent increase in the quarterly lending-rate change caused returns to drop by -0.351% on the 5% significance level, which was dependent on the third implementation.

- Inflation: Another ambiguous picture could be found in the change of price levels. Only countries with a track record of extreme price levels, such as Russia (0.425^{***}) and Brazil (-3.949), or Japan ($-2.058**$) brought significant results in the third implementation.

- Current-Account Balance: This macroeconomic indicator obtained the most significant coefficients among all explanatory variables. Again, emerging markets such as China (-0.022^{***}) or South Africa (0.011^{**}) took the lead in the third implementation. However, also investors in the United States were significantly affected by a current-account deficit (-0.009^{***}). In spite of the number of significant coefficients, one must consider that the significance was often lower after control variables. Moreover, significant coefficients have inconsistent signs across countries and tended to be small compared to other factor sensitivities.

- Crisis: The dummy variable for the global financial crisis brought negative but rarely significant coefficients. In Japan (-0.064^{***}) and India (-0.074^{**}), excess returns dropped significantly during the financial crisis holding everything else constant (according to the third implementation). The different implementations are also consistent with respect to coefficient signs, whereas the height increases after control variables in six cases.

Among the control variables, two variables delivered expectable results. First, hikes in short-term interests mostly had a negative impact on stock returns, especially in India (-0.086^{***}) and Japan (-0.075^{**}). Second, changes in monetary supply were decisive in countries with extreme inflation regimes, such as Russia (0.832^{**}) and again Japan (-0.629^{**}).

(b) Second-Stage Regressions

The regression results of the USD returns (in excess of the risk-free rate) in the factor panel have been reported with four tables across all second-stage regression models: for coefficient estimates and *t*-values see table 14 (full-set variables), table 15 (interaction variables), table 16 for the country-specific dummy variables and table 17 for the control variables. The findings for the explanatory variables have further been summarized in table 23. If not further specified, the results mentioned below refer to the third implementation of any regression.

The hypotheses H.5 and H.6 could be largely accepted due to the documented significance of the EM-dummy variable across FMPs (apart of MOM excess returns) and the joint significance of country-fixed effects. The conclusions by research hypothesis and of the effects per explanatory variable and factor strategy can be found in table 22.

i Market Portfolio (MP) Returns

The measure of fit in terms of R^2 increase steadily from the first (20.37%), to the second (21.68%) and to the last implementation (30.05%). Consequently, the marginal contribution of the control variables to the explanation power of the specified model is higher than for the country dummies. Nevertheless, the highest share of variation can be explained with the main set of macroeconomic indicators.

Among the explanatory variables, we find no relevance for industrial-production changes in explaining international market-risk premia. Neither the main coefficient nor the coefficient of the interaction variable brought about significant results. With regard to the term spread, only the coefficient of the interaction variable was significant on the 5% level with a positive coefficient (0.054^{**}). Another main object in the previous literature, default risk, did not reflect significance for market-risk premia in the lending rate of DM stocks. However, a one-percent increase would cause a lower EM performance of 0.02% relative to DM performance on a 10% significance level. The strongest results could be attained for the sovereign spread (0.066^{***} for DM and relatively -0.135^{***} for EM), inflation (-3.273^{***} overall and additional 4.537^{***} for EM) and changes in the current-account balance (0.003^{**} globally). Finally, the financial crisis did not significantly affect market-risk premia across countries. The joint hypothesis for all explanatory variables to be equal to zero could be rejected with a χ^2 test statistic equal to 29.54^{***}. Hence, hypothesis H.1 can be seen as confirmed.

Although the marginal contribution of the country-specific dummy variables are very low, they have a strong statistical significance. Apart from the constant term and the dummy coefficient for China, all the coefficients were significantly negative on the 1% level. The joint hypothesis that the coefficients of all country-specific dummy variables are not significantly different from zero could be rejected on the 1% level with a χ^2 statistic of 20.55. The control regression with the EM substitute dummy variable did not indicate a significant difference in country idiosyncrasy of market-risk premia between emerging and developed markets.

Some statistical significance could also be found among the coefficient estimates of the control variables. The largest coefficient comes from changes in GDP per capita, equal to 1.031^{**}. An even higher statistical significance but lower coefficient size was reached by changes in the global oil price. Everything else equal, market returns increased by approximately 0.166% when quarterly changes in the oil price increased by 1% on the 1% level of significance.

ii Size (SZE) Returns

The R^2 measure of fit increased again from the first (7.43%), over the second (10.51%) to the third implementation (13.43%). Hence, marginal increase of explanation power was approximately equal between the second and third implementation. Overall, the values show that the explanation power of the regression model for all size FMPs is lower than in the model for international market-risk premia.

On the global scale, size excess returns were significantly sensitive to changes in the term spread (-0.08^{***}), in the sovereign spread (0.046^{***}), the lending rate (-0.025^{***}) or the current-account balance (-0.006^{**}). Although the significance of the lending-rate coefficient was the highest among all the explanatory variables, EM size excess returns moved significantly in the other direction than in DM excess returns (0.029^{***}). The overall joint hypothesis for the explanatory variables not being significantly different from zero cannot be rejected on any usual level (p-value 35.22%). As a consequence, both hypotheses H.2.a and H.2.b must be rejected.

Apart from the United Kingdom, all the country-dummy coefficients are significantly different from the Australian benchmark. The strongest coefficient could be identified for China (0.07^{***}). In general, the size of the coefficients was larger for emerging than for developed markets. This is confirmed with the EM control-regression coefficient of 0.031^{**}. Therefore, the joint null hypothesis for the country-dummy coefficients could be rejected with a χ^2 statistic of 13.50^{***}.

The control variables did not attain significant regression coefficients.

iii Value (VAL) Returns

In case of VAL excess returns, the explanation power of the fixed-effect regression model reaches the lowest value in terms of R^2. The first implementation with explanatory variables can explain 4.82% of the variation. The inclusion of country dummies can marginally increase this value to 6.14%. Finally, the third implementation with additional control variables adds only negligible explanation power, amounting to a R^2 of 6.87%.

Changes in the industrial production played a disparate role in VAL excess returns: While in DM they decreased by (-0.526^{***}), this was not true for EM (relatively higher by 0.675^{***}). Increases in the sovereign spread enhanced VAL excess returns with a sensitivity of 0.037^{*} but not in EM (lower by -0.032^{**}). A higher term spread brought significantly lower excess returns ($-.052^{**}$) in EM than in DM. Another significant result could be found for the lending rate. While in DM value was positively effected by higher rates (0.023^{***}), this effect was lower for EM (by $-.012^{**}$). Other important variables such as the crisis dummy and inflation did not achieve significant results. Overall, the joint null hypothesis could not be rejected on any significance level (p-value 37.01%). Consequently, both hypotheses H.3.a and H.3.b must be rejected.

The country-specific dummy variables were significant in seven countries, of which six on the 1% significance level. Again, the strongest country-idiosyncratic effect has to be attributed to China (0.03^{***}) against the constant term. Hence, the country-dummy coefficients are significantly different from zero on the 1% level, as the rejection of the joint null hypothesis concludes from the test statistic $\chi^2 = 15.87$. Additionally, the coefficient of the EM dummy variable from the control regression was significantly positive with 0.019^{***}.

For the VAL regressions, there are no significant coefficients among the control variables.

iv Momentum (MOM) Returns

The measure of fit for the MOM excess returns was higher than for the other FMPs (but not higher than for the market-portfolio regressions). While the first implementation brought about a R^2 of 13.40%, it increases to 14.89% in the second and finally 18.46% in the third implementation. Hence, especially the control variables contributed a high share of additional explanation power. Most of the variance in MOM excess returns, however, could be explained by explanatory variables.

Among the explanatory variables, the crisis dummy stood out strongly. A drop in quarterly returns of -12.66% (significant on the 1% level) was inflicted on momentum investors during the financial crisis worldwide. Again, there were important variables that yielded significant results between DM and EM: the sovereign-spread coefficient -0.041^{**} for DM and relative increase of 0.051^{***} for EM, the change in industrial production with -0.473^{**} for DM and a relative increase of 0.484^{*} for EM, and the change in current-account balance 0.015^{***} for DM and a relative decrease of -0.031^{***}. The joint hypothesis that the coefficients of explanatory variables are not significantly different from zero could not be rejected (p-value 77.02%). Therefore, the hypothesis H.4.a can be accepted. Conversely, the hypothesis H.4.b with respect to the significance of the crisis dummy and inflation can be accepted partially.

The MOM premia has the highest number of insignificant country-dummy results. Only three of them yielded significant coefficients, among which 0.048^{***} for Germany is the largest. The control regression did not bring a significant coefficient for the EM dummy variable. Also, the null hypothesis for the country variables is the first among all FMP regressions that cannot be rejected (p-value 50.96%).

The change in oil price is the only of all control variables that is attributed a significant coefficient. A quarterly one-percent increase in the oil price implied a -0.1% decrease in quarterly returns, significant on the 1% level.

7 Robustness Tests

The following chapter is dedicated to specific methods that have been employed to improve or check the robustness and hence quality of the analytical results from chapter 6 for valid interpretations later made in chapter 8.

The robustness of the regression results has been checked with the following strategies:

- The estimation of standard errors accounting for heteroskedasticity and cluster differences
- Different rounds of implementation with respect to the inclusion of independent variables
- An additional control regression on market-risk premia for the second-stage models

(a) Huber-White Sandwich Standard-Error Estimation

The estimation of the heteroskedasticity-consistent estimation of standard errors has been realized with the Huber-White sandwich method. The treatment of heteroskedasticity is important because the concept implies that the volatility in variables depends on time. As every panel consists of different time series, this is an immanent threat to this study. Moreover, the method has been applied with a further specializing for addressing clusters. As the reader could already see in tables 4 and 5, both dependent and independent variables realized different levels of volatility between different FMPs and countries. The statistical significance could hence be distorted if estimations would not be calculated cluster-wise.

(b) Regression Implementations

The second strategy aims at identifying instable regression coefficients, primarily among the explanatory variables. This means to observe how the significance of explanatory variables evolves over the different implementations.

For the first-stage regressions, strong stability can be observed for most country-panel regressions. Apart from the regression models of India, reversals from insignificance to significance or in the opposite direction were rare. However, some patterns in reversals could be detected. In general, the inclusion of control variables had a stronger effect on the significance of explanatory variables in emerging than in developed market. The term- and sovereign-spread indicators became significant after control variables in different regressions for emerging markets. As this occurrence used to coincide with relatively high t-values for the coefficients of short-term yields or monetary supply, one should assume an improvement of explanatory power behind this. A similar observation of reversals to significance was possible for the coefficient of current-account changes, which tended to coincide with high t-values of GDP changes. As already mentioned in chapter 6, the country-dummy coefficients showed a high resilience in their statistical significance. Furthermore, there was no occurrence of changing signs over different implementations among significant variables. Finally, there were no strong changes in the p-values for the joint null hypotheses of the explanatory variables over the course of different implementations (Japan and Russia being the only countries with rejected joint null hypotheses).

In the second-stage regressions, the explanatory variables show a more erratic behavior. Especially the full-set and indicator variable for inflation was prone to reversing significance, mostly becoming insignificant after the inclusion of control variables. The highest number of reversals between significance and insignificance could be seen for market-risk premia. Similar but less frequent observations could be made for industrial production and term spread. Nevertheless, especially the interaction variables for emerging markets showed strong resilience when reaching statistical significance in the first implementation. Hence, the full-set macroeconomic indicators were affected by the control variables, as these applied to the whole set of countries as well. Also, the signs of coefficients did not change for the set of those reaching the 10% significance level or higher. The test statistic for the joint null hypothesis of all macroeconomic indicators not being different from zero did never imply different conclusions over the course of different implementations.

(c) Inclusion of Market-Risk Premia

The third strategy seeks to ensure that the detected relationships between FMP returns and macroeconomic indicators is not due to indirect collinearity between between FMP excess returns and the market portfolio. This is a possible threat to the validity of the results as zero-cost FMPs are not designed in a beta-neutral way (i.e. immunized towards market risk). Consequently, the second-stage regressions have been repeated with market-risk premia included, as suggested by Aretz et al. (2010). However, this is difficult because characteristics-based factors have been identified as *integral parts* of market risk, not *alternatives* to it. Hence, regression coefficients in tables 18 to 21 must interpreted with caution. Before that, the results from the first-stage regressions underscore that macroeconomic risk is priced differently across FMPs and the market portfolio. This conclusion can be drawn from the strong significance of the FMP-specific dummy coefficients, as depicted in table 13.

The coefficient of the market-risk premia as explanatory variable was significant for size and value but not for momentum, although its inclusion increased R^2 in all instances. Interestingly, market-risk premia were *negatively* correlated with size and momentum excess returns. This underscores the clear difference in applicability and reliability of measuring factor returns in the approaches by Fama-French on one hand and Bender on the other hand. Only in the case of value, certain effects turned insignificant. The opposing signs of the sovereign spread – positive for the full-set variable and negative for the interaction variable – turned both insignificant. Moreover, the positive coefficient of the lending-rate interaction variable became insignificant, leaving value excess returns positively correlated to increases in default risk globally.

8 Discussion

The purpose of the following chapter is to give concise reflections on (1) the findings of the data analysis from chapters 6 and 7, (2) the limitations to their validity, and (3) the deducted possibilities to improve research in the future.

(a) Interpretation

The explanation power of models that regress country-specific stock returns on changes in macroeconomic indicators is fairly low although variant between different countries. However, the first-stage results confirm that the relationships between different characteristics-based factors and macroeconomic risk are distinctive. The set of macroeconomic indicators could not explain stock returns across all FMPs. Moreover, the strong significance of factor-dummy variables indicates that market-risk premia do not primarily drive the returns of other FMPs. Many regression coefficients on single indicators are in line with expectations: increases in industrial production enhanced excess returns, whereas the financial crisis as well as deteriorations in sovereign, term-structure or inflation risk (under extreme regimes) had a negative impact. Surprisingly disparate results were found for the current-account balance. Overall, it is worth mentioning that the coefficient height *and* significance stood out in emerging markets. Therefore, the given set of macroeconomic indicators seem to explain more of stock returns when the investor is exposed to higher development risk.

The regression model for MRP reached the highest levels of explanation power among all FMPs. Especially indicators that have been neglected in previous research brought about significant results, including sovereign risk, inflation and current-account changes for DM; and term-structure and default risk in emerging markets. It is most noticeable that the signs of both significant and insignificant coefficients are inverted for DM and EM in most cases. This underscores that the overall differences in economic development may have a profound effect on all approximations of macroeconomic risk, which has been unobserved in Factor Investing research so far. The strong significance of country-specific dummy variables indicates that market-risk premia largely differ across countries. This, however, could not be explained with development risk only, approximated by the EM dummy variables. Moreover, a large share of variation in premia could be explained with GDP and oil-price changes. The result for GDP per capita suggests that, across emerging and developed markets, it is a more reliable indicator for growth risk than industrial production.

Macroeconomic risk could not explain SZE excess returns to the same degree as international market-risk premia. Overall, the explanatory variables (including indicator variables) could not be proven to be significantly different from zero. However, sovereign risk, term-structure risk and the current-account balance have been proven significant across all observed countries. The *positive* sign of the sovereign spread and the *negative* sign of changes in the current-account balance seem counter-intuitive at first. However, both point at the difference in revenue diversification between small-cap and large-cap firms. It seems plausible that small-cap stocks benefit and large-cap stocks suffer from a deterioration in international competitiveness of their host market. This interpretation holds partially when comparing with the role of these risk factors in market-risk premia. While only in emerging-markets market excess returns suffered from higher sovereign spreads, the sign of the current-account coefficient was directly opposite. The negative impact from the term spread on SZE premia is also contrasted by opposite findings in market-risk premia. This could hint to different mixes of short- and long-term financing between small- and large-cap firms. Finally, the prime lending rate played a significant role in developed markets, where lower rates would coincide with higher excess returns. The control regression confirmed that size excess returns were significantly higher in emerging markets, which was not true for market-risk premia.

Value FMP excess returns saw the lowest level of explanation power among the second-stage regression models. For developed markets, it could be established that the value factor is *negatively* correlated to changes in industrial production. Neither did changes in GDP per capita explain value excess returns on an international level. This finding is strongly at odds with previous research. Weaker coefficients have bee found for the term and sovereign spreads as well as for the prime lending rate, with strong discrepancies between developed and emerging markets. The control regression with the EM dummy variable confirmed again that the difference between emerging and developed markets played a crucial role. Also, the coefficients of the country-dummy variables have shown that country idiosyncrasy is highly significant, especially among developed markets. Hence, indications for the pervasiveness of development risk is the only secured finding from second-stage regressions of VAL premia.

MOM premia could be explained to a higher degree with macroeconomic-risk variables than SZE or VAL premia but still to a lower extent than market-risk premia. It is the only FMP for which country-dummy variables did not yield significant results. This could support the implication by Chui et al. (2010) that momentum returns are dependent on behavioral factors. Moreover, global MOM excess returns were shown to be highly vulnerable during the financial crisis. This is in line with the theory suggested by Daniel & Moskowitz (2016). Finally, changes in the oil prices have also brought negative spillovers to momentum excess returns. There is no established theory linking the momentum factor with commodity prices. However, one conception could be that exogenous shocks from world-market prices on a strongly exposed and undiversified economy might derange the momentum-implied performance continuance of stocks.

(b) Limitations

The first concern to the author of any thesis must be the question why the chosen approach has not been implemented more often in previous research. In this specific case, why have Factor Investing and emerging-market data been neglected so far?

First, the chosen approach to the construction of FMPs does not control for spillovers between the different characteristics-based factors or between one of them and the market portfolio. Consequently, the factor sensitivities of FMP returns to macroeconomic indicators could be under- over-estimated. Also, this makes the results less comparable to the findings of predecessors. However, the aim of this study was to check the real-world viability of factor-related strategies and not the re-application of rigorous factor replications in previous research. Although more sophisticated methodologies exist, the author partially ruled out the possibility of strong interdependencies between the FMPs (including the market portfolio). The first-stage results demonstrate that macroeconomic risk cannot explain excess returns across different factors.

Second, the striking difference between developed and emerging markets, which has been attributed to development risk, presents a dilemma. As outlined in section (f), many factors of development risk imply less efficient market pricing. If this holds true, the reliability of the results suffers because factor sensitivities presuppose information-efficient market prices. Nevertheless, it is valid to conclude under any circumstances that certain aspects of development risk alter the dynamics of characteristics-based factors in these stock markets significantly. Therefore, the previous research on such factor strategies also relied on pre-requirements to stock-market data.

A possible cause for an errors-in-variable problem is the use of *realized* changes in macroeconomic indicators (e.g. GDP, industrial production, inflation) instead of expectations about their future development. This difference is relevant because only unexpected changes of future discounted economic developments should affect asset prices in an information-efficient market. Therefore, the chosen approach via realized changes runs undoubtedly the risk of imprecise factor-sensitivity estimations. A study has implemented this approach is, for example, Bergbrant & Kelly (2016). This is particularly relevant if one intends to estimate consistent long-term risk premia in a specific market. A cross-market comparative analysis testing the sensitivity of FMPs, though, can still bring forward valuable insights into the explanation power of realized changes in macroeconomic indicators. This is because, under the assumption of market efficiency as in Fama (1970), the sensitivity towards unexpected changes might be mis-estimated for one specific market but differences between markets are still caught.

The availability scope of certain variables could be a possible source of distortions in the results. For example, the lending-rate and the two-year bond yield series were limited for different countries to 50% of the observations or less. Similarly, the macroeconomic indicators that were effectively available constituted risk approximations of inferior quality. In particular, sovereign risk and default risk have been approximated with very broad indicators. The hazard of mis-specification of macroeconomic risk could still be countered by the inclusion of various explanatory and control variables that have been neglected in the foregoing literature.

Finally, the application of the interest-based time series in the data analysis of this thesis was partially flawed. As stock returns were calculated into USD completely, so would it be adequate for the yield-to-maturity of government bonds. This is because interest-rate differentials are expected to drive exchange rates according to basic economic theory.

(c) Further Research

The major findings of this thesis imply that future research should dive deeper into the connection between characteristics-based risk factors and development risk. It is of uttermost relevance for investors and investment managers to know if factor-related strategies expose to different risks in emerging markets. One possibility would be to refer to the realm of country-risk analysis and cross-country assessments such as the WEF Global Competitiveness Index or the World Bank's Ease of Doing Business Index[30], which often entail detailed and enlightening sub-indicators on important parts of the economy or the institutional framework.

Another possible field of further research might be the negative correlation between momentum returns and oil-price changes. Possibly, the dependency of an economy (and hence its stock market) on the world market price of a homogeneous commodity deranges the correlation between past and future performance of a stock. A significant finding could bring knowledge on how to make hedge momentum-related investment strategies against unwanted risk exposures.

Furthermore, it is possible to combine time-series and panel-data analysis with more complicated approaches to modelling. For example, Zinna (2014) scrutinized emerging-market sovereign and default spreads with a Bayesian panel VAR model, enabling the

[30] `http://www.doingbusiness.org/rankings` (accessed on 08/05/2018)

derivation of time-varying betas over the analysis of clustered data.

Finally, different dependent and independent variables of this study can be specified more precisely. According to latest research, as by Fama & French (2014), the value factor should be subdivided into further discrete factors. Default risk should be measured with probabilities of survival, as suggested by Vassalou & Xing (2004). A similar approach can be employed for measuring sovereign risk. These improvements, however, depend on the availability of emerging-market data in the future.

9 Conclusion

In this thesis, the relationship between characteristics-based risk factors in stock returns and macroeconomic risk has been analyzed. Therefore, a simple methodological approach from the theory of Factor Investing has been chosen to reflect the effects on modern investment vehicles: zero-cost, value-weighted factor-mimicking portfolios (FMPs) for the established risk factors size, value and momentum according to the methodology of Bender et al. (2013). The study has been conducted on the returns of 25,224 stocks from ten countries, including both developed and emerging markets. The applicable time frame for the stock-data panels reaches from June 1999 to December 2016 for the final data analysis.

The data analysis of this study has been implemented with a cross-sectional fixed-effect regression model. It included two stages, each with regression models being run for the data panel either sorted on countries or characteristics-based risk factors. In each stage, three implementations of the regression model have been specified for robustness-check purposes. The various sources of macroeconomic risk that have been scrutinized are to a large part similar to previous research, including growth risk, term-structure risk and default risk. However, additional relevant sources including sovereign risk, current-account balance and inflation risk have been extensively established and analyzed.

The most relevant findings of this thesis are: (1) Indicators of macroeconomic risk explain excess returns on factor-related investments to a lower degree than market risk premia. Hence, it cannot be substantiated that factor-related investments are compensated specifically for macroeconomic risk. Especially as for value FMP excess returns, model performance was low. (2) Excess returns on size and value FMPs have been significantly different between emerging and developed markets, implying the profound role of development risk. Moreover, development risk demonstrated a significant impact on other sources of macroeconomic risk as interaction variables were significant in numerous regressions. (3) Country-specific fixed effects have shown relevant in size and value but not in momentum returns, as in line with the international pervasiveness of the latter found by Chui et al. (2010) and Fama & French (2012). (4) Size excess returns have been found to be positively correlated to a lower current-account balance and higher sovereign spread, implying a negative dependence on international competition. (5) In accordance with Daniel & Moskowitz (2016), momentum excess returns were evidently sensitive during the financial-crisis period. With further respect to momentum, another surprising significance was the negative impact of oil-price changes.

While most of related research following Liew & Vassalou (2000) and Vassalou (2003) found stronger significance between macroeconomic risk and FMP excess returns, the findings also coincide with the skeptical views of Griffin et al. (2003), Chen et al. (2006), to some part Aretz et al. (2010) or Bergbrant & Kelly (2016).

The findings of this study are limited as the methods employed differ strongly from those of predecessors. There are two important reasons for that: First, the significance of development risk in the results imply that emerging markets price stocks less efficiently. As a consequence, the replication of factor-related strategies could be dependent on conditions not given in such countries. Second, the chosen approach to the construction of factor-mimicking portfolios reflects the real-world investments but do not hold interdependencies between different factors constant. Both concerns, in turn, make the results of this study less comparable to previous research. Also, macroeconomic indicators were static instead of forecast-based. Future research could benefit from improvements in data, especially for emerging markets, or apply more elaborate models combining time-series and panel analysis. Moreover, it is worth considering further analysis on the relationship between commodity prices and the returns harvested on characteristics-based risk factors, notably momentum.

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Appendix

Further Mathematical Concepts

The Fama-French methodology discussed in section 2.(d) complements the FMP-construction methodology in section 5.(a) with a step, in which the effects of one characteristics-based factor upon another are equalized. Cazalet & Roncalli (2014) depicted this additional step for the equalization in size and value FMPs, SMB_t and HML_t[31], as follows:

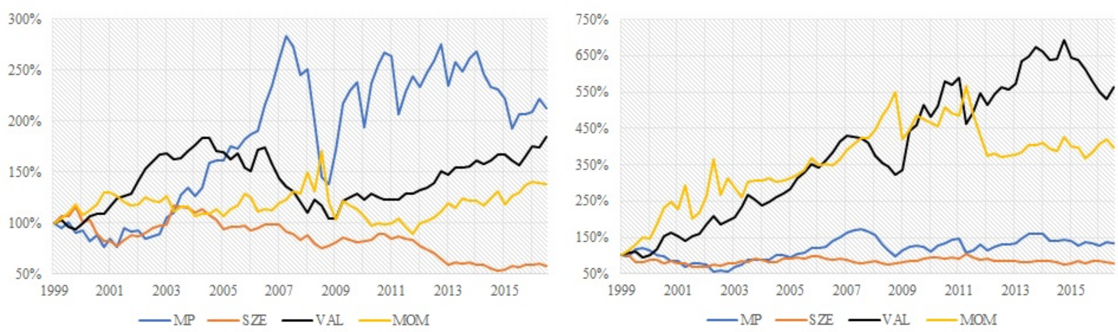
$$SMB_t = \frac{1}{3}\left[R_t(SV) + R_t(SN) + R_t(SG)\right] - \frac{1}{3}\left[R_t(BV) + R_t(BN) + R_t(BG)\right] \quad (15)$$

$$HML_t = \frac{1}{2}\left[R_t(SV) + R_t(BV)\right] - \frac{1}{2}\left[R_t(SG) + R_t(BG)\right] \quad (16)$$

where R_t is the return of all specified stocks at time t and where the following letters each define a specific sub-sample of the stock market: S = small-cap, B = large-cap, V = value stocks, N = neutral layer of value FMPs, and G = growth stocks. The defined quantiles as breaking points in the different stock characteristics are congruent with those outlined in table 10. The combination of these letters denote an intersection of the underlying sub-samples. For example, SV stands for the intersection of all stocks that are to be allocated to the simplified long layers of both size and value FMPs according to the specified breaking points.

Further Graphics

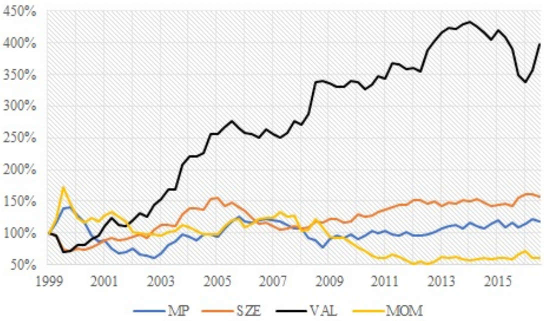
Figure 4: Cumulative FMP Returns in USD – Australia & Germany



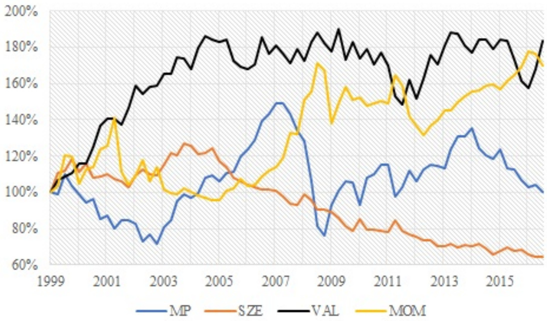
(a) Australia (b) Germany

[31] Fama & French have usually referred to the book-to-market ratio, which is the inverse of the price-to-book value employed in this thesis.

Figure 5: Cumulative FMP Returns in USD – Japan & United Kingdom

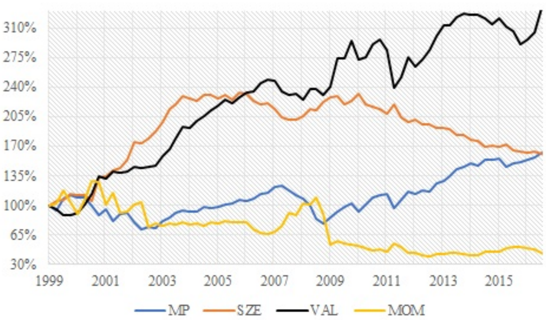


(a) Japan

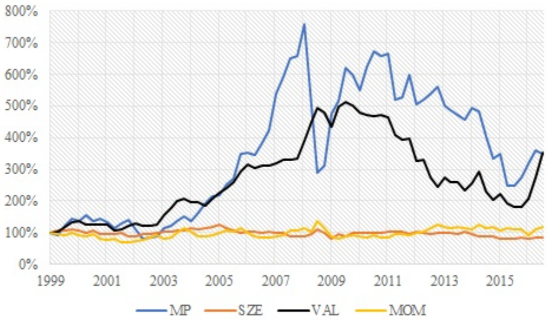


(b) United Kingdom

Figure 6: Cumulative FMP Returns in USD – United States & Brazil

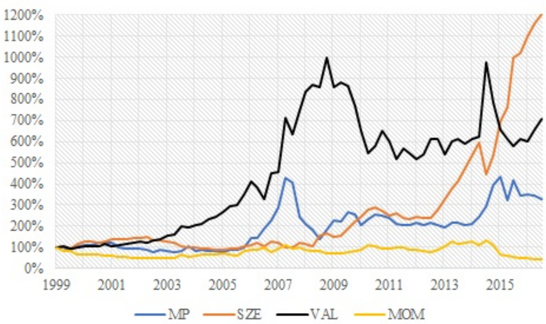


(a) United States

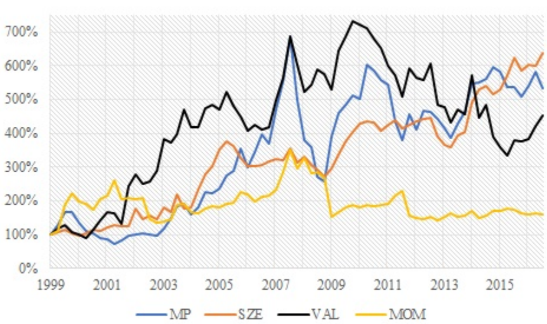


(b) Brazil

Figure 7: Cumulative FMP Returns in USD – China & India

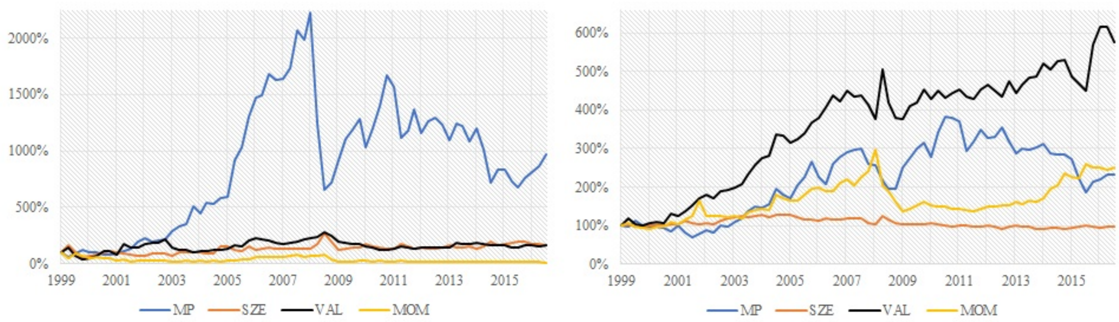


(a) China



(b) India

Figure 8: Cumulative FMP Returns in USD – Russia & South Africa



(a) Russia (b) South Africa

Tables

Table 2: Summary of findings in main works of previous research

	Explanatory Variables			
	IP/GDP	Default Spread	Term Spread	Inflation
Market	$+^{4,8}$			$-^{8}$
Size	$0^{3}/+^{4,5,8}$	$-^{1,7}$	$0^{1,2}$	$0^{3}/-^{8}$
Value	$+^{3,4,5,8}/-^{2}$	$0^{1}/+^{7}$	$+^{1,2}$	$0^{3,8}$
Momentum	$0^{6}/+^{9}/-^{3}$	$0^{6}/+^{2}$	$0^{1,3}/-^{2}$	$-^{3,6}$

Notes: The signs +/−/0 refer to the correlations between the stock returns associated to characteristics-based risk factors (see left column) and changes in the macroeconomic indicators as explanatory variables. The numbers refer to the pieces of literature listed below. All of them but Griffin et al. (2003) and Bergbrant & Kelly (2016) have worked with U.S. American data exclusively. The denoted years refer to the data scope in the respective papers.
1 = Hahn & Lee (2006) and Petkova (2006), 1962-2001;
2 = Aretz et al. (2010), 1975-2008; 3 = Bergbrant & Kelly (2016), 1989-2014;
4 = Liew & Vassalou (2000), 1978-1996; 5 = Vassalou (2003), 1953-1998;
6 = Griffin et al. (2003), various periods between 1926 and 2000;
7 = Vassalou & Xing (2004), 1971-1999; 8 = Kelly (2003), 1956-2001;
9 = Liu & Zhang (2008), 1960-2004

Table 3: Descriptive statistics of stock-market data

	Classification	Listed stocks	Market capitalization	Return	Volatility	Maximal drawdown	Risk-Return Ratio	*p*-value Shapiro-Wilk test
Australia	Developed Market	672	1,341,487	5.22%	20.13%	-38.92%	25.91%	0.001
Germany	Developed Market	1,050	2,110,682	1.47%	19.31%	-50.20%	7.60%	0.020
Japan	Developed Market	4,142	5,496,817	2.26%	15.44%	-43.30%	14.62%	0.232
United Kingdom	Developed Market	3,639	3,888,169	0.29%	14.19%	-45.70%	2.03%	0.003
United States	Developed Market	13,221	34,078,683	3.26%	12.38%	-58.38%	26.31%	0.001
Brazil	Emerging Market	406	727,636	5.97%	27.36%	-31.22%	21.84%	0.000
China	Emerging Market	830	1,498,072	8.42%	30.63%	-28.81%	27.47%	0.000
India	Emerging Market	807	1,188,034	10.76%	29.99%	-32.85%	35.89%	0.030
Russia	Emerging Market	288	472,399	19.01%	34.82%	-24.56%	54.61%	0.006
South Africa	Emerging Market	169	327,060	6.29%	23.93%	-46.86%	26.29%	0.877

Notes: The applicable time frame of the presented numbers is from 1 January 1995 to 1 January 2017. The number of listed stocks means the amount of stocks per market after all filters from chapter 3 have been applied. Market capitalization is the sum of all stocks's market values, converted to USD. The return figure means annualized monthly returns of the value-weighted market portfolio over the defined time frame. Volatility means the annualized monthly standard deviation of the monthly returns. The maximal drawdown refers to the worst possible loss that an investor could have suffered when investing at the peak of the stock market and leaving the market at the trough. The risk-return ratio is the return divided by volatility. The Shapiro-Wilk test checks whether a set of data – here the monthly returns of the value-weighted market portfolio – can be characterized as normally distributed or not. The null hypothesis that the underlying data are not normally distributed cannot be rejected on a specific significance level if the *p*-value is above the significance level.

Table 4: Annualized Factor Returns June 1999 to December 2016

	Market		Size		Value		Momentum	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Australia	4.68%	21.33%	-3.23%	11.10%	3.79%	11.01%	1.97%	16.27%
Germany	1.81%	20.84%	-1.37%	11.52%	11.05%	17.89%	8.74%	23.05%
Japan	0.99%	16.30%	2.78%	11.68%	8.71%	14.52%	-2.96%	18.98%
United Kingdom	0.03%	15.26%	-2.66%	7.58%	3.75%	9.78%	3.26%	13.00%
United States	2.95%	12.98%	2.94%	9.54%	7.57%	10.50%	-4.83%	21.24%
Brazil	7.85%	31.90%	-1.10%	12.83%	7.97%	20.80%	1.09%	19.57%
China	7.46%	32.58%	16.28%	24.30%	12.57%	27.29%	-4.72%	24.87%
India	10.67%	30.78%	11.87%	21.28%	9.57%	31.27%	2.83%	29.57%
Russia	14.78%	39.61%	2.91%	40.14%	2.97%	46.81%	-11.57%	44.55%
South Africa	5.26%	23.08%	-0.20%	9.48%	11.19%	17.12%	5.75%	19.76%
DM	2.09%	17.34%	-0.31%	10.29%	6.97%	12.74%	1.24%	18.51%
EM	9.20%	31.59%	5.95%	21.61%	8.85%	28.66%	-1.32%	27.66%
Global	5.65%	24.47%	2.82%	15.95%	7.91%	20.70%	-0.04%	23.09%

Notes: The mean refers to the annualized returns (i.e. FMP returns including risk-free rate) over the quarterly series from June 1999 to December 2016. *SD* means the annualized standard deviations over the same time series. While *DM* refers to the equal-weighted returns for the developed markets, the equivalent for the emerging markets are found in the row denoted with *EM*. The equal-weight figures for all countries are listed in the row denoted with *Global*.

Table 5: Descriptive Statistics of Macroeconomic Indicators by Country

	ip		*i*		*ts*		λ		*ss*		*ca*		*y*		*r*		*m*1	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Australia	0.46%	1.15%	0.68%	0.56%	0.007	0.291	-0.018	0.382	0.306	40.723	0.138	0.703	0.38%	0.77%	-0.038	0.559	1.58%	2.85%
Germany	0.38%	2.09%	0.35%	0.50%	0.005	0.285	0.049	0.199	-1.594	27.481	0.002	0.363	0.34%	0.84%	-0.055	0.448	2.01%	1.33%
Japan	0.08%	3.59%	0.00%	0.44%	-0.014	0.133	-0.017	0.029	0.668	25.519	-0.009	1.023	0.23%	1.03%	-0.013	0.134	1.41%	1.75%
United Kingdom	-0.10%	1.09%	0.49%	0.68%	0.024	0.336	-0.070	0.396	-0.921	33.175	0.023	0.549	0.31%	0.73%	-0.067	0.550	2.12%	1.94%
United States	0.20%	1.32%	0.55%	0.64%	0.016	0.359	-0.060	0.431	0.335	40.913	0.061	0.938	0.29%	0.79%	-0.046	0.486	1.60%	1.61%
Brazil	0.32%	2.43%	1.66%	0.99%	0.007	0.746	-0.459	3.314	1.910	135.016	0.063	0.721	0.36%	1.32%	-0.101	1.290	2.73%	3.57%
China	-0.03%	1.59%	0.06%	1.05%	-0.006	0.376	-0.021	0.294	6.902	34.949	-0.015	1.287	2.11%	0.70%	0.015	0.498	3.61%	2.16%
India	1.60%	4.31%	1.56%	1.72%	-0.012	0.355	-0.038	0.580	-4.663	60.730	0.005	1.158	1.36%	1.48%	-0.069	0.647	3.24%	5.76%
Russia	0.87%	6.82%	2.86%	1.92%	-0.044	0.754	-0.400	1.653	-2.862	120.151	-0.057	1.602	0.75%	1.60%	-0.248	1.701	5.44%	4.93%
South Africa	0.29%	2.08%	1.39%	1.05%	-0.023	0.326	-0.117	0.717	-6.289	68.928	-0.046	1.274	0.41%	0.85%	0.034	0.385	2.79%	2.99%

Notes: The mean and standard deviation (SD) figures refer to the quarterly changes of the macroeconomic indicators as described in chapter 3. The abbreviations stand for the changes of the following indicators: *ip* for industrial production, *i* for inflation, *ts* for the term spread, λ for lending rate, *ss* for the sovereign spread, *ca* for the current-account balance over GDP, *y* for GDP per capita, *r* for two-year sovereign bond rates and *m*1 for the monetary supply. Only time series of relative change are described in percentage terms.

Table 6: Correlation of international market portfolio (MP) returns in USD

	Australia	Germany	Japan	United Kingdom	United States	Brazil	China	India	Russia
Germany	0.77***								
Japan	0.43***	0.60***							
United States	0.86***	0.88***	0.57***						
United Kingdom	0.74***	0.84***	0.53***	0.80***					
Brazil	0.65***	0.66***	0.45***	0.71***	0.65***				
China	0.38**	0.25*	0.17	0.35**	0.26*	0.31*			
India	0.60***	0.65***	0.58***	0.67***	0.56***	0.58***	0.29*		
Russia	0.53***	0.55***	0.44***	0.58***	0.53***	0.67***	0.21	0.42***	
South Africa	0.65***	0.65***	0.57***	0.70***	0.56***	0.58***	0.22	0.57***	0.54***

Table 7: Correlation of international size (SZE) returns in USD

	Australia	Germany	Japan	United Kingdom	United States	Brazil	China	India	Russia
Germany	0.62***								
Japan	0.24*	0.61***							
United Kingdom	0.82***	0.79***	0.47***						
United States	0.59***	0.72***	0.44***	0.74***					
Brazil	0.41***	0.46***	0.45***	0.58***	0.39***				
China	0.45***	0.29*	0.19	0.40***	0.27*	0.38**			
India	0.22	0.40***	0.49***	0.43***	0.40***	0.46***	0.33**		
Russia	0.37**	0.49***	0.38**	0.53***	0.35**	0.65***	0.27*	0.25*	
South Africa	0.47***	0.56***	0.49***	0.63***	0.43***	0.56***	0.27*	0.33**	0.51***

Notes: For both tables 6 and 7, the significance levels are indicated as follows: * if p-value $< 10\%$, ** if p-value $< 5\%$ and *** if p-value $< 1\%$

Table 8: Correlation of international value (VAL) returns in USD

	Australia	Germany	Japan	United Kingdom	United States	Brazil	China	India	Russia
Germany	0.48***								
Japan	0.48***	0.50***							
United Kingdom	0.73***	0.52***	0.58***						
United States	0.50***	0.69***	0.67***	0.68***					
Brazil	0.61***	0.40***	0.41***	0.71***	0.42***				
China	0.21	0.08	0.22	0.33**	0.18	0.26*			
India	0.43***	0.29*	0.51***	0.55***	0.50***	0.40***	0.30*		
Russia	0.54***	0.53***	0.52***	0.48***	0.56***	0.38**	0.23	0.30*	
South Africa	0.57***	0.29*	0.41***	0.46***	0.38**	0.36**	0.21	0.24*	0.50***

Table 9: Correlation of international momentum (MOM) returns in USD

	Australia	Germany	Japan	United Kingdom	United States	Brazil	China	India	Russia
Germany	0.59***								
Japan	0.43***	0.44***							
United Kingdom	0.81***	0.81***	0.52***						
United States	0.68***	0.75***	0.44***	0.80***					
Brazil	0.64***	0.50***	0.35**	0.62***	0.55***				
China	0.23	0.08	0.23	0.15	0.14	0.23			
India	0.57***	0.54***	0.39***	0.69***	0.61***	0.44***	0.17		
Russia	0.59***	0.45***	0.40***	0.57***	0.61***	0.57***	0.31**	0.43***	
South Africa	0.48***	0.33**	0.24*	0.39***	0.44***	0.32**	0.05	0.38**	0.34**

Notes: For both tables 8 and 9, the significance levels are indicated as follows: * if p-value $< 10\%$, ** if p-value $< 5\%$ and *** if p-value $< 1\%$

Table 10: Stock selection rules for construction of factor-mimicking portfolios (FMPs)

	Criterion	Long Layer	Neutral Layer	Short Layer
SZE	Market capitalization	$MC_{i,Y} \leq Q_{0.5}(MC_Y)$	N/A	$MC_{i,Y} > Q_{0.5}(MC_Y)$
VAL	Price-to-book value	$PTBV_{i,Y} \leq Q_{0.3}(PTBV_Y)$	$Q_{0.3}(PTBV_Y) < PTBV_{i,Y} < Q_{0.7}(PTBV_Y)$	$PTBV_{i,Y} \geq Q_{0.7}(PTBV_Y)$
MOM	6-month return	$R(6M)_{i,t} \geq Q_{0.7}(R(6M)_t)$	$Q_{0.3}(R(6M)_t) < R(6M)_{i,t} < Q_{0.7}(R(6M)_t)$	$R(6M)_{i,t} \leq Q_{0.3}(R(6M)_t)$

Notes: Any designation $X_{i,t}$ stands for the realization of variable X for stock i at month t. MC means market capitalization, $PTBV$ stands for price-to-book value. The subscript Y instead of t refers to the last trading day of June in one particular year. At the same time, X_t stands for the set of all realizations of variable X across all stocks of a country at the end of month t, i.e. $X_t = S(X_{i,t}, \forall i)$.

Table 11: Structure of Data Panel

Time	**Country**	**Return**	**Macroeconomic Indicators**	**Control Variables**
t	i	$r^e_{t,i}$	$M_{t,i}$	$C_{t,i}$
$t+1$	i	$r^e r_{t+1,i}$	$M_{t+1,i}$	$C_{t+1,i}$
$\ldots$	$\ldots$	$\ldots$	$\ldots$	$\ldots$
$t+k$	i	$r^e r_{t+k,i}$	$M_{t+k,i}$	$C_{t+k,i}$
$\ldots$	$\ldots$	$\ldots$	$\ldots$	$\ldots$
T	i	$r^e r_{T,i}$	$M_{T,i}$	$C_{T,i}$
t	$i+n$	$r^e r_{t,i+n}$	$M_{t,i+n}$	$C_{t,i+n}$
$t+1$	$i+n$	$r^e_{t+1,i+n}$	$M_{t+1,i+n}$	$C_{t+1,i+n}$
$\ldots$	$\ldots$	$\ldots$	$\ldots$	$\ldots$
$t+k$	N	$r^e_{t+k,N}$	$M_{t+k,N}$	$C_{t+k,N}$
$\ldots$	$\ldots$	$\ldots$	$\ldots$	$\ldots$
T	N	$r^e_{T,N}$	$M_{T,N}$	$C_{T,N}$

Notes: The table depicts how the data panel spans over the two dimensions time and entity. The first dimension (left column) is the quarterly time series of observations from $t \in \{1, 2, k, \ldots, T\}$, repeating itself for every country $i \in \{1, 2, n, \ldots, N\}$ on the second dimension. The symbol $r^e_{t,i}$ stands for the quarterly excess returns[a] of one particular FMP from country n at time t. Moreover, M and C denote the matrices of quarterly changes in the macroeconomic indicators and control variables, respectively.

[a] As defined in section 5.(a), formula 11

Table 12: First-stage regressions coefficients for explanatory variables

	N	R^2	F-test	ip	ss	ts	λ	i	ca	Crisis	Impl.
Australia	280	7.22%	51.72%	-0.015	0.024	-0.060	-0.025	-0.594	0.003	-0.044	I.
		8.16%	51.95%	-0.015	0.024	-0.060	-0.025	-0.594	0.003	-0.044	II.
		8.73%	67.88%	0.066	0.026	-0.065 ***	-0.028	-0.479	0.003	-0.050	III.
Germany	280	3.51%	51.73%	0.408	-0.002	-0.004		0.214	0.017 **	-0.027	I.
		6.94%	51.96%	0.408	-0.002	-0.004		0.214	0.017 **	-0.027	II.
		8.11%	75.56%	-0.461	-0.001	-0.008		-0.412	0.013	-0.021	III.
Japan	280	3.57%	11.61%	-0.263	-0.006	0.079	-0.247	-1.642	0.006	-0.037 **	I.
		6.80%	11.82%	-0.263	-0.006	0.079	-0.247	-1.642	0.006	-0.037 **	II.
		9.06%	0.54%	-0.083	-0.009	0.101 *	-0.351 **	-2.058 ***	0.007	-0.064 ***	III.
United Kingdom	268	3.36%	50.65%	0.206	0.022	-0.001	0.017	0.161	0.001	-0.003	I.
		6.92%	50.90%	0.206	0.022	-0.001	0.017	0.161	0.001	-0.003	II.
		7.40%	77.07%	0.074	0.009	0.016	0.015	0.084	0.001	-0.003	III.
United States	280	2.37%	65.04%	-0.456	0.003	0.006	0.009	-0.108	-0.006	-0.056	I.
		5.14%	65.22%	-0.456	0.003	0.006	0.009	-0.108	-0.006	-0.056	II.
		5.73%	14.70%	-0.392	-0.004	0.015	0.007	0.800	-0.009 ***	-0.040	III.
Brazil	160	6.97%	43.46%	0.379	-0.009	-0.011	0.004	-2.895	-0.016	-0.021	I.
		7.29%	43.91%	0.379	-0.009	-0.011	0.004	-2.895	-0.016	-0.021	II.
		8.69%	20.68%	0.387	-0.027 ***	0.005	0.002	-3.949	-0.012	-0.027	III.
China	232	5.24%	34.76%	0.454	-0.068 **	0.037 *	0.044	0.629	-0.021 ***	-0.031	I.
		6.34%	35.09%	0.454	-0.068 **	0.037 *	0.044	0.629	-0.021 ***	-0.031	II.
		7.71%	53.22%	0.539	-0.093 *	0.071	0.059	0.135	-0.022 ***	-0.047	III.
India	188	9.20%	37.81%	0.577 ***	-0.002	0.017	-0.015	0.068	-0.016 ***	-0.058	I.
		9.46%	38.21%	0.577 ***	-0.002	0.017	-0.015	0.068	-0.016 ***	-0.058	II.
		11.97%	37.07%	0.563 ***	0.069 ***	-0.061 **	-0.005	0.020	-0.012	-0.074 **	III.
Russia	220	5.41%	0.92%	0.107 ***	-0.006	-0.028	0.004	0.611 **	-0.013	-0.113 *	I.
		6.02%	0.97%	0.107 ***	-0.006	-0.028	0.004	0.611 **	-0.013	-0.113 *	II.
		7.73%	2.98%	0.088 **	0.027	-0.066 ***	0.004	0.425 ***	-0.006	-0.106 *	III.
South Africa	124	6.12%	34.92%	0.204	-0.017	0.000	-0.010	0.669	0.011 **	-0.007	I.
		7.19%	35.55%	0.204	-0.017	0.000	-0.010	0.669	0.011 **	-0.007	II.
		8.99%	22.52%	0.442 *	0.009	-0.021	-0.010	1.007	0.011 **	-0.006	III.

Notes: The lending rate λ has been omitted for Germany due to lack of observations. The abbreviations stand for the changes of the following indicators: ip for industrial production, ss for the sovereign spread, ts for the term spread, λ for lending rate, i for inflation and ca for current-account balance over GDP. See part 5.(b).i for the different steps of implementation (Impl.). The significance levels are indicated as follows: * if p-value $< 10\%$, ** if p-value $< 5\%$ and *** if p-value $< 1\%$.

Table 13: First-stage regression coefficients for factor-dummy variables and control variables

	Cons.	SZE	VAL	MOM	F-test	y	r	$m1$	op	Impl.
Australia	0.008									I.
	-0.044	0.000 ***	0.016 ***	0.014 ***	0.00%					II.
	0.004	0.000 ***	0.016 ***	0.014 ***	0.00%	-0.728	-0.003	-0.097	-0.005	III.
Germany	0.007									I.
	-0.016 ***	0.011 ***	0.041 ***	0.039 ***	0.00%					II.
	-0.020 ***	0.011 ***	0.041 ***	0.039 ***	0.00%	2.252	0.002	0.081	0.034	III.
Japan	0.002									I.
	-0.037 **	0.025 ***	0.039 ***	0.014 ***	0.00%					II.
	-0.007	0.025 ***	0.039 ***	0.014 ***	0.00%	-0.575	-0.075 **	-0.629 **	-0.014	III.
United Kingdom	0.000									I.
	-0.003	0.014 ***	0.027 ***	0.029 ***	0.00%					II.
	-0.018 **	0.014 ***	0.027 ***	0.029 ***	0.00%	0.174	0.016	0.038	-0.005	III.
United States	0.007									I.
	-0.056	0.021 ***	0.032 ***	0.008 ***	0.00%					II.
	-0.011 *	0.021 ***	0.032 ***	0.008 ***	0.00%	0.271	0.009	-0.085	-0.051 **	III.
Brazil	0.052									I.
	-0.021	-0.002 ***	0.010 ***	0.014 ***	0.00%					II.
	0.065	-0.002 ***	0.010 ***	0.014 ***	0.00%	-1.286	0.017	0.002	0.072	III.
China	0.035 ***									I.
	-0.031	0.026 ***	0.021 ***	-0.011 ***	0.00%					II.
	0.011	0.026 ***	0.021 ***	-0.011 ***	0.00%	0.477	0.039	0.335	-0.100 ***	III.
India	0.005									I.
	-0.058	0.006 ***	-0.008 ***	-0.008 ***	0.00%					II.
	0.001	0.006 ***	-0.008 ***	-0.008 ***	0.00%	0.205	-0.086 ***	-0.004	0.087	III.
Russia	0.006									I.
	-0.113 *	-0.004 ***	-0.027 ***	-0.027 ***	0.00%					II.
	0.001	-0.004 ***	-0.027 ***	-0.027 ***	0.00%	-1.616 ***	-0.035	0.832 **	-0.007	III.
South Africa	0.000									I.
	-0.007	-0.009 ***	0.009 ***	0.009 ***	0.00%					II.
	-0.004	-0.009 ***	0.009 ***	0.009 ***	0.00%	-1.13	-0.044	-0.130	0.011	III.

Notes: The abbreviations of the control variables denote the following: y = change in GDP per capita, r = change in 2-year interest rates, $m1$ = change in M1 monetary supply and op = change in oil price. See part 5.(b).i for the different steps of implementation (Impl.). The significance levels are indicated as follows: * if p-value $< 10\%$, ** if p-value $< 5\%$ and *** if p-value $< 1\%$.

Table 14: Second-stage regression coefficients and t-values for full-set explanatory variables

	N	R^2	F-test	ip	ss	ts	λ	i	ca	Crisis	Impl.
MRP	524	20.37%	0.00%	0.993 *** (4.74)	0.107 *** (5.81)	-0.050 * (-1.59)	0.003 (0.22)	-0.829 (-1.15)	0.001 (0.28)	-0.025 (-1.43)	I.
		21.68%	0.00%	0.980 *** (4.76)	0.107 *** (5.66)	-0.050 (-1.57)	0.004 (0.35)	-0.973 (-1.06)	0.002 (0.45)	-0.026 (-1.44)	II.
		30.05%	0.00%	0.302 (1.17)	0.067 *** (2.91)	-0.011 (-0.31)	0.005 (0.45)	-3.274 *** (-3.23)	0.003 ** (2.51)	-0.020 (-1.37)	III.
SZE	524	7.43%	48.33%	-0.139 (-1.44)	0.025 *** (3.81)	-0.052 *** (-2.63)	-0.021 *** (-3.37)	-1.149 (-1.55)	-0.006 *** (-2.86)	0.003 (0.42)	I.
		10.51%	96.73%	-0.146 (-1.72)	0.022 ** (3.14)	-0.051 *** (-2.66)	-0.025 *** (-6.13)	-0.087 (-0.23)	-0.005 *** (-2.89)	0.002 (0.32)	II.
		13.43%	35.22%	0.186 (0.84)	0.046 *** (4.62)	-0.080 *** (-3.37)	-0.026 *** (-10.01)	0.922 (1.18)	-0.006 ** (-2.13)	-0.001 (-0.18)	III.
VAL	524	4.82%	11.34%	-0.467 *** (-6.68)	0.029 *** (2.71)	0.031 * (1.90)	0.026 *** (4.51)	-0.913 ** (-2.05)	-0.002 (-0.43)	-0.011 (-1.11)	I.
		6.14%	31.10%	-0.47 *** (-7.47)	0.028 ** (2.49)	0.030 * (1.90)	0.022 *** (3.69)	-0.120 (-0.60)	-0.002 (-0.48)	-0.009 (-0.95)	II.
		6.87%	37.01%	-0.526 *** (-3.31)	0.037 (1.75)	0.025 (0.71)	0.023 *** (4.71)	-0.130 (-0.38)	-0.002 (-0.45)	-0.010 (-1.17)	III.
MOM	524	13.40%	35.71%	-0.764 ** (-3.17)	-0.062 *** (-4.88)	-0.002 (-0.09)	-0.013 (-0.56)	-1.606 * (-1.93)	0.017 ** (2.18)	-0.128 *** (-4.35)	I.
		14.89%	27.57%	-0.758 ** (-3.25)	-0.061 *** (-4.97)	-0.005 (-0.21)	-0.017 (-0.74)	-1.683 (-1.32)	0.016 ** (2.25)	-0.128 *** (-4.41)	II.
		18.46%	77.02%	-0.473 ** (-2.16)	-0.041 ** (-2.16)	-0.022 (-0.86)	-0.017 (-0.79)	-0.221 (-0.14)	0.015 *** (2.66)	-0.127 *** (-4.51)	III.

Notes: The full-set coefficients give the results for developed markets and are to be read complementary with the coefficients in table 15 for emerging markets. The abbreviations stand for the changes of the following indicators: ip for industrial production, ss for the sovereign spread, ts for the term spread, λ for lending rate, i for inflation and ca for current-account balance over GDP. See part 5.(b).i for the different steps of implementation (Impl.). The significance levels are indicated as follows: * if p-value $< 10\%$, ** if p-value $< 5\%$ and *** if p-value $< 1\%$.

Table 15: Second-stage regression coefficients and t-values for interaction variables

	ip	ss	ts	λ	i	ca	Impl.
MRP	-0.369	-0.149 ***	0.060 *	-0.027 *	2.313 ***	-0.010	I.
	(-1.10)	(-5.06)	(1.61)	(-1.95)	(3.88)	(-0.45)	
	-0.294	-0.151 ***	0.061 *	-0.028 **	3.028 ***	-0.011	II.
	(-0.85)	(-5.01)	(1.65)	(-2.19)	(3.19)	(-0.52)	
	0.183	-0.135 ***	0.054 **	-0.020 *	4.537 ***	-0.013	III.
	(0.63)	(-6.93)	(1.96)	(-1.65)	(4.62)	(-0.80)	
SZE	0.137	-0.003	0.025	0.027 **	1.479 ***	-0.009	I.
	(0.73)	(-0.22)	(0.91)	(3.03)	(2.97)	(-1.09)	
	0.112	-0.001	0.024	0.032 **	0.113	-0.009	II.
	(0.59)	(-0.06)	(0.88)	(4.91)	(0.21)	(-1.20)	
	-0.148	-0.003	0.027	0.029 **	-0.551	-0.008	III.
	(-0.59)	(-0.16)	(0.86)	(6.13)	(-0.68)	(-1.36)	
VAL	0.602 ***	-0.032 **	-0.050 **	-0.015 **	0.146	-0.005	I.
	(4.64)	(-2.33)	(-1.99)	(-2.33)	(0.47)	(-0.65)	
	0.613 ***	-0.031 **	-0.049 *	-0.010	-0.703	-0.005	II.
	(4.08)	(-2.17)	(-1.96)	(-1.44)	(-1.17)	(-0.62)	
	0.675 ***	-0.032 **	-0.052 **	-0.012 *	-0.687	-0.005	III.
	(4.35)	(-1.99)	(-2.13)	(-1.92)	(-1.46)	(-0.65)	
MOM	0.703 **	0.062 ***	-0.025	0.018	1.525 **	-0.032 ***	I.
	(2.47)	(3.68)	(-0.82)	(0.78)	(2.11)	(-3.39)	
	0.681 **	0.061 ***	-0.023	0.022	1.284	-0.031 ***	II.
	(2.48)	(3.73)	(-0.79)	(0.99)	(0.91)	(-3.35)	
	0.484 *	0.051 ***	-0.020	0.020	0.189	-0.031 ***	III.
	(1.87)	(2.94)	(-0.81)	(0.94)	(0.12)	(-3.92)	

Notes: The interaction-variable coefficients above outline the difference of emerging markets to developed markets (i.e. complementary with the coefficients in table 14). The abbreviations stand for the changes of the following indicators: ip for industrial production, ss for the sovereign spread, ts for the term spread, λ for lending rate, i for inflation and ca for current-account balance over GDP. See part 5.(b).i for the different steps of implementation (Impl.). The significance levels are indicated as follows: * if p-value $< 10\%$, ** if p-value $< 5\%$ and *** if p-value $< 1\%$.

Table 16: Second-stage regression coefficients and t-values for country-dummy variables

	Const.	DE	JP	UK	US	BR	CN	IN	RU	ZA	F-test	EM	Impl.
MRP	-0.009 (-1.30)												I.
	-0.002 (-0.23)	-0.046 *** (-15.11)	-0.017 ** (-2.33)	-0.007 *** (-3.20)	-0.005 *** (-3.25)	-0.023 *** (-2.94)	0.024 *** (3.54)	-0.032 *** (-3.34)	-0.022 ** (-2.41)	-0.019 ** (-2.50)	0.30%		II.
	0.007 (1.05)	-0.0575 *** (-13.15)	-0.033 *** (-4.71)	-0.014 *** (-5.84)	-0.009 *** (-5.95)	-0.027 *** (-3.92)	-0.014 (-1.03)	-0.043 *** (-4.28)	-0.027 *** (-2.63)	-0.021 *** (-2.81)	0.00%	-0.003 (-0.24)	III.
SZE	-0.010 (-1.18)												I.
	-0.027 *** (-9.51)	-0.020 *** (-14.15)	0.012 *** (4.23)	-0.001 (-1.08)	0.013 *** (15.63)	0.011 ** (1.97)	0.054 *** (17.91)	0.028 *** (2.92)	0.034 *** (3.55)	0.019 *** (3.03)	0.00%		II.
	-0.035 *** (-5.75)	-0.016 *** (-5.79)	0.019 *** (3.13)	0.001 (0.38)	0.015 *** (9.92)	0.013 * (1.87)	0.070 *** (5.67)	0.032 *** (2.92)	0.032 *** (3.33)	0.018 ** (2.41)	0.02%	0.031 ** (2.25)	III.
VAL	0.005 (0.75)												I.
	-0.008 *** (-4.51)	0.019 *** (12.30)	0.009 *** (7.11)	-0.005 *** (-7.60)	0.007 *** (15.37)	0.017 ** (2.00)	0.032 *** (21.33)	0.009 (0.73)	0.010 (0.69)	0.031 *** (4.05)	0.25%		II.
	-0.005 (-0.93)	0.020 *** (11.08)	0.009 *** (3.27)	-0.004 *** (-5.50)	0.007 *** (11.13)	0.017 ** (2.11)	0.030 *** (3.67)	0.008 (0.77)	0.014 (0.93)	0.033 *** (3.76)	0.01%	0.019 *** (2.59)	III.
MOM	0.000 (0.00)												I.
	0.006 (0.74)	0.041 *** (6.30)	-0.023 *** (-2.96)	-0.006 *** (-3.58)	-0.018 *** (-13.13)	0.013 (1.08)	-0.007 (-0.86)	0.001 (0.05)	-0.004 (-0.24)	0.015 (1.31)	85.85%		II.
	-0.002 (-0.22)	0.048 *** (7.22)	-0.013 (-1.24)	-0.002 (-0.82)	-0.015 *** (-7.95)	0.018 (1.37)	0.004 (0.23)	0.002 (0.12)	-0.003 (-0.16)	0.019 * (1.63)	50.96%	0.014 (1.00)	III.

Notes: The values in the column labeled 'F-test' denote the p-values for the respective joint null hypotheses for country-dummy variables in implementations II. and III. See part 5.(b).i for the different steps of implementation (Impl.). The abbreviations stand for the following countries: DE = Germany, JP = Japan, UK = United Kingdom, US = United States, BR = Brazil, CN = China, IN = India, RU = Russia and ZA = South Africa. The significance levels are indicated as follows: * if p-value $< 10\%$, ** if p-value $< 5\%$ and *** if p-value $< 1\%$.

Table 17: Second-stage regression coefficients and t-values for control variables

	y	r	$m1$	op	Impl.
MRP					I.
					II.
	1.031 *	0.033	0.074	0.166 ***	III.
	(1.92)	(1.32)	(0.43)	(2.76)	
SZE					I.
					II.
	-0.667	-0.025	0.167	-0.052	III.
	(-1.12)	(-1.56)	(1.34)	(-1.36)	
VAL					I.
					II.
	0.358	-0.010	-0.234	-0.004	III.
	(0.71)	(-0.35)	(-1.43)	(-0.19)	
MOM					I.
					II.
	-0.072	-0.013	0.049	-0.105 ***	III.
	(-0.14)	(-0.85)	(0.28)	(-3.96)	

Notes: The abbreviations stand for the following control variables: y for changes in GDP per capita, r for changes in short-term rates, $m1$ for changes in the M1 monetary supply and *op* for oil-price changes. See part 5.(b).i for the different steps of implementation (Impl.). The significance levels are indicated as follows: * if p-value $< 10\%$, ** if p-value $< 5\%$ and *** if p-value $< 1\%$.

Table 18: Second-stage robustness coefficients and t-values for full-set explanatory variables

	N	R^2	F-test	MRP	ip	ss	ts	λ	i	ca	Crisis
SZE	524	17.17%	16.11%	-0.169 **	0.210	0.053 ***	-0.078 ***	-0.024 ***	0.428	-0.005 *	-0.003
				(-2.09)	(-1.05)	(4.57)	(-2.90)	(-6.06)	(0.61)	(-1.87)	(-0.41)
VAL	524	9.41%	31.29%	0.138 ***	-0.546 ***	0.031	0.023	0.022 ***	0.273	-0.002	-0.008
				(-3.20)	(-3.35)	(1.43)	(0.70)	(4.03)	(0.64)	(-0.55)	(-0.97)
MOM	524	19.13%	83.72%	-0.083	-0.461 **	-0.037 *	-0.021	-0.016	-0.464	0.015 ***	-0.128
				(-1.22)	(-2.15)	(-1.96)	(-0.82)	(-0.73)	(-0.30)	(2.65)	(-4.48)

Notes: The full-set coefficients in table 18 give the results for developed markets. The indicator-variable coefficients in table 19 give the deviation in emerging markets from those in developed markets. The column F-test gives the p-values for the joint null hypothesis of all explanatory variables from tables 18 and 19 in each factor-panel regression. The abbreviations stand for the changes of the following indicators: ip for industrial production, ss for the sovereign spread, ts for the term spread, λ for lending rate, i for inflation and ca for current-account balance over GDP. For both tables 18 and 19, the significance levels are indicated as follows: * if p-value $< 10\%$, ** if p-value $< 5\%$ and *** if p-value $< 1\%$.

Table 19: Second-stage robustness test coefficients and t-values for interaction variables

	ip	ss	ts	λ	ca	i
SZE	-0.089	-0.024	0.034	0.025 ***	-0.010 **	0.154
	(-0.40)	(-1.20)	(1.09)	(4.85)	(-2.10)	(0.23)
VAL	0.627 ***	-0.015	-0.058 **	-0.008	-0.003	-1.261 **
	(4.70)	(-0.88)	(-2.51)	(-1.17)	(-0.37)	(-2.43)
MOM	0.513 **	0.040 **	-0.016	0.018	-0.032 ***	0.536
	(1.98)	(2.57)	(-0.64)	(0.81)	(-3.90)	(0.34)

Table 20: Second-stage robustness test coefficients and t-values for country-dummy variables

	Const.	DE	JP	UK	US	BR	CN	IN	RU	ZA	F-test
SZE	-0.030 ***	-0.023 ***	0.014 **	-0.002	0.013 ***	0.007	0.066 ***	0.024 ***	0.027 ***	0.012 **	0.00%
	(-4.80)	(-6.93)	(2.42)	(-0.89)	(9.34)	(1.26)	(6.81)	(3.31)	(4.05)	(2.06)	
VAL	-0.009	0.022 ***	0.033 ***	0.015	0.018	0.038 ***	0.188	-0.016	-0.252	-0.026	0.00%
	(-1.32)	(2.68)	(3.84)	(1.37)	(1.19)	(4.24)	(0.35)	(-0.57)	(-1.40)	(-1.33)	
MOM	0.000	0.015	0.002	-0.002	-0.006	0.016	0.032	-0.009	0.060	-0.092 ***	67.31%
	(0.00)	(1.18)	(0.13)	(-0.11)	(-0.31)	(1.42)	(0.06)	(-0.69)	(0.33)	(-3.33)	

Notes: The coefficients for the country-dummy variables must be interpreted as deviations from the coefficient term. The values under column F-test stand for the p-values for the joint null hypothesis of all country-dummy variables. The abbreviations stand for the following countries: DE = Germany, JP = Japan, UK = United Kingdom, US = United States, BR = Brazil, CN = China, IN = India, RU = Russia and ZA = South Africa. In both tables 20 and 21, the significance levels are indicated as follows: * if p-value < 10%, ** if p-value < 5% and *** if p-value < 1%.

Table 21: Second-stage robustness test coefficients and t-values for control variables

	y	r	$m1$	op
SZE	-0.457	-0.017	0.189	-0.025
	(-0.91)	(-0.92)	(1.52)	(-0.88)
VAL	0.026 ***	0.013 ***	-0.002 ***	0.009
	(8.44)	(3.59)	(-3.59)	(11.13)
MOM	0.045 ***	-0.015	-0.003	-0.016
	(6.14)	(-1.53)	(-1.28)	(-8.50)

Notes: The abbreviations stand for the following control variables: y for changes in GDP per capita, r for changes in short-term rates, $m1$ for changes in the M1 monetary supply and op for oil-price changes.

Table 22: Research hypotheses and conclusions consequential from second-stage regressions

Hypothesis	FMP	Conclusion	Additional Comments
H.1	MRP	Accepted	
H.2.a	SZE	Rejected	
H.2.b	SZE	Rejected	Coefficients of ip and ts rejected completely; interaction variable as for λ negative in DM.
H.3.a	VAL	Rejected	
H.3.b	VAL	Rejected	The expected insignificance of the coefficient of i could be confirmed.
H.4.a	MOM	Accepted	
H.4.b	MOM	Partially Accepted	The crisis coefficient could be confirmed as negative but not for i so.
H.5	all	Partially Accepted	The significance of the EM dummy could not be confirmed for market-risk premia (MRP).
H.6	all	Accepted	

Notes: The research hypotheses have been formulated in chapter 4.

Table 23: Findings from the cross-country (second-stage) regression models

	ip		ss		ts		λ		i		ca		Crisis	EM	Country-Fixed
	DM	EM	DM	EM	DM	EM	DM	EM	DM	EM	DM	EM		Dummy	Effects?
MRP	0	=	+	↓	0	↑	0	↓	–	↑	+	=	0	0	Yes
SZE	0	=	+	=	–	=	–	↑	0	=	–	↓	0	+	Yes
VAL	–	↑	+	↓	0	↓	+	↓	0	=	0	=	0	+	Yes
MOM	–	↑	–	↑	0	=	0	=	0	=	+	↓	–	0	No

Notes: Signs $+/-/0$ under columns labeled with DM mean the sign of *full-set* coefficients for developed markets. Signs ↑ / ↓ / = under columns labeled with EM mean the sign of the coefficients of emerging-market *interaction* variables relative against developed markets. Consequently, the reader would read the combination for one macroeconomic indicator with + for DM and ↓ for EM as follows: significantly positive across developed markets but significantly less positive across emerging markets. The abbreviations stand for the changes of the following indicators: ip for industrial production, i for inflation, ts for the term spread, λ for inflation, ss for the sovereign spread and ca for current-account balance over GDP.