Risk Premia to Political Uncertainty in Global Equity Markets

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1 Introduction

Political uncertainty drives markets. Among macroeconomic forces, it is one of the few factors that systematically affect most assets. Examples include the Brexit decision, the US-government shutdown, and recent political tensions in Italy. None of the named were initially economic crises. They were purely political, however stock markets reacted to each of them. Political uncertainty in asset pricing is a topic of growing relevance as uncertainty about the future of both, multilateral cooperation between regions and stability within them is rising. The election of Donald Trump as president of the United States is only one of the many factors, among growing global inequality, migration fears and discontent in the European Union, that makes the future increasingly uncertain. Even though these facts significantly affect financial markets and receive lots of attention by investors (the Bloomberg Channel is full of political news!), there is still academic research lacking on the interaction between stock markets and political risk. However, the topic has gained attention and empirical assessment became increasingly possible when Baker, Bloom, and S. Davis (2016) published their "Economic Policy Uncertainty index" (EPU), which is the first - and at the time of writing only - known measure to both quantify policy uncertainty and provide a time-series of frequent observations.

This thesis examines whether economic policy uncertainty is indeed a factor of systemic risk to asset markets. It is split into a theoretical and an empirical part, preceded by a short literature review. The theoretical part first summarizes John Cochrane's asset pricing framework, which motivates the existence of risk premia in general. This is followed by summarizing an equilibrium model introduced by Pástor and Veronesi (2013b) which is concerned with the effect of political risk on stock prices. Following theoretical considerations, the hypothesis that Economic Policy Uncertainty should carry a risk premium in bad economic times is formed.

The empirical part uses the eleven MSCI Sector portfolios in three regions (the United States of America, the European Monetary Union and the Emerging markets composite) to test the theoretical conclusions. Using time-series regressions, I I find that there is significant sensitivity to Economic Policy Uncertainty, which is varying by time and industry and more pronounced in the European Union than in the United States. This may hint towards a relationship between the level of regulation and influence of politics.

Taking the sensitivities as input variables to an out of sample cross-sectional regression (Fama and MacBeth (1973)), I find strong empirical support for a risk premium on economic policy uncertainty. The premium is significant across multiple specifications of the model, including correction for the Chen, Roll, and Ross (1986) economic factors and the market premium.

The time-series of risk premia is then used to estimate a conditional factor model, as suggested by Ferson and Harvey (1991). To test theoretical considerations, four regimes are formed based on economic growth and market expectations about monetary policy. Using out of sample testing, I show that there is some predictability of the risk premium with regard to the regimes and the general level of EPU. Specifically, risk premium to policy uncertainty is most pronounced when growth is assumed to be below its long term mean, when market participants expect central banks to ease monetary policy and when the general level of economic policy uncertainty is high. These results confirm theoretical considerations.

The thesis is organized as follows. Section 2 gives a survey of relevant literature. Section 3 summarizes John Cochrane's Asset Pricing framework. Section 4 explains why economic policy uncertainty should carry a premium in bad economic times. Section 5 describes data and methodology. Section 6 presents results when risk premia are assumed to be unconditional. Section 7 presents the results for a conditional version of the model. Section 8 concludes.

2 Literature Review

The economics of uncertainty have long been studied in the finance and economics literature (Ben Bernanke (1980), Bloom, Bond, and Van Reenen (2007)). Eeckhoudt, Gollier, and Schlesinger (2011) is a great summary that provides a general framework of decision making under risk. The concept of risk aversion is carefully developed and the existence of risk premia justified. While it has long been clear, that assets that carry exposure to systemic factors of risk, there is still discussion about which are the driving forces. Since Merton (1973) developed the ICAPM, often falsely interpreted as a "fishing license" (Cochrane (2009) p. 161) for additional factors and Fama and MacBeth (1973) provided an appropriate methodology to estimate risk premia, there has been an explosion of multi-factor models that explain some of the cross-section in asset returns. Arguably the two most influential models, Chen, Roll, and Ross (1986) focuses on macro-economic and Fama and French (1993) on firm specific factors.

Political uncertainty as a possible risk factor received growing attention when it was first quantified by Baker, Bloom and Davis in 2013 (Baker, Bloom, and S. Davis (2016) is the revised version). Their index provided the first time-series that both, follows a traceable methodology and is available on a frequent basis. The authors themselves conducted empirical work and found that innovations in their index were accompanied by recessive economic conditions through a VAR model in the United States. The authors also present evidence that large stock market jumps can be attributed to news about policy, which "trigger 20-25% of jumps in most advanced economies and a larger share in other countries (e.g., China=33% and India=46%)" (Baker, Bloom, and S. J. Davis (2015)). This especially holds during the Euro Crises and the Great Financial crises.

As EPU seems to be a systemic source that drives stock markets, the question whether it carries a risk premium looms. Theoretical foundation to this thought was given by Pástor and Veronesi (2012) and Pástor and Veronesi (2013b). Over the span of two papers, the authors develop a rigorous model that is based on game theoretical thoughts and links policy uncertainty to asset pricing theory. The authors conclude that EPU should carry a risk premia especially in bad economic times. Their comprehensive framework is outlined below. In Kelly, Pástor, and Veronesi (2014) the authors take their theory to reality and examine the price of options that span major political events (mostly elections). They find that such options seem to be more valuable than those that expire before the event, hinting towards a risk premium.

Most closely related to this thesis is the work of Brogaard and Detzel (2015) who study the cross section of asset returns. Using the 25 Fama-French portfolios and correcting for the Carhart four factors (that is momentum, size, value and market) they find a significant risk premium of exposure to EPU. This thesis expands their approach in taking a global perspective and examining risk premia on EPU in three major regions that span the globe. Furthermore,this thesis expands the general model to a dynamic factor model that incorporates EPU and considers the time-series of risk premia on EPU. This approach was motivated by Ferson and Harvey (1991).

3 Asset Pricing

> *Price is expected discounted payoff. This fundamental relation underlies all asset pricing. The discount factor is an index of "bad times". Because investors are willing to pay more for assets that do well in bad times, the risk premium on any asset is determined by how it covaries with the discount factor. All of asset pricing comes down to techniques for measuring the discount factor in a way that is useful for specific applications.* (Cochrane and Culp (2003), p. 57)

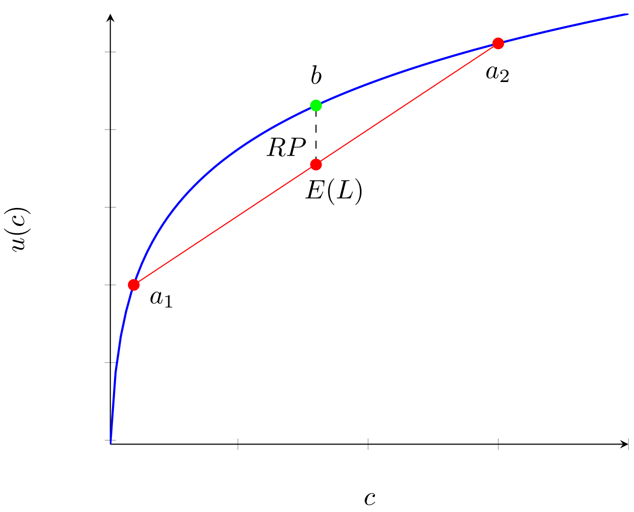
The quote above highlights the elegance of John Cochrane's asset pricing framework: Every approach taken, may it be the CAPM, the ICAPM or the APT can be interpreted as just another way to formulate the one central idea that an asset is priced according to expected discounted payoffs. Furthermore, Cochrane's framework draws ingenuity by starting of at one of the most fundamental ideas of economic theory: declining marginal utility from consumption. This is the starting point from which risk aversion is derived, being at the very core of financial theory and even more so of this thesis concerned with risk premia.

3.1 Risk Aversion

To understand the derivation of risk aversion, consider the Von Neumann–Morgenstern (VNM) utility function with constant relative risk aversion (CRRA), which is given by

$$u(c) = \frac{c^{1-\gamma}}{1-\gamma} \tag{1}$$

where $u(c)$ is the utility of consumption and γ the coefficient of relative risk aversion.



The function is plotted in blue above for a value of $\gamma = 0.99$ (i.e. high risk aversion for illustrative reasons). Now assume two scenarios: In the first scenario the agent receives some fixed amount of money b which he consumes directly. His expected utility is simply $E[u(b)] = u(b)$, drawn above in green. In another case the agent enters a lottery where he has a 50% chance to receive amount a_1 and a 50% chance to receive amount a_2, with a_1 and a_2 such that $\frac{a_1+a_2}{2} = b$. In this case his expected payoff is given by $E[L] = 0.5 * a_1 + 0.5 * a_2 = b$. Even though the agent does have the same expected payoff, his utility is different in both cases. For the lottery his utility is given by $E[u(L)] = 0.5u(a_1) + 0.5u(a_2) < u(b)$ (drawn in red). Hence in order to enter the lottery the agent would require a risk premium given by $RP = E[u(b)] - E[u(L)]$. The same logic can be extended to a two-period model where an agent can decide to either consume b in both periods or to consume a_1 in one period and a_2 in the other. Even though $a_1 + a_2 = 2b$, you can easily see that $u(2b) > u(a_1) + u(a_2)$, which indicates that the agent prefers to have the same level of consumption in both periods.

This consideration gives the first important insight to understand the following theoretical thoughts: agents require premiums for any uncertainty in consumption and they prefer steady payoffs.

3.2 The stochastic discount factor

John Cochrane builds on the same intuition. He argues that the factor to discount future payoffs is stochastic, as it dependents on expectations about the future state of the world. He sets up a simple model in which agents have to decide between consuming today (at time t) or in the next period (at time $t+1$). Whichever amount they save to consume tomorrow they invest in assets. To solve this problem, Cochrane defines a simple inter-temporal utility function given by

$$U(c_t, c_{t+1}) = u(c_t) + \delta E_t[u(c_{t+1})] \tag{2}$$

where δ is the preference of agents to consume today rather than tomorrow (i.e. a measure of impatience). Note that utility of consumption tomorrow can only be expected using information available at time t, as the return to any investment is uncertain. Using this utility function and solving a maximization problem, Cochrane obtains the basic pricing equation.

$$p_t = E_t\left[\delta \frac{u'(c_{t+1})}{u'(c_t)} x_{t+1}\right] \tag{3}$$

where p_t is the price of the asset at time t and x_{t+1} is the payoff at time $t+1$. The above equation is basically a discounted cash flow formula - with one twist: The discount factor is based on expected marginal utility tomorrow. This is why Cochrane calls it the *stochastic* discount factor (SDF), given by

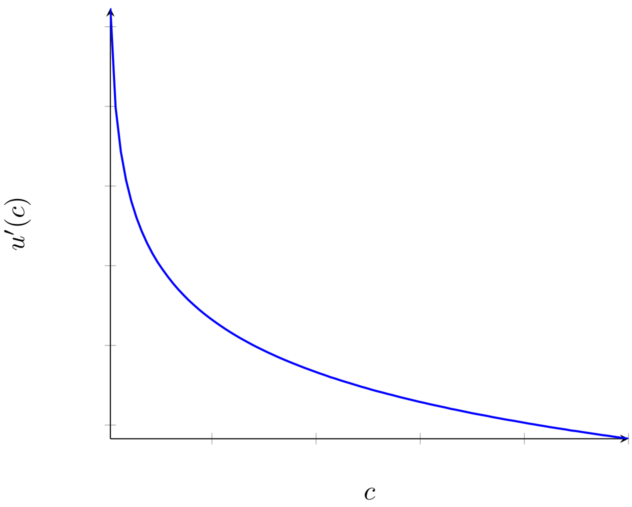
$$m_{t+1} \equiv \delta \frac{u'(c_{t+1})}{u'(c_t)} \tag{4}$$

to express the basic pricing formula as

$$p_t = E_t[m_{t+1} x_{t+1}]. \tag{5}$$

This is "*the* central asset pricing formula. [...] Most of the theory of asset pricing just consists of specializations and manipulations of this formula" (Cochrane (2009), p. 6)

The stochastic discount factor given in equation (4) consists of two parts: δ, which is a measure of impatience, and the ratio of current to future marginal utility from consumption. These properties make it an "index of good and bad times" (Cochrane and Culp (2003), p. 62). This results from the properties of the utility function given in the previous section. Its first derivative is drawn below.



While the utility function itself is concave and rising, the marginal utility is convex and falling. The stochastic discount factor relates to this graph in two ways: it consists of current marginal utility of consumption and expected future marginal utility of consumption. As $u'(c)$ is falling in c, the SDF m grows as $u'(c_{t+1}) > u'(c_t)$ and hence as $c_{t+1} < c_t$. Intuitively, when people expect times to get worse, they seek to delay some assets to $t+1$ in an effort to smooth consumption. Prices rise and returns drop. On the contrary, m falls as $u'(c_{t+1}) < u'(c_t)$ and $c_{t+1} > c_t$. As agents expect better times in the future, they will not be willing to give up consumption today. Prices drop and investment is rewarded with a higher return. It follows from the convexity of $u'(c)$ that the magnitude of these effects rises as general levels of c fall, i.e. in bad times.

3.3 Risk Premia and the SDF

A large part of asset pricing theory, most notably the CAPM and the APT, is concerned with differences in expected returns of the cross section of assets. Both have concluded that there should be a premium for bearing systematic risks. However, they each rely on different strong assumptions. Cochrane's approach is by part so intriguing as it is able to explain risk premia by solely relying on the utility functions given above.

Using the basic definition of covariance, $cov(m,x) = E(mx) - E(m)E(x)$, we can write equation (5) as:

$$p = E(mx) = E(m)E(x) + cov(m,x) \tag{6}$$

which can be connected to the risk free rate through $R^f = \frac{1}{E(m)}$ to get

$$p = \frac{E(x)}{R^f} + cov(m,x) \tag{7}$$

The same argument can be written in returns. For any asset, $1 = E(mR^i)$, where m is the discount factor and R^i is the return of asset i, has to hold. We can then write

$$1 = E(m)E(R^i) + cov(m,R) \tag{8}$$

and substitute the risk free rate R_f to get

$$E(R^i) - R^f = -\frac{cov[m, R^i_{t+1}]}{E[m]} \tag{9}$$

or equivalently

$$E(R^i) - R^f = -\frac{cov[u'(c_{t+1}), R^i_{t+1}]}{E[u'(c_{t+1})]} \tag{10}$$

For any given level of expected utility of consumption tomorrow, $E[u(c_{t+1})]$, the excess return of an asset is linearly related to the covariance of returns and marginal utility. Marginal utility decreases when consumption increases, i.e. in good times. Most Assets pay off well in good times, so the covariance will be negative and there will be some excess return, or risk premium, on these assets. However, if the covariance is positive, that is if an asset pays off well in bad times, risk premium will be negative and agents are willing to accept negative excess returns. For any risk free investment, which gives a steady payoff and therefore has no variance, there is no excess return. For any investment that does have variance, but does not covary with the discount factor, there is no excess return. Idiosyncratic risk is not rewarded and "Systemic means correlated investor's marginal utility - *full stop*" (Cochrane and Culp (2003), p. 66)

These results are intuitively appealing: As shown above, investors have a desire to smooth consumption. Thus, they will be willing to pay for assets that pay of well when consumption is low and pay of badly when consumption is high. Demand for those assets increases prices and lowers returns. Insurance is a great example: Insurance usually pays a negative return for investors. However, people are willing to buy it because it *exactly* pays off, when times are bad and consumption is low. The same reasoning implies, that assets that covary strongly with consumption will have to reward investors with high payoffs, otherwise no one would invest into an asset that gives great returns when one is already wealthy and great losses when one is already poor.

3.4 CAPM and Multi-Factor Models

The CAPM and multi factor models are not "an alternative to the consumption based model, [they are] a special case" (Cochrane (2009), S. 71). Both can be derived from equation (9), which follows from equation (5). They are only specifications of the idea that price is discounted payoffs, generated by using different definitions of the stochastic discount factor. This can be arithmetically derived using the CRRA VNM utilities given in equation (1). Then the stochastic discount factor m can be written as

$$m \equiv \delta \frac{u'(c_{t+1})}{u'(c_t)} = \delta \frac{c_{t+1}^{-\gamma}}{c_t^{-\gamma}} = \delta (\frac{c_{t+1}}{c_t})^{-\gamma} = \delta (\Delta c)^{-\gamma}. \tag{11}$$

Using equation (9) and a first-order Taylor approximation for short time intervals, one can derive

$$E[R_i] - R^f \approx \gamma \beta(\Delta c, R_i) var(\Delta c). \tag{12}$$

Expected excess return is linear in β, which is defined by $\beta = \frac{cov(\Delta c, R_i)}{var(\Delta c)}$. Using this framework, factor models solely differ in their definition of Δc. (Chaigneau (2011))

<u>CAPM</u>

Still one of the most widely used models, the CAPM formulates the idea that investors should only be rewarded for risk that covaries with return to the *market portfolio*. This portfolio consists of all existing investable *and* non-investable assets. If we assume, that investors solely hold the market portfolio and thus their wealth is fully dependent on its performance, and if, additionally investors have a constant propensity to consume, then we can write:

$$\Delta c = \frac{c_{t+1}}{c_t} = \frac{PC_{t+1}^* W_{t+1}}{PC_t^* W_t} = \frac{P_{t+1}^m}{P_t^m} = R^m \tag{13}$$

where W_t is wealth at time t, P_t^m is the price of the market portfolio and R^m is the return to the market portfolio. Consumption growth is equal to the return of the market portfolio, which functions "as a claim to all future consumption" (Cochrane (2009), p. 160). Using the above definition in combination with equation (12), one gets:

$$E[R_i] - R^f \approx \gamma\beta(R_M, R_i)var(R_M) \tag{14}$$

setting $i = M$ to get market excess return ($\beta = 1$) gives

$$E[R_i] - R^f = \gamma var(R_M) \tag{15}$$

which can be substituted back to arrive at

$$E(R^m) - R_f = \beta_i[E(R^m - R^f] \tag{16}$$

which is the basic CAPM equation. For a more exhaustive derivation see Chaigneau (2011).

Multi-Factor Models

The CAPM is a *one factor model*, it assumes that consumption is only dependent on one single factor: the return to the market portfolio. However, it seems rational to assume, that consumption depends on many more factors. As people do not solely generate their wealth from investable assets, there may be many more sources of consumption (such as income from a job or pensions). Assuming a linear relationship

$$c \sim \sum_{i=1}^{n} f^i, \tag{17}$$

c becomes a linear function of the realizations f of factor i. Change in consumption is then linearly related to sum of changes to the factors

$$\Delta c \sim \sum_{i=1}^{n} \Delta f^i. \tag{18}$$

Using equation (12), expected return becomes related to the multiple factors through

$$E[R_i] - R^f \approx \gamma\beta(\sum_{i=1}^{n} \Delta f^i, R_i)var(\sum_{i=1}^{n} \Delta f^i) \tag{19}$$

Assuming that the factors are independent and uncorrelated[1], the statement can be decomposed to

$$E[R_i] - R^f \approx \beta^1\gamma var(\sum_{i=1}^{n} \Delta f^i) + \beta^2\gamma var(\sum_{i=1}^{n} \Delta f^i)... + \beta^3\gamma var(\sum_{i=1}^{n} \Delta f^i) \tag{20}$$

[1]This is a necessary assumption. It is given that $var(\sum_i^n) = \sum_i^n \sum_j^n cov(X_i, X_j)$. Assuming that $cov(X_i, X_j) = 0$, this statement becomes $\sum_i^n cov(X_i, X_i) = \sum_i^j var(X_i)$.

where $\beta^i = \beta(\Delta f^i, R_i)$. Following the same approach as above by defining RP^i as the excess return to a portfolio with $\beta^i = 1$ and $\beta^j = 0 \ \forall \, j \neq i$, I get

$$E[R_i] - R^f \approx \beta^1 RP^1 + \beta^2 RP^2 ... + \beta^n RP^n = \sum_{i=1}^{n} \beta^i RP^i \tag{21}$$

which is the standard representation of a multi-factor model. This representation benefits from being empirically testable and being independent of the subjective risk aversion coefficient γ. The result was derived through own calculations.

3.5 Intertemporal SDF and the ICAPM

The last part of Cochrane's theory relevant to this thesis is concerned with subjective probabilities of different levels of consumption tomorrow. The discount factor is then a linear weighted combination of such probabilities. Cochrane derives this relationship using the concept of contingent claims ("Arrow-Debreu Securities") over different states of the world. States of the world define possible future scenarios (such as recession or expansion on the macro-level or job loss on the investor's level). Investors form their believes about each state of the world s with a probability for this state π_s and state dependent income $y_{t+1}(s)$. Contingent claims on state s are then defined as assets, that pay one unit (f.e. one dollar) in state s and nothing in all other states. They can be bought today at price $pc(s)$. Using these definitions, at time t with some initial income y_t, the investor faces the decision to give up consumption to buy contingent claims on state s. His maximization problem can be written as

$$\max_{c_t, c^s_{t+1}} u(c_t) + \sum_s \delta\pi(s) u[c_{t+1}(s)]$$
$$s.t. \ c_t + \sum_s pc(s) c_{t+1}(s) = y_t + \sum_s pc(s) y_{t+1}(s)$$

where the first part reflects the investors decision to consume today or in future state s and the constraint gives his budget constraint. Solving through Lagrange multipliers leads to

$$pc(s) = \delta\pi(s) \frac{u'[c_{t+1}(s)]}{u'(c_t)}. \tag{22}$$

The above equation gives intuitive insights consistent with what was derived before. If state s is negative (i.e. a recession or a job loss), $c_{t+1}(s)$ will be low and marginal utility high. Investors would then want to buy an asset that pays of in this state and serves as an insurance. Demand for those assets rises $pc(s)$ and lowers return (as given by $\frac{1}{pc(s)} - 1$), which will be low or even negative. On the other hand, if s is a positive state were investors assume to receive a lot of income, demand for contingent claim is low, $pc(s)$ and, indicating a large return. Even though prices increase as probability for the state increases, investors do not pay the rational price (in fact the rational price is paid if $\delta = 1$, i.e. there is no impatience and $\frac{u'[c_{t+1}(s)]}{u'(c_t)}$, i.e. if the future state does not differ from the current).

Equation (22) can be rewritten to get the stochastic discount factor for each state s

$$m(s) = \frac{pc(s)}{\pi(s)} = \delta \frac{u'[c_{t+1}(s)]}{u'(c_t)} \tag{23}$$

with the overall discount factor used to discount $t + 1$ being

$$m = \sum_s \pi(s) m(s) = \sum_s pc(s) = \delta \sum_s \pi(s) \frac{u'[c_{t+1}(s)]}{u'(c_t)}. \tag{24}$$

While this summary has so far been concerned with the cross-section of stock returns, equation (24) is powerful in explaining time varying prices of assets and the role of new information. As $\pi(s)$ are subjective probabilities guessed by rational agents from observations based on information available at time t, rather than true probabilities, any new information that changes the set of probabilities shifts the discount factor. Assume some new information enters the market that indicates a forthcoming recession at $t + 1$. Then probabilities for negative states of the world rise and probabilities for positive states fall. Then weight for high $m(s)$ in m rises and the weight for low $m(s)$ falls. This mechanism will rise m (again m is an indicator for bad times) and subsequently lower returns and rise prices, as shown in equation (5). Intuitively, if agents expect bad times insurance that pays of in such times will be more valuable. This intuition is at the heart of the ICAPM, derived by Merton (1973). The ICAPM expands the regular CAPM in that it *intertemporal*. Investors maximize lifetime consumption and can trade in continuous time, i.e. in infinitely small time increments. Furthermore, it relies subjective probabilities: New information Xt that enters the market shifts expected consumption in the future, as it changes the *set of investment opportunities*, that is, it shifts probabilities $\pi(s)$. Such information are called *state variables.* Through

$$m_{t+1} = \delta \frac{u'[a(X_{t+1})]}{u'a(X_t)]} \tag{25}$$

where consumption is a function a of realization of some factor X. Through a derivation in continuous time that is somewhat similar to that of the CAPM and APT, one then gets:

$$E(R^i_{t+1}) - R^f_t \approx \delta cov_t(R^i_{t+1}, \Delta c_{t+1}/c_t) + \gamma_{Xt} cov(R^i_{t+1}, \Delta X_{t+1}) \tag{26}$$

where δ is the coefficient of relative risk aversion, and γ is the aversion to a change in the set of investment opportunities. Intuitively, γ stems from the fact that individuals have an aversion to information that influence the expected future consumption. Equation (26) can be written using betas to arrive at a multi factor model of the form

$$E(R^i_{t+1}) - R^f_t \approx \beta^c RP^c + \beta^X RP^X \tag{27}$$

This means that investors will value assets that both, pay off well when consumption is low and when information arrives that indicates that future consumption will be low. For the future theories it is crucial that $a(X)$ can vary through time, which affects the aversion to changes in the information variable γ_X and hence RP^X. [2]

3.6 Insights from Asset Pricing

John Cochrane's framework allows for the derivation of risk premia without relying on unlikely assumptions. Rather, each step is a reformulation of one basic equation and each insight depends on the increasing and concave nature of investors utility function, both being reasonable and standard results of microeconomic theory. Whether an asset should pay a risk premium *solely* depends on whether its return covaries with expected future consumption. While the CAPM is one valuable specification of his approach, it disregards a basic fact: "*Investors have jobs.* Or they own houses or shares of small businesses." (Cochrane (2009), p. 172) The market return is undoubtedly a factor that influences future consumption, but may be only one among many. It is reasonable to assume that expected future consumption depends on macro-economic conditions: as the economy moves into a recession, investors are more likely to loose jobs, house prices may decline and small companies exhibit lower profitability. In line with these thoughts, exposure to macro-factors pays an additional premium on top of the market premium, as shown by Chen, Roll, and Ross (1986). As the motivation of this thesis is exploring risk premia on political risk, from a theoretical standpoint the following questions have to be answered:
Does political uncertainty covary with and thus affect future consumption? Does political uncertainty shift the set of investment opportunities? Is this effect static or dynamic?
The following section will present a compelling theoretical model to derive the effect of political risk on asset prices, argue that this relation is conditional and justify a risk premium for exposure to this factor.

[2] As $\beta^X = \frac{cov(R^i_{t+1}, \Delta X_{t+1})}{var(X)}$ and hence $\gamma cov(R^i_{t+1}, \Delta X_{t+1}) = \frac{cov(R^i_{t+1}, \Delta X_{t+1})}{var(X)} \gamma_X var(X) = \beta^X RP^X$ where $\gamma_X var(X) = RP^X$. For a derivation of the whole model starting with the SDF see Cochrane (2009), p. 156 - 158

4 Political Risk

Political Risk has received growing attention in finance and economics literature a couple of years ago, following the quantification of such by Baker, Bloom, and S. Davis (2016). The authors not only build a reliable measure of Policy Uncertainty in various economies, but also link it to stock market returns and investment decisions by economic agents.

Baker, Bloom, and S. Davis (2016) (BBD) compute the Economic Policy Uncertainty Index based on newspaper counts of words related to such uncertainty. While such a measure more closely related to *perceived* uncertainty rather than real decision making in governments, this is consistent with portfolio theory. According to Cochrane (2009), expectations by agents, rather than true underlying developments, drive asset markets, as outlined above. Such expectations affect the stochastic discount factor by shifting the state price density. As BBD measure newspaper data, which is the core medium for society to gain information, it can be assumed that such an index can readily capture information upon which investors build their expectations and hence uncertainty displayed in the markets. This line of arguments is used as a case to employ BBD's measure of Economic Policy Uncertainty as a quantification of political risk observed in markets.

The understanding of political risk that underlies this paper, draws heavily on Pástor and Veronesi (2013b), who build the only rigorous economic model to make forecasts about the effect of political uncertainty known to the author at the time of writing. They employ an equilibrium model involving firm payoffs, investors and governments to derive risk premia on political uncertainty that are higher in bad economic times. Their model shall be summarized below.

4.1 Equilibrium Model

Within Pástor and Veronesi (2013b) model, agents form expectations about future government policy, which affects companies profits. Uncertainty is then split in two parts: The uncertainty about the effects of current government policy, which decreases in time t as agents observe profitability and learn about such, as well as uncertainty about future government policy. As policies affect all firms alike, just to a different extend, they have to be seen as systemic, non-diversifiable risk. While this view builds on a one-country economy, stronger integration of financial markets and spill-overs of political uncertainty shocks make it reasonable to assume, that political uncertainty is at least to some degree non-diversifiable globally (this is also shown empirically by Kelly, Pástor, and Veronesi (2016) as well as Sauer (2017)). Notation in the following model has from time to time been abridged or altered to ensure a seamless integration into this thesis.

4.1.1 Set-Up

Firm Revenue

Pástor and Veronesi (2013b) model firm revenue, which for simplicity is fully distributed to investors, as

$$dB^i = (\mu + g_t)dt + \sigma_1 dZ_t + \sigma_2 dZ_t^i, \tag{28}$$

where B^i denotes the book value of the company which is set equal to the market value (hence dB^i gives profit), μ, σ_1 and σ_2 are constants, and Z_t and Z_t^i denote Brownian motions for macroeconomic and idiosyncratic conditions respectively, which affect returns. As these are random processes with $mean(Z_T, Z_t^i) = 0$, average return is given by $(\mu + g_t)dt$. In this set-up, g_t denotes the effect of any government policy on the mean return of company i. If $g_t = 0$, the company is neutral to the policy and stays constant as long as the prevailing policy g^0 is in place. Then at time τ, the government decides to either stick to g^0 or retain it in favor of $g^n \neq g^0$ which permanently shift the mean return $d\pi = dB^i$ of the respective company. However, g_n (that is the effect of any new policy) is unknown to all agents even at $t > \tau$ (i.e. after the policy change), as explained later, which marks the first source of political uncertainty in the model. Intuitively, return changes as opinions about the prevailing policy change (i.e. as dg_n varies).

Investors

Firms are owned by risk averse individuals j whose utility is given by VNM utility functions with constant relative risk aversion (CRRA)[3]. Hence,

$$u_I(W_T^j) = \frac{(W_T^j)^{1-\gamma}}{1-\gamma}, \tag{29}$$

where W_T^j is the individual investors wealth at time T and $\gamma > 1$ is the coefficient of relative risk aversion. Note that the authors do not include time-varying wealth, as T denotes the last point in time in their finite model when stocks pay liquidating dividends, hence for simplicity the model

[3]For a derivation and discussion of CRRA see Eeckhoudt, Gollier, and Schlesinger (2011)

does not allow for intermediate consumption. Further, as γ is not denoted with a subscript t, the model does not allow for time varying risk aversion (as suggested by Cochrane (2009), p. 425).

Government

Government's utility function is remarkably similar to that of investors, however contains a political cost or benefit from a change of policy, which may be seen as popularity, chances of being re-elected or other solely political concerns. It's utility function is the given by

$$u_G(n) = \frac{c^n W_T^{1-\gamma}}{1-\gamma}, \tag{30}$$

where c^n denotes the political cost/benefit associated with policy n and W_T the wealth of the overall economy (note it does not contain a subscript j, hence $W_T = B_T$, which is the summed value of all firms). When choosing a new policy, the government maximizes utility with respect to policy n:

$$\max_{n \in \{0,...,N)\}} \{E_\tau[\frac{c^n W_T^{1-\gamma}}{1-\gamma}|n]\}. \tag{31}$$

As future government policy is uncertain, so are political costs C^n. This is the second source of political uncertainty in the model. As long as agents do not know C^n, they are unable to rightly forecast which policy $n \in \{0, ..., N\}$ the government is going to adapt. Hence, c^n is only revealed at time τ when policy n is enforced. The authors assume that the prior assumptions about political costs are lognormally distributed around a mean of one, hence

$$c^n \equiv log(c^n) \sim N(1, \sigma_c^2). \tag{32}$$

This assumption yields an interesting insight: as $E(c) = 1$, the government maximizes investor's welfare on average, as $u_G = u_I$ in this case. However, it deviates in a purely random fashion. As σ_c increases, magnitude of such deviations rises and leads to elevated levels of political uncertainty (examples are very large reforms such as the Wall Street reform, the fall of the Berlin Wall or the introduction of the Euro). The conception of government as an imperfect social planner affected by corruption, inequality and special interest groups through the single random variable c^n is consistent with political economy literature, as pointed out by the authors (Pástor and Veronesi (2013b), p. 9).

4.1.2 Learning

As pointed out above, uncertainty about policy impact g_n and political costs c_n are the two major sources of political uncertainty in the model. The authors allow agents to learn about both with time.

Policy Impacts

As explained above, g_n as used in equation (28), is unknown to all agents before and after inception at time τ. The authors allow agents to learn about the impact of g^0 (the prevailing policy) for any $t < \tau$, thus the posterior (e.g. after learning) distribution is:

$$g_t \sim N(\widehat{g}_t, \widehat{\sigma}^2_{g,t}) \tag{33}$$

where

$$\widehat{\sigma}^2_{g,t} = \frac{1}{\frac{1}{\sigma_g^2} + \frac{1}{\sigma}t} \equiv \sigma_g \forall (t = 0) \tag{34}$$

which follows from Bayes rule. Intuitively, as t grows, uncertainty about policy impact decreases form its prior distribution (i.e. assumptions) as agents gather more and more information about firm profitability under the current policy. With each information, they adjust $\widehat{g}_t$ accordingly and as t grows precision of their observations increases. Then at point $t = \tau$, agents either continue to learn about g_0 if no new policy is enforced or start to learn about a new policy g_n if a shift occurs.

Political Costs

Political Costs are unknown to agents in the same manner as policy impacts. However, through observation of speeches, conferences and newspaper articles, agents receive signals to update their estimation about political costs of a certain policy *before* the policy is enforced. Any change in signal s_t^n at time t about policy n received can be modelled via:

$$ds_t^n = c^n dt + hdZ^n_{c,t} \tag{35}$$

Changes in signals are then a combination about changes in the real costs of a policy as well as Brownian Shocks $hdZ^n_{c,t}$ with mean $= 0$. These shocks are purely unrelated to the economic shocks Z_t and idiosyncratic shocks Z_t^i presented in (28), they thus represent purely *political* *shocks.* [4]

Allowing for signals, the prior belief given in equation (32) can be updated to its posterior:

$$c^n \sim N(\widehat{c}_t^n, \widehat{\sigma}_{c,t}^2) \tag{36}$$

The posterior distribution of c^n allows for $d\widehat{c}_t^n \neq 0$, making $\widehat{c}_t^n$ the best estimator about c^n at any point in time t. Thus, agents update $\widehat{c}_t^n$ according to ds_t^n as specified in (35). Furthermore, $\widehat{\sigma}_{c,t}^2$) is now time dependent. Just as in equation (34),

$$\widehat{\sigma}_{c,t}^2 = \frac{1}{\frac{1}{\sigma_c^2} + \frac{1}{\sigma}t} \equiv \sigma_c^2 \forall (t = 0) \tag{37}$$

Hence, uncertainty about political costs decreases from it's prior distribution with time t.

4.1.3 Government Policy Choice

Using the CRRA utility functions given above for investors, one can derive the expected utility of any policy n using

$$u(n) = u(W) - \rho u'(W) \tag{38}$$

where

$$\rho = (\frac{\sigma^2}{2}) - \frac{u''(W)}{u'(W)} \tag{39}$$

is the risk premium demanded (Eeckhoudt, Gollier, and Schlesinger (2011)). (Presumably) using this relationship combined with (34), the authors get:

$$E[u_I(n)] = \widehat{\mu}^n = \widehat{g}^n - \frac{\sigma_{g,n}^2}{2}(T - \tau)(\gamma - 1) \tag{40}$$

which can be interpreted intuitively as the expected value for g minus the loss in utility due to its uncertainty.

As shown in equation (30) government utility solely differs from investor's due to political costs c^n. Thus for government utility (again using Equation (38) one gets:

$$u_G(n) = \widehat{\mu}^n - \frac{c^n}{(\gamma - 1)(T - \tau)} = \widehat{\mu^n} - \widehat{c^n} \tag{41}$$

[4] In Pástor and Veronesi (2013a) the authors give an interesting explanation for the little stock market impacts of political uncertainty due to the Trump administration. They argue, that while there are many signals, these have become less precise, increasing the volatility of the Brownian motion in (35) and decreasing the effect of actual learning, modelled via $c^n dt$. Hence, changes in precision may underlie time varying effect of EPU, as modelled by time-varying β below.

It follows that government will only change policy if

$$\widehat{\mu^n} - \widehat{c^n} > \widehat{\mu^0} - \widehat{c^0} \tag{42}$$

and as

$$\widehat{c^0} = 0 \tag{43}$$

it will only change policy when

$$\widehat{g}^0 - \frac{\sigma_{g,0}^2}{2}(T-\tau)(\gamma-1) < (\widehat{\mu^n} - \widehat{c^n}) \tag{44}$$

which can be rewritten as:

$$\widehat{g}^0 < (\widehat{\mu^n} - \widehat{c^n}) + \frac{\sigma_{g,n}^2}{2}(T-\tau)(\gamma-1). \tag{45}$$

The above equation yields interesting insights which are at the heart of the asset pricing implications of the model. It is easy to see now, that a policy is likely to be replaced if $\widehat{g}^0$ is low, hence if estimated economic impact of the current policy is negative or small. As all agents form their believe about g^0 by observing the current state of the economy, recessions should increase investor's focus on c^n as a policy change becomes more likely.

4.1.4 Effect on Stock Prices

The authors argue that economic policy uncertainty affects the set of investment opportunities and is thus a state variable in the sense of Merton (1973). If this were the case, political uncertainty would affect the state price density as given in equation (24). To formulate this theoretically, Pástor and Veronesi (2013b) build a two period model, excluding intermediate consumption. Their approach can be derived by setting the current market price equal to discounted liquidating dividends at time T:

$$M_t^i = \lambda E_t[B_T] = E_t[\frac{m_T}{m_t}]E_t[B_T^i] = E_t[\frac{m_T}{m_t}B_T^i] \tag{46}$$

where λ is the discount factor, M gives the market value, B the Book Value and thus liquidating dividends at time T (given by integrating over $d\pi$ as given in equation (28))[5]. Then the expected ratio of state-price densities gives the stochastic discount factor (Dybvig and Ross (2003).

As agents learn about the impact of the old policy and political costs of new policies, new information affect the state variables which in turn affect the state price density and the stochastic

[5]The last step is possible as $Cov(\frac{m_T}{m_t}, B_T^i) = 0$, see Dybvig and Ross (2003), p. 15

discount factor. Explicitly,

$$\frac{dm_t}{m_t} = F(d\widehat{Z}_t, d\widehat{Z}^n_{c,t}) \tag{47}$$

The explicit function was abbreviated to focus on the two main sources of risk connected to the state price density. Explicitly, they are information about the economy, which affect $\widehat{g}^0$, given by $d\widehat{Z}_t$ and news about political costs of policy n, which affect $\widehat{c}^n$ and are given by $d\widehat{Z}^n_{c,t}$. Both are represented in equation (45). $d\widehat{Z}_t$ and $d\widehat{Z}^n_{c,t}$ are referred to as economic and political shocks respectively.

<u>Economic Shocks</u>

Shocks to economic fundamentals affect stock prices through

$$\frac{dB_t}{B_t} = (\mu + \widehat{g}_t)dt + \sigma d\widehat{Z}_t \tag{48}$$

which follows from (28) but excludes idiosyncratic shocks Z^i_t to focus on the aggregate economy. They also influence the stochastic discount factor through equation (47) (which is the source of the risk premium). The authors further split up economic shocks into capital and impact shocks.

Capital Shocks do not influence learning about policy impact. They are not driven by uncertainty but rather by changed macro-economic conditions (i.e. changes to μ.

Impact Shocks as shown above, revisions the beliefs about the prevailing policy are adjusted according to general economic circumstances, as the effect of any policy cannot be observed in isolation. Therefore $d\widehat{g}_t$ is perfectly correlated to $d\widehat{Z_t}$. The authors then show, that the impact of a change in $d\widehat{g}_t$ on expected discount factor depends on the initial level of $\widehat{g}_t$: impact increases at high levels and decreases at low levels. Intuitively, a prevailing policy with negative or small positive impact (i.e. low levels of $\widehat{g}_t$) is likely to be replaced in the future (see Equation (45)). A shock is then unlikely to prevail for a long time. However, at high levels of $\widehat{g}_t$ shocks are expected to last and thus have a prevailing impact on the economy until point T. In such a case, the price of impact risk is proportional to $T - t$ as this measures the length of the impact period.

<u>Political Shocks</u>

Political Shocks are given by $d\widehat{Z}^n_{c,t}$ reflect learning about the costs of any possible future policy n (remember that the cost of the current policy is always 0). They are independent of economic shocks. Similar to the logic above, shocks to $\widehat{c}_t^n$ are state dependent in their effect. Intuitively, at high levels of $\widehat{g}_t$, the current policy is likely to stay in place and information about possible future policies should have little impact. On the other hand, at low levels of $\widehat{g}_t$ political shocks are becoming increasingly important as current policy is likely to be changed.

Combining both shocks, the authors imply that *capital shocks* have state independent effects, however *impact shocks* and *political shocks* depend on each others level. At low levels of $\widehat{g}_t$, political shocks matter more than impact shocks, however at high levels of $\widehat{g}_t$ impact shocks affect stock prices more than political shocks.

4.1.5 Risk Premium

As shown in equation (47), changes in the discount factor are induced by economic and political shocks. Equation (32) shows, that the risk premium of an asset should depend on its covariance with the stochastic discount factor. As Pástor and Veronesi (2013b) define the discount factor as a function of economic and political shocks, it is clear that assets that covary stronger with those shocks will covary stronger with the discount factor and should hence carry a larger risk premium. To split the covariance, the authors divide the risk premium into the several types of shocks. [6]

$$E(R)^i = RP_{CapitalShocks} + RP_{ImpactShocks} + RP_{PoliticalShocks} \tag{49}$$

The risk premium for capital shocks is state-independent. However, those for capital and impact shocks depend on the state of the world, as explained above. Precisely:

$$RP_{ImpactShocks} \sim (\tau - t) \text{ as } \widehat{g}_t \to -\infty \tag{50}$$

$$RP_{ImpactShocks} \sim (T - t) \text{ as } \widehat{g}_t \to \infty \tag{51}$$

Which follows the preceding logic: For low values of $\widehat{g}_t$, the current policy will only affect the economy until time τ, which is the date of replacement. Hence, the impact and therefore risk premium for impact shocks decreases as $t \to \tau$. On the contrary, for high levels of $\widehat{g}_t$, policy is likely to stay in place until time T and risk premium diminishes as $t \to T$. As $\tau < T$, $RP_{ImpactShocks}$ is smaller at low levels of $\widehat{g}_t$.

[6] The exact decomposition would be beyond the scope of this summary, see Pástor and Veronesi (2013b), p. 19 and the technical annex

Political shocks follow a similar logic. At high levels of $\widehat{g}_t$, policy is unlikely to be replaced and there should be no premium to political shocks.

$$RP_{PoliticalShocks} \sim 0 \text{ as } \widehat{g}_t \to \infty \tag{52}$$

As the value of $\widehat{g}_t$ depends on economic conditions and political uncertainty only relates to political shocks, i.e. updated estimates of $\widehat{c}_t$, the authors conclude that there should be a risk premium on political uncertainty which increases in bad economic times. This is basically a reformulation of equation (25) where $a(X)$ (the sensitivity of future consumption to changes in the state variable X) changes with the economic conditions. Concretely:

$$a(\widehat{Z^n_{c,t}}, \widehat{Z^n_t}) = \alpha + \gamma_{POL} d\widehat{Z^n_{c,t}} + \gamma_{EC} d\widehat{Z^n_t} + \epsilon \tag{53}$$

where

$$\gamma_{POL} = \delta_{0,POL} + \delta_{POL}\widehat{g}_t \tag{54}$$

and

$$\gamma_{EC} = \delta_{0,EC} + \delta_{EC}\widehat{g}_t \tag{55}$$

As a(x) is directly linked to the risk premium through the ICAPM given in equations (26) and (27), a conditional factor model can be derived from the results of Pástor and Veronesi (2013b). Therefore the standard factor model with respect to EPU and economic conditions given by

$$E[R_{t+1}] - R^f_{t+1} \approx \alpha + \beta_{POL}\gamma_{POL} + \beta_{EC}\gamma_{EC} \tag{56}$$

is extended to arrive at

$$E[R_{t+1}] - R^f_{t+1} \approx \alpha + \beta_{POL}[\delta_{0,POL} + \delta_{POL}\widehat{g}_t] + \beta_{EC}[\delta_{0,EC} + \delta_{EC}\widehat{g}_t]. \tag{57}$$

where the risk premium is conditional on the state of the world. It follows from the preceding theory that δ_{POL} is expected to be negative and δ_{EC} is expected to be positive. That is the risk premium to economic policy uncertainty should be higher in bad economic times. The following will first empirically test a static version of this model (i.e. $a(X)$ is constant) and then the conditional model given above.

5 Static Factor Model

5.1 Data and Methodology

5.1.1 The Fama-Macbeth Procedure

Expected return of an asset should be a function of its exposure to factors that covary with expected future consumption. Hence it should be possible to explain variation in the *cross-section* of asset returns using a limited number of systemic risk factors. This paper explicitly tests whether political uncertainty is one of those factors, as motivated by Pástor and Veronesi (2013b). Their conclusions are tested empirically using the Fama-Macbeth procedure. This methodology was first put forth by Fama and MacBeth (1973) and has been widely used since (Cochrane (2009), p. 245). It can be utilized to estimate a multi factor model of the form given in equation (21) and is composed of two sets of regressions: a time-series regression of returns on several risk factors to estimate betas and a cross-sectional regression of the betas obtained on realized future return.

Time-Series Regression

For each asset or portfolio i in the sample, betas to the risk factors under consideration at time t are computed via a linear regression of the form

$$R_{i,t} = \alpha_t + \sum_n \beta_{i,t,n} f_{t,n} + \epsilon \tag{58}$$

where $R_{i,t}$ is the return of asset i at time t, α is some constant (theoretically equal to the risk free rate), $f_{t,n}$ is the realization of factor n at time t and $\beta_{i,t,n}$ is the exposure of asset i to factor n at time t. It is assumed that the exposure β is not a constant but can vary within the period under examination. To get these time-varying exposures, the above regression is computed for each asset using a rolling window. The original methodology uses five years of window length, however, in an attempt to balance robustness and a satisfying remaining sample size, the window was abbreviated to three years. [7] Concretely, β_t is computed by running the above regression over the horizon from $(t-36)$ to t and is a representation of the exposure of an asset to a factor over the past three years.

[7]Fama and French (CoC) show that the time period does barely influence results (p. 167).

Cross-Sectional Regressions

As indicated by the theory above, assets that have higher exposures to systemic risk factors should pay a higher return on average as they covary with the SDF. To test whether the proposed factors are systemic, a second regression is run at each point in time t+1:

$$R_{i,t+1} - R^f_{t+1} = 0 + \sum_n \gamma_{n,t+1}\beta_{i,t,n} + \epsilon \tag{59}$$

where $R_{i,t+1} - R^f_{t+1}$ gives the excess return of asset i in the next month, $\beta_{i,t,n}$ is the exposure from $t - 36$ to t as computed above and $\gamma_{n,t+1}$ is the premium paid for factor n at time $t + 1$. It is crucial to use returns in the next month, i.e. test *out of sample* to get robust results. The above procedure gives one value for gamma (i.e. risk premia) to each factor in each month. As the standard Fama-Macbeth approach does not allow for time-varying risk premia, each value for the risk premium γ is a realization of the process $\gamma_t = \bar{\gamma} + \epsilon_t$. Hence each γ_t is taken from a distribution, which is assumed to be normal. To test whether the real constant premium $\bar{\gamma}$ is statistically different from 0, simple t-test are performed using the sample mean and sample variance. As betas, being the input variables to the cross-sectional regression, are themselves estimated, the *errors in variance* problem applies (Shanken (1992)) and significance should be taken with some caution.

5.1.2 Stock Market Data

In their original paper, Fama and MacBeth (1973) construct portfolios of assets that have a similar level of exposure to the risk factors under consideration, that is they form decile portfolios based on assets betas. This step is compromised here to focus on the more economically intuitive examination of sector returns, following the assumption that stocks within the same sector should have a roughly similar exposure to political and economic risk factors (see Ferson and Harvey (1991)). Therefore the 11 MSCI Sector Indices within three major regions - Emerging Markets (EM), the United States (US) and the European Monetary Union (EMU) - are used as stock market portfolios. The sector returns are obtained via Bloomberg and given with their corresponding tickers in the data sheet in the appendix. Risk Premia are later estimated both globally and within each region.

5.1.3 Risk Factors

This section describes motivation and data for each risk factor used. As this thesis is concerned with premiums on the global scale, it needs to distinguish between global and local variables. Premia should in theory only be paid for *undiversifiable* risk. If capital markets are globally integrated, as often argued in the literature, national or regional risk factors could be diversified in a global portfolio. Hence, only global risks should pay a premium. To account for these thoughts, all risk factor series are included as both, regional and global series.

<u>Political Risk Factor</u>

As outlined above, political uncertainty is measured by the Economic Policy Uncertainty Index (EPU) by Baker, Bloom, and S. Davis (2016). The authors "seek to capture uncertainty about who will make economic policy decisions, what economic policy actions will be undertaken and when they will be enacted, the economic effects of past, present and future policy actions, and uncertainty induced by policy inaction" (Baker, Bloom, and S. Davis (2016), p. 4), which are roughly the dimensions of uncertainty described by Pástor and Veronesi (2013b). The authors measure such uncertainty by examining the number of articles in the major newspapers for each country that address uncertainty with regard to economic policy via an automated text search. This search uses "the words uncertain or uncertainty, economic or economy, as well as the following policy relevant terms: 'policy', 'tax', 'spending', 'regulation', 'central bank', 'budget', and 'deficit'" (Baker, Bloom, and S. Davis (2016), p. 9). Their automated search is validated by comparing its result to a test group of individuals that judge on uncertainty in an article and leads to satisfying results (see the original paper for more details). While newspaper counts seems to be a somewhat arbitrary measure, it makes sense from an investors perspective. What should ultimately matter is not the *real* level of political uncertainty, but rather the *perceived* level. Investors can hardly monitor government officials directly to judge on current political risk. Hence, they base their subjective assessment on news coverage, which gives the best available way to observe what is happening in the political sphere. This line of arguments justifies usage of the EPU index as a factor proxy for political risk.[8]

All EPU Data was obtained from the authors' homepage. There is a global aggregate avail-

[8]Other indices, such as the political risk score of the Economists Intelligence Unit were considered, however disregarded due to their infrequent innovations.

able as well as one for the European Union. The main United States EPU is computed taking forecaster disagreement and scheduled tax code expirations into account. However, to ensure comparability between regions, this thesis only uses the pure newspaper count. Unfortunately there is no aggregate measure for emerging markets available. Country level data is available for China, Brazil, India, South Korea, which represent roughly 60% of the MSCI EM Sector indices. To construct an aggregate for emerging markets, a market capitalization weighted average of the EPU series at each point in time (to capture changes in market capitalization) of these economies was computed and used in the subsequent analysis. As data for India was only available starting in 2003, it was dropped in the time before.

Macroeconomic Risk Factors

Political Uncertainty is highly correlated with economic draw-downs (Baker, Bloom, and S. Davis (2016)). To mitigate the risk of capturing risk premia on economic factors through policy uncertainty as a mediator variable, these are included in the analysis as control variables. Furthermore, they are jointly used as a proxy for Z_t in equation (53), which are innovations on economic state variables. The aggregate beta to the factors could then be interpreted as β_{EC} in equation (57). To be consistent with earlier research, this thesis relies on Chen, Roll, and Ross (1986) (CRR) and uses their factors. The authors employ an elegant discounted cash-flow framework of the form

$$p = \frac{E(c)}{k} \tag{60}$$

where p is the price of an asset, $E(c)$ are expected cash flows and k is the discount rate. Taking the first derivative one gets:

$$R = \frac{dp}{p} + \frac{c}{p} = \frac{d[E(c)]}{E(c)} - \frac{dk}{k} + \frac{c}{p} \tag{61}$$

where R is the return composed of changes in price $\frac{dp}{p}$ and the dividend yield $\frac{c}{p}$ which can be decomposed to changes in expected cash-flows $\frac{d[E(c)]}{E(c)}$ minus changes in the discount rate $\frac{dk}{k}$ plus the dividend yield. This framework is used to identify the following factors which should affect asset returns through changing k and $E(c)$. Any *unanticipated* changes, i.e. innovations in the factors, should then be factors of systematic risk and carry a premium.

1. *Industrial Production*: Changes in industrial production should affect future expected cash-flows in a positive manor (i.e. higher production leads to higher expected cash-flows). CRR

test the month over month and the year over year change, however drop the latter due to insignificance. They argue, that change rates in industrial production are "noisy enough to be treated as an innovation" (Chen, Roll, and Ross (1986), p. 386). The authors find a significant positive risk premium on month over month change of industrial production.

This thesis uses month over month changes for each region and globally. As there was no aggregate measure available for emerging markets, it is computed as a market capitalization weighted average in a similar manner as described for EPU above. The aggregate includes data from China, India, South Korea, Brazil and Russia.

2. *Inflation*: Inflation is split into an unanticipated and an anticipated part. Innovations in both should affect returns of assets through their impact on the discount factor and the nominal level of cash-flows. As both work into opposing directions, the effect is unclear from theory. However, in their empirical research the authors show that both variables carry a *negative* risk premium. This result makes intuitive sense: An asset who's value increases when inflation goes up serves as a hedge, or insurance, against changes in the rate of inflation. As argued above, such assets should pay a lower return.

   Inflation measures for this thesis were obtained through the CPI index for the global level, EMU and US. The aggregate for EM is computed similarly as the measure for industrial production. Expected inflation was then proxied through the average of the last three month's inflation rate. Unexpected inflation is then given by

$$UI_t = I_t - E[I_t|t-1] = I_t - \frac{1}{3}\sum_{a=1}^{3} I_{t-a}. \tag{62}$$

   Where UI_t is unexpected inflation, $E[I_t|t-1]$ is expected inflation at time $t-1$ and I_t is actual inflation at time t. Unexpected inflation is by definition an innovation and is included in its raw form. Concerning expected inflation, changes were used as the input series.

3. *Risk Premia (UPR)*: Changes in the overall level of risk premium are estimated through the yield difference between high yield and treasury bonds. These should affect the discount factor in equation (61). Under the assumption of risk neutrality, expected risk premium is zero, and hence the pure realization can be interpreted as an innovation. Intuitively, URP is a measure of changes in risk aversion. CRR find Positive risk premia for this variable.

   This thesis uses Bloomberg Barclays aggregates for the computation, both globally and for each region. There is an aggregate available for emerging markets.

4. *Term Spread (UTS)*: Term spread is included to capture unexpected return on long bonds. Assuming risk neutrality its expected value is 0, making it an innovation. While UPR measures changes in risk aversion, UTS measures pure term-structure effects. The authors find a significantly negative premium for this variable.

   Again, Bloomberg Barclays Aggregates were used to determine the term spread in this thesis.

5. *Market Index*: Being the most widely agreed on risk factor and one of the theoretical foundations of asset pricing through the CAPM, market return is included as a risk factor. On a regional level the STOXX Europe 600, the S&P 500, the MSCI EM and the MSCI World are used for EMU, US, EM and the world respectively in an effort to capture the market as fully as possible.

All data for the economic factors were obtained through Bloomberg, tickers are given in the appendix.

5.1.4 Summary Statistics

Summary statistics, graphs and the correlation matrix are all given in the appendix. As expected, Economic Policy uncertainty is a counter cyclical variable in all regions, being negatively correlated to industrial production and positively correlated to the risk premium on low-grade bonds, as shown in Table A2. However, correlation measures are small in magnitude, ranging from -0.052 to -0.13 for industrial production and from 0.012 to 0.041 for risk premia on the regional level. Furthermore, correlation between dEPU is high throughout the regions, implying global transition of policy uncertainty (see Sauer (2017) for more details and paths of transition). Policy uncertainty is furthermore a very volatile variable, with standard deviations ranging from about 37 to about 47 on the regional level. Given these volatility, true means and hence expected values can be assumed to be zero.

5.2 Results

5.2.1 Time-Series Regressions

In the first step time series regressions over a rolling subsample of 36 months are calculated. Due to their large difference in variance, all explanatory variables besides market return were scaled by their standard deviation and demeaned. Hence an increase of one can be interpreted as an increase by one standard deviation. A β of one is interpreted as an return increase of one percentage point for the given sector when the explanatory variable increases by one standard deviation. Betas were estimated through the regression given in equation (58). Mean Exposure to the factors was then calculated by averaging over the three year Betas. Following Chen, Roll, and Ross (1986), regressions were performed both including and excluding the market, leading to significantly different sensitivities, as shown in tables A3 and A4.

Table A3 gives average betas when the market index is excluded. All sectors show a large negative β to Economic Policy Uncertainty, as expected from theory. However, exposure differs strongly between sectors and regions, with $\varnothing\beta_{EPU}^{EM} = -1.02$, $\varnothing\beta_{EPU}^{EMU} = -1.28$ and $\varnothing\beta_{EPU}^{USA} = -0.81$. The difference between exposure in the European Monetary Union and the United States may be explained by the differing regulatory and economic systems: While there is few regulation and hence impact of political decision on the Economy in the United States, Economy in the EMU region is highly regulated ind influenced by politics. A somewhat similar pattern can be observed when considering the values given in table A3. The highest exposure is obtained for the finance industry in the EMU, which is both, highly regulated and strongly influenced by the political decisions about the Euro and the future existence of the monetary union. The finance sector in the USA however shows a below average and not significant sensitivity to EPU, which is intuitive as regulation for this industry is far lower in the United States. A similar pattern is observed for most sectors. On average markets show a negative exposure to nearly all factors ($\varnothing\beta_{DEI} = -0.68$, $\varnothing\beta_{IND} = -0.01$, $\varnothing\beta_{URP} = -0.94$) with the only exemptions being Unexpected Inflation ($\varnothing\beta_{URP} = 0.28$) and Term Spread ($\varnothing\beta_{UTS} = 0.25$). These results are somewhat counterintuitive and can only be explained by the consistently positive values for α obtained in the regressions.

Exposure does not only differ through industries but also through time. Figures A7, A8 and A9 show the time paths for β_{EPU} obtained through regressions excluding the market. The average value over all sectors within one region is plotted as a black dot and the blue lines show 90% confidence intervals. Betas seem to vary significantly through time. As explained in the theoretical section, Pástor and Veronesi (2013b) indicate that stocks should react more strongly to political uncertainty in bad economic times. This can clearly be observed in the figures. Within all three regions, there is large negative sensitivity to Economic Policy Uncertainty in the period between 2002 and 2004, which extends until 2006 in the United States, roughly corresponding to the aftermath of the dotcom bubble. Within the boom before the financial crises, there was virtually no sensitivity to EPU in all markets, however, there was a sudden jump, most strongly in EM and EMU, at the beginning of the financial crises. Markets remained very sensitive to political uncertainty until around 2011 in the USA. Exposure in the European Monetary Union decreased slightly, however remained significant through the Euro crises until around 2015. Emerging Markets Beta declined to around zero in 2012 and remained at virtually no sensitivity. Exposure in the United states increased again in recent years following the election of Donald Trump.

Most of these intuitive results vanish when including the market index, as shown in table A4. Many sectors now show a *positive* exposure towards Economic Policy Uncertainty. As the market is itself strongly influenced by EPU [9], it may capture most effects of EPU in the multiple regression, making results harder to interpret.

5.2.2 Cross-Sectional Regression

In the second step, cross sectional regressions of betas on returns of the various sectors are performed for each month in the sample. While the initial procedure requires running regressions and allowing for an intercept, John Cochrane suggest to set the intercept to zero.

> *You can run the cross-sectional regression with or without a constant. The theory says that the constant or zero-beta excess return should be zero. You can impose this restriction or estimate a constant and see if it turns out to be small. The usual trade-off between efficiency (impose the null as much as possible to get efficient estimates) and robustness applies.* (Cochrane (2009), p. 212)

Following this procedure, cross sectional regressions are performed, both including and excluding β_M[10]. They take the form:

$$R^{i,t} = 0 + \gamma^{i,t}_{POL}\beta^{i,t}_{POL} + \gamma^{i,t}_{DEI}\beta^{i,t}_{DEI} + \gamma^{i,t}_{UI}\beta^{i,t}_{UI} + \gamma^{i,t}_{IND}\beta^{i,t}_{IND} + \gamma^{i,t}_{URP}\beta^{i,t}_{URP} + \gamma^{i,t}_{UTS}\beta^{i,t}_{UTS} \quad (63)$$

and

$$R^{i,t} = 0 + \gamma^{i,t}_{M}\beta^{i,t}_{M} + \gamma^{i,t}_{POL}\beta^{i,t}_{POL} + \gamma^{i,t}_{DEI}\beta^{i,t}_{DEI} + \gamma^{i,t}_{UI}\beta^{i,t}_{UI} + \gamma^{i,t}_{IND}\beta^{i,t}_{IND} + \gamma^{i,t}_{URP}\beta^{i,t}_{URP} + \gamma^{i,t}_{UTS}\beta^{i,t}_{UTS} \quad (64)$$

[9] Market Betas are optioned in a similar fashion by regressing the market return on the explanatory factors in all regions and are given by $\beta^{EM}_{EPU} = -1.2$, $\beta^{EMU}_{EPU} = -1.5$ and $\beta^{USA}_{EPU} = -1.02$. All values are significant to the $\alpha = 1\%$ level.

[10] Cross-Sectional Regressions allowing for an intercept were computed as a check on robustness. Results are documented in the appendix.

where $R^{i,t}$ is the return of sector i in month t, $\beta_F^{i,t}$ is the β to the factor F at time calculated through multiple regressions over the preceding 36 month, excluding month t (i.e. over the time-frame $t-37$ to $t-1$).

Local Factors

Table 1: Results from regressions with local explanatory factors

Observations for risk premia were obtained through:

$$R_t = 0 + \gamma_t^M \beta_{t-1}^M + \gamma_t^{POL} \beta_{t-1}^{POL} + \gamma_{t-1}^{DEI} \beta_{t-1}^{DEI} + \gamma_t^{UI} \beta_{t-1}^{UI} + \gamma_t^{IND} \beta_{t-1}^{IND} + \gamma_t^{URP} \beta_{t-1}^{URP} + \gamma_t^{UTS} \beta_{t-1}^{UTS} + \epsilon_t$$

both including and excluding market beta and using β to local risk factors as explanatory variables. The samples include 2145 observations (11 sectors, 195 months) on the local and 6435 observations (33 sectors, 195 months) on the global scale. Values for $\hat{\gamma}$ are the average over the whole sample, sample standard errors are given in parenthesis.

	R_{GL}		R_{EM}		R_{EMU}		R_{US}	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\widehat{\gamma^M}$		0.421		0.678***		0.136		0.413
		(0.301)		(0.334)		(0.365)		(0.301)
$\widehat{\gamma^{POL}}$	−0.164**	−0.284***	−0.042	−0.379**	−0.097	−0.274*	−0.434**	−0.227
	(0.088)	(0.089)	(0.162)	(0.197)	(0.131)	(0.186)	(0.222)	(0.225)
$\widehat{\gamma^{DEI}}$	−0.096*	−0.062	−0.004	−0.091	−0.291	−0.350	0.346	0.640**
	(0.063)	(0.057)	(0.135)	(0.146)	(0.282)	(0.308)	(0.244)	(0.361)
$\widehat{\gamma^{UI}}$	−0.085	−0.055	0.035	−0.040	−0.346	−0.341	0.403*	0.710**
	(0.077)	(0.065)	(0.157)	(0.165)	(0.294)	(0.322)	(0.275)	(0.391)
$\widehat{\gamma^{IND}}$	0.055	−0.086	0.637***	1.037***	0.185	0.043	−0.087	−0.075
	(0.134)	(0.095)	(0.272)	(0.257)	(0.209)	(0.220)	(0.216)	(0.222)
$\widehat{\gamma^{URP}}$	0.054	0.026	−0.124	0.153	0.150	0.138	0.056	−0.074
	(0.043)	(0.039)	(0.130)	(0.191)	(0.247)	(0.237)	(0.160)	(0.214)
$\widehat{\gamma^{UTS}}$	0.038	−0.087**	−0.230*	−0.157	−0.244*	−0.244	0.072	0.206
	(0.053)	(0.052)	(0.157)	(0.199)	(0.160)	(0.199)	(0.149)	(0.166)
Obs.	6,435	6,435	2,145	2,145	2,145	2,145	2,145	2,145
R^2	0.571	0.590	0.729	0.749	0.663	0.690	0.666	0.690

Note: *p<0.15; **p<0.1; ***p<0.05

Results using local factors over the 195 months remaining in the sample after calculating βs are summarized in table 1 above, standard errors are given in parenthesis. Models (1) and (2) use returns for all global sectors, resulting in 195*33 = 6435 observations. Models (3) to (8) only use returns for one specific region, resulting in 195*11 = 2145 observations. For each region, results are given when β_M is excluded and when it is included. On a global scale, exposure to political uncertainty carries a significant risk premium in both specifications, even increasing in magnitude when including β_M as a explanatory variable. Changes in expected inflation carry a significant negative premium when the market is excluded and the term spread carries a significant negative premium when the market is included. Market risk premium itself is not significant. Within the different regions, there is a significant negative premium on political uncertainty in EM and the EMU in models that include B_M. The largest premium in absolute terms is optained for the US, however vanishes in the second specification given in model (8). In EM there are additional significant premiums for β_M, β_{IND} (both specifications) and β_{UTS} (only in model (3)). In the EMU β_{UTS} carries a negative premium when β_M is excluded. In the US there are significant positive premia on both inflation variables when β_M is included. R^2 for the models are fairly high both, when β_M is excluded (0.571 - 0.729) and included (0.59 - 0.749), which is consistent with the results of other authors.

To make sense of these results it is important to consider why a negative risk premium on EPU could be justified. Economic Policy Uncertainty rises when times are *"bad"*. Any asset that has a positive β to EPU rises in value when overall risk rises, it hence serves as a hedge. As outlined in the theoretical section above, assets that act as an insurance should pay lower return on average. On the other hand, assets that have a negative β to EPU loose value when Policy Uncertainty rises. They pay off badly when times are bad (or expected risk is high), they should thus pay a positive premium to compensate for the risk. Consequently, the negative risk premium to EPU in all regions and specifications is in line with theory as it indicates that sectors with a low or even positive exposure to EPU pay off worse on average. Conversely, holding sectors that are strongly adversely affected by EPU (i.e. that have a large negative β) is rewarded by a positive premium. The same line of arguments hold for the large negative γs to inflation variables, as assets that rise in value when inflation rises can be interpreted as an insurance. While many macroeconomic premia are not significant, their sign is roughly in line with the findings of Chen, Roll, and Ross (1986). One can conclude, that local EPU carries a significant risk premium in excess of premia to the market and macroeconomic variables.

Global Factors

Table 2: Results from regressions with global explanatory variables

Observations for risk premia were obtained through:

$$R_t = 0 + \gamma_t^M \beta_{t-1}^M + \gamma_t^{POL} \beta_{t-1}^{POL} + \gamma_{t-1}^{DEI} \beta_{t-1}^{DEI} + \gamma_t^{UI} \beta_{t-1}^{UI} + \gamma_t^{IND} \beta_{t-1}^{IND} + \gamma_t^{URP} \beta_{t-1}^{URP} + \gamma_t^{UTS} \beta_{t-1}^{UTS} + \epsilon_t$$

both including and excluding market beta and using β to global risk factors as explanatory variables. The samples include 2145 observations (11 sectors, 195 months) on the local and 6435 observations (33 sectors, 195 months) on the global scale. Values for $\hat{\gamma}$ are the average over the whole sample, sample standard errors are given in parenthesis.

	R_{GL}		R_{EM}		R_{EMU}		R_{US}	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
β_M		−0.435		0.122		1.905*		−1.007
		(0.536)		(1.373)		(1.210)		(0.896)
β_{POL}	−0.150*	−0.175**	−0.169	−0.178	−0.192*	−0.172	−0.182	−0.158
	(0.096)	(0.092)	(0.154)	(0.164)	(0.132)	(0.159)	(0.153)	(0.185)
β_{DEI}	0.001	0.166	0.046	0.169	−0.344	−0.227	0.038	−0.006
	(0.131)	(0.137)	(0.214)	(0.246)	(0.333)	(0.416)	(0.206)	(0.228)
β_{UI}	0.009	0.174	−0.034	0.075	−0.176	−0.049	0.059	0.044
	(0.133)	(0.138)	(0.208)	(0.238)	(0.324)	(0.413)	(0.216)	(0.238)
β_{IND}	−0.047	−0.049	0.134	0.263	0.242	0.172	−0.071	−0.013
	(0.114)	(0.118)	(0.291)	(0.312)	(0.232)	(0.281)	(0.189)	(0.196)
β_{URP}	−0.108	−0.099	−0.237*	−0.356***	0.146	−0.071	−0.089	−0.010
	(0.090)	(0.096)	(0.158)	(0.181)	(0.204)	(0.246)	(0.137)	(0.191)
β_{UTS}	0.149***	0.150***	−0.235**	−0.394***	0.132	0.049	0.115	0.086
	(0.066)	(0.066)	(0.123)	(0.144)	(0.115)	(0.135)	(0.145)	(0.173)
Observations	6,435	6,435	2,145	2,145	2,145	2,145	2,145	2,145
R^2	0.634	0.645	0.754	0.765	0.662	0.642	0.628	0.626

Note: *p<0.15; **p<0.1; ***p<0.05

As discussed above, local risk should be diversifiable globally in integrated financial markets and hence not correlate with the SDF of an investor that holds a well diversified portfolio. Motivated by these arguments, a second sequence of regressions is performed using βs obtained through multiple regressions on global risk factors as explanatory variables. Results are given in table A5. Risk Premium to EPU decreases both in absolute magnitude and in significance for all regions. Furthermore, market risk premium becomes negative (however insignificant) for the global and US panel. It seems like the overall level of significance declined sharply, with premia becoming less in line with theory and smaller in magnitude. While there are premia to EPU in this specification, these might simply be caused by the large correlation between global and local EPU (see table A2 in the appendix). Due to this evidence, the hypothesis that only global EPU should carry a premium is declined. In general, investors seem to be rewarded with premia to local risk factors. This result is consistent with Cochrane's theory, if individuals invest by majority locally. Obviously, expected future consumption in some region and hence the SDF of investors should react to local, not global news. It seems very unlikely, that expected salary, job loss and other consumption related variables are stronger affected by global variables than local ones.

6 Conditional Model

This section will expand the previous results to empirically test the conditional factor model given in equation (57). Pástor and Veronesi (2013b) argue, that risk premia to EPU should be dependent on the state of the economy. Their argument is twofold: Sensitivity to policy uncertainty should be higher in bad times as it is more likely for governments to change policy which affects expected returns of companies - β_{EPU} should therefore be higher. Furthermore, economic policy uncertainty shifts the state price density in bad times, as a policy change by the government becomes more likely. Hence, even at given levels of β_{EPU} the risk premium γ_{EPU} should rise in bad times.

The following will first define what "bad times" actually mean and construct four different regimes based on economic news and monetary policy. Levels of βs and γs will then be analyzed within these different regimes following a similar methodology as given above.

6.1 Economic Regimes

Economic news are an intuitive indicator of "good and bad times" that should affect risk premia in theory. Furthermore, it is likely that premia are affected by monetary policy (B. Bernanke (2013)). In constructing economic regimes that affect stock returns, the methodology of Gupta et al. (2014) is applied. The authors construct four regimes, combining real economic and monetary variables. The original paper uses OECD Composite Leading Indicators as a proxy for the real economy and CPI as a measure for the monetary situation. As inflation risk is already captured by the baseline model of this thesis, CPI should not be used as a monetary indicator to avoid tautological results. The main focus of this research is on the premium for political risk, it thus seems natural to use monetary policy as the defining variable for the monetary regime. While monetary policy can be directly observed, what should actually matter for markets are expectations about future policy. These expectations can be measured through the market implied policy rate, obtained from forward contracts spanning 6 month into the future. If these are higher than current policy rates, markets expect tightening and if they are lower markets expect easing. As expectations about the future, not the current state of the world affects asset prices, risk premia should adjust according to these expectations.

Among several proxies that were considered for the economic regimes (f.e. unemployment rate, GDP growth and Composite Leading Indicators), the Now-Casting index initially developed by Giannone, Reichlin, and Small (2008) was chosen. It is superior to the alternatives as it serves as an aggregate of all information available that indicate the current state of the economy in one index. This index gives an estimate about *current quarter* GDP as "within each quarter, the contemporaneous value of GDP growth is not available, but can be estimated using higher-frequency variables that are published in a more timely manner" (Giannone, Reichlin, and Small (2008)). As the index and all input variables are observable to market participants, it gives a good proxy for the current *perceived* state of the economy As shown above, *perceived*, not *real* values should shift the state price density.

Table 3: Regimes

Construction of Regimes Ec as a combination of the economic regime (E) and the monetary regime (M). Frequency of occurrence is given for each regime in each region.

E \ M	Market Implied Rate $\geqslant$ Current Rate	Market Implied Rate $<$ Current Rate
Now-Casting $\geqslant$ 100	Positive Easing (P/E) EM: 52 EMU: 67 US: 29	Positive Tightening (P/T) EM: 62 EMU: 64 US: 104
Now-Casting $<$ 100	Negative Easing (N/E) EM: 112 EMU: 84 US: 44	Negative Tightening (N/T) EM: 5 EMU: 16 US: 54

A negative economic regime is defined by a slower than long-term average growth rate (a Now-Casting value below 100) and a positive regime as a higher than average growth (a value of above 100). All data was obtianed through Bloomberg, tickers are given in the general data sheet in the appendix. Table 3 shows construction of the regimes and frequency within each region. One can clearly see, that the monetary policy was overwhelmingly easing when the economic growth was below long term average (Now-Casting < 100) in EM and EMU. There is no such clear result for times when growth was above long term average (Now-Casting $\geqslant 100$) and for the United States.

6.2 Time varying Beta

Pástor and Veronesi (2013b) conclude, that Economic Policy Uncertainty should affect stock prices in bad economic times. To see if their result holds, βs to EPU are compared within the four regimes. The estimates were obtained through an in sample test by regressing stock returns on the explanatory macroeconomic variables (excluding market) within the specific regime. Results are reported in table 4, all values besides EMU positive/tightening are statistically significant to the $\alpha = 10\%$ level.

Table 4: Full Sample Beta to EPU

Average values for sectoral β^{EPU} computed in sample within the prevailing economic regime correcting for the CRR factors and excluding the market. All values are significant to the $\alpha = 10\%$ level.

		M = T	M = E
Global	E = P	-0.32	-0.81
	E = N	-1.21	-1.51
EM	E = P	-0.88	-1.42
	E = N	NA	-0.90
EMU	E = P	0.02	-0.74
	E = N	-1.86	-2.27
USA	E = P	-0.19	0.11
	E = N	-1.01	-1.61

The results confirm the model of Pástor and Veronesi (2013b). Globally and within EMU and USA, average sensitivity is by far larger in negative economic regimes than in positive regimes. Within emerging markets, the negative/tightening regime cannot be estimated, as there are only five observations of this regime, while there are six explanatory variables. The positive/easing regime within EM shows a slightly larger sensitivity than the negative/easing segment, differing from the relationship found across other regions. Within all regions, there is evidence that stocks are more sensitive to EPU in easing than in tightening regimes. This could be explained by the regime switching fear implied by EPU. Monetary policy is set by the interaction of governments and central banks and the EPU Index includes uncertainty about such monetary policy in its measurement. [11] In easing regimes, market participants expect central banks to maintain or lower interest rates. Economic policy uncertainty however may imply, that these expectations are less robust and that a switch towards tightening has to be feared. The monetary part of EPU should then increase the overall negative effect of EPU on stock returns. Contrary in tightening regimes economic policy uncertainty may imply a switch towards towards easing. Then the monetary part of EPU would contribute positively to stock returns, lessening its overall negative effect. Hence, in easing regimes EPU might imply a *regime-switching-fear*. Another explanation could be the especially large effect of economic conditions on monetary policy in the sample period. Much of this time was dominated by *quantitative easing*, which was a tool to stimulate the economy after the financial crises.[12] In any case the significantly different values for β_{EPU} justify the use of the four regimes defined above.

6.3 Time varying Risk Premia

It has been shown above that the effect of EPU differs strongly throughout the four regimes defined. As uncertainty about government policy seems to be a stronger factor in bad than in good times and in easing than in tightening regimes, one would expect risk premia to differ accordingly, as EPU covaries more strongly with asset returns and shifts the state price density. To test this a conditional factor model is applied to the data.

6.3.1 Conditional Factor Models

The methodology used below follows Ferson and Harvey (1991). Among others they pioneered the approach of dynamic factor models. They propose a conditional version of the multi-factor model which incorporates time-variation in the risk premium. This is consistent with the ICAPM as some variables may only shift the set of investment opportunities in certain states of the world and may be neutral in others, which is what Pástor and Veronesi (2013b) express in their theory. The model then is

$$E[R_i|Z_{t-1}] = \gamma_0(Z_{t-1}) + \sum_{f=1}^{n} \beta_{t-1}^{i,f} \gamma^f(Z_{t-1}) \tag{65}$$

[11] see Baker, Bloom, and S. Davis (2016) where 'central bank' is included in the keywords

[12] Consideration about *regime-switching-fear* are empirically tested for risk premia in table A8 in the appendix, however cannot be confirmed.

where the expected return at any point is conditioned on information Z available at $t-1$. With $\gamma_0(Z_{t-1}) = R_f$, the conditional expected excess return depends on variation in β as well as variation in the risk premium through

$$E[R_i - R_f|Z_{t-1}] = \sum_{f=1}^{n} \beta_{t-1}^{i,f} \gamma^f(Z_{t-1}) \tag{66}$$

where the risk premium $\gamma^f(Z_{t-1})$ is dependent on the available information at $t-1$. The authors then impose a linear relationship between the risk premium and state variables:

$$\gamma_{f,t}(Z_{t-1}) = \delta_0 + \delta_f Z_{t-1} \tag{67}$$

Plugging the linear relation one gets

$$E[R_i - R_f|Z_{t-1}] = \sum_{f=1}^{n} \beta_{t-1}^{i,f}(\delta_0 + \delta_f Z_{t-1}) \tag{68}$$

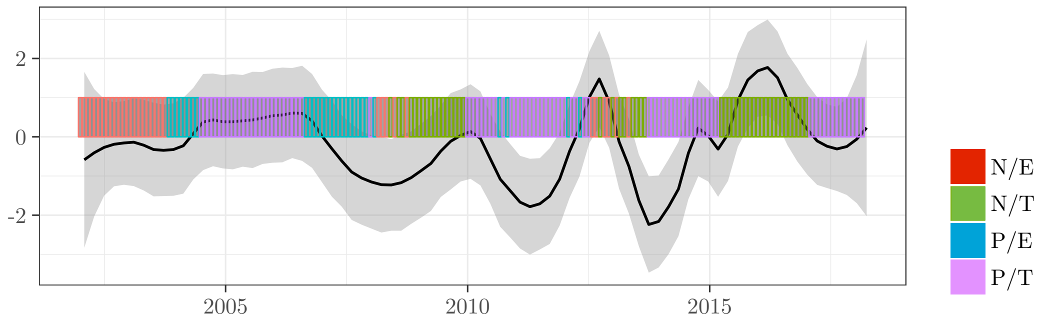
which is similar to equation (57) derived in the theoretical section. The risk premium is thus split into a constant part δ_0 and a part that varies with some variable Z_{t-1}. Using the regime approach given above, the following section will evaluate whether the risk premium to political uncertainty is dependent on the prevailing economic regime known to the investor at $t-1$.

To do so, time series of risk premia are obtained through the Fama-Macbeth approach presented above. The time series of premia is then used as the dependent variable in a regression using the regimes as regressors. As the list of regimes is exhaustive, there is no intercept in the regressions. Using β_{t-1} in the cross sectional regression, the time series of risk premia could intuitively be interpreted as the excess return to an investor who does his best effort to form a mimicking portfolio using information from rolling regressions over the past three years. While the expected return of such a portfolio is given by $E[R_t] = \gamma_t$ the realized return is given by $R_t = \gamma_t + \epsilon_t$. Hence, it is hard to know whether actual variation in the risk premium is observed or just random variance in the residual. While the average residual over the whole sample has to be 0 by definition, this is not necessarily true for each subsample studied here. Even though these concerns apply, Adrian, Crump, and Moench (2015) argue, that the Harvey-Ferson methodology offers satisfying results.

6.3.2 Descriptive Results

Figure 1 shows the risk premium to EPU for the United States.

Figure 1: Risk Premium US



As the original series is very volatile, it was smoothened through conditional means using 20% of available observations [13], 85% confidence intervals are shown in grey and economic regime in the previous month is visualized through the coloured bar. For the United States, one can clearly see, that the risk premium turns significant three times: During the financial crises (accompanied by a negative economic regime), during the Euro Crises in 2011 (with no economic change in regime) and - most pronounced - in 2013 amid fears about US government shutdown (with a short change towards negative economic outlook). Furthermore, there is a notable however insignificant reaction to the inauguration of Donald Trump in 2017, possibly cushioned by the very positive economic situation.

Figure 2: Risk Premium EMU

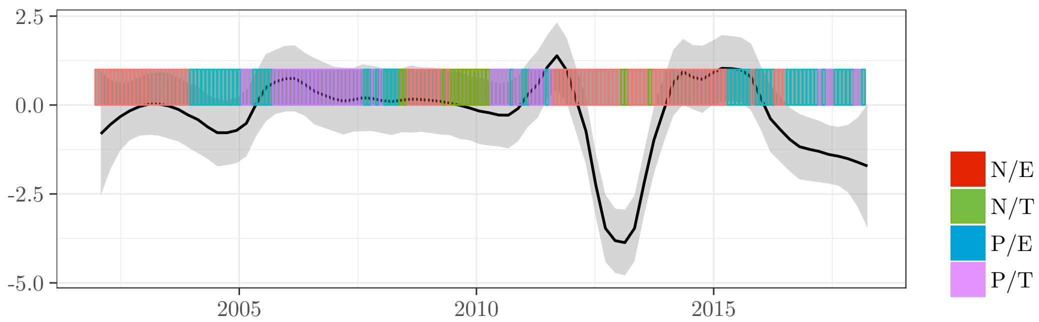
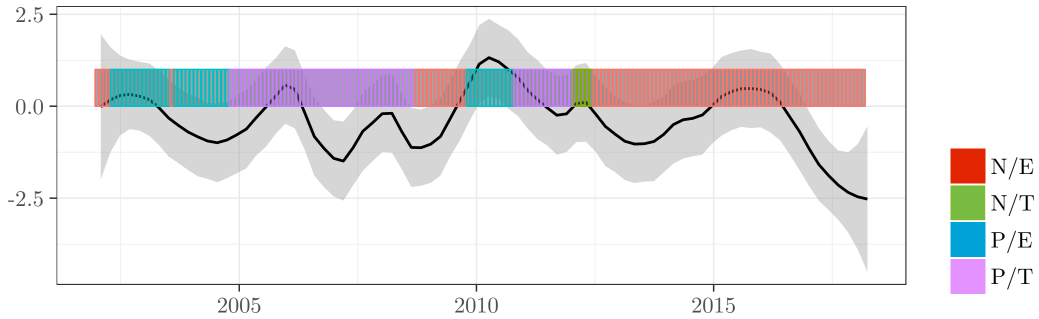


Figure 2 plots the same for the European Monetary Union. Risk Premia in this region barely reacted to the financial crises. They show a huge and significant reaction to the European Debt

[13]This smoothing method relies on local regressions. This means OSL regressions are run on each subset and the smoothed values are the estimate of such regressions.

Crises in 2012/2013, which was accompanied by a negative economic regime while the central bank was still pursuing ultra-loose monetary policy. Interestingly, risk premia have been rising in recent years, probably as a consequence of the migration crises, populist movements and rising fear of a breaking union, which were pushed by the Brexit decision. None of these were accompanied by negative economic or monetary regimes.

Figure 3: Risk Premium EM



Finally, figure 3 plots the behaviour for emerging markets. There were significant premia right before the financial crises, which cannot be explained by economic regimes. However, during the crises and since 2013, the composite emerging market regime is negative/easing and accompanied by steady risk premia on EPU. These got more pronounced amid the election of Donald Trump, which seems to have influenced systemic risk all over the world *but* the United States of America itself.

The plots clearly show, that times of high political uncertainty were accompanied by high premia. There also seems to be some evidence towards a higher effect of EPU in bad economic times. These insights are tested using OLS regressions on the time-series of risk premia in the next section.

6.3.3 Regression Results

Results of regressions of risk premia on economic regimes and the level of economic policy uncertainty on a global scale (i.e. across all three regions) are shown in table 5. Each regression includes risk premia from January 2002 to March 2018, i.e. 195 observations per region. These are combined to receive a total sample of $3 * 195 = 585$ observations. Several multiple regressions are performed. Models (1) to (3) take factor variables for the economic, monetary and combined regime within the respective region in the previous month as the sole explanatory variable. There is clear evidence that risk premia turn significant and are higher in magnitude for times where

Table 5: Regression of risk premia on instrumental variables

Model forecasts time-varying risk premia with information about the economic regime E, Monetary Regime M and combined regime Ec as well as level of EPU available in the previous month. Individual values for δ are obtained through $\gamma_t^{EPU} = \delta_t^R R_{t-1} + \epsilon_t$ and $\gamma_t^{EPU} = \delta_t^{Ec:P}(Ec^*_{t-1} EPU_{t-1}) + \epsilon_t$ where R is the respective regime. As each point in the sample is attributed to a regime, there is no intercept. The sample consists of 585 observations (3 γ for each month in 195 months).

	(1)	(2)	(3)	(4)	(5)
$\delta^{Ec} \| E = N$	−0.409***				
	(0.174)				
$\delta^{Ec} \| E = P$	−0.197				
	(0.159)				
$\delta^{Ec} \| M = E$		−0.404***			
		(0.157)			
$\delta^{Ec} \| M = T$		−0.156			
		(0.175)			
$\delta^{Ec} \| Ec = N/E$			−0.581***		
			(0.201)		
$\delta^{Ec} \| Ec = N/T$			0.092		
			(0.344)		
$\delta^{Ec} \| Ec = P/E$			−0.123		
			(0.253)		
$\delta^{Ec} \| Ec = P/T$			−0.244		
			(0.204)		
δ^{EPU}				−0.003***	
				(0.001)	
$\delta^{EPU:Ec} \| Ec = N/E$					−0.003***
					(0.001)
$\delta^{EPU:Ec} \| Ec = N/T$					0.001
					(0.002)
$\delta^{EPU:Ec} \| Ec = P/E$					−0.001
					(0.002)
$\delta^{EPU:Ec} \| Ec = P/T$					−0.004***
					(0.002)
Obs.	585	585	585	585	585
R^2 ‖ $Adj.R^2$	0.012 ‖0.008	0.013 ‖0.009	0.017 ‖0.01	0.021 ‖0.019	0.027 ‖0.021

Note: *p<0.15; **p<0.1; ***p<0.05

economic sentiment is negative and the market participants expect further easing.[14] R^2 is 1.2% and 1.3% for the models using only one regime and increases to 1.7% for the combined model. Even though these numbers are low, there seems to be some predictability in risk premia and hence stock market return.

Models (4) and (5) take the level of EPU as a second explanatory variable. As shown in the descriptive statistics, risk premia seem to react to major events that induce heightened levels of uncertainty. While the input time series to the original model and Fama-Macbeth regression was the change in EPU and risk premia refer to the reaction of markets to such change, the input variable used here is the *level* of EPU. The effect is significantly negative as shown in (4), which indicates that risk premium paid on sensitivity to changes in political uncertainty is higher in absolute terms when the current level of EPU is high, as was the case during the major political crises outlined above. Intuitively, when there is a lot of political uncertainty, the price for an insurance against such increases. Model (5) then shows, that this effect is most significant in times of negative economic and easing monetary regime. There is also a significant interaction effect for positive/tightening regimes which is somewhat counterintuitive to theory. This effect might be spurious, as the Euro-Crises and the Government shutdown, which were the two major effects driving risk premia in the United States, randomly fell into such regimes. This view is supported as the interaction with P/T is only significant in the United States (see table A7 in the appendix). R^2 is nearly doubling from the first to the last model, reaching 2.7%. However, as values for adjusted R^2 are barely increasing, this result is to be taken with caution. Even though there is small explanatory power of the test, there seems to be evidence towards some out of sample predictability (see Ferson and Harvey (1991)).

Concluding, there seems to be evidence that risk premia rise in negative economic times, even more pronounced when the market participants expect the central bank to further ease interest rates and when there is a lot of political uncertainty in the market. These results confirm the conclusions of Pástor and Veronesi (2013b).

[14]Higher risk premia in times when market participants expect easing may be due to the regime switching fear, as shortly discussed above. This hypothesis is tested in table A8 in the appendix. The model specification uses the level of central bank target rates as an additional explanatory variable, following the intuition that regime switching fear should be stronger as interest rates approach the zero lower bound. This simple methodology however finds no evidence to support the hypothesis.

7 Conclusion

This paper explored the existence and behaviour of risk premia to Economic Policy Uncertainty as measure by Baker, Bloom, and S. Davis (2016). The theoretical part first focused on asset pricing theory to derive the ICAPM and then presented the model of Pástor and Veronesi (2012) to argue that EPU should be a factor that shift the state price density in bad economic times.

These conclusions were tested in a static and a dynamic model. Estimation on the static model used the Fama-Macbeth regressions and found, that exposure to regional EPU pays a significant premium in global equity markets. Exposure to global EPU however does not carry a premium.

A dynamic factor model examined time-series predictability of the risk premium. Following the theoretical discussion, regimes were defined using monetary and economic input series and used to forecast risk premia on economic policy uncertainty. There is strong evidence that risk premia increase in negative economic times when central banks are expected to ease policy and the overall level of Economic Policy Uncertainty is high. These results clearly support the theoretical model of Pástor and Veronesi (2013b).

Further research should take the presented methodology to a longer horizon and examine robustness of the results in different settings. Furthermore, literature is lacking a theoretical framework that links central bank policy to risk premia despite their significant influence. Another branch of research could examine the stock market reaction to major political events in a quasi-event study setting and examine whether these are forecastable. If so, efforts to built a "policy-sensitive" investment strategy may be fruitful.

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8 Appendix

Table A1: Data

Variable	Source	Ticker
MSCI EM Materials Sector Local a	Bloomberg	MSFLMAT Index
MSCI EM Energy Sector Local a	Bloomberg	MSFLENR Index
MSCI EM Consumer Discretionary Local	Bloomberg	MSFLCDIS Index
MSCI EM Industrials Local	Bloomberg	MSFLIND Index
MSCI EM Consumer Staples Local	Bloomberg	MSFLCSTA Index
MSCI EM Health Care Local	Bloomberg	MSFLHC Index
MSCI EM Financials Local	Bloomberg	MSFLFNCL Index
MSCI EM Information Technology Local	Bloomberg	MSFLIT Index
MSCI EM Telecommunication Services Sector Local a	Bloomberg	MSFLTEL Index
MSCI EM Utilities Sector Local a	Bloomberg	MSFLUTI Index
MSCI EM Real Estate Local	Bloomberg	MSFLRE Index
MSCI EM Local	Bloomberg	MSELEGF Index
MSCI EM Local	Bloomberg	MSELEGF Index
China CPI YoY	Bloomberg	CNCPIYOY Index
India CPI Industrial Workers YoY	Bloomberg	INCPIINY Index
South Korea CPI YoY	Bloomberg	KOCPIYOY Index
Brazil CPI IPCA YoY	Bloomberg	BZPIIPCY Index
Russia CPI YoY	Bloomberg	RUCPIYOY Index
China Value Added of Industry YoY	Bloomberg	CHVAIOY Index
India Industrial Production YoY	Bloomberg	CHVAIOY Index
South Korea IP-Mining/Manufacturing/Electricity&Gas NSA YoY	Bloomberg	KOIPIY Index
Brazil Industrial Production NSA YoY	Bloomberg	BZIPYOY% Index
Russia Industrial Production 2010=100 YoY	Bloomberg	RUIPRNYY Index
Emerging Markets Investment Grade TR Index Value Unhedged USD	Bloomberg	BEHGTRUU Index
EM USD Aggregate 1-5 Year Total Return Index Unhedged USD	Bloomberg	BEM5TRUU Index
Emerging Markets High Yield Total Return Index Value Unhedged	Bloomberg	BEBGTRUU Index
China Market Cap USD	Bloomberg	WCAUCHIN Index
India Exchange Market Capitalization USD	Bloomberg	WCAUINDI Index
South Korea Exchange Market Capitalization USD	Bloomberg	WCAUSK Index
Brazil Exchange Market Capitalization USD	Bloomberg	WCAUBRAZ Index
Russia Exchange Market Capitalization USD	Bloomberg	WCAURUSS Index
South Africa Exchange Market Capitalization USD	Bloomberg	WCAUSAF Index
Mexico Exchange Market Capitalization USD	Bloomberg	WCAUMEX Index
EPU China	policyuncertainty.com	
EPU Brazil	policyuncertainty.com	
EPU South Korea	policyuncertainty.com	
EPU India	policyuncertainty.com	
China Now-Casting Index	Bloomberg	NCIXCN Index
South Africa Now-Casting Index	Bloomberg	NCIXZA Index
South Korea Now-Casting Index	Bloomberg	NCIXKO Index
Brazil Now-Casting Index	Bloomberg	NCIXBZ Index
Russia Now-Casting Index	Bloomberg	NCIXRU Index
Mexico Now-Casting Index	Bloomberg	NCIXMX Index
China 1 Year Benchmark Lending Rates	Bloomberg	CHLR12M Index
MSCI EMU Energy Sector Local	Bloomberg	MSULENR Index
MSCI EMU Materials Sector Local	Bloomberg	MSULMAT Index
MSCI EMU Industrial Local	Bloomberg	MSULIND Index
MSCI EMU Consumer Discretionary Local	Bloomberg	MSULCDIS Index
MSCI EMU Consumer Staples Local	Bloomberg	MSULCSTA Index
MSCI EMU Health Care Local	Bloomberg	MSULHC Index
MSCI EMU Financials Local	Bloomberg	MSULFNCL Index
MSCI EMU Information Technology Local	Bloomberg	MSULIT Index
MSCI EMU Telecommunications Services Sector Local	Bloomberg	MSULTEL Index
MSCI EMU Utilities Sector Local	Bloomberg	MSULUTI Index
MSCI EMU Real Estate Local	Bloomberg	MSULRE Index
MSCI EMU Local	Bloomberg	MSDLEMU Index
STOXX Europe 600 Price Index EUR	Bloomberg	SXXP Index
Euro Area MUICP All Items YoY NSA	Bloomberg	ECCPEMUY Index
Eurostat Industrial Production Industry Ex Construction YoY	Bloomberg	EUIPEMUY Index
EuroAgg Corporate 10+ Year TR Index Value Unhedged	Bloomberg	LEC0TREU Index
EuroAgg Corporate 1-3 Year TR Index Value Unhedged	Bloomberg	LEC1TREU Index
Pan-European High Yield Total Return Index Value U	Bloomberg	LP01TREU Index
Pan-European Aggregate Treasury TR Index Value Unhedged EUR	Bloomberg	LP12TREU Index
Euro Area Now-Casting Index	Bloomberg	NCIXEA Index
EUR Fwd Cash	Bloomberg	S0133FC 6M1D BCAL Curncy

ECB Deposit Facility Announcement Rate	Bloomberg	EUORDEPO Index
EPU Europe	policyuncertainty.com	
MSCI USA Energy Index	Bloomberg	MXUS0EN Index
MSCI USA Materials Index	Bloomberg	MXUS0MT Index
MSCI USA Industrials Index	Bloomberg	MXUS0IN Index
MSCI USA Consumer Discretionary Index	Bloomberg	MXUS0CD Index
MSCI USA Consumer Staples Index	Bloomberg	MXUS0CS Index
MSCI USA Health Care Index	Bloomberg	MXUS0HC Index
MSCI USA Financials Index	Bloomberg	MXUS0FN Index
MSCI USA Information Technology Index	Bloomberg	MXUS0IT Index
MSCI USA Telecom Service Index	Bloomberg	MXUS0TC Index
MSCI USA Utilities Index	Bloomberg	MXUS0UT Index
MSCI US Real Estate Index GICS Level 2	Bloomberg	MXUS0UT Index MXUS0RE Index
MSCI USA Price Return USD Index	Bloomberg	MXUS Index
S&P 500 Index	Bloomberg	SXP Index
US CPI Urban Consumers YoY NSA	Bloomberg	CPI YOY Index
US Industrial Production YOY SA	Bloomberg	IP YOY Index
US Corporate High Yield Total Return Index Value Unhedged USD	Bloomberg	LF98TRUU Index
US Treasury Bills Total Return Index Value Unhedge	Bloomberg	LD20TRUU Index
US Agg 10+ Year Total Return Value Unhedged USD	Bloomberg	LU10TRUU Index
US Agg 1-3 Year Total Return Value Unhedged USD	Bloomberg	LU13TRUU Index
US Now-Casting Index	Bloomberg	NCIXUS Index
USD Fwd Cash	Bloomberg	S0042FC 6M1D BCAL Curncy
Federal Funds Target Rate Mid Point of Range	Bloomberg	FDTRMID Index
EPU USA	policyuncertainty.com	
MSCI World Index	Bloomberg	MXWO Index
IMF World CPI % Change	Bloomberg	WBIPSWLD Index
Industrial Production World SA	Bloomberg	WBIPSWLD Index
Global Agg 1-3 Year Total Return Index Value Unhedged USD	Bloomberg	LG13TRUU Index
Global Agg 10+ Year Total Return Index Value Unhedged USD	Bloomberg	LG10TRUU Index
EPU World	policyuncertainty.com	

Figure A1: Term Spread

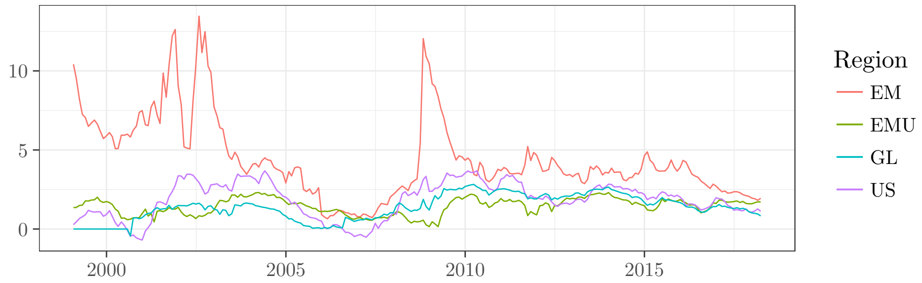

Figure A2: Risk Premium

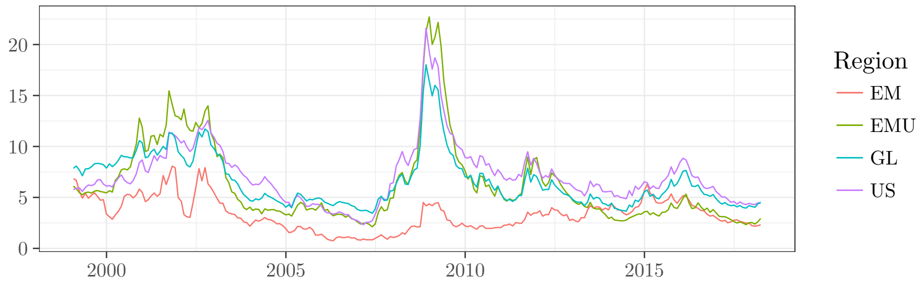

Figure A3: Industrial Production

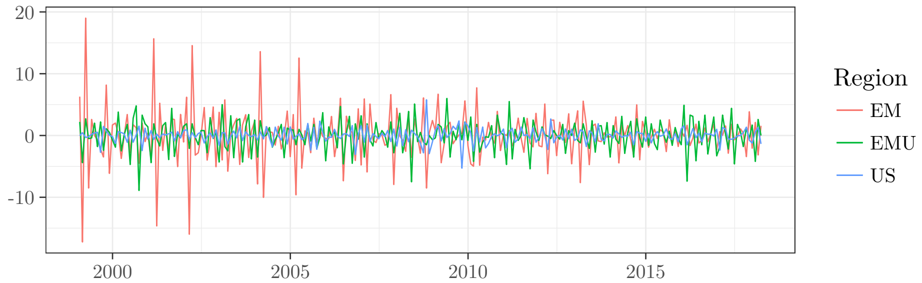

Figure A4: Change in Expected Inflation

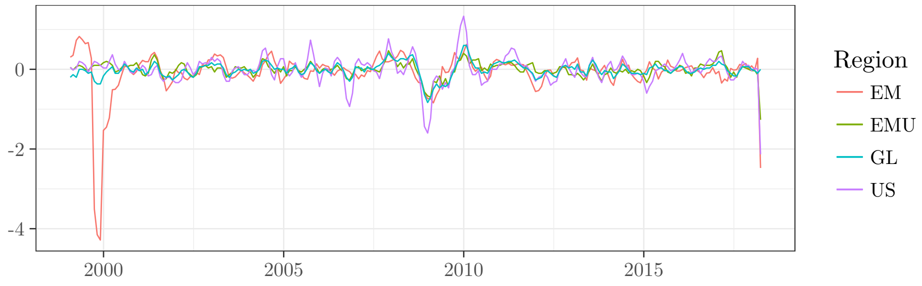

Figure A5: Unexpected Inflation

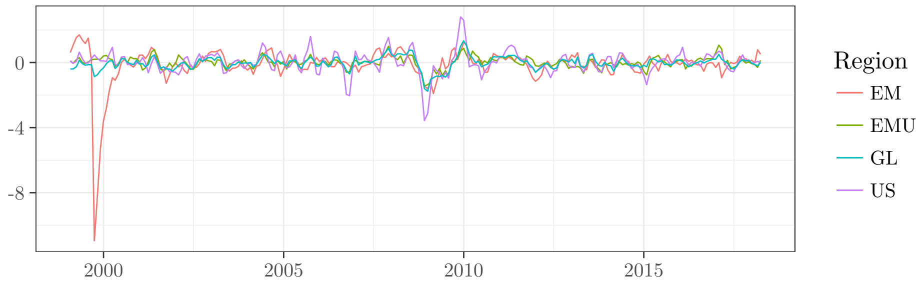

Figure A6: Change in Economic Policy Uncertainty

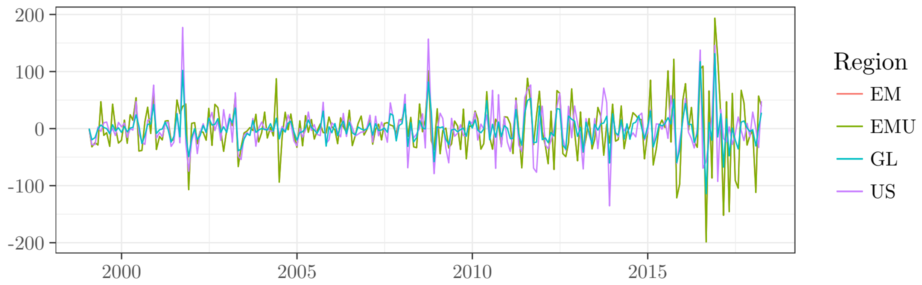

Figure A7: Beta to EPU in EM

$\beta^{EPU_{EM}}$ calculated as a rolling mean over the period $t_{36} - t$, which makes the series considerably lagged. For each month the mean value is shown with the blue band indicating the corresponding range.

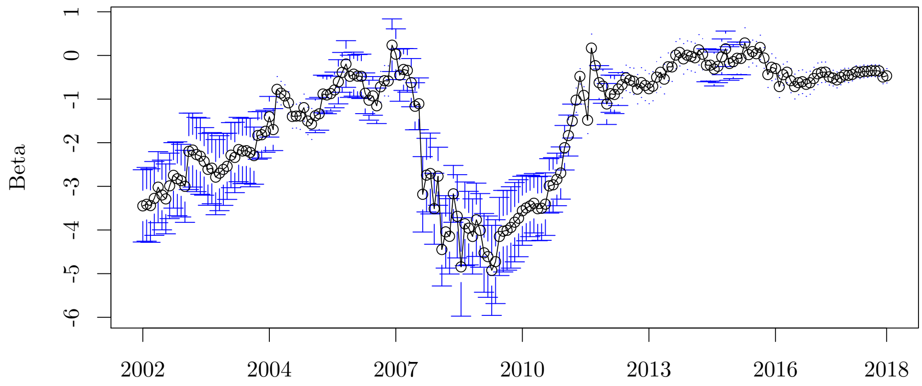

Figure A8: Beta to EPU in EMU

$\beta^{EPU_{EMU}}$ calculated as a rolling mean over the period $t_{36} - t$, which makes the series considerably lagged. For each month the mean value is shown with the blue band indicating the corresponding range.

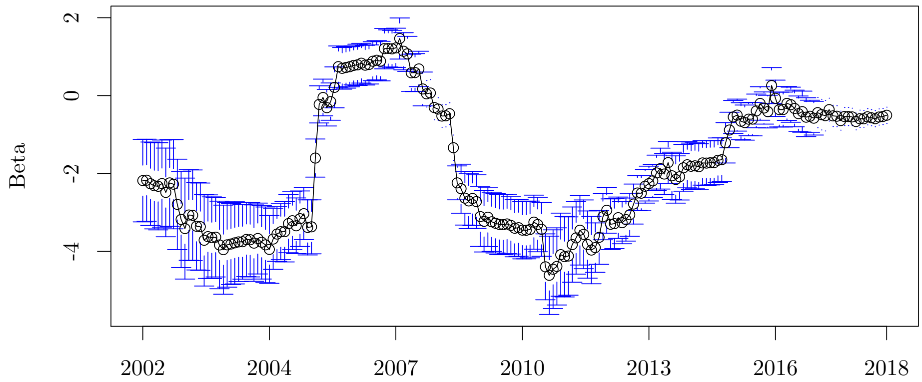

Figure A9: Beta to EPU in USA

β^{EPU}_{USA} calculated as a rolling mean over the period $t_{36} - t$, which makes the series considerably lagged. For each month the mean value is shown with the blue band indicating the corresponding range.

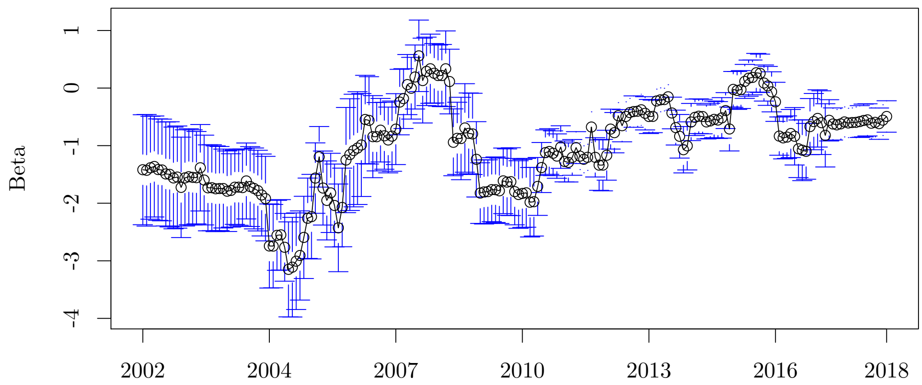

Table A2: Correlation Matrix

Correlation of all explanatory input variables over the whole sample (GL IND is excluded because it is computed as an average of the local IND values). EPU is negatively correlated to IND in every region, indicating that it is a countercyclical variable. Changes in EPU are strongly correlated between regions, with values reaching from 0.352 to 0.582. The global EPU is similarly correlated to all local series, indicating that it captures common dynamics.

	EM						EMU						USA						GL				
	IND	DEI	UI	URP	UTS	EPU	IND	DEI	UI	URP	UTS	EPU	IND	DEI	UI	URP	UTS	EPU	DEI	UI	URP	UTS	EPU
EM IND	1	-0.05	-0.03	-0.01	-0.01	-0.04	0.26	-0.03	-0.01	-0.01	-0.02	0.01	-0.10	-0.01	0.03	0.01	-0.01	0.04	-0.07	-0.05	0.01	-0.01	-0.011
EM DEI	-0.05	1	0.89	-0.11	-0.13	-0.01	0.02	0.05	0.08	-0.11	0.01	0.06	-0.05	0.10	0.12	-0.10	0.05	-0.01	0.43	0.45	-0.18	0.17	0.01
EM UI	-0.03	0.90	1	-0.10	-0.11	0.01	0.02	0.20	0.07	-0.10	0.01	0.02	-0.03	0.23	0.11	-0.07	0.08	-0.03	0.43	0.42	-0.16	0.18	-0.01
EM URP	-0.01	-0.11	-0.10	1	0.82	0.03	0.01	-0.14	-0.16	0.45	-0.03	0.04	0.02	-0.12	-0.15	0.44	0.13	0.01	-0.31	-0.30	0.57	0.03	0.03
EM UTS	-0.01	-0.13	-0.11	0.82	1	0.01	0.00	-0.18	-0.22	0.78	-0.20	0.04	0.04	-0.18	-0.22	0.73	0.27	0.01	-0.37	-0.36	0.85	0.01	0.02
EM EPU	-0.04	-0.01	0.00	0.03	0.01	1	-0.03	0.01	0.02	0.02	-0.03	0.41	0.02	0.04	0.03	0.03	-0.01	0.35	0.08	0.04	0.03	-0.0	0.76
EMU IND	0.26	0.02	0.02	0.01	0.00	-0.03	1	-0.04	-0.04	0.01	0.01	-0.05	0.08	0.01	0.01	0.00	0.00	-0.01	-0.01	-0.01	0.00	-0.01	-0.05
EMU DEI	-0.03	0.05	0.20	-0.14	-0.18	0.01	-0.04	1	0.84	-0.28	0.01	0.02	0.04	0.79	0.63	-0.25	-0.02	-0.03	0.67	0.66	-0.24	-0.06	-0.01
EMU UI	-0.01	0.08	0.07	-0.16	-0.22	0.02	-0.04	0.84	1	-0.32	0.12	0.03	0.03	0.63	0.73	-0.31	-0.05	0.02	0.70	0.75	-0.28	-0.08	0.02
EMU URP	-0.01	-0.11	-0.10	0.45	0.78	0.02	0.01	-0.28	-0.32	1	-0.49	0.04	0.03	-0.30	-0.33	0.92	0.26	0.01	-0.42	-0.41	0.95	0.13	0.02
EMU UTS	-0.02	0.01	0.01	-0.02	-0.20	-0.03	0.06	0.01	0.12	-0.49	1	-0.01	0.04	0.23	0.25	-0.29	0.45	-0.00	0.19	0.19	-0.46	0.38	-0.01
EMU EPU	0.01	0.02	0.02	0.04	0.04	0.41	-0.05	0.02	0.03	0.04	-0.01	1	0.05	0.09	0.07	0.05	-0.01	0.58	0.09	0.08	0.05	0.03	0.78
US IND	-0.10	-0.05	-0.03	0.02	0.04	0.02	0.08	0.04	0.03	0.03	0.04	0.05	1	0.09	0.07	0.03	0.02	-0.02	-0.01	0.01	0.02	0.03	0.03
US DEI	-0.01	0.10	0.26	-0.12	-0.18	0.04	0.01	0.79	0.63	-0.30	0.23	0.09	0.09	1	0.87	-0.26	0.04	0.04	0.71	0.70	-0.27	0.00	0.07
US UI	0.03	0.12	0.11	-0.15	-0.22	0.03	0.01	0.63	0.73	-0.33	0.25	0.07	0.07	0.87	1	-0.30	0.02	0.08	0.72	0.77	-0.31	-0.01	0.09
US URP	0.00	-0.01	-0.07	0.44	0.73	0.03	0.00	-0.25	-0.31	0.92	-0.29	0.05	0.03	-0.26	-0.30	1	0.51	0.01	-0.35	-0.35	0.90	0.34	0.04
US UTS	-0.0	0.05	0.06	0.13	0.27	-0.01	0.00	-0.02	-0.05	0.26	0.45	-0.01	0.02	0.04	0.06	0.51	1	-0.03	0.05	0.04	0.17	0.74	-0.02
US EPU	0.04	-0.01	-0.03	0.01	0.00	0.35	-0.01	-0.03	0.02	0.01	-0.00	0.58	-0.02	0.04	0.08	0.01	-0.03	1	0.07	0.07	0.06	0.01	0.80
GL DEI	-0.07	0.43	0.43	-0.30	-0.37	0.08	-0.01	0.67	0.70	-0.42	0.19	0.09	-0.01	0.71	0.72	-0.35	0.05	0.07	1	0.96	-0.43	0.09	0.10
GL UI	-0.05	0.45	0.42	-0.29	-0.36	0.04	-0.01	0.66	0.75	-0.41	0.19	0.08	0.01	0.70	0.77	-0.35	0.04	0.07	0.96	1	-0.42	0.01	0.08
GL URP	0.00	-0.18	-0.16	0.57	0.85	0.03	0.00	-0.24	-0.28	0.95	-0.46	0.05	0.02	-0.27	-0.31	0.90	0.17	0.02	-0.43	-0.42	1	-0.02	0.04
GL UTS	-0.01	0.17	0.18	0.03	0.01	-0.00	-0.01	-0.06	-0.08	0.13	0.38	0.03	0.03	0.00	-0.01	0.34	0.74	0.01	0.09	0.10	-0.02	1	0.02
GL EPU	-0.01	0.01	-0.00	0.03	0.02	0.76	-0.05	-0.01	0.02	0.02	-0.01	0.784	0.03	0.07	0.09	0.04	-0.02	0.80	0.10	0.08	0.04	0.02	1

Table A3: Full sample Beta excluding market

Values for β obtained from full sample regressions of the form:

$$R_t = \alpha + \beta_t^{EPU} EPU_t + \beta_t^{DEI} DEI_t + \beta_t^{UI} UI_t + \beta_t^{IND} IND_t + \beta_t^{URP} URP_t + \beta_t^{UTS} UTS_t + \epsilon_t$$

Returns for all sectors in all regions are negatively effected by changes in EPU. The strongest effect is observed for the financial sector in EMU and the weakest for the Telecommunication sector in USA. Most values for β^{EPU} are significant to the $\alpha = 0.05$ level.

	α	β^{EPU}	β^{DEI}	β^{UI}	β^{IND}	β^{URP}	β^{UTS}
EM Materials	0.90***	-0.81***	-1.27	1.37	-0.08	-0.53	-0.65*
EM Energy	1.24***	-1.15***	-3.54***	2.95***	-0.33	-0.65*	-1.07***
EM Cons. Discretionary	1.16***	-1.49***	-1.47	0.84	0.18	-0.46	0.05
EM Industrials	0.55*	-1.21***	-0.45	0.64	-0.08	-0.84***	-0.24
EM Cons. Staples	0.98***	-0.49***	-1.17*	1.10*	-0.24	-0.60***	-0.07
EM Health Care	1.22***	-0.43*	-0.97	0.92	-0.85***	0.22	-0.22
EM Financials	0.92***	-1.35***	-1.82*	1.03	-0.14	-0.77***	-0.31
EM Information Tech.	0.98***	-1.47***	-2.38*	1.18	0.21	-0.35	0.03
EM Telecommunication	0.57**	-0.59**	-3.05***	1.52*	-0.24	-1.14***	-0.29
EM Utilities	0.61***	-0.91***	-0.67	0.62	-0.07	-0.54**	-0.52**
EM Real Estate	0.56	-1.32***	-1.75	1.37	-0.05	-0.89**	-0.34
EMU Energy	0.35	-0.95***	-0.22	0.00	-0.21	-0.71**	0.09
EMU Materials	0.62*	-1.62***	-0.89	0.55	-0.05	-0.98***	0.19
EMU Industrial	0.68**	-1.90***	-1.71	1.29	0.12	-0.73*	0.72**
EMU Cons. Discretionary	0.44	-1.72***	-1.51	0.98	0.08	-1.15***	0.39
EMU Cons. Staples	0.40*	-0.74***	-0.59	0.31	0.14	-0.64***	0.02
EMU Health Care	0.40	-0.32	-0.97	0.83	0.08	-0.54*	0.34
EMU Financials	0.06	-2.24***	-0.57	0.08	0.29	-0.93**	0.65
EMU Information Tech.	0.51	-1.44***	-3.41**	2.90**	0.58	-0.94	0.77
EMU Telecommunication	-0.06	-1.34***	-2.29*	1.58	0.21	-0.77*	0.76*
EMU Utilities	0.05	-0.77***	0.08	-0.33	-0.06	-1.18***	0.06
EMU Real Estate	0.48	-1.04***	0.72	-1.36	0.33	-0.50	0.84***
USA Energy	0.55*	-0.66**	1.92*	-2.62***	0.44	-1.79***	0.56
USA Materials	0.59*	-1.38***	1.01	-1.47	0.11	-1.51***	0.54
USA Industrials	0.54**	-1.19***	1.44	-1.42	-0.18	-1.55***	0.71**
USA Cons. Discretionary	0.58**	-1.28***	0.45	-0.82	-0.25	-1.39***	0.96***
USA Cons. Staples	0.38**	-0.29	0.37	-0.52	0.33	-0.78***	0.40*
USA Health Care	0.50**	-0.33	0.01	-0.29	-0.17	-0.95***	0.38
USA Financials	0.33	-0.94***	1.17	-0.99	-0.19	-1.61***	0.67
USA Information Tech.	0.63	-1.85***	-0.54	-0.23	-0.34	-1.76***	1.25***
USA Telecommunication	-0.21	-0.17	0.28	-0.74	0.07	-1.08***	0.47
USA Utilities	0.30	-0.43*	0.06	-0.34	0.39	-1.36***	0.29
US Real Estate	0.49	-0.43	1.16	-1.40	-0.52	-1.77***	0.92**

Note: *p<0.15; **p<0.1; ***p<0.05

Table A4: Full sample Beta including market

Values for β obtained from full sample regressions of the form:

$$R_t = \alpha + \beta_t^{EPU} EPU_t + \beta_t^{DEI} DEI_t + \beta_t^{UI} UI_t + \beta_t^{IND} IND_t + \beta_t^{URP} URP_t + \beta_t^{UTS} UTS_t + \epsilon_t$$

Returns for all sectors in all regions are negatively effected by changes in EPU. The strongest effect is observed for the financial sector in EMU and the weakest for the Telecommunication sector in USA. Most values for β^{EPU} are significant to the $\alpha = 0.05$ level. Much of the sensitivities vanish when correcting for the market, indicating that the market captures much of EPU and other factors. All variables show a positive β to the market, significant at the $\alpha = 0.05$ level.

	α	β^{M}	β^{EPU}	β^{DEI}	β^{UI}	β^{IND}	β^{URP}	β^{UTS}
EM Materials	-0.01	1.07***	0.43***	0.72	0.05	0.04	0.23	-0.32*
EM Energy	0.28	1.14***	0.16	-1.43**	1.55***	-0.21	0.16	-0.72***
EM Cons. Dis.	0.32**	0.99***	-0.34**	0.36	-0.37	0.29*	0.24	0.35**
EM Industrials	-0.32***	1.02***	-0.03	1.43***	-0.61	0.03	-0.12	0.07
EM Cons. Staples	0.50***	0.56***	0.16	-0.13	0.40	-0.18	-0.20*	0.10
EM Health Care	0.95***	0.31***	-0.07	-0.39	0.53	-0.81***	0.44*	-0.12
EM Financials	0.03	1.05***	-0.13	0.13	-0.26	-0.02	-0.02	0.01
EM IT	-0.02	1.17***	-0.11	-0.21	-0.27	0.33	0.49**	0.39*
EM Tele.	-0.09	0.77***	0.31**	-1.62***	0.57	-0.15	-0.59***	-0.05
EM Utilities	-0.01	0.73***	-0.06	0.67	-0.28	0.01	-0.03	-0.30*
EM Real Estate	-0.44	1.17***	0.05	0.42	-0.07	0.08	-0.06	0.02
EMU Energy	0.18	0.68***	0.06	0.60	-0.52	-0.31	-0.06	-0.25
EMU Materials	0.37**	1.03***	-0.09	0.36	-0.25	-0.21	0.01	-0.32
EMU Industrials	0.41***	1.10***	-0.27**	-0.38	0.45	-0.05	0.32**	0.17
EMU Cons. Dis.	0.18	1.09***	-0.11	-0.20	0.15	-0.08	-0.11	-0.15
EMU Cons. Staples	0.27	0.53***	0.05	0.06	-0.10	0.06	-0.13	-0.24
EMU Health Care	0.27	0.53***	0.46**	-0.33	0.43	0.00	-0.03	0.08
EMU Financials	-0.25	1.27***	-0.35*	0.98	-0.90	0.10	0.29	0.02
EMU IT	0.16	1.40***	0.63**	-1.72*	1.82**	0.37	0.39	0.08
EMU Tele.	-0.27	0.87***	-0.05	-1.23	0.90	0.08	0.07	0.33
EMU Utilities	-0.13	0.73***	0.31	0.97	-0.90	-0.17	-0.48**	-0.30
EMU Real Estate	0.33	0.59***	-0.17	1.44	-1.81***	0.24	0.06	0.55**
USA Energy	0.24	0.82***	0.16	1.53*	-1.93***	0.50**	-0.52	-0.14
USA Materials	0.13	1.20***	-0.17	0.43	-0.44	0.21	0.36	-0.50*
USA Industrials	0.12	1.10***	-0.08	0.91**	-0.48	-0.09	0.16	-0.23
USA Cons. Dis.	0.14	1.15***	-0.12	-0.11	0.17	-0.16	0.40***	-0.03
USA Cons. Staples	0.21	0.43***	0.15	0.16	-0.15	0.36**	-0.11	0.03
USA Health Care	0.27	0.61***	0.28	-0.28	0.23	-0.12	0.00	-0.14
USA Financials	-0.13	1.20***	0.27	0.59	0.03	-0.10	0.26	-0.36
USA IT	0.08	1.42***	-0.42*	-1.22	0.98	-0.22	0.44	0.03
USA Tele.	-0.55**	0.89***	0.72***	-0.14	0.02	0.14	0.29	-0.30
USA Utilities	0.15	0.39***	-0.04	-0.13	-0.01	0.42*	-0.77***	-0.04
USA Real Estate	0.16	0.86***	0.43	0.76	-0.67	-0.45	-0.44	0.19

Note: *p<0.15; **p<0.1; ***p<0.05

Table A5: Results from regressions with local explanatory variables and intercept

Observations for risk premia were obtained through:

$$R_t = \alpha + \gamma_t^{POL}\beta_{t-1}^{POL} + \gamma_{t-1}^{DEI}\beta_{t-1}^{DEI} + \gamma_t^{UI}\beta_{t-1}^{UI} + \gamma_t^{IND}\beta_{t-1}^{IND} + \gamma_t^{URP}\beta_{t-1}^{URP} + \gamma_t^{UTS}\beta_{t-1}^{UTS} + \epsilon_t$$

and

$$R_t = \alpha + \gamma_t^{M}\beta_{t-1}^{M} + \gamma_t^{POL}\beta_{t-1}^{POL} + \gamma_{t-1}^{DEI}\beta_{t-1}^{DEI} + \gamma_t^{UI}\beta_{t-1}^{UI} + \gamma_t^{IND}\beta_{t-1}^{IND} + \gamma_t^{URP}\beta_{t-1}^{URP} + \gamma_t^{UTS}\beta_{t-1}^{UTS} + \epsilon_t$$

using β to local risk factors as explanatory variables. The samples included 2145 observations (11 sectors, 195 months) on the local and 6435 observations (33 sectors, 195 months) on the global scale.Values for $\widehat{\gamma}$ are the average over the whole sample, sample standard errors are given in parenthesis. While many risk premia become insignificant and the regression loads strongly on the intercept, $\widehat{\gamma_{POL}}$ remains significant on the global level when exposure to the market is added as a control. Even though not statistically significant, the sign for this premium remains negative for all regions. The market carries a negative premium in most specifications.

	R_{GL}		R_{EM}		R_{EMU}		R_{US}	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\widehat{\alpha}$	0.524***	0.792***	1.092***	1.275***	0.161	1.442***	0.421	0.425
	(0.230)	(0.229)	(0.457)	(0.626)	(0.397)	(0.562)	(0.412)	(0.661)
$\widehat{\gamma_M}$		−0.339		−0.590		−1.329***		0.001
		(0.327)		(0.718)		(0.644)		(0.674)
$\widehat{\gamma^{POL}}$	−0.052	−0.208***	−0.149	−0.123	0.086	−0.167	−0.105	−0.090
	(0.075)	(0.089)	(0.204)	(0.436)	(0.142)	(0.212)	(0.234)	(0.264)
$\widehat{\gamma^{DEI}}$	−0.044	−0.043	0.177	0.097	−0.485*	−0.429	0.198	0.599
	(0.054)	(0.055)	(0.170)	(0.176)	(0.302)	(0.308)	(0.275)	(0.455)
$\widehat{\gamma^{UI}}$	−0.070	−0.064	0.136	0.034	−0.556**	−0.433	0.272	0.626
	(0.065)	(0.064)	(0.166)	(0.191)	(0.313)	(0.323)	(0.291)	(0.478)
$\widehat{\gamma^{IND}}$	−0.045	−0.013	0.174	0.494*	0.070	−0.097	0.015	−0.090
	(0.097)	(0.093)	(0.319)	(0.333)	(0.220)	(0.241)	(0.359)	(0.384)
$\widehat{\gamma^{URP}}$	0.050*	0.060**	−0.015	0.390**	0.299	0.309	0.009	−0.061
	(0.035)	(0.035)	(0.160)	(0.206)	(0.280)	(0.247)	(0.176)	(0.251)
$\widehat{\gamma^{UTS}}$	−0.006	−0.054	−0.082	0.086	−0.247	−0.315*	0.146	0.136
	(0.043)	(0.049)	(0.191)	(0.202)	(0.185)	(0.215)	(0.155)	(0.195)
Obs.	6,435	6,435	2,145	2,145	2,145	2,145	2,145	2,145
R^2	0.639	0.607	0.743	0.749	0.659	0.666	0.715	0.698

Note: *p<0.15; **p<0.1; ***p<0.05

Table A6: Results from regressions with global explanatory variables and intercept

Observations for risk premia were obtained through:

$$R_t = \alpha + \gamma_t^{POL}\beta_{t-1}^{POL} + \gamma_{t-1}^{DEI}\beta_{t-1}^{DEI} + \gamma_t^{UI}\beta_{t-1}^{UI} + \gamma_t^{IND}\beta_{t-1}^{IND} + \gamma_t^{URP}\beta_{t-1}^{URP} + \gamma_t^{UTS}\beta_{t-1}^{UTS} + \epsilon_t$$

and

$$R_t = \alpha + \gamma_t^{M}\beta_{t-1}^{M} + \gamma_t^{POL}\beta_{t-1}^{POL} + \gamma_{t-1}^{DEI}\beta_{t-1}^{DEI} + \gamma_t^{UI}\beta_{t-1}^{UI} + \gamma_t^{IND}\beta_{t-1}^{IND} + \gamma_t^{URP}\beta_{t-1}^{URP} + \gamma_t^{UTS}\beta_{t-1}^{UTS} + \epsilon_t$$

using β to global risk factors as explanatory variables. The samples included 2145 observations (11 sectors, 195 months) on the local and 6435 observations (33 sectors, 195 months) on the global scale. Values for $\hat{\gamma}$ are the average over the whole sample, sample standard errors are given in parenthesis. This regression loads less heavily on the intercept, however there are few significant risk premia. $\widehat{\gamma_{EPU}}$ stays significant on the global level when controlling for the market, however is smaller in magnitude and t-value than in the version using local explanatory variables. The table supports the above conclusion, that local risk factors are priced.

	R_{GL}		R_{EM}		R_{EMU}		R_{US}	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\hat{\alpha}$	0.314	0.246	0.721**	0.498	0.341	0.586	0.179	0.385
	(0.227)	(0.228)	(0.371)	(0.422)	(0.391)	(0.450)	(0.337)	(0.407)
$\widehat{\gamma^M}$		−0.139		−0.140		1.773*		0.308
		(0.535)		(1.510)		(1.205)		(0.870)
$\widehat{\gamma^{POL}}$	−0.090	−0.138*	−0.081	−0.051	−0.094	−0.021	−0.145	−0.058
	(0.088)	(0.086)	(0.164)	(0.179)	(0.154)	(0.185)	(0.165)	(0.205)
$\widehat{\gamma^{DEI}}$	0.060	0.162	−0.174	−0.027	−0.445	−0.255	−0.013	−0.211
	(0.129)	(0.133)	(0.255)	(0.270)	(0.365)	(0.448)	(0.213)	(0.269)
$\widehat{\gamma^{UI}}$	0.042	0.143	−0.219	−0.097	−0.245	−0.014	−0.025	−0.231
	(0.128)	(0.132)	(0.251)	(0.262)	(0.359)	(0.443)	(0.219)	(0.267)
$\widehat{\gamma^{IND}}$	−0.186**	−0.200**	0.325	0.371	0.327	−0.079	−0.024	0.129
	(0.108)	(0.112)	(0.298)	(0.319)	(0.240)	(0.320)	(0.242)	(0.273)
$\widehat{\gamma^{URP}}$	−0.022	−0.021	−0.065	−0.194	0.301	0.148	0.028	0.067
	(0.097)	(0.102)	(0.179)	(0.206)	(0.230)	(0.271)	(0.148)	(0.230)
$\widehat{\gamma^{UTS}}$	0.091*	0.095*	−0.109	−0.175	0.107	0.063	0.136	0.094
	(0.062)	(0.061)	(0.143)	(0.162)	(0.127)	(0.141)	(0.140)	(0.179)
Obs.	6,435	6,435	2,145	2,145	2,145	2,145	2,145	2,145
R^2	0.669	0.677	0.756	0.745	0.686	0.647	0.699	0.681

Note: *p<0.15; **p<0.1; ***p<0.05

Table A7: Conditional Model within Regions

Model forecasts time-varying risk premia with information about the economic regime Ec and level of EPU in the previous month. Individual values for δ are obtained through:

$$\gamma_t^{EPU} = \delta_t^{Ec} Ec_{t-1} + \epsilon_t$$

and

$$\gamma_t^{EPU} = \delta_t^{Ec:P} (Ec_{t-1}^{*} EPU_{t-1}) + \epsilon_t.$$

As each point in the sample is attributed to a regime, the intercept was suppressed. The sample consists of 195 observations (1 γ for each month in 195 months). Within each region, the R^2 rises significantly when the level of EPU is included. The thesis that the risk premium rises in negative economic regimes when the central bank is easing is confirmed for EM and EMU. In the US there is a significant risk premium in the P/T regime, possibly due to events that randomly fell into this period. Values for adjusted R^2 also show, that in the United States the regime by itself does not predict risk premia. The overall effect is strongest in EM.

	Dependent variable:					
	$\gamma^{EPU}(EM)$		$\gamma^{EPU}(USA)$		$\gamma^{EPU}(EMU)$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\delta^{Ec} \Vert Ec = N/E$	−0.702***		−0.772		−0.367	
	(0.295)		(0.547)		(0.292)	
$\delta^{Ec} \Vert Ec = N/T$	0.735		0.386		−0.972*	
	(1.232)		(0.458)		(0.650)	
$\delta^{Ec} \Vert Ec = P/E$	0.126		−0.333		−0.199	
	(0.430)		(0.583)		(0.351)	
$\delta^{Ec} \Vert Ec = P/T$	−0.350		−0.317		0.043	
	(0.350)		(0.339)		(0.388)	
$\delta^{Ec:P} \Vert Ec = N/E$		−0.004***		−0.005		−0.002*
		(0.001)		(0.004)		(0.002)
$\delta^{Ec:P} \Vert Ec = N/T$		0.005		0.004		−0.012***
		(0.006)		(0.003)		(0.005)
$\delta^{Ec:P} \Vert Ec = P/E$		0.002		−0.004		−0.002
		(0.004)		(0.006)		(0.002)
$\delta^{Ec:P} \Vert Ec = P/T$		−0.002		−0.005**		−0.002
		(0.003)		(0.003)		(0.003)
Obs.	195	195	195	195	195	195
$R^2 \Vert Adj.R^2$	0.036 ‖0.016	0.045 ‖0.025	0.020 ‖0.0	0.037 ‖0.17	0.021 ‖0.001	0.051 ‖0.031
Note:						*p<0.15; **p<0.1; ***p<0.05

Table A8: Conditional Model including Interest Rate

The hypothesis, that γ^{EPU} rises in easing times due to a "regime switching fear" is tested. The model follows the idea, that such fear should be stronger as interest rates approach the zero-lower bound.
The model forecasts time-varying risk premia with information about the economic regime Ec, the level of EPU and the central bank target rate i in the previous month. Individual values for δ are obtained through:

$$\gamma_t^{EPU} = \alpha + \delta_t^i i_{t-1} + \epsilon_t \qquad (1),$$

$$\gamma_t^{EPU} = \delta_t^M M_{t-1} + \delta_t^{M:i} M_{t-1} * i_{t-1} + \epsilon_t \qquad (2)$$

and

$$\gamma_t^{EPU} = \alpha + \delta_t^i i_{t-1} + \delta_t^{EPU} EPU_{t-1} + \delta^{EPU:i} i_{t-1} * EPU_{t-1} + \epsilon_t \qquad (3)$$

As each point in the sample is attributed to a regime, the intercept was suppressed for model (2). The sample consists of 195 observations (1 γ for each month in 195 months).
There is no evidence to support the hypothesis, that risk premia increase close to the zero lower bound. The effect of the central bank target rate on risk premia is hardly significant in any specification. While model (3) provides weak evidence, the effect seems to be opposite than assumed. Values for adjusted R^2 are generally lower than in the specifications excluding i. One possible explanation is that expectations about future monetary policy are already captured by the forward rate used in regime construction.

	Dependent variable:		
	$\gamma^{EPU}(US)$		
	(1)	(2)	(3)
α	−0.329**		0.987***
	(0.172)		(0.461)
δ^i	0.014		−0.178*
	(0.048)		(0.118)
$\delta^M \ \|M = E$		−0.422**	
		(0.239)	
$\delta^M \ \|M = T$		−0.221	
		(0.248)	
$\delta^{M:i} \ \|M = E$		0.006	
		(0.066)	
$\delta^{M:i} \ \|M = T$		0.019	
		(0.096)	
δ^{EPU}			−0.009***
			(0.003)
$\delta^{EPU:i}$			0.001*
			(0.001)
Obs.	585	585	585
$R^2 \ \|Adj.R^2$	0.0001 ‖ − 0.002	0.013 ‖0.006	0.019 ‖0.014
Note:			*p<0.15; **p<0.1; ***p<0.05

9 Declaration of Authorship

I hereby declare that the thesis submitted is my own unaided work. All direct or indirect sources used are acknowledged as references.
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