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# Economic policy uncertainty and stock return synchronicity in the increasingly integrated European Union

Finance

Master's thesis

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**Abstract of master's thesis**

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**Abstract**

I analyze how government policy uncertainty and economic integration affect stock return synchronicity in the European Union over the period 1990 to 2015, using the novel economic policy uncertainty indices of Baker, Bloom, and Davis (2015). I find that stock return synchronicity between and inside the member states increases with economic policy uncertainty, policy uncertainty is higher in weaker economic conditions, and synchronicity generally increases when economic conditions decline, when measured with GDP growth. These results are consistent with the theoretical predictions of Pástor and Veronesi (2013).

Furthermore, I find that stock return synchronicity between countries increases when joining the EU or the euro area, and the effect is stronger when joining the euro area. This suggests that currency integration is more important in the European financial markets than general economic integration. Joining the EU or the euro area also affects synchronicity inside the countries, but the direction of the effect depends on the country. I suggest that this may be due to differences in policy stability and the degree to which joining the EU develops the economic and financial systems in the country.

These findings show that policy uncertainty and the European integration may have important implications on the ability of investors to diversify their portfolios, on market efficiency, and on the effectiveness of corporate governance methods.

**Keywords** economic policy, uncertainty, synchronicity, integration, European Union, euro

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Tässä tutkimuksessa tarkastelen, kuinka epävarmuus hallituksen politiikasta ja taloudellinen yhtenäistyminen vaikuttavat osaketuottojen yhtenäisyyteen Euroopan Unionissa. Tarkastelujaksoni sisältää vuodet 1990-2015. Käytän tutkimuksessani uutta talouspolitiikan epävarmuuden indeksiä, jonka ovat kehittäneet Baker, Bloom ja Davis (2015). Tulokset osoittavat, että osaketuotot jäsenmaiden välillä ja sisällä liikkuvat yhtenäisemmin, kun epävarmuus talouspolitiikasta on korkeammalla, että talouspoliittinen epävarmuus on suurempaa, kun taloudellinen tilanne on heikompi ja, että osaketuotot liikkuvat yhtenäisemmin, kun taloustilanne on heikompi, jos yleistä taloustilannetta mitataan bruttokansantuotteen kasvulla. Nämä löydökset tukevat teoreettisia ennusteita, jotka Pástor ja Veronesi (2013) esittävät.

Lisäksi tulokset näyttävät, että maan osakemarkkina liikkuu yhtenäisemmin toisten maiden markkinoiden kanssa sen jälkeen, kun se on liittynyt Euroopan Unioniin ja myös, kun se on ottanut käyttöön yhteisvaluutta euron. Havaittu vaikutus on suurempi, kun maa ottaa käyttöön euron. Tämä kertoo siitä, että yhteisellä valuutalla on suurempi vaikutus osakemarkkinoiden yhtenäisyyteen kuin yleisen tason taloudellisella yhtenäistymisellä. Tulokset osoittavat myös, että liittyminen Euroopan Unioniin ja euroalueeseen vaikuttaa maan sisäisten osaketuottojen yhtenäisyyteen, mutta tämän vaikutuksen suunta vaihtelee maiden välillä. Esitän, että tämä saattaa johtua maakohtaisen poliittisen epävarmuuden tasosta ennen liittymistä Euroopan Unioniin ja siitä, että Euroopan Unionin tuoma muutos talous- ja rahoitusjärjestelmien kehityksen tasoon riippuu maan lähtötasosta.

Tutkimuksen löydökset osoittavat, että talouspoliittinen epävarmuus ja Euroopan yhtenäistyminen saattavat vaikuttaa sijoittajien hajautuskykyyn, markkinoiden tehokkuuteen ja yhtiöiden hallinnointikoodin (engl. corporate governance) tehokkuuteen.

**Avainsanat** talouspolitiikka, epävarmuus, osaketuottojen yhtenäisyys, integraatio, Euroopan unioni, euro

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## 1 Introduction

While the research on uncertainty and economic behavior dates back to the early days of modern economics (e.g. Keynes, 1936), the ability of contemporary technology to build accurate and continuous measures of uncertainty, and the recent series of economic and financial crises have brought up an upsurge of research focusing on the economic impact of uncertainty, particularly economic policy uncertainty. Economic policy uncertainty is the uncertainty about the economic policies that the government will choose in the future. Not only do government policy choices have clear direct effects on the operating environment of the private sector, such as through taxation, but also an indirect influence through factors such as the general macroeconomic conditions and changes in the demand provided by other agents who are affected by the policy choices. Intuitively, the uncertainty originating from government actions is largely non-diversifiable due to the pervasiveness of regulation and the sheer number of possible avenues through which policy choices affect firms.

The beginning of the millennium has shown multiple major economic and political shocks, including, but not limited to, the 9/11 terrorist attacks and the subsequent wars, the financial crisis of 2007-2009 leading to the Great Recession of 2008-2012, and most recently the European sovereign debt crisis starting in 2009, also referred to as the Eurozone debt crisis. The latest has demonstrated how the decisions of governments in relatively small countries, such as Greece, can have extensive consequences in some of the largest economies in the world, including overall stock market jumps of several percent in economies such as the U.S., France, and Germany around decision announcements (Pástor and Veronesi, 2013). Uncertainty seems to intensely rise during such events, as measured by multiple proxies, such as stock market volatility, the cross-sectional spread of firm- and industry-level earnings, and productivity growth (e.g. Bloom, 2009). While the likes of Bloom (2009) mostly consider relatively short economic and political shocks and the uncertainty spikes around them, the recent developments have shown that the global economic and financial system is also vulnerable to sustained multi-year crises that are susceptible to holding the level of uncertainty high for extended periods of time.

The effects of uncertainty on the economy are intuitively not clear. On the one hand, it may be intuitive to think that uncertainty can depress economic activity. The more certain the information at hand is, the easier it should be to make deterministic decisions. Uncertainty may lead to a wait-and-see attitude, given the value in the real option to delay and possibly expand or abandon the opportunity in question. On the other hand, uncertainty may actually have an increasing effect in economic activity, particularly corporate investment. Consider an example of Hassett and Sullivan (2012): A firm that starts selling goods at price $P_0$ is affected by the introduction of a random tax which causes the price to change between a lower price $P_1$ and an equally higher price $P_2$. Given an upward-sloping supply curve, the gain at the good state $P_2$ would exceed the loss in the bad state $P_1$. Now, assuming that the quantity of goods produced can be increased, uncertainty can increase profits and thus investment. Early literature examining the relationship of uncertainty and investment has found support for the latter (e.g. Hartman, 1972 and Abel, 1983). However, as Hassett and Sullivan (2012) note, a crucial assumption in the example is that adjustment is costless, whereas in reality, adjustment is virtually always costly, and investments are most of the time irreversible: custom purpose-built equipment is unlikely to have value to other firms, especially in bad economic conditions when the reversibility of the investment would be most needed. Academics have later incorporated the irreversibility and adjustment costs into the theories, most notably Bernanke (1983) and Rodrik (1991). Empirical support has been presented for this logic as well (e.g. Pindyck, 1988).

Research on the asset pricing implications of policy uncertainty has focused on an election-based approach. Political elections provide a stable and normally highly exogenous dataset of events that first induce political uncertainty as the familiar incumbent government has to step down, and then resolve uncertainty as the election results reveal information about the future government and their likely policies. Empirical research has shown that national equity markets tend to show abnormal returns around elections, and that elections generate higher market volatility (e.g. Pantzalis et al., 2000 and Bialkowski et al., 2008). The results are in line with the well-known Uncertain Information Hypothesis of Brown et al. (1988) who predict that risk and expected returns increase when uncertainty increases. However, using elections as a proxy for uncertainty may incur several problems. Most importantly, by construction, elections can only be used to measure assumed variation at the time of the election, leaving the variation of policy uncertainty uncaptured for the lengthy periods between elections (Gulen and Ion, 2015). In the European countries and the U.S., this means that an observation only occurs every 4 or 5 years, excluding prematurely called elections. Second, the election dataset is not able to quantify the level of uncertainty or the resolution of uncertainty, but rather relies on the assumption that an election resolves political uncertainty. As Brogaard and Detzel (2015) point out, there is no strong mechanism binding the decision-making of the elected politicians to their pre-election statements. Furthermore, the political decision-making process will nearly always require compromises and negotiation, making certain forecasts based on ideology and statements a virtual impossibility.

To form a better, continuous measure of policy uncertainty, Baker, Bloom, and Davis (2015) develop a novel index of economic policy uncertainty based on newspaper coverage frequency of key policy-relevant terms. A number of studies have utilized the new index in empirical and theoretical work. Gulen and Ion (2013) find that policy uncertainty can explain up to a third of the drop in investment during the financial crisis of 2007 to 2009. Brogaard and Detzel (2015) construct a very similar index and show that increases in policy uncertainty are associated with lower contemporaneous market returns and higher market volatility. Pástor and Veronesi (2013) use the index to test their theory of the relation between policy uncertainty and equity risk premia.

While proper measures of economic policy uncertainty have only been available for a relatively short time, the same applies to theoretical guidance on the relationship between political news and the financial markets. Pástor and Veronesi (2012, 2013) aim to fill the gap by providing equilibrium models on the asset pricing implications of political uncertainty. They interpret policy changes as "government actions that change the economic environment". I follow the same interpretation in this paper. Pástor and Veronesi consider two kinds uncertainty: *political uncertainty* which they relate to uncertainty about whether the current government policy will change, and *impact uncertainty* which is uncertainty about the impact a new policy will have on the profitability of the private sector. In their first paper, Pástor and Veronesi (2012) construct a model where firm profitability follows a stochastic process whose mean is influenced by the current government policy, and where government decision-making follows both economic and non-economic motives. They show that it is optimal for the government to change policy when the current policy's impact on firm profitability is seen as sufficiently negative. This leads to a situation where policy changes are expected after unexpectedly low realized profitability, or downturns. Following the model, they find two separate effects on stock prices: First, a policy change pushes stock prices up due to increasing firm profitability following the government's decision rules. Second, since a policy change reverts the gains from learning about the old policy, a policy change increases discount rates. Intuitively, information about the old policy essentially becomes worthless since the old policy is no longer active. They find that this discount rate effect is stronger than the profitability effect, unless the old policy was very poor. Then, on average, stock prices react negatively to a policy change. Furthermore, they show that since the impact of new policies is less known, policy changes increase the volatility of the discount factor, and thus risk premia go up, and stocks become more volatile and more highly correlated.

In their second paper, Pástor and Veronesi (2013) develop a very similar but more advanced model of government policy choice. While their first study focuses on the stock market announcement reactions of policy changes, the second paper examines how prices respond to signals about possible future policy decisions, or the general level of policy uncertainty. They add two new features to the model: learning about political costs of new policies, and policy heterogeneity. They show that the government is more likely to adopt a policy with a lower political cost and if the policy's impact on firm profitability is perceived as higher or less uncertain. This resembles the traditional mean-variance optimizing investor. As a result, policy change is more likely in worse economic conditions where the current policy is considered as adverse. Pástor and Veronesi label this effect as government-provided "put protection" which effectively protects the market from bad times by replacing poor policies. Continuing, they show asset pricing implications that arise when investors learn about the impact of potential policies on firm profitability and about the political costs of potential policies. Quoting Pástor and Veronesi (2013): "For instance, -- the Greek prime minister's announcement of his wish to hold a referendum must have led investors to update their beliefs about the probability at Greece will decide to leave the Eurozone in the future". Their model shows that political uncertainty commands a risk premium that is larger in worse economic conditions. Pástor and Veronesi analytically find that policy uncertainty pushes up the equity risk premium and the volatilities and correlations of stocks. Using the economic policy uncertainty index of Baker et al. (2015) and stock price data for the S&P500 index constituents, they conduct a brief empirical check, finding supportive evidence for the implications of their model. Pástor and Veronesi's (2013) theory is described in more detail in section 2.

Through the predictions on individual stock return correlations, Pástor and Veronesi's (2012, 2013) models introduced above suggest that higher economic policy uncertainty should drive synchronicity up. Synchronicity is the degree to which individual stock prices move up and down together (Li et al., 2003). Intuitively, a higher synchronicity indicates that the prices are driven to a higher degree by aggregate components, as opposed to firm-specific factors. Changes in stock return synchronicity can have multiple important implications on the economy and financial markets, mostly derived from the influential notion of Roll (1988) that the relative amounts of market-level and firm-level information capitalized into prices are the most important determinants of stock market co-movement, or synchronicity.

First, Campbell et al. (2001) remark that the diversification achieved by a certain number of stocks depends on the level of idiosyncratic volatility in the stock that make up the portfolio. The more firm-specific variation, the more stocks are required to fully diversify. Since a large part of investors are arguably not fully diversified, a greater firm-specific variation in returns, or lower synchronicity, leaves the non-diversified investors exposed to greater risk. Second, higher synchronicity may be indicative of market inefficiency. Roll (1988) finds that firm-specific price movements reflect trading by those with private information. Following the same logic, Morck et al. (2000) imply that lower synchronicity, or higher firm-specific variation, may be indicative of more active arbitrage. Third, synchronicity may have corporate governance implications. Morck et al. (1988) find that corporate governance actions such top management turnover or investor pressure are associated with firm performance relative to the industry. In other words, poor performance alongside the whole industry is viewed as understandable, not leading to actions. Based on their earlier work, Li et al. (2003) argue that corporate governance mechanisms in general are more effective when an individual firm's performance is more easily differentiated from its industry.

While stock market synchronicity has been conceptually examined since French and Roll (1986) and Roll (1988), and despite the multitude of implications, a relatively limited amount of empirical research has been presented, mainly focusing on the role of market maturity. Roll (1988) first shows that only a small part of the price movements of individual stocks can be explained by broad economic influences and industry influences. Campbell et al. (2001) show that, in the U.S., synchronicity has shown a stable decline during the period from 1962 to 1997. Li et al. (2003) also show a similar, although weaker, trend internationally. They attribute the trend mostly to developments in the openness of capital markets and institutional integrity. In addition, Morck et al. (2000) show that stock prices move together more in emerging markets than in rich economies, attributing the differences among countries mainly to weaker or stronger property rights. They argue that "strong property rights promote informed arbitrage, which capitalizes detailed firm-specific information". Others have since repeated the examination between emerging and developed markets (e.g. Fernandes and Ferreira, 2008; Khandaker and Heaney, 2009), showing consistent results. Finally, Gul et al. (2010) relate synchronicity to ownership concentration, foreign shareholding, and audit quality. They find that synchronicity is concavely related to largest shareholder ownership, and further show higher synchronicity when the largest shareholder is government-related.

The growing integration of the world economy adds a further dimension. The European economy and financial markets are becoming increasingly integrated and developed, which has been one of the large goals of the Union since its inception. As the EU sets in place mechanisms to direct the European economy, political power is transferred from the individual nations to the Union. An example of this is the introduction of a common currency, the euro. Countries that decide to adopt the euro surrender control over monetary policy to the European Central Bank (ECB), thus making the economy of the country more dependent on the common European economic policy. While more developed countries have been found to show lower levels of synchronicity, the increasing economic integration between countries should intuitively make stock markets more united as well, leading to higher synchronicity between the countries. Clearly, when administrative measures are implemented to connect the governments and economies of countries, the influence of factors outside an individual country should grow. Since these outside factors likely affect all stocks in the country to some degree, we see a growing impact of common influences, further leading to a higher degree of co-movement. Now, as the evolution of the European Union aims to both develop the markets and make them more united, there may be multiple contemporaneous, opposite effects. Furthermore, when some of the power of the internal politics of the country is transferred to the EU, if EU policy is more stable than country policy, synchronicity may actually decline inside the country. Therefore, while synchronicity between the countries can be expected to increase with the level of integration, the effect inside the individual countries may actually vary based on factors such as the variability or instability of the internal country politics. This dynamic is further discussed in section 2.

### *1.1 Research questions*

In this paper, I examine the relationship of economic policy uncertainty and stock return synchronicity in the European Union (EU), both inside the member countries and inside the Union. I aim to provide answers to

1) whether the time-varying economic policy uncertainty has an effect on stock return synchronicity,
2) whether this effect is state-dependent on the economic conditions,
3) and whether stock return synchronicity is influenced by the increasing European integration.

Given Pástor and Veronesi's (2012, 2013) theoretical work, policy uncertainty is generally expected to drive synchronicity up, especially in weaker economic conditions. In addition, I investigate the effects of both a country joining the EU, as well as the Eurozone. To proxy for policy uncertainty, I employ the widely adopted European policy uncertainty indices of Baker et al. (2015). To measure stock market synchronicity, I use the $R^2$ statistic from a market model regression, following French and Roll (1986), Roll (1988), and the earlier literature on synchronicity.

### *1.2 Contribution to the literature*

My thesis contributes to the existing literature in the following ways:

1) I provide the first empirical evidence on the relationship between economic policy uncertainty and stock return synchronicity, using the widely accepted R-squared based measure to proxy for synchronicity.
2) I examine and provide the first empirical evidence on the effects of the increasing integration of the European economy on stock market integration by studying stock return synchronicity intra-country and inter-country inside the European Union.

### *1.3 Limitations of the study*

Individual economic policy uncertainty indices are available for six of the European Union member states, including France, Germany, Italy, the Netherlands, Spain, and the United Kingdom. In addition, a common European index is available. All of these do not completely cover the full sample period. Most notably, the indices for the Netherlands and Spain are only available since 2001 and 2003, respectively. However, I argue that the common European policy uncertainty index is a suitable proxy for policy uncertainty in the EU member states in the context of my study, since my focus is especially on the growing political and economic integration of the European Union. This is also supported by the fact that the indices seem to move together, in general. The mean correlation between the individual indices during the period when all indices are available is approximately 0,65. However, the smaller number of observations for some indices may lead to lower statistical power in the results. This is visible when the signs of the regressions for the countries are generally very similar, but some of the coefficients are not statistically significant.

The same limitation applies to the availability of value-weighted stock market indices for some of the countries. While such indices are generally available for many decades for the larger stock markets, many of the smaller countries have shorter availability of such indices. However, to mitigate this limitation, I repeat all tests for both an equally weighted measure of stock return synchronicity calculated directly from the individual stock returns, as well as for the value-weighted indices available.

### *1.4 Main findings*

In support of Pástor and Veronesi (2013), I find that both intra-country and inter-country stock return synchronicity increase with economic policy uncertainty, that policy uncertainty is generally higher in weaker economic conditions, and that stock return synchronicity generally increases when economic conditions decline, when measured with GDP growth. However, the empirical evidence shows only weak support for the hypothesis that the influence of policy uncertainty is higher in weaker economic conditions. Rather, the relationship seems linear in the sample.

Next, I hypothesize that stock return synchronicity between the European countries is expected to increase with the level of political and economic integration, as the countries are affected to a higher degree by new common factors, such as the regulation by the EU institutions and the introduction of the euro as a shared currency. Intuitively, since the exposure to factors such as regulation cannot be fully diversified, the importance of common systematic factors grows, and thus synchronicity is expected to be higher. In support of the hypothesis, I find that both joining the European Union and joining the euro area increase stock return synchronicity between countries. Interestingly, I also find that the inter-country effect of joining the euro area is stronger than that of joining the EU: currency integration seems to be more important in the financial markets than general economic and political integration.

The influence of the growing integration is less clear inside the countries. On the one hand, the common European policy has a stronger effect on all stocks, leading to higher co-movement. On the other hand, the common European policy may be more stable than the country policy, leading to decreased systematic variation. Furthermore, joining the EU and the euro area may significantly develop the markets in some countries, leading to lower synchronicity, as implied by the earlier literature on emerging markets. The magnitude of the different contemporaneous effects depends on multiple qualities of the country at the time of joining the EU or the euro area. Therefore, I expect that the European integration also has an effect on stock return synchronicity inside the countries, but I expect the direction of the effect to depend on the country. The empirical evidence supports this view: in approximately half of the countries synchronicity increases and in the other half declines when joining the EU or the euro area. Moreover, the direction of the effects of joining the EU and adopting the euro is not always consistent for a country. This is natural, since the two events are on average separated by approximately six years, and thus the underlying qualities of the country can be significantly different at the two points of time. As opposed to the inter-country examination, the evidence does not provide support for a difference in the relative strength of the two effects inside the countries.

Finally, I find that the influence of the common European policy uncertainty on stock return synchronicity does not depend on the level of integration, but remains approximately the same after joining the EU or the euro area.

### *1.5 Structure*

The remainder of the paper is arranged as follows. Section 2 introduces the theoretical background and develops my hypotheses. Section 3 describes the data and methodology. Section 4 presents the empirical results. Section 5 summarizes and concludes the study.

## 2 Theoretical background and and hypothesis development

### *2.1 The stock pricing implications of policy uncertainty*

The following reviews the main construction of the general equilibrium model relating political uncertainty and stock prices, as presented in Pástor and Veronesi (2013)[1].

Suppose an economy with a finite time horizon $[0, T]$, with a continuum of firms $i \in [0, 1]$ The firms are fully financed by equity. Let $B_t^i$ be the capital of firm $i$ at time $t$. At $t = 0$, the capital of all firms is $B_0^i = 1$. Now, assume that the capital is invested with a stochastic rate of return $d\Pi_t^i$, and proceeds are reinvested. Then, the capital of firm $i$ follows $dB_t^i = B_t^i d\Pi_t^i$. As all firms are financed by equity,

[1] I aim to provide an overview on the mathematical construction and the intuition behind the model. For an exhaustive analytical derivation of all propositions, refer to the papers of Pástor and Veronesi (2012, 2013).

profits are over the book value of equity, $B_t^i$, and thus Pástor and Veronesi refer to $d\Pi_t^i$ as the profitability of firm $i$. The profitability follows the process

$$d\Pi_t^i = (\mu + g_t)dt + \sigma dZ_t + \sigma_1 dZ_t^i$$

for $t \in [0, T]$. $\mu, \sigma$ and $\sigma_1$ are constants, $Z_t$ is a Brownian motion, $Z_t^i$ is a firm-specific Brownian motion, and $g_t$ represents the current government policy's effect on the profitability of firms. For a policy that has no impact on firm profitability, $g_t = 0$.

Next, at time $\tau$, $0 < \tau < T$, a policy decision is made either to adopt one of $N$ new policies or to keep the current policy. Then, the policy's impact on profitability, $g_t$, is

$$g_t = \begin{cases} g^0 & for\ t \leq \tau \\ g^0 & for\ t > \tau \quad if\ the\ old\ policy\ is\ chosen \\ g^n & for\ t > \tau \quad if\ a\ new\ policy\ n\ is\ chosen \end{cases} \tag{2}$$

Crucially, $g_t$ is unknown for all $t \in [0, T]$, as the impact that policies have on profitability is uncertain for both the government that is making the policy decision as well as the investors owning the firms. The prior impacts are normally distributed.

Now, investors maximize expected utility based on terminal wealth:

$$u(W_T^j) = \frac{(W_T^j)^{1-\gamma}}{1-\gamma} \tag{3}$$

for each investor $j \in [0,1]$. $W_t^j$ is the wealth for investor $j$ at time $T$, and $\gamma$ is the relative risk aversion. The government maximizes a similar power utility function, with one key difference: the government also considers the political cost, or benefit, of choosing a policy. Let us denote the political cost of choosing policy $n \in \{0, \dots, N\}$ by $C^n$. Then, the government's policy decision maximizes

$$E_\tau \left[ \frac{C^n W_T^{1-\gamma}}{1-\gamma} \mid policy\ n \right], \tag{4}$$

where $W_T$ is the final aggregate capital. $C^n$ is greater than 1 when there is a political cost, and less than 1 when there is a political benefit for the government to choose policy $n$. When the old policy is retained, there is no political cost or benefit, and $C^n = 1$. The prior $\{C^n\}_{n=1}^N$ are log-normally distributed. Importantly, the source of political uncertainty in the model is the uncertainty about $\{C^n\}_{n=1}^N$. Both analytically and intuitively, when the political cost related to each of the potential policies is more uncertain, it is more difficult to predict which policy will get chosen.

The political cost component also captures factors that can lead the government to deviate from strictly maximizing investor welfare, such as the distribution of wealth, corruption, or special interest groups, all discussed in the political economy literature[2]. Given these disturbances, analytically the log-normal nature of the political cost, Pástor and Veronesi note that the government in the model is quasi-benevolent, maximizing investor wealth on average but not always. They also point out that while this allows for capturing uncertainty in the model, it does not necessarily imply that the government has misguided motives, but rather acknowledges the complexity of the political environment.

Next, let us introduce the effect of learning new information in the model. First, consider the impact of all possible policies $n \in \{0, \dots, N\}$ on firm profitability. For all policies, including the current one, the policy impact is unknown to both the investors and the government. From time 0 to $\tau$, they observe the realized profitability of all firms, and learn about $g^0$, the impact of the current policy. If the realized profitability differs from the expected profitability, an *impact shock* arises, and beliefs about $g^0$ are revised: up when the realized profitability is higher, and down when the realized profitability is worse than expected. It is important to note that while the agents learn about the impact of the current policy, decreasing the uncertainty about $g^0$ over time, no learning about the impact of any potential new policies happens. This is intuitive, since realized profitability cannot be observed for any other than the prevailing policy. Similarly, if there is a policy change at time $\tau$, the agents start learning about the new policy instead of the old one, and beliefs about the impact of the active policy are reset.

[2] Pástor and Veronesi refer to the textbook of Drazen (2000), and the papers of Alesina and Rodrik (1994), Persson and Tabellini (1994), Grossmann and Helpman (1994), Coate and Morris (1995), Shleifer and Vishny (1993), and Rose-Ackerman (1999).

Second, consider the political costs associated with choosing a policy. As opposed to the policy impact on profitability, the political cost of the current policy, $C^0$, is known, since this is considered a one-time cost which has already incurred when the policy was chosen. In contrast, the political costs of all potential new policies $n \in \{1, \dots, N\}$ are unknown. The investors and the government learn about the political costs of potential new policies through political news, negotiations, and debates, among other political events. Pástor and Veronesi refer to these as *political signals* which lead to *political shocks* in the model. Note that while the agents can only learn about the profitability effect of the currently active policy, as discussed earlier, they can learn more about the political cost of any potential policy also before the policy decision. Furthermore, note that learning in general only decreases uncertainty and does not completely remove it.

Given the framework described so far, Pástor and Veronesi derive from the utility function of the government (equation 4) that the government only chooses policy $n$ if for all policies $m \neq n, m \in \{0, \dots, N\}$:

$$\tilde{\mu}^n - \tilde{c}^n > \tilde{\mu}^m - \tilde{c}^m \,, \tag{5}$$

where $\tilde{\mu}$ represents the impact on profitability and $\tilde{c}$ represents the political cost. Now, since the political cost has already incurred for the old policy, as discussed earlier, $\tilde{c}^0 = 0$. Therefore, the government will only change policy at time $\tau$ if the old policy has a sufficiently low impact on average firm profitability.

Next, let us review the relevant asset pricing implications. The model proposes that policy uncertainty affects stock prices through *impact shocks* and through *political shocks*. The shocks are induced by learning that generates stochastic variation in the beliefs about policy impacts and political costs. Intuitively, the effects are the following[3]. First, the impact shocks command an *impact risk premium*,

[3]My intention is to provide an overview of the logic. Analytically, the beliefs at time $t$ are represented by a set of stochastic state variables $(\hat{g}_t, \hat{c}_t^1, \dots, \hat{c}_t^N)$. Recall, that $g_t$ is generally the profitability impact of the prevailing policy at time $t$, and $c_\tau^n$ represents the political cost of policy $n$, should it be chosen at time $\tau$. This set has a direct effect on the diffusion process followed by the stochastic discount factor which in turn describes the movement of the state price density. Then, both impact shocks and political shocks will command a risk premium. For the full derivation, refer to sections 4.1 to 4.3 of Pástor and Veronesi (2013).

since investors require compensation for uncertainty about the impact of the current policy on firm profitability. Learning about the profitability impact will change future capital growth expectations and beliefs about how likely the government is to change policy. Second, the political shocks command a *political risk premium*, as investors require compensation for uncertainty about which new policy will be chosen in the future.

Both of these are highly state-dependent. When the believed profitability impact of the prevailing policy goes down, it is increasingly likely that the current policy will be replaced with a new policy. This means that the profitability impact of the current policy will be temporary, and only relevant until the policy change. In contrast, when the believed profitability impact of the prevailing policy goes up, it is less and less likely that the current policy would be replaced, meaning that the impact of the current policy will be more permanent, thus making impact shocks more relevant. A similar logic applies to political shocks. When the probability of a policy change rises, uncertainty about the political costs of potential new policies becomes more important, making political shocks more relevant. Whereas when it is unlikely that the current policy will change, the potential new policies are less important.

While the state-dependency is modeled in relation to $\hat{g}_t$, the perceived policy impact on firm profitability, it would be easy to express the same state-dependency in terms of economic conditions as well. When economic conditions are strong, it is clearly unlikely that the prevailing policy is seen as a bad policy. Whereas when economic conditions are weak, the current policy is unlikely seen as a very good policy.

Pástor and Veronesi show that given a set of policies that yield the same utility based on the impact in profitability, the policies with higher political uncertainty will draw lower announcement returns. Since the uncertainty is not firm-specific, it pushes up discount rates and thus depresses asset prices. However, it must be noted that theoretically a higher announcement return does not necessarily maximize the utility on which the policy decision is based on. A policy can be welfare-improving even if it has a higher uncertainty about its profitability impact. Prices and welfare coincide only when the policies in question are equally risky. However, in this paper I focus on investigating the degree of co-movement of stock prices and not the level of prices as such.

Finally, the model implies that individual stocks will be more correlated with each other when political uncertainty is higher. Since all firms are considered equally exposed to the policy choices of the government, changes in the risk premium components affect all firms similarly. As the risk premium components discussed above are common to all stocks, when the influence of a component grows relatively larger, the degree to which all stocks are affected by the same factor increases. Then, we should see the stocks get more correlated with each other. Pástor and Veronesi find that the *political risk premium* is the largest component of the total risk premium when political uncertainty is high. Changes in the political risk premium are induced by *political shocks* which, again, affect all firms. While the assumption that all firms are equally affected by government actions is not necessarily true in reality, it is intuitive that most firms are generally affected by government decisions, even if that may be to a varying degree. The following introduces my hypotheses based on the theory presented above.

According to the theory of Pástor and Veronesi (2013), in good economic conditions, the government is likely to retain its current policy. Thus, the level of political uncertainty is low. In contrast, when the economic conditions are worse, the government is expected to act and policy change is more likely. When policy change is more likely, the relevance of the uncertainty about which policy will be chosen is higher. Therefore, the first hypothesis is:

H1: Economic policy uncertainty is higher when economic conditions are worse.

Next, relying on the first hypothesis, when political uncertainty is higher, the political component of the equity risk premium affecting all firms is also higher. Since this political risk premium cannot be fully diversified, stock returns are to a greater extent affected by a common component, and it follows that:

H2: The intra-country and inter-country stock return synchronicity is higher when policy uncertainty is higher.

It also immediately follows from H1 and H2 that:

H3: The intra-country and inter-country stock return synchronicity is higher when economic conditions are worse.

Next, according to the model of Pástor and Veronesi, political shocks have a state-dependent effect on stock prices. In addition to the sign of these shocks being as discussed above, they should matter the most when economic conditions are weak, and vice versa. Therefore:

H4: Policy uncertainty has a stronger effect on stock return synchronicity when economic conditions are worse.

### *2.2 The European economic integration and stock return synchronicity*

The European economy is becoming increasingly united through administrative channels designed and executed by common European governing bodies. The key institutions include the European Parliament, the European Council, the Council of the European Union, and the European Commission[4]. The European Parliament represents the European citizens through elected members. The European Council includes the heads of state of the member states. Similarly, the Council of the European Union consists of one national minister from each member state. However, which national minister attends each time they meet is dependent on the topic at hand. For example, when financial topics are discussed, the ministers of finance attend. Finally, the European Commission is formed by one Commissioner from each country. The Commission is considered politically independent. It drafts and proposes all law of the European Union, holding monopoly over legislative initiative. Following a proposal from the Commission, the Council of the European Union and the European Parliament together adopt the wording of the act, and potentially approve the act. The Commission then implements the approved legislation. This forms the ordinary legislative procedure of the European Union[5].

The legislative procedure leads to a number of legal measures guiding or mandating the legislation of the individual member countries. Some of the measures include *regulations*, *directives*, *decisions*, *recommendations*, and *opinions*. Some are binding acts, while others are merely guidelines. In May

[4] In addition to the four mentioned institutions, there are over a dozen other institutions with considerable economic or political power. A full introduction to all of the institutions can be found at http://europa.eu/about-eu/institutions-bodies/index_en.htm (accessed on May 10th, 2016).
[5] A more in-depth description of the legislative process of the European Union can be found at http://www.europarl.europa.eu/aboutparliament/en/20150201PVL00004/Legislative-powers (accessed on May 10th, 2016).

2016, the total number of different types or legislation in force was over 32 thousand acts[6]. When a country joins the Union, it comes under the force of this legislation, immediately integrating it to the Union. Clearly, some of the implementation of the integration happens over time, but at this point it is clear to the investors that the whole legislation must be adopted, and thus this information should be incorporated in to asset prices as well.

All member states of the EU are part of the Economic and Monetary Union (EMU). The purpose of the EMU is to coordinate and converge the economic, fiscal, and monetary policies of the member states. Importantly, the EMU is not an institution, but rather an implementation plan to achieve the aforementioned purpose. The responsibility of the implementation of the convergence is divided to seven EU institutions, including all four mentioned above, and the European Central Bank. The EMU is a three-stage plan, and all member states follow the stages at their own, but closely monitored, pace.

The final stage of the EMU is adopting a single currency inside the EU, the euro. All countries joining the EU agree to eventually adopt the euro, unless explicitly granted an opt-out. Currently, only Denmark and the United Kingdom have such an opt-out. Interestingly, and often overlooked, this means that countries that are part of the EU but that have not yet adopted the euro, such as Sweden, are eventually obliged to adopt the common currency.

The Eurosystem is formed by the European Central Bank (ECB) and the central banks of the member states in the euro area. The ECB has two main roles: it manages the euro and conducts the economic and monetary policy of the EU. The primary objective of the the ECB is to keep prices stable to support economic growth and job creation[7]. The role of the member state central banks is to implement the policy defined by the ECB. There are multiple ways through which the ECB can influence the economy and the financial markets. Most importantly, it has direct control over the main interest rates on its lending to commercial banks, controlling the supply of money and inflation. These include the rates on the main refinancing operations providing liquidity to the banking system, the

[6] Based on the public records available at http://eur-lex.europa.eu/ (accessed on May 7th, 2016). (Advanced search with options: Domain: EU law and related documents, Subdomain: Legislation, Limit to legislation in force, Exclude corrigenda.)

[7] According to the overview of the European Central Bank provided by the EU, available at http://europa.eu/about-eu/institutions-bodies/ecb/index_en.htm (accessed on May 11th, 2016).

deposit facility for overnight deposits from the banks, and the marginal lending facility for overnight credit to the banks. These rates have a fundamental influence on the financial markets, exposing all assets to the policy decisions of the ECB.

Joining the EU and later the euro area define two distinct points in time when a considerable “integration shock” happens between the new member and the EU. While joining the EU exposes the new member state to the bulk of legislation discussed earlier, adopting the euro has a similar effect through the Eurosystem. Note that generally there is a significant period of time between the two shocks, allowing for investigating them separately. The exact joining dates are presented in table 1 in section 3.

Given the economic and financial significance of both events, the stock returns should be affected. After the integration shock, all stocks in the country are more affected by the same factors as in the other member countries, including economic and political elements such as regulation by common institutions. The degree to which the individual stocks are affected is likely to vary according to the exposure to, for instance, foreign trade. However, some factors, such as the exposure to the common European financial regulation, can never be fully diversified. Now, as the stock markets in the different countries are affected by the same factors to a greater degree, it follows that:

> H5: Inter-country stock return synchronicity is higher after the country joins the European Union and the euro area.

The effect inside the country is less clear. On the one hand, new common factors, such as the European regulation that the country adopts, affect all stocks to some degree. This would increase the relative importance of systematic factors, leading to higher synchronicity. On the other hand, if the variation in these new systematic factors is significantly lower than in the old elements, the total systematic variation would decrease, and we should thus expect lower synchronicity. Intuitively, if joining the EU decreases the relative importance of the country policy uncertainty compared to the European policy uncertainty, and if the European policy is generally more stable than the country policy, we should see lower synchronicity. Given that stability is one of the most important goals of the EU, this is likely relevant in countries where political instability is generally higher. Note, however, that synchronicity does not consider the level of the variation as such, but merely the relative levels of systematic and idiosyncratic variation. Thus, even when the relative influence of systematic factors grows compared to firm-specific factors, synchronicity may be lower if the variation in the systematic factors decreases. Given the multiple contemporaneous effects, the intra-country hypothesis is less resolute:

> H6: Joining the EU and the euro area have an effect on intra-country synchronicity, but the direction of the effect depends on the country.

Recall that all new member states must agree not only to accept the full weight of the EU legislation but also to eventually adopt the euro, barring an explicitly negotiated and granted opt-out. Specifically, they commit to joining the euro area as soon as they have set in place the obligatory national laws and meet the economic requirements known as the "convergence criteria". The criteria contain conditions on, for instance, price stability, exchange rate stability, and public finance, including strict limits on government deficit and debt levels.[8]

Now, since the decision to eventually adopt the common currency must be made contemporaneously with the decision to join the EU, the uncertainty about the currency decision will no longer be about whether it *will* happen, but rather about *when* it will happen. From the perspective of the traditional financial theory, this means that part of the information related to the currency decision is released to the market already at this point. It follows that part of the asset pricing shock related to adopting the euro should be seen already together with the shock related to joining the EU.

However, the convergence criteria are highly demanding. This is clearly illustrated by the time periods it took the current euro area countries to meet the conditions. For the countries that have joined the EU after the inception of euro in 1999, the average period between joining the EU and adopting the euro has been 2175 days, or 15 days short of 6 years. The shortest period a country has been able to meet the criteria in has been 975 days, or 3.7 years, for Slovenia. Due to the length of the time period between them, these are clearly two separate events.

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[8] A full overview of the requirements and the specific numeric criteria are available online at http://ec.europa.eu/economy_finance/euro/adoption/who_can_join/index_en.htm (accessed on May 11th, 2016).

Then, given any uncertainty at all about how long it will take for the new member state to comply to the requirements, only some part of the information related to the decision to join the euro area can be incorporated into prices at the moment of joining the EU. Considering that it is virtually impossible to perfectly accurately forecast any economic or financial developments across several years, there must be some uncertainty. Therefore, I argue that separately both joining the EU and joining the euro area should induce a significant integration shock, leading to significant asset pricing implications. However, as it is also clear that the two decisions are conceptually made at the same time, as discussed earlier, I also argue that a part of the total shock induced by joining the euro area should coincide with the moment of joining the EU. It follows:

> H7: Both joining the EU and joining the euro area have a significant effect on stock return synchronicity, but the effect observed when joining the EU is stronger.

Finally, since the political systems of the EU member states are tightly joined, it is intuitively expected that the influence of the general European policy uncertainty should be higher on the country after joining the EU. The same intuition applies to joining the euro area, especially due to surrendering monetary policy to the ECB. Therefore:

> H8: The common European policy uncertainty has a stronger effect on stock return synchronicity after the country has joined the EU and after the country has joined the euro area.

## 3 Data and methodology

### *3.1 Data*

I examine stock market synchronicity in the European Union using data from 27 EU member countries[9]. The sample covers a period of 26 years from January 1990 to December 2015. In the beginning of the period, 12 of the 27 countries were EU members, while the other 15 have joined at

[9] There are currently 28 member countries in the European Union, but I exclude Romania from the sample due to data availability and quality.

some point during the period. At the end of the period, 19 of the 27 countries had joined the euro area. Table 1 summarizes the joining dates of the countries.

I use daily stock price data for all available stocks during the sample period, including the dead stocks that have been active at some point during the period. The stock price data are total return indices provided by Thomson Reuters Datastream. In addition, I use daily value-weighted country-level indices for the stock markets of the 27 countries, also obtained through Datastream. Equally weighted indices are calculated directly from the individual stock prices to best match the country-level indices to the sample of stocks. The sample covers a total of 6 784 trading days in 312 months, and a total of 26 893 stocks that have been traded at some point during the period.

As a proxy of policy uncertainty, I use the recent economic policy uncertainty index by Baker et al. (2015)[10]. The index is based on newspaper articles, specifically the frequency of articles containing policy-relevant terms, and is validated by human audits of several thousand articles. Individual monthly policy uncertainty indices are available for 6 EU member countries, including France, Germany, Italy, Netherlands, Spain, and the United Kingdom. In addition, I utilize the common European index for the remainder of the countries. Figure 1 plots the monthly time series for all of the mentioned policy uncertainty indices. As can be seen, the availability of all individual indices does not fully cover the total sample period. However, all tests are repeated separately for both the European index as well as the country indices. Table 2 summarizes the policy uncertainty index data.

I use three different measures of economic conditions: GDP growth, the Economic Sentiment Indicator (ESI), and the Business Climate Indicator (BCI). Quarterly GDP data is provided by the OECD Statistics for all countries[11]. The monthly ESI and BCI are collected and provided by the Directorate-General for Economic and Financial Affairs (DG ECFIN), under the European Commission[12]. Figure 2 plots the European policy certainty index and GDP growth. For convenience, the index in the plot is scaled to the same mean and standard deviation as the GDP growth. Figure 3 plots the GDP growth and the scaled ESI, and figure 4 plots the GDP growth and the scaled BCI.

[10] The index is publicly available at http://www.policyuncertainty.com (accessed on May 10th, 2016).
[11] The data is publicly available at http://stats.oecd.org (accessed on May 10th, 2016). I use a standard cubic spline interpolation to turn the quarterly GDP time series into a monthly series for all countries.
[12] The data is publicly available at http://ec.europa.eu/economy_finance (accessed on May 10th, 2016).

**Table 1**
**The dates of joining the European Union and the euro area**

This table reports the dates when the 27 sample countries have joined the European Union and the euro area, if applicable. In addition, the period between the two dates is reported.

| | Joined the EU on | Joined the euro area on | Difference | |
|---|---|---|---|---|
| | | | Days | Years |
| Austria | 1-Jan-1995 | 1-Jan-1999 | 1461 | 4,0 |
| Belgium | 1-Jan-1958 | 1-Jan-1999 | 14 975 | 41,0 |
| Bulgaria | 1-Jan-2007 | - | - | - |
| Croatia | 1-Jan-2013 | - | - | - |
| Cyprus | 1-May-2004 | 1-Jan-2008 | 1340 | 3,7 |
| Czech | 1-May-2004 | - | - | - |
| Denmark | 1-Jan-1973 | - | - | - |
| Estonia | 1-May-2004 | 1-Jan-2011 | 2 436 | 6,7 |
| Finland | 1-Jan-1995 | 1-Jan-1999 | 1 461 | 4,0 |
| France | 1-Jan-1958 | 1-Jan-1999 | 14 975 | 41,0 |
| Germany | 1-Jan-1958 | 1-Jan-1999 | 14 975 | 41,0 |
| Greece | 1-Jan-1981 | 1-Jan-2001 | 7 305 | 20,0 |
| Hungary | 1-May-2004 | - | - | - |
| Ireland | 1-Jan-1973 | 1-Jan-1999 | 9 496 | 26,0 |
| Italy | 1-Jan-1958 | 1-Jan-1999 | 14 975 | 41,0 |
| Latvia | 1-May-2004 | 1-Jan-2014 | 3 532 | 9,7 |
| Lithuania | 1-May-2004 | 1-Jan-2015 | 3 897 | 10,7 |
| Luxembourg | 1-Jan-1958 | 1-Jan-1999 | 14 975 | 41,0 |
| Malta | 1-May-2004 | 1-Jan-2008 | 1 340 | 3,7 |
| Netherlands | 1-Jan-1958 | 1-Jan-1999 | 14 975 | 41,0 |
| Poland | 1-May-2004 | - | - | - |
| Portugal | 1-Jan-1986 | 1-Jan-1999 | 4 748 | 13,0 |
| Slovakia | 1-May-2004 | 1-Jan-2009 | 1 706 | 4,7 |
| Slovenia | 1-May-2004 | 1-Jan-2007 | 975 | 2,7 |
| Spain | 1-Jan-1986 | 1-Jan-1999 | 4 748 | 13,0 |
| Sweden | 1-Jan-1995 | - | - | - |
| UK | 1-Jan-1973 | - | - | - |

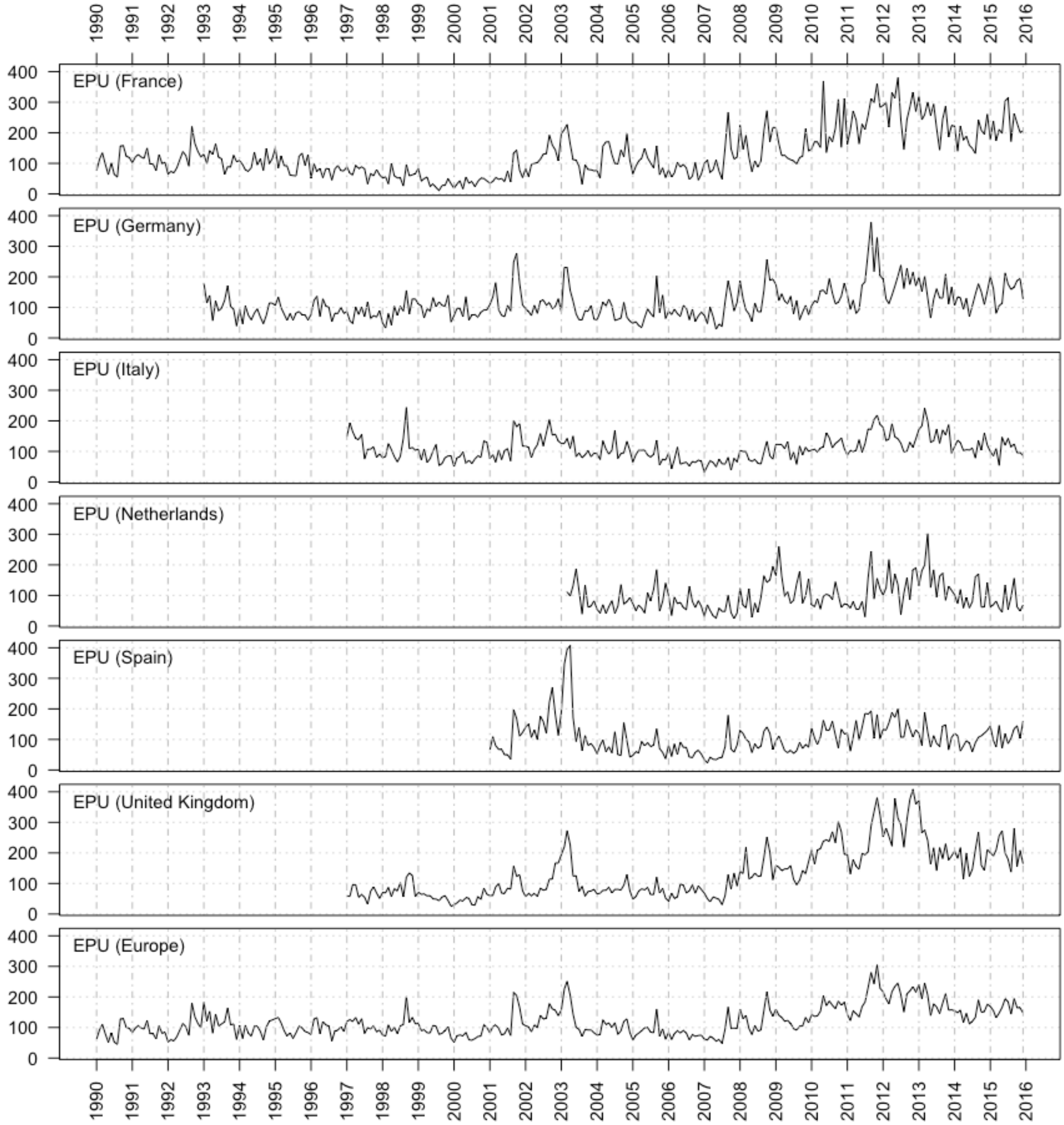


**Figure 1. The policy uncertainty indices.**
This figure plots the monthly time series for the sample of seven economic policy uncertainty indices by Baker et al. (2015).

**Table 2**
**Summary of the policy uncertainty index data**

This table summarizes the economic policy uncertainty indices by Baker et al. (2015). The index is based on newspaper mention frequency of policy-related terminology. An index is available for the common European level of policy uncertainty, as well as for six European Union member states individually.

| | Mean | Median | St. dev. | Index begins on |
|---|---|---|---|---|
| France | 129,10 | 110,56 | 76,60 | 1-Jan-1990 |
| Germany | 113,03 | 103,94 | 51,86 | 1-Jan-1993 |
| Italy | 108,76 | 104,04 | 38,65 | 1-Jan-1997 |
| Netherlands | 98,29 | 83,47 | 50,46 | 1-Mar-2003 |
| Spain | 107,01 | 97,62 | 56,62 | 1-Jan-2001 |
| United Kingdom | 133,76 | 111,51 | 83,84 | 1-Jan-1990 |
| Europe | 119,49 | 106,60 | 47,56 | 1-Jan-1990 |

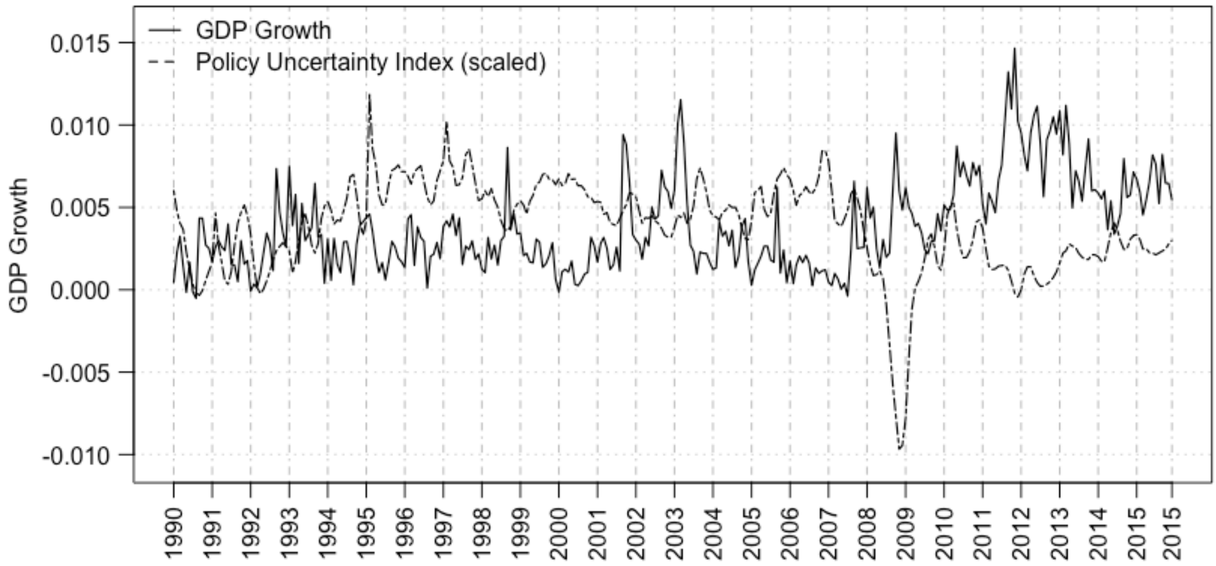


**Figure 2. GDP growth and the European policy uncertainty index.**
This figure plots the European GDP growth (1 = 100%), and the European policy uncertainty index by Baker et al. (2015) scaled to the same mean and standard deviation.

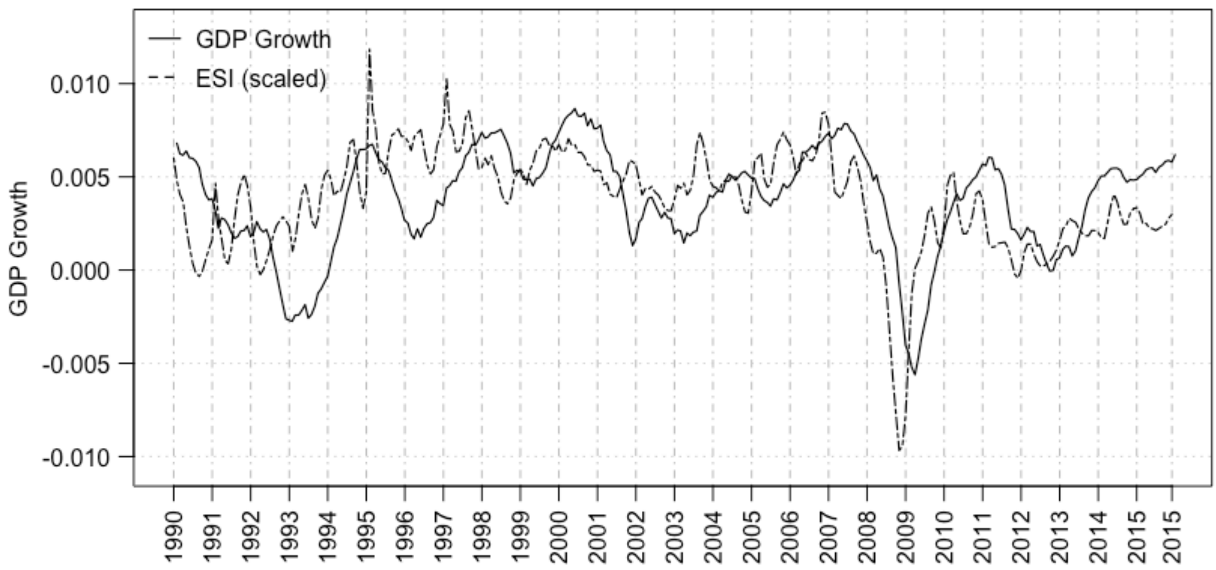


**Figure 3. GDP growth and the Economic Sentiment Indicator.**
This figure plots the European GDP growth (1 = 100%), and the European Economic Sentiment Indicator (ESI) scaled to the same mean and standard deviation.

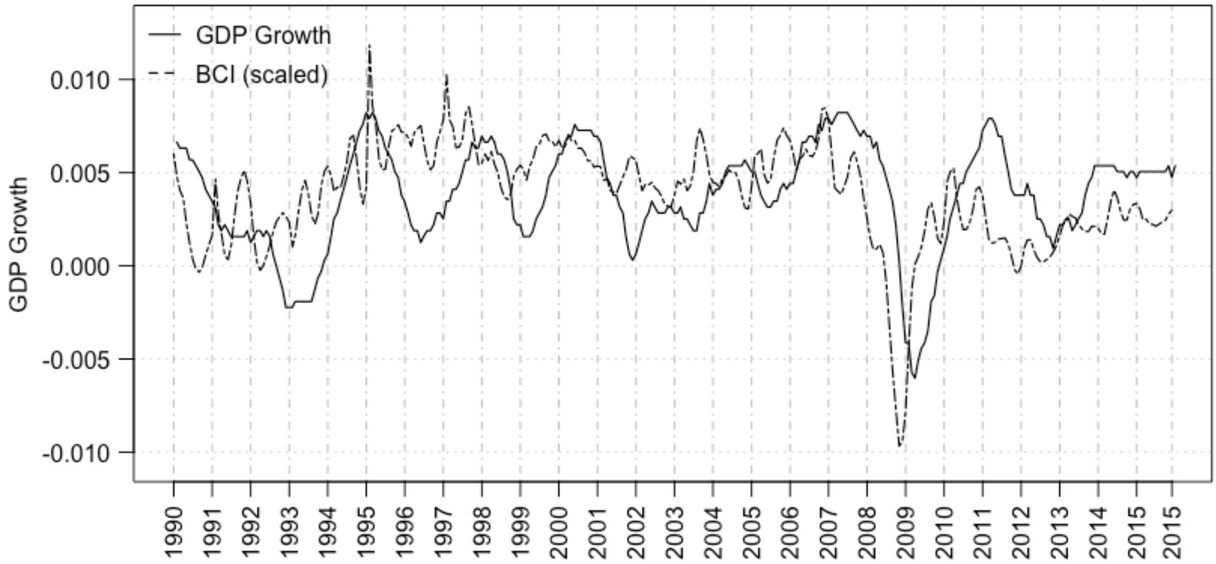


**Figure 4. GDP growth and the Business Climate Indicator.**
This figure plots the European GDP growth (1 = 100%), and the European Business Climate Indicator (BCI) scaled to the same mean and standard deviation.

### *3.2 Methodology*

To measure stock return synchronicity, I employ a market model regression for individual stocks in the sample countries. This methodology follows Roll (1988) and French and Roll (1986), and has become the standard approach to quantifying synchronicity in the literature (e.g. Morck et al., 2000; Li et al., 2003; Chan and Hameed, 2006; Gul et al., 2010). The market model is defined as

$$r_{i,t} = a_i + b_i r_{m,t} + e_{i,t} \,, \tag{6}$$

where $r_{i,t}$ is the total return of each stock $i \in n$ on day $t \in \tau$, and $r_{m,t}$ is the respective market return. All returns used are logarithmic returns. To obtain a monthly time series, I run the regression for each country $j \in J$, for each month $\tau \in T_j$, where $J$ includes the 27 countries in the sample, and $T_j$ includes all months for which data is available for the country $j$. For robustness, I define $r_{m,t}$ in the regression in two different ways. First, I use a standard value-weighted market index for the country $j$. Second, I define $r_{m,t}$ as the equally weighted average return for all stocks $n$ in the country $i$ excluding stock $j$:

$$r_{m,t} = \frac{J_{j,t} \times \, r_{j,t} - r_{i,t}}{J_{n,t} - 1} \tag{7}$$

Intuitively, I exclude the stock itself since it will by definition be perfectly correlated with itself, potentially introducing upward bias. The less stocks in the country $j$ during the period $\tau$, the more bias would be introduced.

The $R^2$ statistic of the market model regression allows for distinguishing the the firm-specific movements from market-wide movements, or systematic factors (Roll, 1988). Then, the average $R^2$ for all stocks in a country describes the level of stock return synchronicity inside the country. Higher values of $R^2$ indicate higher synchronicity, as more of the variation in the return of the individual stock is explained by the return of the other stocks.

Since the $R^2$ statistic is by construction bounded within the interval [0, 1], I apply a logistic transformation to make it suitable for use as a dependent variable, a standard econometric practice (e.g. Morck et al., 2000). Then, the final measure of synchronicity is defined as:

$$S_{j,\tau} = \log\left(\frac{R_{j,\tau}^2}{1 - R_{j,\tau}^2}\right), \tag{8}$$

where $S_{j,\tau}$ is the stock return synchronicity in country $j$ for month $\tau$.

In addition, I investigate the inter-country stock return synchronicity using country-level stock market indices. Then, the market model regression takes the form

$$r_{j,t} = a_j + b_j \, r_{Europe,t} + e_{j,t} \, , \tag{9}$$

where $r_{j,t}$ is the stock market return for country $j \in J$ on day $t \in \tau$, and $r_{Europe,t}$ is the equally weighted average return of all other European country indices in the sample. The $R^2$ value is then collected for each country $j \in J$, for each month $\tau \in T_j$, where $J$ includes the 27 countries in the sample, and $T_j$ includes all months for which data is available for the country $j$. Again, I repeat the tests using both value-weighted and equally weighted country-level indices.

To examine the hypotheses, I introduce $S_{j,\tau}$ and the factors discussed in the hypotheses in section 2 in standard ordinary least squares regressions. However, since $S_{j,\tau}$ shows a significant amount of autocorrelation, I also introduce the lagged $S_{j,\tau}$ as an independent variable, which soaks up nearly all of the serial correlation. The same applies to the economic policy uncertainty index by Baker at al. (2015). Furthermore, as an additional measure against autocorrelation, all significance statistics presented are calculated using Newey-West standard errors robust to heteroskedasticity and autocorrelation.

In addition, since each regression is run for each country, a distribution of signs is observed for each coefficient estimate. This allows for using the binomial distribution to calculate a probability of observing such a distribution given the null hypothesis that there is no effect. Therefore, I calculate the binomial probability of observing the distribution seen if both a positive and a negative sign are equally likely. This gives another tool for examining the direction and the significance of the effects. All regression result tables include the binomial probabilities under the coefficient estimates.

The individual regressions are presented along with their results in the next section.

## 4 Empirical results

### *4.1 Economic policy uncertainty and economic conditions*

Hypothesis 1 states that the level of policy certainty is higher when economic conditions are worse, since the government is more likely to change policy when economic conditions are weaker. To examine this, I run the following regression:

$$PU_{j,\tau} = a + b\ Econ_{j,\tau} + e_{\tau}\ , \tag{10}$$

where $PU_{j,\tau}$ is the economic policy uncertainty index for country $j$ for month $\tau$, and $Econ_{j,\tau}$ is respectively one of the three measures of economic conditions: GDP growth, the Economic Sentiment Indicator (ESI), and the Business Climate Indicator (BCI). Given the hypothesis, the expected sign of $b$ is negative.

Since there is significant serial correlation in $PU_{j,\tau}$, I add a lagged version to the independent variables, after which the autocorrelation in the residuals is practically zero. The regression takes the form

$$PU_{j,\tau} = a + b\ Econ_{j,\tau} + c\ PU_{j,\tau-1} + e_{\tau}\ . \tag{11}$$

Table 3 reports the slope estimates for $b$ and the *p*-values based on Newey-West standard errors, for all countries for which the individual economic policy uncertainty index is available as well as for Europe.

For 19 of the 21 regressions, the sign of $b$ is negative, as expected. Three of the estimates are significant at the 0.1% level, four at the 1% level, and four more at least at the 10% level, while ten of the estimates are not statistically significant. On a country level, none of the estimates are statistically significant for Germany and Spain, while the other countries show at least some support for the notion that policy uncertainty is higher in weaker economic conditions. However, subsample analysis reveals that the estimates for GDP growth for both Germany and Spain are statistically

**Table 3**
**Policy uncertainty and economic conditions**

This table reports the estimated slope coefficients $b$ and their Newey-West $p$-values from the following regression:

$$PU_{j,\tau} = a + b\ Econ_{j,\tau} + c\ PU_{j,\tau-1} + e_{\tau}$$

where $PU_{j,\tau}$ is the economic policy uncertainty index for country $j$ for month $\tau$, and $Econ_{j,\tau}$ is respectively one of the three measures of economic conditions: GDP growth, the Economic Sentiment Indicator (ESI), and the Business Climate Indicator (BCI). Given the hypothesis, the expected sign of $b$ is negative. To proxy policy uncertainty, I use the economic policy uncertainty indices by Baker et al. (2015). Both the equally weighted and value-weighted synchronicity measures are reported. In addition, binomial probabilities for the null hypothesis that both signs are equally likely are reported.

| | GDP growth | | | ESI | | | BCI | | |
|---|---|---|---|---|---|---|---|---|---|
| France | -4711,9 | (0,000) | *** | -0,41 | (0,048) | * | -0,54 | (0,058) | * |
| Germany | -1114,7 | (0,161) | | 0,03 | (0,888) | | -0,01 | (0,976) | |
| Italy | -610,3 | (0,317) | | -0,85 | (0,001) | *** | -0,73 | (0,008) | ** |
| Netherlands | -4934,3 | (0,008) | ** | -1,97 | (0,000) | *** | -2,67 | (0,001) | ** |
| Spain | -773,1 | (0,465) | | -0,04 | (0,906) | | -0,02 | (0,962) | |
| UK | -1233,9 | (0,054) | * | -0,22 | (0,308) | | 0,18 | (0,257) | |
| Europe | -2144,5 | (0,001) | ** | -0,28 | (0,026) | * | -0,16 | (0,376) | |
| N (total) | 7 | | | 7 | | | 7 | | |
| N (success) | 7 | | | 6 | | | 6 | | |
| P | 0,00 | | | 0,01 | | | 0,01 | | |

Significance indicators: *** 0,1%, ** 1%, * 10%

significant for the period from 2005 to 2015, at the 5% and 1% levels, respectively. The estimates are also both negative and economically more significant for the subsample period for the two countries.

In addition, I calculate the binomial probability for the signs of the slopes being as estimated, given the null hypothesis that a positive and a negative slope are equally likely to be found. For all three measures, if there was truly no relation, the probability of seeing the number of negative signs as estimated is essentially zero. The results of the binomial tests are reported in table 3 as well.

Therefore, the evidence does support the hypothesis that there is a negative relationship between policy uncertainty and economic conditions.

### *4.2 Stock return synchronicity and economic policy uncertainty*

#### 4.2.1 Intra-country synchronicity

Hypothesis 2 predicts that stock return synchronicity is higher when policy uncertainty is higher, since the political risk premium, which is intuitively higher when policy uncertainty is higher, cannot be fully diversified. To investigate the hypothesis, I run the following regression:

$$S_{j,\tau} = a + b\, PU_{j,\tau} + e_\tau\ , \tag{12}$$

where $S_{j,\tau}$ is the intra-country synchronicity for country $j$ for month $\tau$, and $PU_{j,\tau}$ is the respective level of economic policy uncertainty. Following the hypothesis, the expected sign of $b$ is positive.

Since there is significant serial correlation in $S_{j,\tau}$, I again add a lagged version to the independent variables, after which the autocorrelation in the residuals is practically zero. Then, the regression is the following:

$$S_{j,\tau} = a + b\, PU_{j,\tau} + c\, S_{j,\tau-1} + e_\tau\ . \tag{13}$$

I repeat the regression first using the individual policy uncertainty indices for the 6 countries available, and then for all 27 countries using the common European policy uncertainty index. In addition, both are repeated for equally weighted and value-weighted market returns. The estimates for coefficients $b$ as well as their Newey-West $p$-values are reported in table 4.

Using the country-specific economic policy uncertainty indices, 10 out of 12 estimates are positive as expected. Four of them are significant at the 0.1% level, two at the 1% level, and two at the 5% level. In total, 8 of the 12 estimates are significant at least at the 5% level. Furthermore, all of the significant estimates are positive. I calculate the binomial probabilities to see the number of positive estimates observed, given the null hypothesis that a positive and negative sign would be equally likely, or that there would be no relation between synchronicity and policy uncertainty. For both equally weighted and value-weighted measures of synchronicity, the probability of observing this many positive estimates if there was no relation is less than 2%. In total, observing 10 positive signs of 12 trials if both signs were equally likely is less than 0.4%.

While not statistically significant for all countries, specifically the Netherlands, the evidence supports the hypothesis that higher policy uncertainty is associated with higher stock return synchronicity.

Next, I proxy for policy uncertainty with the common European policy uncertainty index. For the equally-weighted synchronicity measure, 17 of the 27 estimates have the expected positive sign. Nine estimates are significant at the 0.1% level, four at the 1% level, and seven at the 10% level. In total, 20 of the 27 estimates are significant at least at the 10% level. For the value-weighted synchronicity measure, 19 of the 27 estimates have a positive sign. Seven coefficients are significant at the 0.1% level, five at the 1% level, and a total of 15 at least at the 10% level.

Interestingly, both the equally weighted and the value-weighted estimate for the Netherlands are now significant at least at the 5% level, and have the expected positive sign. This may be due to the fact that while the European policy uncertainty index covers the full period from 1990 to 2015, the index for the Netherlands only spans the period 2003 to 2015, or only 156 months. This is exactly half the number of observations as for the full European index. If the lesser statistical power is due to the lesser number of observations, it may actually imply further support for the hypothesis. A simple regression of $PU_{Netherlands}$ on $PU_{Europe}$ shows that the two indices are strongly related ($t$ = 6.88), which further supports the view that a longer sample period for the individual country index would likely show stronger results as well.

**Table 4**
**Stock synchronicity and political uncertainty (Intra-country)**

This table reports the estimated slope coefficients $b$ and their Newey-West $p$-values from the following regression:

$$S_{j,\tau} = a + b\ PU_{j,\tau} + c\ S_{j,\tau-1} + e_{\tau}\ .$$

where $S_{j,\tau}$ is the intra-country synchronicity for country $j$ for month $\tau$, and $PU_{j,\tau}$ is the respective level of economic policy uncertainty. The expected $b$ is positive. To proxy policy uncertainty, I use the economic policy uncertainty indices by Baker et al. (2015). Both the equally weighted and value-weighted synchronicity measures are reported. In addition, binomial probabilities for the null hypothesis that both signs are equally likely are reported.

| | EW | | | VW | | |
|---|---|---|---|---|---|---|
| | | | Country PU Index | | | |
| France | 0,0001 | (0,000) | *** | 0,0015 | (0,000) | *** |
| Germany | 0,0001 | (0,025) | * | 0,0016 | (0,000) | *** |
| Italy | 0,0003 | (0,047) | * | 0,0022 | (0,006) | ** |
| Netherlands | 0,0000 | (0,921) | | 0,0001 | (0,904) | |
| Spain | 0,0001 | (0,001) | ** | 0,0005 | (0,365) | |
| UK | 0,0002 | (0,000) | *** | -0,0011 | (0,152) | |
| N (total) | 6 | | | 6 | | |
| N (success) | 5 | | | 5 | | |
| P | 0,02 | | | 0,02 | | |
| | | | European PU Index | | | |
| Austria | -0,0003 | (0,763) | | 0,0009 | (0,054) | * |
| Belgium | 0,0002 | (0,836) | | 0,0020 | (0,001) | ** |
| Bulgaria | -0,0038 | (0,019) | * | 0,0020 | (0,273) | |
| Croatia | 0,0050 | (0,004) | ** | 0,0024 | (0,007) | ** |
| Cyprus | -0,0048 | (0,001) | *** | -0,0006 | (0,186) | |
| Czech | 0,0072 | (0,000) | *** | 0,0024 | (0,035) | * |
| Denmark | -0,0019 | (0,059) | * | 0,0005 | (0,283) | |
| Estonia | 0,0015 | (0,333) | | 0,0004 | (0,526) | |
| Finland | 0,0036 | (0,001) | *** | 0,0032 | (0,000) | *** |
| France | 0,0026 | (0,000) | *** | 0,0021 | (0,000) | *** |
| Germany | 0,0001 | (0,839) | | 0,0016 | (0,001) | ** |
| Greece | -0,0021 | (0,141) | | -0,0003 | (0,594) | |
| Hungary | 0,0034 | (0,005) | ** | 0,0016 | (0,032) | * |
| Ireland | 0,0000 | (0,957) | | 0,0015 | (0,007) | ** |
| Italy | 0,0027 | (0,000) | *** | 0,0025 | (0,000) | *** |
| Latvia | -0,0038 | (0,070) | * | 0,0000 | (0,994) | |
| Lithuania | -0,0040 | (0,014) | * | 0,0011 | (0,174) | |
| Luxembourg | 0,0056 | (0,002) | ** | 0,0049 | (0,000) | *** |
| Malta | -0,0017 | (0,071) | * | -0,0006 | (0,219) | |
| Netherlands | 0,0019 | (0,038) | * | 0,0038 | (0,000) | *** |
| Poland | 0,0017 | (0,090) | * | 0,0000 | (0,973) | |
| Portugal | 0,0033 | (0,000) | *** | 0,0022 | (0,000) | *** |
| Slovakia | -0,0130 | (0,000) | *** | 0,0045 | (0,000) | *** |
| Slovenia | 0,0044 | (0,005) | ** | -0,0010 | (0,239) | |
| Spain | 0,0000 | (0,966) | | -0,0005 | (0,394) | |
| Sweden | 0,0044 | (0,000) | *** | 0,0029 | (0,002) | ** |
| UK | 0,0053 | (0,000) | *** | -0,0012 | (0,345) | |
| N (total) | 27 | | | 27 | | |
| N (success) | 17 | | | 19 | | |
| P | 0,06 | | | 0,01 | | |

Significance indicators: *** 0,1%, ** 1%, * 10%

For the European policy uncertainty index, the binomial distribution shows that there is a 6% (EW) and 1% (VW) chance for the observed numbers of positive slope signs if there was no relation between policy uncertainty and synchronicity. Combined, there is less than a 0.5% chance of observing so many positive signs if there was no relation.

In total, 36 of the 43 statistically significant estimates have the expected positive sign.

Therefore, on average the empirical evidence strongly supports the hypothesis that higher economic policy uncertainty is associated with higher intra-country stock return synchronicity.

### 4.2.2 Inter-country synchronicity

To examine the inter-country synchronicity, I run a similar regression:

$$S_{j,\tau} = a + b\, PU_{j,\tau} + c\, S_{j,\tau-1} + e_{\tau}\ , \tag{14}$$

where $S_{j,\tau}$ is now the inter-country synchronicity for country $j$ for month $\tau$, and $PU_{j,\tau}$ is the respective level of country policy uncertainty or European policy uncertainty. The expected sign of $b$ is again positive, since higher policy uncertainty is expected to be associated with higher synchronicity.

Table 5 reports the coefficients $b$ and their Newey-West $p$-values. For country policy uncertainty, five out of six estimates are positive for both equally and value-weighted measures. I total 10 of the 12 estimates as significant at least at the 10% level. Moreover, all significant estimates are positive.

For common European policy uncertainty, using the equally weighted country-level indices, 17 out of 27 estimates have the expected positive sign, and using the value-weighted country-level indices, 25 of the 27 estimates have the expected sign. This is a clear first suggestion that synchronicity between the European countries increases with the level of policy uncertainty. Especially for the value-weighted indices, the results are also highly significant: 12 estimates are significant at the 0.1% level, five at the 1% level, and a total of 21 out of 27 at least at the 10% level.

**Table 5**
**Stock synchronicity and political uncertainty (Inter-country)**

This table reports the estimated slope coefficients $b$ and their Newey-West $p$-values from the following regression:

$$S_{j,\tau} = a + b\ PU_{j,\tau} + c\ S_{j,\tau-1} + e_\tau$$

where $S_{j,\tau}$ is the inter-country synchronicity for country $j$ for month $\tau$, and $PU_{j,\tau}$ is the level of country policy uncertainty or European policy uncertainty. The expected $b$ is positive. To proxy policy uncertainty, I use the economic policy uncertainty indices by Baker et al. (2015). Both the equally weighted and value-weighted synchronicity measures are reported. In addition, binomial probabilities for the null hypothesis that both signs are equally likely are reported.

| | EW | | | VW | | |
|---|---|---|---|---|---|---|
| | | | Country PU Index | | | |
| France | 0,0001 | (0,000) | *** | 0,0015 | (0,000) | *** |
| Germany | 0,0001 | (0,025) | * | 0,0016 | (0,000) | *** |
| Italy | 0,0003 | (0,047) | * | 0,0022 | (0,006) | ** |
| Netherlands | -0,0000 | (0,921) | | 0,0001 | (0,904) | |
| Spain | 0,0001 | (0,001) | ** | 0,0005 | (0,365) | |
| UK | 0,0002 | (0,000) | *** | -0,0011 | (0,152) | |
| N (total) | 6 | | | 6 | | |
| N (success) | 5 | | | 5 | | |
| P | 0,02 | | | 0,02 | | |
| | | | European PU Index | | | |
| Austria | 0,0006 | (0,034) | * | 0,0011 | (0,000) | *** |
| Belgium | 0,0002 | (0,521) | | 0,0010 | (0,001) | ** |
| Bulgaria | -0,0001 | (0,397) | | 0,0000 | (0,794) | |
| Croatia | 0,0002 | (0,256) | | 0,0005 | (0,007) | ** |
| Cyprus | 0,0000 | (0,962) | | -0,0004 | (0,161) | |
| Czech | 0,0003 | (0,116) | | 0,0010 | (0,001) | *** |
| Denmark | 0,0009 | (0,005) | ** | 0,0008 | (0,004) | ** |
| Estonia | 0,0005 | (0,068) | * | -0,0002 | (0,146) | |
| Finland | 0,0010 | (0,000) | *** | 0,0013 | (0,000) | *** |
| France | 0,0013 | (0,000) | *** | 0,0009 | (0,000) | *** |
| Germany | 0,0004 | (0,200) | | 0,0012 | (0,000) | *** |
| Greece | 0,0002 | (0,231) | | 0,0005 | (0,032) | * |
| Hungary | 0,0006 | (0,010) | ** | 0,0005 | (0,052) | * |
| Ireland | 0,0004 | (0,065) | * | 0,0013 | (0,001) | *** |
| Italy | 0,0008 | (0,003) | ** | 0,0009 | (0,000) | *** |
| Latvia | -0,0001 | (0,459) | | 0,0003 | (0,013) | * |
| Lithuania | -0,0002 | (0,353) | | 0,0005 | (0,073) | * |
| Luxembourg | 0,0000 | (0,989) | | 0,0015 | (0,000) | *** |
| Malta | -0,0003 | (0,004) | ** | 0,0001 | (0,434) | |
| Netherlands | 0,0006 | (0,023) | * | 0,0011 | (0,000) | *** |
| Poland | 0,0007 | (0,024) | * | 0,0009 | (0,001) | *** |
| Portugal | 0,0009 | (0,000) | *** | 0,0012 | (0,000) | *** |
| Slovakia | -0,0003 | (0,037) | * | 0,0000 | (0,881) | |
| Slovenia | -0,0002 | (0,219) | | 0,0002 | (0,166) | |
| Spain | -0,0001 | (0,540) | | 0,0011 | (0,000) | *** |
| Sweden | 0,0006 | (0,043) | * | 0,0007 | (0,002) | ** |
| UK | -0,0001 | (0,844) | | 0,0007 | (0,008) | ** |
| N (total) | 27 | | | 27 | | |
| N (success) | 17 | | | 25 | | |
| P | 0,06 | | | 0,00 | | |

Significance indicators: *** 0,1%, ** 1%, * 10

Given the sign distribution and the significance, the empirical evidence supports the view that stock return synchronicity between the European countries increases with both country policy uncertainty and the common European policy uncertainty.

### *4.3 Stock return synchronicity and economic conditions*

#### 4.3.1 Intra-country synchronicity

Hypothesis 3 states that stock return synchronicity is expected to be higher when economic conditions are weaker. This follows directly from the first two hypotheses: if policy uncertainty is higher when economic conditions are weaker, and if synchronicity is higher when policy uncertainty is higher, we would naturally also expect synchronicity to be higher when economic conditions are weaker. To examine this, I run the following regression:

$$S_{j,\tau} = a + b\ Econ_{j,\tau} + e_{\tau}\ , \tag{15}$$

where $S_{j,\tau}$ is the intra-country synchronicity for country $j$ for month $\tau$, and $Econ_{j,\tau}$ is respectively one of the three measures of economic conditions: GDP growth, the Economic Sentiment Indicator (ESI), and the Business Climate Indicator (BCI). Given the hypothesis, the expected sign of $b$ is negative.

Again, to counter the serial correlation in the synchronicity, I add the lagged synchronicity, after which there is no significant autocorrelation in the error terms:

$$S_{j,\tau} = a + b\ Econ_{j,\tau} + c\ S_{j,\tau-1} + e_{\tau}\ . \tag{16}$$

I repeat the regression for the synchronicity measures based on equally weighted and value-weighted market returns. The estimates for coefficients $b$ as well as their Newey-West *p*-values are reported in table 6.

Let us first review the results for the synchronicity based on equally weighted market returns. First, for GDP growth, 17 out of 21 regressions with available data have an expected negative sign for the slope coefficient. In total, 10 out of 21 are statistically significant at least at the 10% level. Second, for the ESI, just 12 of 26 coefficients have the expected negative sign. Similarly, only nine are statistically significant at least at the 10% level. Third, for the BCI, 18 out of 26 coefficients have the expected negative sign, but only nine are statistically significant at least at the 10% level.

Next, consider the value-weighted synchronicity measure. For GDP growth, 13 out of 21 coefficients have the expected negative sign, and eight are statistically significant at least at the 10% level. For the ESI, 14 out of 26 estimates have a negative sign, and nine are significant at least at the 5% level. Finally, for the BCI, 17 out of 26 estimates have a negative sign, and seven are significant at least at the 10% level.

Again, I calculate the binomial probability for observing such results if there is no relation. For GDP growth, the probabilities are 0.1% (EW) and 9.5% (VW). For the ESI, the probabilities are much higher at 57.7% (EW) and 27.9% (VW). And for the BCI, the probabilities are 1.4% (EW) and 3.8% (VW). While GDP growth and the BCI provide some support for the argument that there may be a relation, the ESI does not provide any evidence for my hypothesis or for the opposite hypothesis.

Generally, the evidence provides only some support for the hypothesis that synchronicity is higher when economic conditions are lower. It can hardly be said based on these results that there would be a universal effect. Furthermore, some of the most significant estimates seem to have a positive, unexpected sign. For instance, five out of the six estimates are highly significant for Greece, and all six have an unexpected positive sign. Similarly, all four available estimates for Cyprus are highly significant and have a positive sign. Both countries still have an expected positive relationship between synchronicity and policy uncertainty, as can be seen in the results regarding the previous hypothesis.

On the other hand, in some countries there is an expected relation. For instance, for the Czech Republic, Hungary, and the Netherlands, synchronicity seems to be clearly higher when GDP growth is lower.

Interestingly, even though the first two hypotheses are supported by the empirical evidence, the third related hypothesis receives on average only dubious support from the results. The effect is highly dependent on the country, in both direction and significance.

**Table 6**
**Stock synchronicity and economic conditions (Intra-country)**

This table reports the estimated slope coefficients $b$ and their Newey-West $p$-values from the following regression:

$$S_{j,\tau} = a + b\ Econ_{j,\tau} + c\ S_{j,\tau-1} + e_\tau$$

where $S_{j,\tau}$ is the intra-country synchronicity for country $j$ for month $\tau$, and $Econ_{j,\tau}$ is respectively one of the three measures of economic conditions: GDP growth, the Economic Sentiment Indicator (ESI), and the Business Climate Indicator (BCI). The expected sign of $b$ is negative. Both the equally weighted and value-weighted synchronicity measures are reported. In addition, binomial probabilities for the null hypothesis that both signs are equally likely are reported.

| | EW | | | | | | | | | VW | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GDP growth | | | ESI | | | BCI | | | GDP growth | | | ESI | | | BCI | | |
| Austria | -14,12 | (0,228) | | 0,003 | (0,231) | | 0,004 | (0,162) | | -7,04 | (0,288) | | 0,001 | (0,509) | | 0,002 | (0,341) | |
| Belgium | -16,21 | (0,175) | | -0,001 | (0,713) | | -0,002 | (0,581) | | -11,98 | (0,092) | * | 0,002 | (0,323) | | 0,004 | (0,100) | * |
| Bulgaria | NA | NA | | -0,003 | (0,730) | | -0,012 | (0,169) | | NA | NA | | 0,002 | (0,819) | | 0,001 | (0,960) | |
| Croatia | NA | NA | | -0,009 | (0,136) | | -0,013 | (0,049) | * | NA | NA | | -0,004 | (0,596) | | -0,007 | (0,380) | |
| Cyprus | NA | NA | | 0,015 | (0,000) | *** | 0,012 | (0,000) | *** | NA | NA | | 0,006 | (0,010) | * | 0,005 | (0,006) | ** |
| Czech | -15,73 | (0,004) | ** | 0,000 | (0,847) | | 0,000 | (0,992) | | -24,51 | (0,005) | ** | -0,021 | (0,002) | ** | -0,014 | (0,002) | ** |
| Denmark | -9,64 | (0,203) | | -0,006 | (0,104) | | -0,002 | (0,576) | | -10,76 | (0,125) | | -0,005 | (0,036) | * | -0,003 | (0,165) | |
| Estonia | -11,17 | (0,012) | * | -0,007 | (0,224) | | -0,007 | (0,150) | | 2,50 | (0,434) | | 0,002 | (0,454) | | 0,001 | (0,585) | |
| Finland | -5,97 | (0,371) | | 0,000 | (0,992) | | -0,002 | (0,281) | | -5,29 | (0,287) | | 0,000 | (0,840) | | -0,002 | (0,239) | |
| France | -22,63 | (0,029) | * | 0,001 | (0,559) | | 0,002 | (0,328) | | -21,10 | (0,006) | ** | 0,000 | (0,813) | | 0,000 | (0,917) | |
| Germany | -2,03 | (0,816) | | 0,004 | (0,084) | * | 0,002 | (0,241) | | 9,36 | (0,228) | | 0,005 | (0,016) | * | 0,004 | (0,010) | ** |
| Greece | 11,70 | (0,009) | ** | 0,013 | (0,000) | *** | 0,011 | (0,000) | *** | 7,25 | (0,111) | | 0,012 | (0,000) | *** | 0,010 | (0,001) | *** |
| Hungary | -25,18 | (0,000) | *** | -0,008 | (0,021) | * | -0,002 | (0,684) | | -10,74 | (0,022) | * | -0,007 | (0,015) | * | -0,001 | (0,797) | |
| Ireland | -2,08 | (0,383) | | NA | NA | | NA | NA | | -3,89 | (0,043) | * | NA | NA | | NA | NA | |
| Italy | -21,44 | (0,006) | ** | 0,000 | (0,902) | | -0,001 | (0,732) | | -21,78 | (0,012) | * | -0,003 | (0,185) | | -0,003 | (0,155) | |
| Latvia | NA | NA | | 0,005 | (0,378) | | -0,001 | (0,906) | | NA | NA | | -0,001 | (0,813) | | -0,001 | (0,829) | |
| Lithuania | NA | NA | | -0,007 | (0,037) | * | -0,005 | (0,064) | * | NA | NA | | -0,005 | (0,247) | | -0,003 | (0,431) | |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Luxembourg | 4,00 | (0,409) | | -0,020 | (0,138) | | -0,007 | (0,102) | | -6,68 | (0,176) | | -0,010 | (0,010) | ** | -0,005 | (0,031) | * |
| Malta | NA | NA | | -0,012 | (0,002) | ** | -0,013 | (0,002) | ** | NA | NA | | -0,004 | (0,188) | | -0,001 | (0,732) | |
| Netherlands | -18,34 | (0,067) | * | 0,002 | (0,287) | | 0,007 | (0,055) | * | -46,64 | (0,000) | *** | -0,003 | (0,219) | | -0,003 | (0,502) | |
| Poland | 3,14 | (0,671) | | 0,007 | (0,097) | * | -0,004 | (0,551) | | 6,73 | (0,475) | | 0,011 | (0,029) | * | -0,004 | (0,616) | |
| Portugal | -15,62 | (0,031) | * | -0,002 | (0,502) | | -0,004 | (0,292) | | -16,67 | (0,008) | ** | -0,002 | (0,332) | | -0,002 | (0,422) | |
| Slovakia | 24,60 | (0,254) | | 0,032 | (0,000) | *** | 0,015 | (0,030) | * | -19,46 | (0,371) | | -0,013 | (0,000) | *** | -0,012 | (0,011) | * |
| Slovenia | -70,76 | (0,000) | *** | 0,000 | (0,958) | | -0,001 | (0,866) | | 7,20 | (0,322) | | 0,003 | (0,379) | | -0,004 | (0,268) | |
| Spain | -7,21 | (0,507) | | -0,009 | (0,068) | * | -0,010 | (0,046) | * | 7,64 | (0,358) | | 0,000 | (0,967) | | -0,001 | (0,528) | |
| Sweden | -1,76 | (0,781) | | 0,007 | (0,106) | | -0,007 | (0,033) | * | 4,37 | (0,740) | | 0,005 | (0,409) | | -0,010 | (0,194) | |
| UK | -12,26 | (0,021) | * | 0,004 | (0,299) | | 0,005 | (0,154) | | 6,99 | (0,615) | | 0,008 | (0,119) | | 0,003 | (0,375) | |
| N (total) | 21 | | | 26 | | | 26 | | | 21 | | | 26 | | | 26 | | |
| N (success) | 17 | | | 12 | | | 18 | | | 13 | | | 14 | | | 17 | | |
| P | 0,00 | | | 0,58 | | | 0,01 | | | 0,09 | | | 0,28 | | | 0,04 | | |

Significance indicators: *** 0,1%, ** 1%, * 10%

### 4.3.2 Inter-country synchronicity

To investigate whether the inter-country synchronicity depends on economic conditions, I run the following regression:

$$S_{j,\tau} = a + b\, Econ_{j,\tau} + c\, S_{j,\tau-1} + e_{\tau}\,, \tag{17}$$

where $S_{j,\tau}$ is the inter-country synchronicity for country $j$ for month $\tau$, and $Econ_{j,\tau}$ is respectively one of the three measures of economic conditions: GDP growth, the Economic Sentiment Indicator (ESI), and the Business Climate Indicator (BCI). Given the hypothesis, the expected sign of $b$ is negative.

Table 7 reports the estimated coefficients $b$ and their Newey-West $p$-values. For GDP growth, 17 (EW) and 18 (VW) out of the 21 estimates have the expected positive sign. 25 of the 42 estimates are statistically significant at least at the 10% level. The ESI and BCI measures provide no significant support for the notion that weaker economic conditions would drive synchronicity higher.

On average, the results are similar to the intra-country examination. While weaker GDP growth seems to drive inter-country synchronicity higher more so than the intra-country synchronicity, the other two measures of economic conditions are insignificant. However, since GDP growth is arguably a more prestigious and widely used measure of economic conditions, the empirical evidence seems to provide some support for the hypothesis that inter-country synchronicity is higher when economic conditions are weaker.

**Table 7**
**Stock synchronicity and economic conditions (Inter-country)**

This table reports the estimated slope coefficients $b$ and their Newey-West $p$-values from the following regression:

$$S_{j,\tau} = a + b\ Econ_{j,\tau} + c\ S_{j,\tau-1} + e_{\tau}$$

where $S_{j,\tau}$ is the inter-country synchronicity for country $j$ for month $\tau$, and $Econ_{j,\tau}$ is respectively one of the three measures of economic conditions: GDP growth, the Economic Sentiment Indicator (ESI), and the Business Climate Indicator (BCI). The expected sign of $b$ is negative. Both the equally weighted and value-weighted synchronicity measures are reported. In addition, binomial probabilities for the null hypothesis that both signs are equally likely are reported.

| | EW | | | | | | | | | VW | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GDP growth | | | ESI | | | BCI | | | GDP growth | | | ESI | | | BCI | | |
| Austria | -5,95 | (0,329) | | 0,002 | (0,293) | | 0,001 | (0,326) | | -4,16 | (0,337) | | 0,001 | (0,693) | | 0,001 | (0,679) | |
| Belgium | -12,69 | (0,028) | * | 0,002 | (0,134) | | 0,002 | (0,166) | | -2,47 | (0,537) | | 0,001 | (0,374) | | 0,002 | (0,149) | |
| Bulgaria | NA | NA | | 0,001 | (0,074) | * | 0,001 | (0,173) | | NA | NA | | -0,001 | (0,098) | * | -0,001 | (0,224) | |
| Croatia | NA | NA | | 0,000 | (0,906) | | 0,000 | (0,889) | | NA | NA | | -0,004 | (0,009) | ** | -0,006 | (0,003) | ** |
| Cyprus | NA | NA | | 0,002 | (0,043) | * | 0,002 | (0,011) | * | NA | NA | | 0,004 | (0,033) | * | 0,004 | (0,003) | ** |
| Czech | -4,19 | (0,001) | ** | -0,002 | (0,018) | * | -0,002 | (0,028) | * | -12,21 | (0,000) | *** | -0,001 | (0,302) | | -0,002 | (0,174) | |
| Denmark | -8,37 | (0,014) | * | 0,001 | (0,738) | | 0,000 | (0,823) | | -8,28 | (0,086) | * | 0,001 | (0,508) | | -0,001 | (0,571) | |
| Estonia | -3,65 | (0,001) | ** | -0,002 | (0,118) | | -0,002 | (0,037) | * | 0,68 | (0,172) | | 0,000 | (0,490) | | 0,000 | (0,482) | |
| Finland | -1,85 | (0,493) | | 0,002 | (0,290) | | -0,001 | (0,243) | | 2,01 | (0,563) | | 0,002 | (0,236) | | -0,002 | (0,127) | |
| France | -16,60 | (0,012) | * | 0,001 | (0,374) | | 0,001 | (0,470) | | -7,88 | (0,073) | * | 0,002 | (0,178) | | 0,002 | (0,209) | |
| Germany | -5,90 | (0,094) | * | 0,002 | (0,262) | | 0,002 | (0,144) | | -2,95 | (0,428) | | 0,001 | (0,618) | | 0,002 | (0,199) | |
| Greece | -2,75 | (0,070) | * | 0,000 | (0,729) | | 0,000 | (0,615) | | -4,80 | (0,023) | * | -0,002 | (0,096) | * | -0,002 | (0,052) | * |
| Hungary | -3,27 | (0,012) | * | -0,003 | (0,009) | ** | -0,001 | (0,540) | | -2,74 | (0,086) | * | -0,003 | (0,027) | * | -0,001 | (0,682) | |
| Ireland | -2,58 | (0,018) | * | NA | NA | | NA | NA | | -1,17 | (0,310) | | NA | NA | | NA | NA | |
| Italy | -11,37 | (0,004) | ** | 0,001 | (0,690) | | 0,000 | (0,962) | | -11,46 | (0,002) | ** | 0,000 | (0,741) | | 0,000 | (0,957) | |
| Latvia | NA | NA | | 0,000 | (0,851) | | -0,001 | (0,287) | | NA | NA | | 0,000 | (0,647) | | 0,000 | (0,589) | |
| Lithuania | NA | NA | | -0,001 | (0,532) | | 0,000 | (0,715) | | NA | NA | | -0,001 | (0,186) | | -0,001 | (0,206) | |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Luxembourg | 1,22 | (0,470) | | 0,001 | (0,122) | | 0,001 | (0,300) | | -0,64 | (0,703) | | -0,002 | (0,085) | * | -0,001 | (0,243) | |
| Malta | NA | NA | | -0,002 | (0,004) | ** | -0,001 | (0,015) | * | NA | NA | | 0,000 | (0,618) | | 0,000 | (0,991) | |
| Netherlands | -7,52 | (0,041) | * | 0,001 | (0,329) | | 0,002 | (0,420) | | -14,69 | (0,000) | *** | 0,000 | (0,823) | | 0,001 | (0,707) | |
| Poland | 5,59 | (0,073) | * | -0,002 | (0,267) | | 0,001 | (0,686) | | 1,26 | (0,704) | | -0,002 | (0,186) | | 0,003 | (0,303) | |
| Portugal | -8,34 | (0,009) | ** | -0,001 | (0,161) | | -0,002 | (0,153) | | -12,42 | (0,000) | *** | -0,001 | (0,538) | | -0,001 | (0,650) | |
| Slovakia | 2,46 | (0,082) | * | 0,001 | (0,079) | * | 0,001 | (0,143) | | -0,39 | (0,495) | | 0,000 | (0,404) | | 0,000 | (0,679) | |
| Slovenia | -0,61 | (0,607) | | 0,002 | (0,039) | * | 0,001 | (0,438) | | -3,97 | (0,072) | * | -0,001 | (0,465) | | -0,002 | (0,033) | * |
| Spain | 0,61 | (0,688) | | 0,000 | (0,310) | | 0,000 | (0,784) | | -10,22 | (0,000) | *** | 0,000 | (0,696) | | 0,002 | (0,282) | |
| Sweden | -2,73 | (0,550) | | 0,001 | (0,198) | | 0,000 | (0,876) | | -3,48 | (0,381) | | 0,003 | (0,022) | * | 0,001 | (0,466) | |
| UK | -1,28 | (0,684) | | 0,001 | (0,068) | * | 0,000 | (0,903) | | -11,36 | (0,001) | ** | 0,001 | (0,449) | | 0,001 | (0,607) | |
| N (total) | 21 | | | 26 | | | 26 | | | 21 | | | 26 | | | 26 | | |
| N (success) | 17 | | | 9 | | | 13 | | | 18 | | | 12 | | | 13 | | |
| P | 0,00 | | | 0,92 | | | 0,42 | | | 0,00 | | | 0,58 | | | 0,42 | | |

Significance indicators: *** 0,1%, ** 1%, * 10%

### *4.4 Stock return synchronicity, policy uncertainty, and economic conditions*

#### 4.4.1 Intra-country synchronicity

Hypothesis 4 states that policy uncertainty has a stronger effect on synchronicity when economic conditions are weaker. To test the hypothesis, I run the following regression with an interaction term:

$$S_{j,\tau} = a + b\ PU_{j,\tau}\ Econ_{j,\tau} + c\ PU_{j,\tau} + d\ Econ_{j,\tau} + e_\tau\ , \tag{18}$$

where $S_{j,\tau}$ is the intra-country synchronicity for country $j$ for month $\tau$, $PU_{j,\tau}$ is respective level of economic policy uncertainty, and $Econ_{j,\tau}$ is respectively one of the three measures of economic conditions: GDP growth, the Economic Sentiment Indicator (ESI), and the Business Climate Indicator (BCI). The expected sign of $b$ is negative, since the effect $PU$ has is expected to be higher when $Econ$ is lower.

To account for the serial correlation in $S_{j,\tau}$, I add the lagged synchronicity to the independent variables, and calculate all significance statistics with heteroskedasticity and autocorrelation consistent Newey-West standard errors. With the lag, the regression takes the following form:

$$S_{j,\tau} = a + b\ PU_{j,\tau}\ Econ_{j,\tau} + c\ PU_{j,\tau} + d\ Econ_{j,\tau} + e\ S_{j,\tau-1} + e_\tau \tag{19}$$

I repeat the regression first using the individual policy uncertainty indices for the 6 countries available, and then for all 27 countries using the common European policy uncertainty index. In addition, I run the tests for synchronicity measures based on equally weighted and value-weighted market returns, for all three proxies of economic conditions.

The results for the regressions using the individual country indices for policy uncertainty are presented in table 8. For GDP growth, four out of six estimates have the expected negative sign, for both equally weighted and value-weighted measures of synchronicity. For the ESI and the BCI, only six out of the remaining 24 estimates have the expected sign, and all estimates for the ESI and the BCI are also very close to zero. Furthermore, only four out of all 36 coefficients are statistically significant even at the 10% level. Even though the binomial distribution suggests that it would be somewhat unlikely to see such results for the state-dependency on GDP growth if there actually is no dependency (11% probability for both EW and VW, 7% combined), the results as a whole suggest that the effect of the individual policy uncertainty indices on synchronicity seems to have no state-dependency on economic conditions.

Using the common European policy uncertainty index as a proxy for policy uncertainty for the 27 countries in the sample yields similar results. In total, 64 of all 146 coefficients estimated have the expected negative sign, which means that generally nothing can be said about the direction of the effect. Also, only 25 of the 146 estimates are statistically significant even at the 10% level. The results are reported in table 9.

When examining individual countries in the latter specification, there are some exceptions. Most notably, there is a clear dependency on GDP growth in Finland for both equally weighted and value-weighted synchronicity measures, significant at the 1% level. The sign is also as expected: policy uncertainty seems to induce significantly more synchronicity when GDP growth is slower[13]. While not quite as significant, a similar effect for the Czech Republic is visible in the results for the three measures of economic conditions.

For all specifications of the regression, the direct association between stock return synchronicity and policy uncertainty (coefficient $c$) remains significant, with very similar results as those discussed in section 4.2.

[13] However, this does not qualify as a test of causality, but merely association.

**Table 8**
**Stock synchronicity, policy uncertainty, and economic conditions (Intra-country, Country PU Index)**

This table reports the estimated slope coefficients $b$ and their Newey-West $p$-values from the following regression:

$$S_{j,\tau} = a + b\ PU_{j,\tau}\ Econ_{j,\tau} + c\ PU_{j,\tau} + d\ Econ_{j,\tau} + e_\tau$$

where $S_{j,\tau}$ is the intra-country synchronicity for country $j$ for month $\tau$, $PU_{j,\tau}$ is the respective level of economic policy uncertainty, and $Econ_{j,\tau}$ is respectively one of the three measures of economic conditions: GDP growth, the Economic Sentiment Indicator (ESI), and the Business Climate Indicator (BCI). The expected sign of $b$ is negative. Both the equally weighted and value-weighted synchronicity measures are reported. In addition, binomial probabilities for the null hypothesis that both signs are equally likely are reported.

| | EW | | | | | | | | | VW | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GDP growth | | | ESI | | | BCI | | | GDP growth | | | ESI | | | BCI | | |
| France | -0,13 | (0,451) | | -9,8E-06 | (0,783) | | -2,0E-05 | (0,570) | | -0,01 | (0,959) | | 1,6E-05 | (0,574) | | 1,1E-05 | (0,714) | |
| Germany | -0,29 | (0,011) | * | -4,9E-05 | (0,301) | | -8,6E-06 | (0,814) | | -0,17 | (0,087) | * | 4,2E-05 | (0,276) | | 4,1E-05 | (0,147) | |
| Italy | -0,09 | (0,709) | | 1,0E-04 | (0,159) | | 5,9E-05 | (0,552) | | -0,10 | (0,649) | | 1,2E-04 | (0,102) | | 7,8E-05 | (0,389) | |
| Netherlands | 0,19 | (0,216) | | 1,1E-04 | (0,069) | * | 1,1E-04 | (0,149) | | 0,05 | (0,796) | | 6,1E-05 | (0,293) | | 1,2E-04 | (0,110) | |
| Spain | -0,32 | (0,189) | | -4,4E-05 | (0,677) | | -8,9E-06 | (0,936) | | 0,23 | (0,255) | | 9,4E-05 | (0,292) | | 1,1E-04 | (0,229) | |
| UK | 0,03 | (0,583) | | 3,3E-05 | (0,117) | | 2,6E-05 | (0,231) | | -0,24 | (0,338) | | 2,4E-04 | (0,007) | ** | 1,4E-04 | (0,152) | |
| N (total) | 6 | | | 6 | | | 6 | | | 6 | | | 6 | | | 6 | | |
| N (success) | 4 | | | 3 | | | 3 | | | 4 | | | 0 | | | 0 | | |
| P | 0,11 | | | 0,34 | | | 0,34 | | | 0,11 | | | 0,98 | | | 0,98 | | |

Significance indicators: *** 0,1%, ** 1%, * 10%

**Table 9**
**Stock synchronicity, policy uncertainty, and economic conditions (Intra-country, European PU Index)**

This table reports the estimated slope coefficients $b$ and their Newey-West $p$-values from the following regression:

$$S_{j,\tau} = a + b\ PU_{Europe,\tau}\ Econ_{j,\tau} + c\ PU_{Europe,\tau} + d\ Econ_{j,\tau} + e_{\tau}$$

where $S_{j,\tau}$ is the intra-country synchronicity for country $j$ for month $\tau$, $PU_{Europe,\tau}$ is level of European economic policy uncertainty, and $Econ_{j,\tau}$ is respectively one of the three measures of economic conditions: GDP growth, the Economic Sentiment Indicator (ESI), and the Business Climate Indicator (BCI). The expected sign of $b$ is negative. Both the equally weighted and value-weighted synchronicity measures are reported. In addition, binomial probabilities for the null hypothesis that both signs are equally likely are reported.

| | EW | | | | | | | | | VW | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GDP growth | | | ESI | | | BCI | | | GDP growth | | | ESI | | | BCI | | |
| Austria | -0,19 | (0,476) | | -2,6E-05 | (0,736) | | -3,4E-05 | (0,683) | | -0,16 | (0,263) | | -5,1E-05 | (0,385) | | -5,0E-05 | (0,413) | |
| Belgium | -0,41 | (0,248) | | 4,3E-05 | (0,518) | | 3,5E-05 | (0,640) | | 0,15 | (0,457) | | 9,0E-05 | (0,124) | | 7,5E-05 | (0,259) | |
| Bulgaria | NA | NA | | 4,1E-04 | (0,000) | *** | 4,5E-04 | (0,000) | *** | NA | NA | | -1,1E-04 | (0,465) | | -3,5E-04 | (0,093) | * |
| Croatia | NA | NA | | -2,3E-04 | (0,276) | | -3,9E-04 | (0,086) | * | NA | NA | | -1,1E-04 | (0,509) | | -1,1E-04 | (0,557) | |
| Cyprus | NA | NA | | 2,1E-05 | (0,740) | | 7,6E-05 | (0,191) | | NA | NA | | -1,5E-05 | (0,789) | | 6,8E-06 | (0,897) | |
| Czech | 0,13 | (0,206) | | -9,9E-05 | (0,027) | * | -9,4E-05 | (0,060) | * | -0,56 | (0,017) | * | -3,4E-04 | (0,001) | ** | -2,9E-04 | (0,002) | ** |
| Denmark | 0,03 | (0,881) | | 8,8E-05 | (0,216) | | 5,7E-06 | (0,950) | | -0,16 | (0,352) | | 6,2E-06 | (0,933) | | -5,0E-05 | (0,529) | |
| Estonia | -0,21 | (0,140) | | -2,1E-04 | (0,176) | | -1,7E-04 | (0,213) | | -0,02 | (0,881) | | -3,5E-05 | (0,666) | | -1,6E-05 | (0,748) | |
| Finland | -0,37 | (0,002) | ** | -6,9E-05 | (0,487) | | -6,1E-05 | (0,411) | | -0,28 | (0,002) | ** | -4,5E-06 | (0,955) | | -6,9E-05 | (0,259) | |
| France | -0,33 | (0,262) | | 4,4E-05 | (0,514) | | 2,3E-05 | (0,727) | | -0,12 | (0,608) | | 6,2E-05 | (0,224) | | 6,0E-05 | (0,235) | |
| Germany | -0,48 | (0,023) | * | -1,3E-04 | (0,027) | * | -7,5E-05 | (0,148) | | -0,30 | (0,140) | | -2,1E-05 | (0,699) | | -1,1E-05 | (0,790) | |
| Greece | 0,02 | (0,887) | | -4,2E-05 | (0,581) | | -8,2E-06 | (0,904) | | 0,08 | (0,474) | | -3,0E-05 | (0,688) | | -1,4E-06 | (0,985) | |
| Hungary | -0,04 | (0,720) | | -1,8E-05 | (0,813) | | -2,1E-05 | (0,876) | | -0,12 | (0,279) | | -2,8E-05 | (0,741) | | -9,5E-05 | (0,457) | |
| Ireland | -0,02 | (0,563) | | NA | NA | | NA | NA | | 0,05 | (0,114) | | NA | NA | | NA | NA | |
| Italy | 0,04 | (0,838) | | 7,7E-05 | (0,096) | * | 5,7E-05 | (0,380) | | 0,01 | (0,958) | | 1,0E-04 | (0,021) | * | 8,3E-05 | (0,146) | |
| Latvia | NA | NA | | 3,6E-04 | (0,104) | | 3,4E-04 | (0,041) | * | NA | NA | | 4,8E-05 | (0,769) | | -3,2E-05 | (0,807) | |
| Lithuania | NA | NA | | 1,5E-04 | (0,092) | * | 1,6E-04 | (0,066) | * | NA | NA | | -2,2E-04 | (0,081) | * | -1,1E-04 | (0,248) | |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Luxembourg | 0,19 | (0,063) | * | -3,1E-04 | (0,250) | | -1,8E-04 | (0,196) | | -0,12 | (0,235) | | 1,0E-04 | (0,387) | | 6,8E-05 | (0,318) | |
| Malta | NA | NA | | 2,1E-05 | (0,811) | | -1,2E-05 | (0,892) | | NA | NA | | -1,9E-05 | (0,752) | | -1,6E-05 | (0,743) | |
| Netherlands | 0,18 | (0,405) | | 1,3E-04 | (0,069) | * | 2,0E-04 | (0,147) | | -0,07 | (0,799) | | 8,3E-05 | (0,310) | | 1,5E-04 | (0,327) | |
| Poland | 0,14 | (0,319) | | 8,2E-05 | (0,234) | | 3,0E-05 | (0,819) | | 0,17 | (0,264) | | 5,6E-05 | (0,491) | | 4,1E-05 | (0,790) | |
| Portugal | 0,09 | (0,517) | | 7,2E-05 | (0,166) | | 8,7E-05 | (0,253) | | 0,11 | (0,353) | | 1,8E-05 | (0,640) | | 2,3E-05 | (0,681) | |
| Slovakia | -0,17 | (0,677) | | -8,9E-05 | (0,595) | | -2,2E-05 | (0,907) | | 0,47 | (0,036) | * | 1,3E-04 | (0,129) | | 1,3E-04 | (0,175) | |
| Slovenia | 0,44 | (0,064) | * | -1,4E-05 | (0,905) | | 2,5E-06 | (0,986) | | 0,18 | (0,439) | | 4,5E-05 | (0,601) | | -9,5E-05 | (0,181) | |
| Spain | -0,07 | (0,750) | | 2,6E-05 | (0,744) | | -1,4E-05 | (0,862) | | 0,29 | (0,123) | | 7,3E-05 | (0,247) | | 6,6E-05 | (0,299) | |
| Sweden | 0,14 | (0,151) | | -6,8E-05 | (0,290) | | 1,3E-04 | (0,002) | ** | 0,13 | (0,474) | | 1,4E-05 | (0,887) | | 2,0E-04 | (0,063) | * |
| UK | -0,12 | (0,437) | | -9,1E-05 | (0,140) | | -4,9E-05 | (0,457) | | -0,35 | (0,282) | | 1,9E-04 | (0,177) | | -7,6E-05 | (0,529) | |
| N (total) | 21 | | | 26 | | | 26 | | | 21 | | | 26 | | | 26 | | |
| N (success) | 11 | | | 13 | | | 13 | | | 11 | | | 12 | | | 15 | | |
| P | 0,33 | | | 0,42 | | | 0,42 | | | 0,33 | | | 0,58 | | | 0,16 | | |

Significance indicators: *** 0,1%, ** 1%, * 10%

### 4.4.2 Inter-country synchronicity

To assess the inter-country effects, I run the regression

$$S_{j,\tau} = a + b\, PU_{Europe,\tau}\, Econ_{j,\tau} + c\, PU_{Europe,\tau} + d\, Econ_{j,\tau} + e\, S_{j,\tau-1} + e_{\tau}\ , \qquad (20)$$

where $S_{j,\tau}$ is the inter-country synchronicity for country $j$ for month $\tau$, $PU_{Europe,\tau}$ is the level of European economic policy uncertainty, and $Econ_{j,\tau}$ is one of the three measures of economic conditions: GDP growth, the Economic Sentiment Indicator (ESI), and the Business Climate Indicator (BCI). The expected sign of $b$ is negative, since the effect $PU$ has is expected to be higher when $Econ$ is lower.

Table 10 reports the results. The inter-country results are very similar to the intra-country results: While some individual countries are affected, the sign distributions are indifferent, and only 25 of all 146 coefficients reported are statistically significant even at the 10% level. Therefore, in general, the evidence does not seem to support the hypothesis that policy uncertainty would have a stronger effect on stock return synchronicity when economic conditions are worse.

**Table 10**
**Stock synchronicity, policy uncertainty, and economic conditions (Inter-country, European PU Index)**

This table reports the estimated slope coefficients $b$ and their Newey-West $p$-values from the following regression:

$$S_{j,\tau} = a + b\, PU_{Europe,\tau}\, Econ_{j,\tau} + c\, PU_{Europe,\tau} + d\, Econ_{j,\tau} + e_\tau$$

where $S_{j,\tau}$ is the inter-country synchronicity for country $j$ for month $\tau$, $PU_{Europe,\tau}$ is level of European economic policy uncertainty, and $Econ_{j,\tau}$ is respectively one of the three measures of economic conditions: GDP growth, the Economic Sentiment Indicator (ESI), and the Business Climate Indicator (BCI). The expected sign of $b$ is negative. Both the equally weighted and value-weighted synchronicity measures are reported. In addition, binomial probabilities for the null hypothesis that both signs are equally likely are reported.

| | EW | | | | | | | | | VW | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GDP growth | | | ESI | | | BCI | | | GDP growth | | | ESI | | | BCI | | |
| Austria | -0,14 | (0,153) | | -1,0E-05 | (0,781) | | -2,6E-05 | (0,492) | | -0,13 | (0,125) | | -2,1E-05 | (0,518) | | -1,9E-05 | (0,612) | |
| Belgium | -0,12 | (0,429) | | 1,7E-06 | (0,963) | | -3,5E-06 | (0,927) | | 0,07 | (0,572) | | 3,6E-05 | (0,232) | | 3,0E-05 | (0,410) | |
| Bulgaria | NA | NA | | 4,7E-05 | (0,004) | ** | 4,3E-05 | (0,023) | * | NA | NA | | 2,4E-05 | (0,411) | | 2,6E-05 | (0,458) | |
| Croatia | NA | NA | | 3,6E-05 | (0,289) | | 5,3E-05 | (0,207) | | NA | NA | | 3,4E-05 | (0,366) | | 5,0E-05 | (0,232) | |
| Cyprus | NA | NA | | 4,3E-06 | (0,816) | | 8,5E-06 | (0,607) | | NA | NA | | -1,6E-06 | (0,959) | | 1,9E-05 | (0,472) | |
| Czech | -0,03 | (0,345) | | -2,7E-05 | (0,115) | | -1,7E-05 | (0,412) | | -0,11 | (0,081) | * | -7,3E-05 | (0,053) | * | -6,6E-05 | (0,107) | |
| Denmark | -0,05 | (0,515) | | -3,3E-05 | (0,340) | | -5,8E-05 | (0,148) | | -0,02 | (0,798) | | 1,4E-06 | (0,969) | | -5,9E-05 | (0,125) | |
| Estonia | -0,06 | (0,016) | * | -6,4E-05 | (0,061) | * | -4,8E-05 | (0,080) | * | 0,00 | (0,891) | | 1,7E-06 | (0,885) | | 1,1E-06 | (0,908) | |
| Finland | -0,10 | (0,064) | * | -9,9E-06 | (0,756) | | -7,1E-06 | (0,805) | | -0,16 | (0,001) | *** | -2,1E-05 | (0,400) | | -8,5E-06 | (0,724) | |
| France | -0,18 | (0,175) | | 2,3E-06 | (0,954) | | -9,7E-06 | (0,795) | | -0,07 | (0,505) | | -5,3E-06 | (0,835) | | -9,4E-06 | (0,730) | |
| Germany | -0,23 | (0,009) | ** | -9,2E-05 | (0,005) | ** | -7,0E-05 | (0,025) | * | 0,02 | (0,848) | | -1,1E-06 | (0,969) | | -2,7E-05 | (0,280) | |
| Greece | 0,07 | (0,039) | * | 1,6E-05 | (0,401) | | 2,0E-05 | (0,345) | | 0,08 | (0,038) | * | 1,2E-05 | (0,518) | | 8,7E-06 | (0,658) | |
| Hungary | 0,03 | (0,378) | | 2,3E-05 | (0,384) | | -2,4E-05 | (0,601) | | 0,01 | (0,837) | | 2,0E-05 | (0,515) | | 1,8E-07 | (0,997) | |
| Ireland | 0,01 | (0,568) | | NA | NA | | NA | NA | | 0,07 | (0,002) | ** | NA | NA | | NA | NA | |
| Italy | 0,06 | (0,498) | | 2,2E-05 | (0,265) | | 9,2E-06 | (0,765) | | 0,11 | (0,123) | | 2,7E-05 | (0,145) | | 1,7E-05 | (0,492) | |
| Latvia | NA | NA | | -1,5E-05 | (0,745) | | -1,2E-05 | (0,732) | | NA | NA | | -7,2E-05 | (0,021) | * | -5,3E-05 | (0,078) | * |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lithuania | NA | NA | | -8,7E-06 | (0,815) | | 4,4E-06 | (0,837) | | NA | NA | | -7,8E-05 | (0,056) | * | -5,2E-05 | (0,071) | * |
| Luxembourg | 0,07 | (0,043) | * | 2,8E-06 | (0,902) | | -4,5E-06 | (0,723) | | -0,03 | (0,267) | | 2,2E-05 | (0,477) | | 1,2E-05 | (0,481) | |
| Malta | NA | NA | | 7,1E-06 | (0,557) | | 4,3E-06 | (0,609) | | NA | NA | | -3,4E-06 | (0,838) | | 8,3E-07 | (0,966) | |
| Netherlands | -0,08 | (0,449) | | 1,7E-05 | (0,570) | | 2,1E-05 | (0,694) | | 0,02 | (0,760) | | 1,7E-06 | (0,945) | | -1,8E-05 | (0,680) | |
| Poland | 0,02 | (0,735) | | 3,1E-05 | (0,499) | | 1,2E-05 | (0,869) | | 0,01 | (0,932) | | 1,7E-05 | (0,704) | | -2,4E-05 | (0,684) | |
| Portugal | -0,02 | (0,723) | | 7,2E-06 | (0,730) | | 7,6E-06 | (0,795) | | 0,03 | (0,626) | | 8,5E-06 | (0,649) | | 1,1E-05 | (0,700) | |
| Slovakia | -0,06 | (0,049) | * | -1,6E-05 | (0,365) | | -2,0E-06 | (0,901) | | 0,00 | (0,808) | | 2,1E-06 | (0,833) | | 3,7E-06 | (0,692) | |
| Slovenia | 0,04 | (0,166) | | 1,2E-05 | (0,551) | | 3,4E-06 | (0,864) | | 0,01 | (0,934) | | 2,1E-05 | (0,125) | | -6,4E-06 | (0,780) | |
| Spain | 0,00 | (0,968) | | 9,8E-06 | (0,249) | | 1,5E-05 | (0,109) | | 0,14 | (0,061) | * | 5,4E-06 | (0,842) | | -2,5E-05 | (0,385) | |
| Sweden | -0,10 | (0,140) | | -2,3E-06 | (0,941) | | 1,2E-05 | (0,764) | | -0,07 | (0,144) | | -1,9E-05 | (0,391) | | 7,8E-06 | (0,765) | |
| UK | -0,09 | (0,245) | | -9,7E-07 | (0,973) | | -5,8E-05 | (0,021) | * | -0,04 | (0,554) | | -4,3E-05 | (0,083) | * | -6,6E-05 | (0,001) | ** |
| N (total) | 21 | | | 26 | | | 26 | | | 21 | | | 26 | | | 26 | | |
| N (success) | 14 | | | 11 | | | 13 | | | 9 | | | 11 | | | 13 | | |
| P | 0,04 | | | 0,72 | | | 0,42 | | | 0,67 | | | 0,72 | | | 0,42 | | |

Significance indicators: *** 0,1%, ** 1%, * 10%

### *4.5 Stock return synchronicity and the integration of the European Union*

Hypotheses 5 and 6 state that stock return synchronicity should be affected by joining the European Union and the euro area, as new political, economic, and financial factors are introduced. In addition, hypothesis 7 expects that the effect of joining the EU is generally stronger than that of joining the euro area. To examine these hypotheses, I run the following regression:

$$S_{j,\tau} = a + b\,EU_{j,\tau} + c\,Euro_{j,\tau} + e_\tau \tag{21}$$

where $S_{j,\tau}$ is the synchronicity for country $j$ for month $\tau$, $EU_{j,\tau}$ is a binary variable which is 0 when the country is not a member of the EU and 1 after the country has joined the EU, and $Euro_{j,\tau}$ is a similar binary variable which is 1 after the country has adopted the euro.

I add the lagged synchronicity to counter serial correlation, and calculate all significance statistics using Newey-West standard errors. Then, the regression is the following:

$$S_{j,\tau} = a + b\,EU_{j,\tau} + c\,Euro_{j,\tau} + d\,S_{j,\tau-1} + e_\tau. \tag{22}$$

Due to the availability periods of value-weighted stock market indices for many of the countries, regressions using the value-weighted measures for stock return synchronicity would not be possible or statistically sound for the effect of joining the EU. For many countries, the date of joining the EU is either before the availability of an index, or so shortly after the joining date that the number of monthly observations before the date would be clearly too small. Therefore, the results for joining the EU are only discussed for the equally weighted measure of synchronicity which does not suffer from the problem.

During the sample period from 1990 to 2015, 15 of the 27 countries joined the EU, and the remaining 12 countries were already member states at the beginning of the period. All euro area members in the sample adopted the currency at some point during the sample period, since the euro was first implemented in 1999 which is in the middle of the period.

### 4.5.1 Inter-country synchronicity

Let us first examine the inter-country synchronicity. Now, $S_{j,\tau}$ in equation 22 is the inter-country stock return synchronicity based on country-level stock market indices. Both coefficients $b$ and $c$ are expected to be positive, as synchronicity between the countries is expected to increase with the level of integration.

Table 11 reports the results for joining the European Union. As discussed above, the value-weighted synchronicity measure is ignored in this case due to the mismatch of the joining dates and available index data for the relevant countries. Out of 15 estimates, ten have the expected positive sign, and the average value is also positive (0.038). Ten estimates are statistically significant at least at the 10% level. The binomial probability of observing this sign distribution if both signs were equally likely is somewhat low at 6%. Moreover, eight of the ten statistically significant estimates have a positive sign.

Table 12 presents the respective results for adopting the euro. For the equally weighted measure, 13 out of 19 estimates have the expected positive sign. For the value-weighted measure, 14 out of 18 estimates are positive. Furthermore, for the value-weighted measure, all negative estimates are statistically insignificant. A total of 26 out of 37 estimates are statistically significant at least at the 10% level. The binomial likelihoods of observing the sign distributions if there is no effect are very low: 3.2% (EW) and 0.4% (VW), combined less than 0.2%.

The inter-country evidence clearly suggests that stock return synchronicity is generally higher between the countries after joining the EU or the euro area, or when the level of economic and financial integration increases.

**Table 11**
**Stock synchronicity and joining the European Union (Inter-country)**

This table reports the estimated slope coefficients $b$ and their Newey-West $p$-values from the following regression:

$$S_{j,\tau} = a + b\ EU_{j,\tau} + c\ Euro_{j,\tau} + d\ S_{j,\tau-1} + e_\tau$$

where $S_{j,\tau}$ is the inter-country synchronicity for country $j$ for month $\tau$, and $EU_{j,\tau}$ is a binary variable which is 0 when the country is not a member of the EU and 1 after the country has joined the EU, and $Euro_{j,\tau}$ is a similar binary variable which is 0 when the country has not adopted the euro and 1 after the country has joined the euro area. The coefficient $b$ is expected to be positive. Only the equally weighted synchronicity measure is reported due to the mismatch of the joining dates and available index data for the relevant countries. In addition, the binomial probability for the null hypothesis that both signs are equally likely is reported.

| | EW | | |
|---|---|---|---|
| Austria | 0,014 | (0,727) | |
| Bulgaria | -0,026 | (0,072) | * |
| Croatia | -0,001 | (0,959) | |
| Cyprus | 0,051 | (0,027) | * |
| Czech | 0,052 | (0,001) | *** |
| Estonia | 0,066 | (0,003) | ** |
| Finland | 0,122 | (0,005) | ** |
| Hungary | 0,078 | (0,000) | *** |
| Latvia | -0,051 | (0,028) | * |
| Lithuania | -0,011 | (0,595) | |
| Malta | -0,002 | (0,936) | |
| Poland | 0,107 | (0,000) | *** |
| Slovakia | 0,045 | (0,030) | * |
| Slovenia | 0,024 | (0,175) | |
| Sweden | 0,098 | (0,000) | *** |
| N (total) | 15 | | |
| N (success) | 10 | | |
| P | 0,06 | | |

Significance indicators: *** 0,1%, ** 1%, * 10%

**Table 12**
**Stock synchronicity and joining the euro area (Inter-country)**

This table reports the estimated slope coefficients $c$ and their Newey-West $p$-values from the following regression:

$$S_{j,\tau} = a + b\, EU_{j,\tau} + c\, Euro_{j,\tau} + d\, S_{j,\tau-1} + e_{\tau}$$

where $S_{j,\tau}$ is the inter-country synchronicity for country $j$ for month $\tau$, and $EU_{j,\tau}$ is a binary variable which is 0 when the country is not a member of the EU and 1 after the country has joined the EU, and $Euro_{j,\tau}$ is a similar binary variable which is 0 when the country has not adopted the euro and 1 after the country has joined the euro area. The coefficient $c$ is expected to be positive. Both the equally weighted and value-weighted synchronicity measures are reported. In addition, the binomial probability for the null hypothesis that both signs are equally likely is reported.

| | EW | | | VW | | |
|---|---|---|---|---|---|---|
| Austria | 0,036 | (0,307) | | 0,082 | (0,026) | * |
| Belgium | 0,023 | (0,429) | | 0,148 | (0,000) | *** |
| Cyprus | -0,022 | (0,417) | | -0,001 | (0,975) | |
| Estonia | 0,003 | (0,918) | | -0,013 | (0,237) | |
| Finland | 0,120 | (0,006) | ** | 0,140 | (0,013) | * |
| France | 0,168 | (0,000) | *** | 0,228 | (0,000) | *** |
| Germany | 0,084 | (0,012) | * | 0,151 | (0,000) | *** |
| Greece | 0,069 | (0,000) | *** | 0,137 | (0,000) | *** |
| Ireland | 0,070 | (0,000) | *** | 0,119 | (0,000) | *** |
| Italy | 0,181 | (0,000) | *** | 0,189 | (0,000) | *** |
| Latvia | 0,066 | (0,152) | | 0,035 | (0,081) | * |
| Lithuania | -0,065 | (0,025) | * | -0,034 | (0,399) | |
| Luxembourg | 0,084 | (0,000) | *** | NA | NA | |
| Malta | -0,034 | (0,077) | * | -0,002 | (0,889) | |
| Netherlands | 0,176 | (0,000) | *** | 0,177 | (0,000) | *** |
| Portugal | 0,083 | (0,000) | *** | 0,141 | (0,000) | *** |
| Slovakia | -0,042 | (0,031) | * | 0,004 | (0,691) | |
| Slovenia | -0,041 | (0,029) | * | 0,031 | (0,119) | |
| Spain | -0,020 | (0,067) | * | 0,202 | (0,000) | *** |
| N (total) | 19 | | | 18 | | |
| N (success) | 13 | | | 14 | | |
| P | 0,03 | | | 0,00 | | |

Significance indicators: *** 0,1%, ** 1%, * 10%

### 4.5.2 Intra-country synchronicity

Next, let us consider synchronicity inside the country. Now, $S_{j,\tau}$ in equation 22 is the intra-country stock return synchronicity based on the returns of individual stocks and the equally or value-weighted market index. The coefficients $b$ and $c$ are expected to be significant, but hypothesis 6 expects that the sign of the coefficients depends on the country.

Table 13 reports the results for joining the EU. Again, only equally weighted results are presented for joining the EU due to data availability in relation to the joining dates. Out of the 15 estimates, 8 are positive and 7 are negative. However, 12 of the 15 estimates are significant at least at the 10% level. Seven are significant at the 0.1% level, two at the 1% level, and three more at least at the 10% level. While the average slope estimate is positive (0.041), the direction of the effect clearly depends on the country. On the other hand, the effect is generally statistically significant.

Table 14 reports the effect of joining the euro area. Both the equally weighted and the value-weighted measure of synchronicity are examined, since the dates of joining the euro are generally later than those for joining the EU. As discussed earlier in section 2.2, the average period between joining the EU and joining the euro area has been nearly six years, allowing for a sufficiently long sample before and after the joining date for the value-weighted indices as well. In total, 19 countries adopted the euro during the sample period. Out of these, 8 estimates have a positive sign when using the equally weighted synchronicity measure, and 10 out of 18 estimates have a positive sign when using the value-weighted synchronicity measure. As with the effect of joining the EU, a clear direction for the influence on stock synchronicity cannot be distinguished. For the equally weighted measure, 12 out of 19 estimates are statistically significant: four at the 0.1% level, three at the 1% level, and five at least at the 10% level. For the value-weighted measure, 10 out of 18 are statistically significant: six at the 0.1% level, two at the 1% level, and two at least at the 10% level. While the direction of the effect depends on the country, for at least half of the countries the effect is statistically significant.

The evidence is consistent with the notion that the direction of the effect depends on the country. On the one hand, the integration exposes the stocks to the same systematic factors, leading to higher synchronicity. On the other hand, the variation in the new systematic factors may be lower, as common European policy may be more stable than the country policy. Moreover, joining the EU has rigorous requirements, which can have such positive effects on the maturity of the financial market in the country that stock return synchronicity may decline.

**Table 13**
**Stock synchronicity and joining the European Union (Intra-country)**

This table reports the estimated slope coefficients $b$ and their Newey-West $p$-values from the following regression:

$$S_{j,\tau} = a + b\ EU_{j,\tau} + c\ Euro_{j,\tau} + d\ S_{j,\tau-1} + e_\tau$$

where $S_{j,\tau}$ is the intra-country synchronicity for country $j$ for month $\tau$, and $EU_{j,\tau}$ is a binary variable which is 0 when the country is not a member of the EU and 1 after the country has joined the EU, and $Euro_{j,\tau}$ is a similar binary variable which is 0 when the country has not adopted the euro and 1 after the country has joined the euro area. Only the equally weighted synchronicity measure is reported due to the mismatch of the joining dates and available index data for the relevant countries. In addition, the binomial probability for the null hypothesis that both signs are equally likely is reported.

| | EW | | |
|---|---|---|---|
| Austria | -0,375 | (0,000) | *** |
| Bulgaria | -0,511 | (0,000) | *** |
| Croatia | 0,224 | (0,080) | * |
| Cyprus | -0,407 | (0,000) | *** |
| Czech | 0,360 | (0,000) | *** |
| Estonia | 0,336 | (0,008) | ** |
| Finland | -0,146 | (0,113) | |
| Hungary | 0,471 | (0,000) | *** |
| Latvia | -0,780 | (0,000) | *** |
| Lithuania | -0,276 | (0,043) | * |
| Malta | -0,128 | (0,297) | |
| Poland | 0,057 | (0,482) | |
| Slovakia | 0,795 | (0,008) | ** |
| Slovenia | 0,709 | (0,000) | *** |
| Sweden | 0,292 | (0,039) | * |
| N (total) | 15 | | |
| N (success) | 8 | | |
| P | 0,30 | | |

Significance indicators: *** 0,1%, ** 1%, * 10%

**Table 14**
**Stock synchronicity and joining the euro area (Intra-country)**

This table reports the estimated slope coefficients $c$ and their Newey-West $p$-values from the following regression:

$$S_{j,\tau} = a + b\ EU_{j,\tau} + c\ Euro_{j,\tau} + d\ S_{j,\tau-1} + e_{\tau}$$

where $S_{j,\tau}$ is the intra-country synchronicity for country $j$ for month $\tau$, and $EU_{j,\tau}$ is a binary variable which is 0 when the country is not a member of the EU and 1 after the country has joined the EU, and $Euro_{j,\tau}$ is a similar binary variable which is 0 when the country has not adopted the euro and 1 after the country has joined the euro area. Both the equally weighted and value-weighted synchronicity measures are reported. In addition, the binomial probability for the null hypothesis that both signs are equally likely is reported.

| | EW | | | VW | | |
|---|---|---|---|---|---|---|
| Austria | -0,022 | (0,719) | | 0,027 | (0,541) | |
| Belgium | -0,194 | (0,002) | ** | 0,140 | (0,001) | *** |
| Cyprus | -0,150 | (0,025) | * | -0,050 | (0,388) | |
| Estonia | -0,102 | (0,503) | | 0,006 | (0,930) | |
| Finland | 0,221 | (0,000) | *** | 0,251 | (0,000) | *** |
| France | 0,088 | (0,021) | * | 0,074 | (0,010) | * |
| Germany | -0,131 | (0,010) | ** | -0,045 | (0,292) | |
| Greece | -0,065 | (0,257) | | -0,088 | (0,129) | |
| Ireland | -0,161 | (0,010) | * | 0,200 | (0,000) | *** |
| Italy | 0,035 | (0,497) | | -0,007 | (0,883) | |
| Latvia | 0,010 | (0,950) | | 0,018 | (0,837) | |
| Lithuania | -0,084 | (0,115) | | -0,159 | (0,183) | |
| Luxembourg | 0,404 | (0,082) | * | NA | NA | |
| Malta | -0,229 | (0,006) | ** | -0,207 | (0,001) | *** |
| Netherlands | 0,265 | (0,000) | *** | 0,199 | (0,003) | ** |
| Portugal | 0,110 | (0,081) | * | 0,198 | (0,000) | *** |
| Slovakia | -1,690 | (0,000) | *** | 0,572 | (0,000) | *** |
| Slovenia | 0,138 | (0,364) | | -0,322 | (0,089) | * |
| Spain | -0,459 | (0,000) | *** | -0,141 | (0,005) | ** |
| N (total) | 19 | | | 18 | | |
| N (success) | 8 | | | 10 | | |
| P | 0,68 | | | 0,24 | | |

Significance indicators: *** 0,1%, ** 1%, * 10%

### 4.6 The relative strength of the effects of joining the European Union or the euro area

To examine the relative strength of the effects, I perform a standard Z-test for the difference in means in the two result sets. The average absolute coefficient value for the intra-country effect of joining the EU is 0.39 (EW), while the average absolute coefficient value for joining the euro area is 0.24 (EW). However, the Z-score for the difference in means is only 0,78. Therefore, while the intra-country effect is on average 63% stronger for joining the EU, this is not nearly statistically significant.

On the other hand, for the inter-country effect of joining the EU, the average absolute coefficient value is 0.05 (EW), while the respective average for joining the euro area is 0.07 (EW). Interestingly, based on the averages, the effect of joining the euro area seems to be approximately 40% higher. The Z-score for the difference in the means is 1,88, so this difference is also statistically significant. In contrast to the hypothesis, it seems that adopting the euro may actually have a stronger effect on inter-country synchronicity than joining the EU.

The hypothesis is largely based on the view that the political systems of the countries get more integrated when the new member state joins the EU, and that the commitment to join the euro area as well has to be made at the same time. Since part of the information of adopting the euro is revealed already at this point, part of the asset pricing shock should also be seen at this point. However, the evidence suggests that the synchronicity between the countries may actually be more affected by joining the euro than joining the EU. It seems that the actual implementation of the currency integration taking place after officially joining the euro area is more relevant to investors than merely the theoretical moment when the information is revealed. However, this is not necessarily inconsistent with the informational reasoning. If the shock related to adopting the common currency is observed in two parts, first when joining the EU and second when the currency integration is implemented, the latter may be so much stronger than the former that it is actually observed greater than the former combined with the shock related to joining the EU. The evidence seems to support this view that a common currency is a clearly greater integrator of the financial markets than the integration of political institutions or general economic guidelines as such.

### 4.7 Stock return synchronicity, policy uncertainty, and the integration of the European Union

Finally, I investigate how the European integration affects the influence of policy uncertainty on stock return synchronicity. According to hypothesis 8, the effect of the general European policy uncertainty should be higher after the country has joined the EU or the euro area, since the political systems will be much more tightly joined. To examine the hypothesis, I run the following regressions:

$$S_{j,\tau} = a + b\, PU_{Europe,\tau}\, EU_{j,\tau} + c\, PU_{Europe,\tau} + d\, EU_{j,\tau} + e\, S_{j,\tau-1} + e_{\tau}\,, \tag{23}$$

$$S_{j,\tau} = a + b\, PU_{Europe,\tau}\, Euro_{j,\tau} + c\, PU_{Europe,\tau} + d\, Euro_{j,\tau} + e\, S_{j,\tau-1} + e_{\tau}\,, \tag{24}$$

where $S_{j,\tau}$ is the synchronicity for country $j$ for month $\tau$, $PU_{Europe,\tau}$ is the European policy uncertainty index, $EU_{j,\tau}$ is a binary variable which is 0 when the country is not a member of the EU and 1 after the country has joined the EU, and $Euro_{j,\tau}$ is a similar binary variable which is 0 when the country has not adopted the euro and 1 after the country has joined the euro area. According to the hypothesis, the coefficient $b$ is expected to be positive.

First, let us examine the effect on intra-country synchronicity. Table 15 reports the estimates for the state-dependency on joining the EU. Again, only the equally-weighted synchronicity measure is reported due to the availability of index data in relation to the joining dates. Out of 15 estimates, nine have the expected positive sign, but only three are statistically significant. Table 16 presents the estimates for the state-dependency on joining the euro area. For the equally weighted synchronicity measure, 12 out of 19 estimates have the expected positive sign, while none of the estimates are statistically significant. For the value-weighted measure, 11 out of 18 estimates are positive as expected, but only five are statistically significant at least at the 10% level.

While the binomial probabilities for observing such sign distributions for the estimates are somewhat low if there is no effect, it is clear that generally the coefficients are not statistically significant. Even though the sign distributions support the view that policy uncertainty would have a stronger effect on synchronicity when the level of integration is higher, the empirical evidence provides no support for the statistical significance of this state-dependency.

Second, consider the effect on inter-country synchronicity. Table 17 presents the coefficients for the state-dependency on joining the EU, and table 18 presents the estimates for the state-dependency on joining the euro area. Generally, the results provide very little support for the hypothesis that policy uncertainty has a stronger effect on synchronicity when the level of integration is higher.

**Table 15**
**Stock synchronicity, policy uncertainty, and joining the European Union (Intra-country)**

This table reports the estimated slope coefficients $b$ and their Newey-West $p$-values from the following regression:

$$S_{j,\tau} = a + b\ PU_{Europe,\tau}\ EU_{j,\tau} + c\ PU_{Europe,\tau} + d\ EU_{j,\tau} + e\ S_{j,\tau-1} + e_{\tau}$$

where $S_{j,\tau}$ is the intra-country synchronicity for country $j$ for month $\tau$, and $PU_{Europe,\tau}$ is the European policy uncertainty index, $EU_{j,\tau}$ is a binary variable which is 0 when the country is not a member of the EU and 1 after the country has joined the EU. The coefficient $b$ is expected to be positive. The equally weighted and synchronicity measure is reported. In addition, the binomial probability for the null hypothesis that both signs are equally likely is reported.

| | EW | | |
|---|---|---|---|
| Austria | 0,0031 | (0,052) | * |
| Bulgaria | 0,0004 | (0,844) | |
| Croatia | 0,0008 | (0,776) | |
| Cyprus | -0,0003 | (0,891) | |
| Czech | -0,0015 | (0,135) | |
| Estonia | 0,0011 | (0,609) | |
| Finland | -0,0022 | (0,194) | |
| Hungary | 0,0011 | (0,496) | |
| Latvia | -0,0006 | (0,742) | |
| Lithuania | 0,0027 | (0,213) | |
| Malta | 0,0009 | (0,670) | |
| Poland | 0,0016 | (0,338) | |
| Slovakia | -0,0096 | (0,016) | * |
| Slovenia | 0,0006 | (0,803) | |
| Sweden | -0,0048 | (0,022) | * |
| N (total) | 15 | | |
| N (success) | 8 | | |
| P | 0,30 | | |

Significance indicators: *** 0,1%, ** 1%, * 10%

**Table 16**
**Stock synchronicity, policy uncertainty, and joining the euro area (Intra-country)**

This table reports the estimated slope coefficients $b$ and their Newey-West $p$-values from the following regression:

$$S_{j,\tau} = a + b\ PU_{Europe,\tau}\ Euro_{j,\tau} + c\ PU_{Europe,\tau} + d\ Euro_{j,\tau} + e\ S_{j,\tau-1} + e_\tau$$

where $S_{j,\tau}$ is the intra-country synchronicity for country $j$ for month $\tau$, and $PU_{Europe,\tau}$ is the European policy uncertainty index, $Euro_{j,\tau}$ is a binary variable which is 0 when the country has not adopted the euro and 1 after the country has joined the euro area. The coefficient $b$ is expected to be positive. Both the equally weighted and value-weighted synchronicity measures are reported. In addition, the binomial probability for the null hypothesis that both signs are equally likely is reported.

| | EW | | VW | | |
|---|---|---|---|---|---|
| Austria | 0,000 | (0,315) | 0,001 | (0,498) | |
| Belgium | 0,000 | (0,893) | 0,001 | (0,443) | |
| Cyprus | 0,000 | (0,948) | 0,003 | (0,179) | |
| Estonia | 0,000 | (0,791) | -0,002 | (0,292) | |
| Finland | 0,000 | (0,745) | 0,002 | (0,216) | |
| France | 0,000 | (0,142) | 0,002 | (0,007) | ** |
| Germany | 0,000 | (0,512) | 0,002 | (0,068) | * |
| Greece | 0,000 | (0,479) | 0,001 | (0,645) | |
| Ireland | 0,000 | (0,478) | 0,000 | (0,841) | |
| Italy | 0,000 | (0,155) | 0,003 | (0,037) | * |
| Latvia | 0,000 | (0,524) | 0,000 | (0,964) | |
| Lithuania | -0,001 | (0,255) | -0,018 | (0,059) | * |
| Luxembourg | 0,001 | (0,266) | NA | NA | |
| Malta | 0,000 | (0,859) | 0,002 | (0,278) | |
| Netherlands | 0,000 | (0,619) | 0,003 | (0,127) | |
| Portugal | 0,000 | (0,368) | 0,002 | (0,105) | |
| Slovakia | 0,000 | (0,362) | -0,001 | (0,691) | |
| Slovenia | 0,000 | (0,399) | -0,005 | (0,014) | * |
| Spain | 0,000 | (0,227) | -0,001 | (0,641) | |
| N (total) | 19 | | 18 | | |
| N (success) | 12 | | 11 | | |
| P | 0,08 | | 0,12 | | |

Significance indicators: *** 0,1%, ** 1%, * 10%

**Table 17**
**Stock synchronicity, policy uncertainty, and joining the European Union (Inter-country)**

This table reports the estimated slope coefficients $b$ and their Newey-West $p$-values from the following regression:

$$S_{j,\tau} = a + b\ PU_{Europe,\tau}\ EU_{j,\tau} + c\ PU_{Europe,\tau} + d\ EU_{j,\tau} + e\ S_{j,\tau-1} + e_{\tau}$$

where $S_{j,\tau}$ is the inter-country synchronicity for country $j$ for month $\tau$, and $PU_{Europe,\tau}$ is the European policy uncertainty index, $EU_{j,\tau}$ is a binary variable which is 0 when the country is not a member of the EU and 1 after the country has joined the EU. The coefficient $b$ is expected to be positive. The equally weighted and synchronicity measure is reported. In addition, the binomial probability for the null hypothesis that both signs are equally likely is reported.

| | EW | | |
|---|---|---|---|
| Austria | 0,0031 | (0,052) | * |
| Bulgaria | 0,0004 | (0,844) | |
| Croatia | 0,0008 | (0,776) | |
| Cyprus | -0,0003 | (0,891) | |
| Czech | -0,0015 | (0,135) | |
| Estonia | 0,0011 | (0,609) | |
| Finland | -0,0022 | (0,194) | |
| Hungary | 0,0011 | (0,496) | |
| Latvia | -0,0006 | (0,742) | |
| Lithuania | 0,0027 | (0,213) | |
| Malta | 0,0009 | (0,670) | |
| Poland | 0,0016 | (0,338) | |
| Slovakia | -0,0096 | (0,016) | * |
| Slovenia | 0,0006 | (0,803) | |
| Sweden | -0,0048 | (0,022) | * |
| N (total) | 15 | | |
| N (success) | 8 | | |
| P | 0,30 | | |

Significance indicators: *** 0,1%, ** 1%, * 10%

**Table 18**
**Stock synchronicity, policy uncertainty, and joining the euro area (Inter-country)**

This table reports the estimated slope coefficients $b$ and their Newey-West $p$-values from the following regression:

$$S_{j,\tau} = a + b\ PU_{Europe,\tau}\ Euro_{j,\tau} + c\ PU_{Europe,\tau} + d\ Euro_{j,\tau} + e\ S_{j,\tau-1} + e_{\tau}$$

where $S_{j,\tau}$ is the inter-country synchronicity for country $j$ for month $\tau$, and $PU_{Europe,\tau}$ is the European policy uncertainty index, $Euro_{j,\tau}$ is a binary variable which is 0 when the country has not adopted the euro and 1 after the country has joined the euro area. The coefficient $b$ is expected to be positive. Both the equally weighted and value-weighted synchronicity measures are reported. In addition, the binomial probability for the null hypothesis that both signs are equally likely is reported.

| | EW | | VW | | |
|---|---|---|---|---|---|
| Austria | 0,000 | (0,315) | 0,001 | (0,498) | |
| Belgium | 0,000 | (0,893) | 0,001 | (0,443) | |
| Cyprus | 0,000 | (0,948) | 0,003 | (0,179) | |
| Estonia | 0,000 | (0,791) | -0,002 | (0,292) | |
| Finland | 0,000 | (0,745) | 0,002 | (0,216) | |
| France | 0,000 | (0,142) | 0,002 | (0,007) | ** |
| Germany | 0,000 | (0,512) | 0,002 | (0,068) | * |
| Greece | 0,000 | (0,479) | 0,001 | (0,645) | |
| Ireland | 0,000 | (0,478) | 0,000 | (0,841) | |
| Italy | 0,000 | (0,155) | 0,003 | (0,037) | * |
| Latvia | 0,000 | (0,524) | 0,000 | (0,964) | |
| Lithuania | -0,001 | (0,255) | -0,018 | (0,059) | * |
| Luxembourg | 0,001 | (0,266) | NA | NA | |
| Malta | 0,000 | (0,859) | 0,002 | (0,278) | |
| Netherlands | 0,000 | (0,619) | 0,003 | (0,127) | |
| Portugal | 0,000 | (0,368) | 0,002 | (0,105) | |
| Slovakia | 0,000 | (0,362) | -0,001 | (0,691) | |
| Slovenia | 0,000 | (0,399) | -0,005 | (0,014) | * |
| Spain | 0,000 | (0,227) | -0,001 | (0,641) | |
| N (total) | 19 | | 18 | | |
| N (success) | 12 | | 11 | | |
| P | 0,08 | | 0,12 | | |

Significance indicators: *** 0,1%, ** 1%, * 10%

### *4.8 Subperiod analysis*

I perform subperiod analysis for all regressions except those including the events of joining the European Union and the euro area, since such one-time events are not suitable for subperiod examination. I divide the sample into two subsamples from 1990 to 2005 and from 2005 to 2015. In addition, I examine the sample divided into 5-year periods with the exception of the first period being 6 years, since the full sample period is 26 years long.

There is a clear pattern in the subperiod investigation: the signs of the estimates are on average consistent in the subsamples, and there are minor changes in the magnitude of the coefficients, but the statistical significance of the estimates decreases when the length of the sample period decreases. Therefore, the subperiod analysis does not reveal significant changes in the effects over time.

The generally lower statistical significance of the subsample results is likely due to the reduced number of observations, especially since the estimates for the 5-year subperiods are on average the least significant. While the synchronicity measure itself is based on daily stock returns and is not affected, dividing the resulting monthly synchronicity time series into smaller periods reduces the number of observations drastically. The full sample covers 26 years, or 312 months. For a 5-year subperiod, the number of observations is merely 60. Therefore, it is not surprising that I find that the statistical significance of the results decreases when the subperiod length decreases.

## 5 Summary and conclusion

The recent political and financial crises have raised questions about the significance of political uncertainty in financial markets, specifically policy uncertainty. Government policies have an impact on firm profitability, and thus uncertainty about the policies is relevant to investors. Clearly, since virtually all firms are exposed to government regulation and economic policy to some degree, this uncertainty cannot be diversified away. The prior literature on the asset pricing implications of policy uncertainty has focused on using political elections as a proxy for uncertainty resolution, but the recent introduction of continuous measures of policy uncertainty allows for investigating also the periods between elections.

My paper examines the influence of policy uncertainty on the degree of stock price co-movement in the European Union. The EU is becoming increasingly integrated, political power is centralized, and the general level of political uncertainty seems to be rising. Thus, centralized policy decisions are affecting a larger number of countries and investors than ever before. Furthermore, the growing integration may intuitively be expected to increase stock market co-movement between the countries, as the importance of common, non-diversifiable political and economic factors is growing. Moreover, a common currency, the euro, is tightly integrating the financial systems of the countries. The greater integration may have multiple implications for firms and investors. Higher stock return synchronicity implies that investors are less able to diversify their portfolios, as more stocks are required to reach enough return variation, since there is less firm-specific variation. Higher synchronicity may also be indicative of market inefficiency (Roll, 1988), and hinder the effectiveness of corporate governance measures (Morck at al., 1988).

I base my empirical examination on a sample of 27 current EU member states[14] and 26 years of daily stock returns from January 1990 to December 2015. Following the earlier literature, I use the $R^2$ statistic from a simple market model regression as a measure of synchronicity (e.g. Roll, 1988). To proxy for policy uncertainty, I used the recent economic policy uncertainty index based on newspaper articles, developed by Baker et al. (2015).

[14] I exclude Romania due to the availability and quality of data.

I find empirical support for multiple implications of the theoretical work of Pástor and Veronesi (2012, 2013). First, the evidence suggests that economic policy uncertainty is generally higher when economic conditions are weaker. This is intuitive, since in bad economic conditions the government is expected to act in order to fix the situation, while in good economic conditions policy changes are less likely. This result is also clearly applicable to the European crisis situation during the recent years. Second, I find that stock return synchronicity increases with economic policy uncertainty. This holds for both individual country-level policy uncertainty and common European policy uncertainty, as well as for both intra-country and inter-country stock return synchronicity. Especially the inter-country synchronicity increases with the level of common European policy uncertainty.

Following the first two, synchronicity is expected to be higher when economic conditions are worse. However, I find only dubious support for this prediction: the effect is highly dependent on the country, in both direction and significance. For some countries, such as the Czech Republic, Hungary, and the Netherlands, the intra-country synchronicity is higher when GDP growth is lower. On the other hand, for Greece and Cyprus, the intra-country synchronicity seems to be lower when economic conditions are weaker. Considering inter-country synchronicity and economic conditions, the examination with GDP growth provides some support for the view that synchronicity increases when economic conditions decline, but when using the the Economic Sentiment Indicator or the Business Climate Indicator as proxies for economic conditions, there is no observable association.

Furthermore, the equilibrium model of Pástor and Veronesi (2013) suggests that the effect of policy uncertainty on synchronicity is higher when economic conditions are lower. On average, I find no support for this state-dependency in Europe.

Next, I hypothesize that both joining the European Union and later adopting the euro lead to integration shocks that affect stock return synchronicity. Since the individual countries are affected to a higher degree by the same new factors, I argue that inter-country synchronicity should be higher after joining the EU or the euro area. Such new systematic factors are imposed for instance through the regulation and policy decisions of the common European institutions. In support of the hypothesis, the empirical evidence clearly suggests that stock return synchronicity is generally higher between countries after joining the EU or the euro area. Furthermore, I find that the effect observed when joining the euro area is on average 40% higher than that of joining the EU. This implies that a common currency is a more important factor in the financial markets than general political of economic integration. This is further supported by the fact that a country has to commit to joining the euro area already when joining the EU, and thus part of the shock related to joining the euro area actually coincides with joining the EU. If even then the remaining shock observed at the time of joining the euro area is higher than the two former shocks combined, the currency integration is clearly more important than the general political or economic integration.

Inside the countries, the effect is intuitively less clear. On the one hand, synchronicity may rise when new factors common to all stocks increase. Again, such factors may be introduced, for instance, by the regulation and economic policy imposed by the common European institutions. On the other hand, if those new factors show less variation than the old ones, it may actually be that the total variation in the systematic factors declines, thus leading to lower synchronicity. Intuitively, it may be that the policy of the common European institutions is more stable than the policy of the individual governments of some countries. Furthermore, earlier literature suggests that synchronicity is lower in more developed markets (e.g. Morck et al., 2000). Then, if the rigorous requirements of joining the EU significantly develop the economic and financial systems of the joining country, we may also see a negative shock in synchronicity. Consistent with the existence of multiple contemporaneous effects, the empirical evidence suggests that while both joining the EU or the euro area generally have a significant effect on synchronicity, the direction of the effect clearly depends on the country. Furthermore, I find that there is no significant difference in the magnitude of the two shocks in synchronicity inside the countries, as opposed to the inter-country effects discussed above.

While I document the country-dependency of the influence that economic and financial integration has on stock return synchronicity inside the country, and provide some feasible intuition behind it, further investigation is required to reach credible conclusions. Clearly, there are multiple simultaneous effects depending on multiple underlying factors. However, the economic policy uncertainty index data that I use in the empirical examination is not sufficient to investigate the levels of policy stability in the individual countries and in the common European institutions. In addition, further research is required to quantify how much the economic and financial systems of each of the joining countries has developed, and whether any such developments in market maturity are associated with stock return synchronicity, as suggested by the earlier literature.

Finally, I examine whether the influence of the common European policy uncertainty on stock return synchronicity grows with the integration of the EU. However, the empirical evidence provides very little support for this state-dependency.

In conclusion, I show that there is a significant relation between stock return synchronicity, economic policy uncertainty, and the growing integration of the European Union. Generally, I find that stock return synchronicity in the EU increases with both economic policy uncertainty and the level of integration, especially between the member states.

My paper suggests at least two directions for further research. First, the direction of the relationship between the growing economic integration and intra-country stock return synchronicity is highly country-dependent. The reasons for this country-dependency are not clear, and merit further investigation. Second, while a smaller avenue, the results on the relative importance of joining the EU and later adopting the euro prompt a question on whether simply a common currency is more important to the financial markets than general political and economic integration.

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