Economic Policy Uncertainty and the Volatility of Sovereign CDS Spreads

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Abstract

The volatility of sovereign CDS spreads reflects the degree of uncertainty about the solvency of a country. This study, covering Germany, France, Italy, Spain, Great Britain, the USA, Canada, and Japan empirically investigates whether economic policy uncertainty helps to explain CDS volatility? It turns out that there is a positive link between economic policy uncertainty and CDS volatility. This link is particularly strong for Italy and Spain - two countries that were at the center of the European debt crisis. Moreover, US policy uncertainty affects the CDS volatility of almost all other considered countries.

Keywords: Credit default swap; Economic policy uncertainty; Sovereign credit risk; Volatility

JEL codes: D80, E66, G18

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1 Introduction

A sovereign credit default swap (CDS) is a derivative contract that compensates for losses from a default on government debt, the restructuring of government debt, and other predefined credit events. The premium or "spread" that must be payed for such contracts reflects the market expectation about the creditworthiness of a country. The volatility of CDS spreads reflects the degree of uncertainty surrounding these expectations.

Rising CDS spreads, for example, indicate that a credit event may become more likely, or that the market commands a higher risk premium for bearing credit risk. High CDS volatility, in contrast, indicates that CDS spreads become a less reliable measure of credit risk because the views of market participants about the solvency of a country change rapidly.

This paper investigates whether economic policy uncertainty (EPU) helps to explain the volatility of sovereign CDS spreads. Commercial banks, central banks, and other financial institutions monitor CDS markets closely because they hold large amounts of government debt. European Central Bank statistics report that in the EU 28 deposit taking corporations held 20%, central banks held 4,7%, and other financial institutions held 12% of EU wide government debt outstanding in 2015. Soveregn CDS volatility is therefore clearly an important issue for these institutions. In particular, high CDS volatility may provide a timely market based signal of shaky economic policy. This information may in turn be valuable for risk management and policy analysis.

The existing literature (Hilscher and Nosbusch (2010), Dieckmann and Plank (2011), and Aizenman et al. (2013), among others) focuses mainly on determinants of the *level* of sovereign CDS spreads.[1] Another strand of the literature (Tamakoshi and Hamori, 2013; Lucas et al., 2014) studies spillovers between stock, bond, and CDS markets. There is also a fast growing literature on the impact of uncertainty on various dimensions of economic activity (Bloom (2009), Boutchkova et al. (2012), Kelly et al. (2016), and Pástor and Veronesi (2013), among many others). This literature finds that rising economic and political uncertainty dampens real economic activity, increases risk premia, and drives up the volatility of stocks.

The impact of economic policy uncertainty (EPU) on sovereign CDS *volatility* has until now not been studied at all. This paper contributes to the literature by empirically investigating this issue.

Theoretical arguments and a large body of empirical evidence (see, Carmignani (2003) for a

[1] See Augustin (2014) for a survey of this literature.

survey) suggest that policy uncertainty may lead to rising deficits, larger levels of public debt, and reduced economic performance. Rising uncertainty about the economic policy of a country may thus fuel uncertainty about the ability of the country to repay its debt and this may drive up the volatility of CDS spreads. Figure 1 provides support for such a link. The figure shows the joint evolution of an index of economic policy uncertainty for Germany and the volatility of German CDS spreads. As can be seen, both series move closely together.[2]

The pricing of CDS contracts provides further insights. The CDS spread s_t at time t expressed in basis points is approximately equal to

$$s_t \approx 10000 \cdot pd_t^Q \cdot lgd_t = 10000 \cdot pd_t \cdot m_t \cdot lgd_t \tag{1}$$

where pd_t^Q is the risk neutral probability of default, pd_t is the objective default probability, m_t is the market price of risk, and lgd_t is the loss given default.[3]

It is reasonable to assume that the loss given default does not change much on a daily frequency. Indeed, CDS contracts are typically priced assuming that the lgd is constant over the life of the contract (see Chaplin, 2005, Ch 9). Furthermore, empirical evidence summarized and discussed in Cochrane (2005), Ch 20, suggests that the market price of risk varies with the business cycle. One may therefor also assume that the market price of risk m is roughly constant on a daily frequency. Making these two assumptions and taking the first difference in (1) yields

$$s_t - s_{t-1} = \Delta s_t \approx \Delta pd_t. \tag{2}$$

Equation (2) says that daily changes in CDS spreads are to a good part driven by revisions in the objective probability of default. The volatility of daily CDS changes should then, as a consequence, mainly reflect uncertainty about default probabilities. Figure 1 thus suggests that economic policy uncertainty may be an important driver of uncertainty about default probabilities and hence sovereign CDS volatility.

This study assesses whether economic policy uncertainty helps to explain the volatility of sovereign CDS spreads for Germany, France, Italy, Spain, UK, the USA, Canada, and Japan. Economic policy uncertainty is measured by the EPU indices introduced in Baker et al. (2015). These indices, constructed from keyword searches in newspaper archives, have become a popular and widely accepted measure of economic policy uncertainty. The effects of economic policy

[2] Both series are standardized to be comparable. Sections 2 and 3 describe the construction of these series in detail.

[3] Under some simplifying assumptions such as a constant hazard rate of default and a constant risk free rate equation (1) becomes an exact expression for the CDS spread.

uncertainty on CDS volatility are estimated with alternative econometric representations of a simple dynamic model of CDS volatility. The representations enable direct estimation of dynamic multipliers of the impact of transitory and permanent shocks to economic policy uncertainty on CDS volatility.

The main empirical findings of this paper can be summarized as follows: The estimates suggest that there is a positive link between economic policy uncertainty and sovereign CDS volatility in all considered countries. The results also suggest that effects of economic policy uncertainty on CDS volatility often spread out over time. Furthermore, US economic policy uncertainty does also affect sovereign CDS volatility in other countries. In contrast, economic policy uncertainty in the European Union does not seem to have longer lasting effects on US sovereign CDS volatility.

The paper proceeds as follows: The next section introduces the CDS data and the EPU indices. Section 3 outlines the methodology to estimate CDS volatility. Section 4 describes the econometric methodology to quantify effects of economic policy uncertainty on CDS volatility. Section 5 contains the empirical analysis. The final section provides conclusions.

2 Data

As already mentioned, the study considers Germany, France, Italy Spain, Great Britain, the USA, Canada, and Japan. The empirical analysis combines daily data on sovereign CDS spreads with monthly data on EPU indices for these countries. The data range from 2008m10 - 2014m9. The sample starts in fall 2008 because CDS trading for developed economies really took off at the peak of the crisis in 2008 (see IMF, 2013, Ch 2).

2.1 Economic policy uncertainty

Baker et al. (2015) recently developed a news-based index that measures uncertainty about the economic policy in a country. The authors release a monthly index for each of the considered countries on their economic policy uncertainty homepage.[4] The construction of the indices rests on key word searches in the electronic archives of the most important newspapers of a country.

For the USA, for instance, the search goes over the digital archives of the newspapers USA Today, Miami Herald, Chicago Tribune, Washington Post, Los Angeles Times, Boston Globe, San Francisco Chronicle, Dallas Morning News, New York Times, and Wall Street Journal. The counted articles must contain the triples: "economic" or "economy", "uncertain" or "uncertainty"

[4] http://www.policyuncertainty.com/

and at least one of the terms “congress”, “deficit”, “Federal Reserve”, “legislation” or “White House”. The individual raw counts in each newspaper are first scaled by the total number of articles in the same newspaper and month. Then each newspaper-level series is standardized to unit standard deviation from 1985 to 2010 and for each month an average across the considered newspapers is computed. Finally, the resulting series is normalized to a mean of 100 from 1985 to 2009.

Baker et al. (2015) provide a detailed description of the construction of their EPU indices. For each country they give detailed information about the set of searched newspapers and the combination of keywords on which the searches are based. They also report a number of checks for accuracy and unbiasedness. For the US they ran an audit study based on human readings to compare the computer generated index with the human based index. They also compare the index with other measures of economic uncertainty such as the VIX - an index of the option-implied volatility on the S&P500 stock index. Furthermore, they examine whether political slant in the newspaper coverage biases the indices. The checks suggest that their EPU indices are reliable measures of economic policy uncertainty.

The EPU indices have become very popular in empirical research. At the time of writing Baker, Bloom, and Davis list more that sixty studies that have used their EPU indices on their uncertainty homepage. Other measures of uncertainty have also frequently been used in empirical studies. These other measures include various measures of stock market volatility, measures of the disagreement of professional forecasters, and measures extracted from large sets of economic time series (Jurado et al., 2015).

In the context of this study the EPU indices of Baker et al. (2015) have two potential advantages over other uncertainty measures. First, the EPU indices focus directly on economic policy uncertainty whereas other measures such as the disagreement of professional forecasters and stock market volatility have a much broader focus. Measures of disagreement of forecaster, for example, try to capture uncertainty about economic variables such as output and inflation. Second, the EPU indices use information from *keyword* searches in newspapers rather than information from other economic series that could themselves be driven by developments in the CDS market. Reverse causality is thus unlikely to be an issue.

As already mentioned keywords include words like “deficit”, “regulation”, or “legislation”. For no country do the searches contain words like “CDS”, “volatility”, “financial markets”, or any similar terms (see, Baker et al. (2015), Appendix A, p42-46). It appears therefore reasonable to treat EPU indices as being exogenous in the models of CDS volatility that will later be estimated.

Table 1 reports summary statistics for the EPU indices used in this study. The statistics indicate that policy uncertainty in France and Great Britain was on average somewhat larger and more volatile than in the other countries. In Germany and the US economic policy uncertainty is of a similar magnitude. The table also shows an EPU index for the European Union which is based on the news counts for Germany, France, Italy, Spain and Great Britain. The statistics suggest that economic policy uncertainty was on average somewhat larger in the EU than in the US.

Klößner and Sekkel (2014) find spillovers of policy uncertainty shocks across countries. In particular, they find that the US tends to be an exporter of policy uncertainty whereas countries like Germany, Italy, France, and Canada tend to be receivers of policy uncertainty shocks. The correlations between the policy uncertainty indices reported in Table 2 are consistent with their findings. The pairwise correlation coefficients are all positive and typically between 30% - 50%. Japan is an exception. The correlation of the Japanese index with the US index is also about 50%, but the correlation with the other country indices is only around 7% - 30%.

2.2 CDS spreads

The data on CDS spreads are quotes for contracts with a maturity of five years since contracts of this maturity are most frequently traded (Vogel et al., 2013). The data are on a daily frequency and come from the Bloomberg database. Table 3 reports summary statistics for the daily CDS spreads on the considered countries. As can be seen, CDS spreads stay on average below 100 basis points for all countries except Italy and Spain. For these countries the average CDS spreads are an order of magnitude larger. These high levels reflect the serious concerns about the size of government debt in these countries.

3 CDS volatility

CDS spreads must like most other financial series be differenced to become stationary. The analysis therefore considers daily changes in CDS spreads $\Delta s_t = s_t - s_{t-1}$, $t = 1, ..., T$.[5]

As an example, Figure 2 shows how the daily CDS spread changes for Spain - a country that was particularly hard hit by the financial crisis - evolved over time. Firstly, it is easy to see that the differenced series is stationary. Secondly, large and small spread changes occur in clusters.

[5] Augmented Dickey-Fuller tests (results available upon request) support the hypothesis that the level series have a unit root.

The presence of these clustering effects indicate that the volatility of CDS spread changes varies over time. Such clustering effects occur also in all the other country series. [6]

Let us now turn to the computation of CDS volatility: First the daily CDS spread changes Δs_t are regressed on their first i lags

$$\Delta s_t = \alpha_0 + \alpha_1 \Delta s_{t-1} + ... + \alpha_i \Delta s_{t-i} + e_t \tag{3}$$

to remove any predictable variation in Δs_t. It turns out that there is only little autocorrelation in the Δs_t series. The estimated α_i coefficients are all typically close to zero. Nevertheless, equation (3) always includes four lags to make sure that any systematic component in the first moment of Δs_t is removed.

Then the volatility of Δs_t in month m is calculated from the absolute values of the residuals e_t from (3) as

$$\sigma_m = a\sqrt{\frac{\pi}{2}} \sum_{i=1}^{D} \frac{|e_i|}{D} \tag{4}$$

where D is the number of trading days (usually 21 or 22) within month m.[7] The scaling factor $a = \sqrt{252}$ converts daily volatility into annual volatility. The factor $\sqrt{\pi/2}$ comes from the result that the expectation of the absolute value of a random variable $R = \sigma \cdot u$ where σ is a positive constant and u is standard normally distributed is $E(|R|) = \sigma\sqrt{2/\pi}$. This correction has also been used in Schwert (1989) and Ederington and Guan (2005).

Absolute rather than squared deviations are used to measure volatility because squared deviations are in contrast to absolute deviations very sensitive to extreme observations. Furthermore, the empirical evidence in Ederington and Guan (2006) supports the use of absolute deviations in measuring volatility.

Table 4 shows descriptive statistics for the computed volatility of the CDS spread changes. As already noted, the CDS spreads of Italy and Spain - both countries at the center of the European debt crisis - are on average much larger than the spreads for the other countries in the sample. Table 4 further shows that the CDS spreads of Italy and Spain are also considerably more volatile.

[6]For Spain the CDS spread was extremely volatile in 2011 - 2012 when the country became a major concern for the Euro-zone. After repeated downgradings of its government debt Spain finally asked for 100 billion euro in financial assistance from the European Union on June 9 2012.

[7]In the few cases where some observations are missing D is equal to the number of available data points in the particular moth.

4 Econometric methodology

The empirical analysis of the effects of economic policy uncertainty on sovereign CDS volatility rests on a pth-order autoregression in sovereign CDS volatility

$$y_m = \alpha_0 + \alpha_1 y_{m-1} + ... + \alpha_p y_{m-p} + \beta x_m + u_m \tag{5}$$

augmented with an EPU index. In (5) $y_m = log(\sigma_m^c)$ denotes the natural logarithm of CDS volatility for country c in month m, the variable $x_m = log(epu_m^c)$ denotes the log of the EPU index for country c in month m, and u_m is an independently and identically distributed error term with zero mean and finite variance. The coefficients to be estimated are $\alpha_0, ..., \alpha_p$, and β. Stability of the model requires that all roots of the characteristic polynomial $(1-\alpha_1 z - ... - \alpha_p z^p)$ of the autoregressive part of the model are outside the unit circle.

The model is set up in logarithmic form for two reasons. First, volatility must be positive per definition. Taking logarithms guaranties that the model implied volatilities are always positive. Second, the distribution of CDS volatility is heavily skewed to the right. Taking logarithms brings the distribution much closer to a normal distribution.

Equation (5) defines a dynamic model that can be represented in different ways. Solving model (5) forward by recursive substitution yields the representation

$$y_{m+k} = \gamma_0 + \gamma_1 y_{m-1} + ... + \gamma_p y_{m-p} + \delta_k x_{m+k} + \delta_{k-1} x_{m+k-1} + ... + \delta_0 x_m + e_{m+k} \tag{6}$$

where $e_{m+k} = \theta_0 u_m + \theta_1 u_{m+1} + ... + \theta_{k-1} u_{m+k-1} + u_{m+k}$ is a moving average of order $k-1$.

Ordinary least squares (OLS) estimates the coefficients in the alternative representation (6) consistently since the variables $x_m, ..., x_{m+k}$ are exogenous by assumption and the variables $y_{m-1}, ..., y_{m-p}$ are predetermined. The standard errors need to be corrected for autocorrelation, however. Newey-West autocorrelation and heteroskedasticity consistent (HAC) standard errors provide such a correction (Newey and West, 1987).

The baseline model given by equation (5) is of course more parsimonious because it has fewer parameters than the alternative representation given by equation (6). But the alternative representation of the model has other advantages.

First, estimates based on equation (6) are less vulnerable to measurement error in y. To see this suppose for simplicity that the true model is $y_m^* = \alpha y_{m-1}^* + \beta x_m + u_m$ where $|\alpha| < 1$, but we can only observe $y_m = \alpha y_{m-1} + \beta x_m + u_m$ where $y_m = y_m^* + v_m$ and $y_{m-1} = y_{m-1}^* + v_{m-1}$ are error ridden measures of y_m and y_{m-1}. The measurement errors v_m and v_{m-1} are assumed to be unsystematic and uncorrelated with each other. It can than be shown that the covariance between y_{m-1} and the error term u_m in (5) is $\text{Cov}(y_{m-1}, u_m) = -\alpha\sigma^2_{m-1}$ whereas the covariance between y_{m-1} and the error term e_{m+k} in (6) is $\text{Cov}(y_{m-1}, e_{m+k}) = -\alpha^{k+1}\sigma^2_{m-1}$. Thus the influence of any measurement error in y_{m-1} decreases quickly as k increases in (6). Estimates based on the alternative representation (6) are therefore less likely to be seriously affected by measurement error in CDS volatility. The price for this is the larger number of coefficients that need to be estimated and the possibility of less precise estimates of the δ-coefficients due to possible high correlation of successive values of x_m.

Second, representation (6) can be used to estimate dynamic multipliers directly. Dynamic multipliers can of course be analytically calculated from estimates for (5) by iteration, but the corresponding standard errors are more difficult to obtain since the expressions for the multipliers are then nonlinear functions of the estimated parameters. In contrast, the coefficients $\delta_j = \partial y_{m+k}/\partial x_{m+k-j}$, $j = 0, ..., k$ in equation (6) measure the effects of a transitory shock in x on current and future values of y directly and the associated (robust HAC) standard errors are readily available from any standard econometric package.

Model (5) has a second useful representation. Adding and subtracting the terms $\delta_k x_{m+k-1} - \delta_k x_{m+k-1} + ... + (\delta_0 + ... + \delta_k)x_m - (\delta_0 + ... + \delta_k)x_m$ to equation (6) yields

$$y_{m+k} = \gamma_0 + \gamma_1 y_{m-1} + ... + \gamma_p y_{m-p} + \lambda_k \Delta x_{m+k} + \lambda_{k-1}\Delta x_{m+k-1} + ... + \lambda_0 x_m + e_{m+k} \tag{7}$$

where Δ denotes the first difference operator. In this version the λ coefficients measure the effect of a permanent change in x on current and future values of y. In particular, $\lambda_k = \delta_k$, $\lambda_{k-1} = (\delta_k + \delta_{k-1})$, and $\lambda_0 = (\delta_k + \delta_{k-1} + ... + \delta_0)$.

The estimates of λ_j, $j = 0, ..., k$ are therefore direct estimates of the effects of a permanent change in economic policy uncertainty on CDS volatility. Note that the above adding and subtracting strategy does neither change the γ-coefficients nor the error term e_{m+k}. The estimated intercept and the estimated coefficients on the lagged y terms in (6) and (7) are therefore identical.

External policy uncertainty can easily be incorporated into the representations outlined above. The dynamic multipliers that measure the effect of a transitory shock to external economic policy uncertainty on domestic CDS volatility can be estimated from

$$y_{m+k} = \gamma_0 + \gamma_1 y_{m-1} + ... + \gamma_p y_{m-p} + \delta_k x^{dom}_{m+k} + ... + \delta_0 x^{dom}_m + \varphi_k x^{ext}_{m+k} + ... + \varphi_0 x^{ext}_m + e_{m+k} \tag{8}$$

where $x^{ext}_m = log(epu^{ext}_m)$ and $x^{dom}_m = log(epu^{dom}_m)$ is the logarithm of external and domestic economic policy uncertainty in month m, respectively. Analogously, effects of a permanent increase in external economic policy uncertainty can be estimated from

$$y_{m+k} = \gamma_0 + \gamma_1 y_{m-1} + ... + \gamma_p y_{m-p} + \lambda_k \Delta x^{dom}_{m+k} + ... + \lambda_0 x^{dom}_m + \kappa_k \Delta x^{ext}_{m+k} + ... + \kappa_0 x^{ext}_m + e_{m+k}. \quad (9)$$

Again, both equations must be estimated with HAC robust standard errors for asymptotically valid inference.

5 Empirical analysis

The first part of the analysis focuses on domestic economic policy uncertainty by estimating the baseline model and its representations for each country. The second part of the analysis allows for a separate impact of US economic policy uncertainty on the CDS volatility in the other countries. To account for this possibility the US policy uncertainty index is added to the equations. For the US the EPU index for the EU is included instead to quantify possible effects of EU economic policy uncertainty on US CDS volatility. All models are then re-estimated with two alternative measures of CDS volatility to check whether the empirical findings depend on how volatility is calculated.

5.1 Baseline model

As just mentioned, the empirical analysis starts with the simple baseline model (5). In order to determine the number of lagged volatility terms to be included the model is first estimated with three lags of y for each country. Table 5 reports the results. As can be seen, in almost all cases only the first lag of y is statistically significant at conventional levels. Two lags are only required for Germany and the US. The model explains the CDS volatility for the European countries quite well and the fit also is reasonable good for the other countries. More importantly, for the majority of the countries the estimated coefficient on economic policy uncertainty is positive and statistically significant.

To assess the adequacy of the baseline model equation (5) is re-estimated for each country with the number of lagged y as determined in the first step. The resulting residuals are then tested for the presence of autocorrelation, general forms of heteroskedasticity, and autoregressive conditional heteroskedasticity. Each residual series passes these tests.

One implication of the the baseline model is that lagged economic policy uncertainty should not have an independent effect on contemporaneous CDS volatility since the included lagged volatility terms should soak up effects of past economic policy uncertainty. To test this implication equation (5) is estimated for each country with contemporaneous economic policy uncertainty x_m and its first lag x_{m-1} included. Lagged economic policy uncertainty is never found to be statistically significant.[8]

5.2 Multipliers

The findings for baseline model provide clear evidence for a positive link between contemporaneous economic policy uncertainty and sovereign CDS volatility. The alternative representations (6) and (7) to which we turn now help to investigate how the effects of shocks to economic policy uncertainty spread out over time.

As already explained, the coefficients δ_j in equation (6) measure the response of CDS volatility to a transitory shock to economic policy uncertainty in percentage terms. The empirical analysis considers effects on future CDS volatility up to three months. This horizon is chosen mainly for two reasons. First, the sample size is around 70 observations. Stretching the horizon much further would therefore eat up many degrees of freedom relative to the total number of observations. Second, it appears to be unlikely that a transitory change in policy uncertainty has a strong impact on CDS volatility many month into the future. Uncertainty should be resolved after a reasonable amount of time.

Table 6 shows the estimated coefficients for equation (6). For each country the lagged volatility terms included in equation (6) correspond to the lagged volatility terms in the baseline model. P-values based on Newey-West HAC standard errors are reported in parenthesis below coefficients.

The estimated coefficient on x_{m+3} in Table 6 captures the immediate impact of economic policy uncertainty on CDS volatility. As can be seen, these estimates are always positive and often they are somewhat larger than the corresponding estimates in the baseline model. The explicit conditioning on lagged economic policy uncertainty terms and the smaller impact of any measurement errors in CDS volatility may explain this finding.

The rather small p-values for the estimated multipliers of the immediate impact of economic policy uncertainty indicate that the estimates are often statistically significant or very close to being significant at conventional levels. More importantly, the estimates are also economically significant. For example, an increase in the Italian EPU-index of one percent is predicted to lead to somewhat more than a half percent increase in Italian CDS volatility. The estimates imply similar magnitudes for Germany, Spain, Great Britain, and the US. The estimated immediate effect of an increase in policy uncertainty is somewhat smaller, but still sizable for France,

[8] To conserve space these tests are not reported. The results are of course available upon request.

Canada, and Japan.

The estimated coefficients on x_{m+2}, x_{m+1}, and x_m are often positive as well, indicating that economic policy uncertainty feeds also into future CDS volatility. In the case of Italy and Spain the estimates are quite large and almost always highly significant. Thus transitory shocks to economic policy uncertainty appear to affect CDS volatility quite strongly and persistently in these countries.

As outlined in section 4, equation (7) yields multipliers for a permanent change in domestic economic policy uncertainty. These multipliers are just sums of the individual multipliers estimated from equation (6). Table 7 reports the estimates for these multipliers together with p-values based on HAC standard errors. Again, almost all estimated multipliers are positive and many of them are also statistically significantly different from zero.

The pattern of the estimates differs somewhat across countries. For France and Italy, the estimated coefficient on x_m predicts that a permanent increase in economic policy uncertainty leads to an increase in CDS volatility of 1.1% and 1.6%, respectively, after three month. For Spain the predicted increase in CDS volatility is even 2.2%. For Japan CDS volatility is predicted to rise about 0.8% in three months time. This response originates mainly from the imediate response of CDS volatility and from a delayed response. The estimated responses are more modest for the remaining countries. For Germany and the US the response to a permanent shock peaks after two month. For Great Britain the peak comes also after two month, but the response dies out thereafter. For Canada the largest response comes also after just one month.

5.3 US economic policy uncertainty and foreign CDS volatility

The empirical findings in Colombo (2013) suggest that US economic policy uncertainty shocks have a negative effect on Euro area real economic activity. Does an increase in economic policy uncertainty in the US also translate into increasing CDS volatility for other countries? To answer this question the baseline model and its alternative representations are estimated with US economic policy uncertainty included as a further variable. In the case of the US the model includes the EPU index for the EU to see whether European economic policy uncertainty affects the volatility of CDS contracts on US debt.

Table 8 shows the estimates for the extended baseline model. The estimates indicate that US economic policy uncertainty and the CDS volatility for other countries are always positively related. The estimated coefficients on US economic policy uncertainty x_m^{ext} are with the exception of Canada statistically significant. They are often also larger than the country specific coefficients. For the US the variable x_m^{ext} is EU economic policy uncertainty. As can be seen, the estimated impact of EU policy uncertainty on US CDS volatility is positive but small and not statistically significant. The coefficients on domestic economic policy uncertainty x_m^{dom} are now often not significant at conventional levers but nearly so for all EU countries. The corresponding p-values are 0.15 for Germany, 0.13 for France, and 0.11 for Italy.

Table 9 reports the estimates of the multipliers for transitory shocks to US economic policy uncertainty. For the US the multipliers are again for a shock to EU economic policy uncertainty. The estimated multipliers for the impact of the US policy uncertainty are almost always positive. Due to the rather high correlation between successive lags in the US EPU index the estimates are, however, not always very precise.

The coefficients on x_{m+3}^{ext} of the immediate impact of US policy uncertainty on the CDS volatility of France, Italy, and Spain are quite large and highly significant. The instantaneous impact of a shock to EU economic policy uncertainty on US CDS volatility is now also positive and statistically significant, but the large negative coefficients on x_{m+2}^{ext} and x_{m+1}^{ext} indicate that this effect gets quickly reversed. The estimated multipliers for the immediate effect of domestic economic policy uncertainty on CDS volatility are now with the exception of France also always significant for the European countries and Canada.

The p-values of the estimated multipliers for a permanent shock to US policy uncertainty in Table 10 are in contrast Table 9 often very small. This is a symptom of the high autocorrelation in the US EPU index that leads to imprecise estimates of individual coefficients but precise estimates of sums of coefficients. The estimated coefficients on x_m^{ext} that measure the effect of a permanent shock to US economic policy uncertainty on domestic CDS volatility after four periods are with the exception of Canada always quite large and statistically highly significant. The insignificant estimate for the US suggests that EU economic policy uncertainty has no long lasting effects on the CDS volatility for the US.

The estimates further suggest that permanent shocks to domestic and US economic policy uncertainty increase CDS volatility to a similar extent in Italy and Spain. For Germany a permanent domestic shock appears to have only a short lived effect on CDS volatility whereas a permanent shock coming from the US has a longer lasting effect. Such a shock is estimated to have an even larger effect for France and Japan.

5.4 Robustness

The empirical findings reported up to now suggest that there is clear positive link between economic policy uncertainty and CDS volatility. To see whether these findings are sensitive to the method of calculating CDS volatility all equations where re-estimated with volatility computed with two alternative methods.

In the first alternative method ($A1$) CDS volatility is calculated as

$$\sigma_m^{A1} = a\sqrt{\sum_{i=1}^{D} \frac{e_i^2}{D}} \tag{10}$$

from the squared residuals e_i^2 of the daily CDS changes from regression (3) on their first four lags. Here D denotes again the number of trading days within month m and $a = \sqrt{252}$ is the scaling factor that converts daily volatility into annual volatility.

In the second method (A2) the daily variance of CDS spread changes is calculated with an exponentially weighted moving average (EWMA)

$$\sigma_t^2 = \lambda\sigma_{t-1}^2 + (1-\lambda)e_t^2 \tag{11}$$

where e_t^2 is the squared residual from (3). An EWMA weights more recent observations more heavily than older observations. The parameter λ that lies between 0 and 1 determines how quickly the weights decline. This λ is estimated for each country by minimizing the mean squared forecast error.[9] The square root of average of the σ_t^2's within month m

$$\sigma_m^{A2} = a\sqrt{\sum_{i=1}^{D} \frac{\sigma_i^2}{D}} \tag{12}$$

scaled by a is then taken as another measure of sovereign CDS volatility.

It turns out that the results obtained with the two alternative measures of sovereign CDS volatility are very similar to the results obtained with CDS volatility measured as described in Section 3. The empirical findings are therefore not sensitive to the way how CDS volatility is actually calculated.

As argued above it appears to be plausible to assume that economic policy uncertainty is exogenous in the estimated single equation models for sovereign CDS volatility. The analysis that follows assesses whether the empirical findings hold in a less restrictive vector autoregressive (VAR) model as well. To this end the following VAR

$$z_m = \mu + \Phi_1 z_{m-1} + ... + \Phi_p z_{m-p} + v_m \tag{13}$$

[9]Note that this EWMA can be interpreted as an IGARCH(1,1) model without intercept.

is estimated for each country. In (13) the column vector $z_m = (x_m^{ext}, x_m^{dom}, y_m)$ contains external EPU, domestic EPU, and sovereign CDS volatility, the $\Phi' s$ are the corresponding coefficient matrices, and v_m is an $iidN(0, V)$ column vector of disturbances.

The ordering of the variables in y_m imply a recursive structure where there is no contemporaneous relationship between external EPU, domestic EPU, and CDS volatility in the first equation of the system. In the second equation external EPU may contemporaneously affect domestic EPU but CDS volatility has no contemporaneous effect on domestic EPU. In the third equation external and domestic EPU may contemporaneously affect sovereign CDS volatility.

For each country the estimated VAR contains the first three lags of z_m. Figure 3 summarizes the country specific response of CDS volatility to an unexpected structural shock in external and domestic EPU, respectively. The shocks are one unit shocks rather one standard deviation shocks to ease comparisons with the single equation results reported in section 5.3.

It turns out that the VAR based impulse responses (IR) tell the same story as the dynamic multipliers from the single equation models. The response of sovereign CDS volatility to EPU is typically short-lived but in many cases statistically and economically significant. CDS volatility for the European countries in the sample and for Japan responds somewhat stronger to US EPU than to domestic EPU. US sovereign CDS volatility responds positively to European EPU but this response reverts quickly. Taken together these patterns strongly mirror the findings from the single equation models.

6 Conclusions

The empirical evidence presented in this paper provides robust evidence for a clear positive link between economic policy uncertainty and sovereign CDS volatility. Both, domestic and US policy uncertainty appear to have quite a substantial impact on the volatility of CDS spreads. Sound economic policy therefore seems to be an important prerequisite for modest levels of sovereign CDS volatility. Put differently, high levels of sovereign CDS volatility are a symptom of significant domestic and/or external policy uncertainty.

Bedendo and Colla (2015) find that concerns about the solvency of a county translate into higher corporate credit risk. Lower levels of economic policy uncertainty may thus also lead to lower levels of corporate CDS volatility. Exploring this issue is left for future research.

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Figures

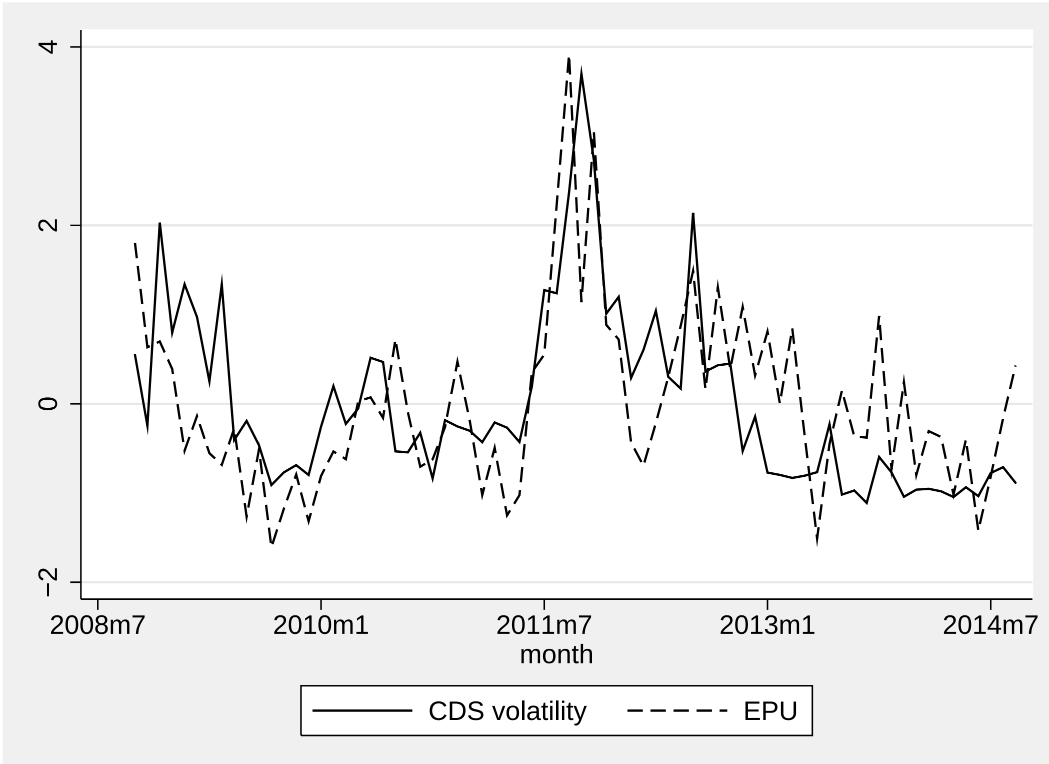

Figure 1: Economic policy uncertainty (EPU) and CDS volatility for Germany.

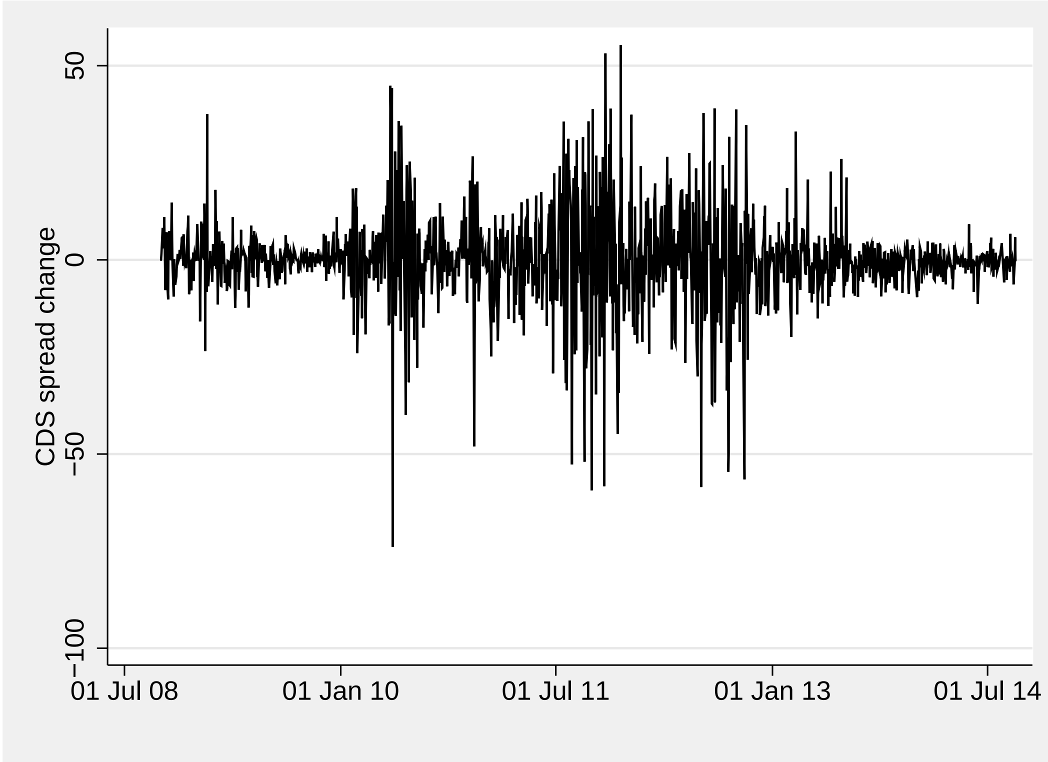

Figure 2: Daily changes of the CDS spread for Spain.

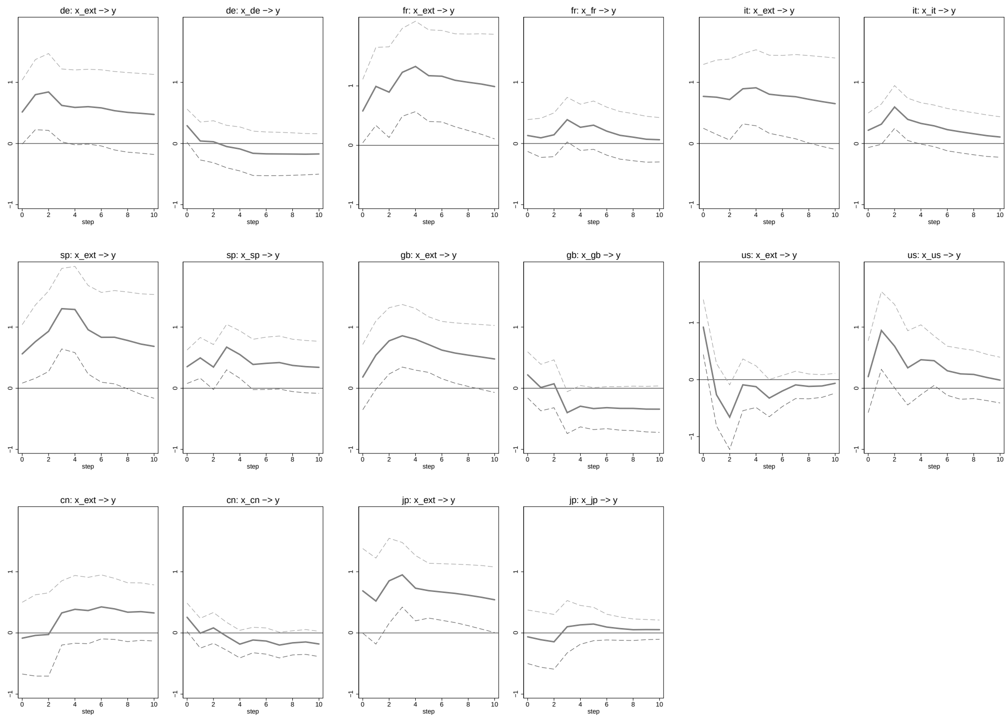

Figure 3: Impulse-responses to external and domestic EPU shocks.

Tables

Table 1: Summary statistics of economic policy uncertainty indices

Country	de	fr	it	sp	gb	us	cn	jp	eu
mean	152.2	210.9	127.2	114.0	218.1	144.2	148.8	117.7	181.5
sd	57.6	71.4	42.7	38.3	74.1	35.6	76.7	34.0	51.0
min	59.6	99.4	42.1	54.4	95.7	72.1	26.1	44.8	95.3
max	377.8	422.7	248.9	200.3	408.7	245.1	363.5	196.0	331.5
N	72	72	72	72	72	72	72	72	72

Table 2: Correlations between economic policy uncertainty indices

Country	de	fr	it	sp	gb	us	cn	jp	eu
de	1.00								
fr	0.46	1.00							
it	0.51	0.45	1.00						
sp	0.57	0.52	0.58	1.00					
gb	0.59	0.59	0.60	0.53	1.00				
us	0.57	0.36	0.31	0.53	0.41	1.00			
cn	0.55	0.36	0.32	0.33	0.58	0.45	1.00		
jp	0.24	0.07	0.18	0.10	0.20	0.52	0.30	1.00	
eu	0.83	0.72	0.76	0.75	0.87	0.55	0.58	0.22	1.00

Table 3: Summary statistics of CDS spreads

Country	de	fr	it	sp	gb	us	cn	jp
mean	45.2	85.2	224.8	230.9	60.7	36.9	98.3	73.3
sd	24.1	53.2	131.1	136.0	26.6	10.6	41.7	26.0
min	15.1	19.7	57.6	40.6	18.5	15.5	53.1	18.5
max	119.2	249.6	591.5	642.0	164.8	65.1	276.3	157.2
N	1544	1545	1547	1536	1519	1260	1350	1485

Table 4: Summary statistics of CDS volatility

country	de	fr	it	sp	gb	us	cn	jp
mean	24.5	46.3	124.5	135.1	28.8	15.6	57.1	33.6
sd	17.4	37.7	89.1	98.4	18.0	8.5	49.0	21.4
min	5.2	5.6	15.2	20.7	3.8	4.0	15.2	7.4
max	88.7	171.4	399.5	400.8	73.7	56.0	319.1	114.0
N	72	72	72	72	72	61	72	72

Table 5: Economic policy uncertainty and CDS volatility: baseline model.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Country	de	fr	it	sp	gb	us	cn	jp
Variables	y_m	y_m	y_m	y_m	y_m	y_m	y_m	y_m
x_m	0.257*	0.292*	0.343*	0.485***	0.0559	0.438**	0.0666	0.245
	(0.147)	(0.157)	(0.182)	(0.162)	(0.157)	(0.210)	(0.110)	(0.237)
y_{m-1}	0.487***	0.785***	0.565***	0.697***	0.476***	0.254*	0.564***	0.396***
	(0.122)	(0.119)	(0.119)	(0.123)	(0.123)	(0.130)	(0.133)	(0.127)
y_{m-2}	0.230*	0.111	0.0677	-0.0123	0.155	-0.284**	0.0759	-0.0341
	(0.127)	(0.141)	(0.133)	(0.150)	(0.134)	(0.133)	(0.152)	(0.140)
y_{m-3}	0.0918	-0.0602	0.118	0.0622	0.201	0.189	-0.0779	0.118
	(0.117)	(0.116)	(0.115)	(0.118)	(0.123)	(0.129)	(0.123)	(0.125)
const	-0.737	-0.987	-0.530	-1.098*	0.196	0.0783	1.303**	0.564
	(0.658)	(0.785)	(0.743)	(0.643)	(0.866)	(1.014)	(0.559)	(1.017)
N	69	69	69	69	69	58	69	69
R-squared	0.705	0.752	0.653	0.751	0.585	0.199	0.376	0.221

Notes: For each country y_m and x_m denote the logarithms of CDS volatility and the economic policy uncertainty index in month m, respectively. Standard errors in parenthesis below coefficients. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% lever, respectively.

Table 6: Economic policy uncertainty and CDS volatility: effects of a transitory shock to economic policy uncertainty.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Country	de	fr	it	sp	gb	us	cn	jp
Variables	y_{m+3}	y_{m+3}	y_{m+3}	y_{m+3}	y_{m+3}	y_{m+3}	y_{m+3}	y_{m+3}
x_{m+3}	0.759	0.249	0.536	0.645	0.579	0.546	0.399	0.339
	(0.000)	(0.320)	(0.051)	(0.007)	(0.116)	(0.158)	(0.022)	(0.290)
x_{m+2}	0.161	0.260	0.413	0.665	0.0283	0.418	-0.145	0.0815
	(0.542)	(0.194)	(0.056)	(0.000)	(0.941)	(0.390)	(0.229)	(0.756)
x_{m+1}	-0.0594	0.208	0.454	0.355	-0.122	-0.467	0.199	-0.00710
	(0.799)	(0.304)	(0.091)	(0.012)	(0.709)	(0.223)	(0.112)	(0.980)
x_m	-0.183	0.373	0.199	0.518	-0.550	-0.199	-0.296	0.434
	(0.356)	(0.058)	(0.421)	(0.007)	(0.152)	(0.536)	(0.067)	(0.092)
y_{m-1}	0.302	0.429	0.130	0.0716	0.580	0.00797	0.0977	0.0761
	(0.012)	(0.003)	(0.292)	(0.620)	(0.000)	(0.935)	(0.559)	(0.594)
y_{m-2}	0.244					-0.0172		
	(0.073)					(0.912)		
const	-2.072	-3.798	-3.712	-5.907	1.585	1.223	2.595	-0.931
	(0.229)	(0.070)	(0.048)	(0.000)	(0.311)	(0.338)	(0.008)	(0.565)
N	67	68	68	68	68	56	68	68

Notes: The variables y_m and x_m denote the logarithms of CDS volatility and the economic policy uncertainty index in month m, respectively. P-values based on HAC standard errors in parenthesis below coefficients.

Table 7: Economic policy uncertainty and CDS volatility: effects of a permanent shock to economic policy uncertainty.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Country	de	fr	it	sp	gb	us	cn	jp
Variables	y_{m+3}	y_{m+3}	y_{m+3}	y_{m+3}	y_{m+3}	y_{m+3}	y_{m+3}	y_{m+3}
Δx_{m+3}	0.759	0.249	0.536	0.645	0.579	0.546	0.399	0.339
	(0.000)	(0.320)	(0.051)	(0.007)	(0.116)	(0.158)	(0.022)	(0.290)
Δx_{m+2}	0.920	0.508	0.949	1.311	0.608	0.963	0.254	0.420
	(0.014)	(0.153)	(0.008)	(0.000)	(0.186)	(0.050)	(0.212)	(0.237)
Δx_{m+1}	0.860	0.717	1.403	1.665	0.485	0.496	0.453	0.413
	(0.034)	(0.071)	(0.003)	(0.000)	(0.339)	(0.098)	(0.101)	(0.308)
x_m	0.677	1.090	1.602	2.183	-0.0644	0.297	0.157	0.847
	(0.070)	(0.011)	(0.001)	(0.000)	(0.827)	(0.206)	(0.466)	(0.036)
y_{m-1}	0.302	0.429	0.130	0.0716	0.580	0.00797	0.0977	0.0761
	(0.012)	(0.003)	(0.292)	(0.620)	(0.000)	(0.935)	(0.559)	(0.594)
y_{m-2}	0.244					-0.0172		
	(0.073)					(0.912)		
const	-2.072	-3.798	-3.712	-5.907	1.585	1.223	2.595	-0.931
	(0.229)	(0.070)	(0.048)	(0.000)	(0.311)	(0.338)	(0.008)	(0.565)
N	67	68	68	68	68	56	68	68

Notes: The variables y_m and x_m denote the logarithms of CDS volatility and the economic policy uncertainty index in month m, respectively. Δ denotes the first difference operator. P-values based on HAC standard errors in parenthesis below coefficients.

Table 8: US economic policy uncertainty and domestic CDS volatility: baseline model.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Country	de	fr	it	sp	gb	us	cn	jp
Variables	y_m	y_m	y_m	y_m	y_m	y_m	y_m	y_m
x_m^{dom}	0.202	0.248	0.289	0.412**	-0.159	0.501*	0.0235	-0.123
	(0.153)	(0.161)	(0.181)	(0.161)	(0.166)	(0.273)	(0.113)	(0.242)
x_m^{ext}	0.500**	0.550**	0.506**	0.374*	0.725***	0.0265	0.167	0.865***
	(0.246)	(0.260)	(0.233)	(0.221)	(0.257)	(0.314)	(0.221)	(0.280)
y_{m-1}	0.445***	0.700***	0.585***	0.664***	0.569***	0.225*	0.622***	0.341***
	(0.116)	(0.0843)	(0.1000)	(0.0835)	(0.0946)	(0.131)	(0.0918)	(0.109)
y_{m-2}	0.235**					-0.221*		
	(0.117)					(0.129)		
const	-2.527**	-2.987**	-1.985*	-2.222**	-1.389	0.0332	0.468	-1.507
	(1.056)	(1.227)	(1.169)	(0.955)	(1.096)	(1.260)	(1.037)	(1.183)
N	70	71	71	71	71	59	71	71
R-squared	0.709	0.728	0.610	0.754	0.594	0.164	0.463	0.301

Notes: The variables y_m and x_m^{dom} denote the logarithms of CDS volatility and the domestic economic policy uncertainty index in month m, respectively. In case of the US x_m^{ext} is the logarithm of the European Union economic policy uncertainty index, for all other countries x_m^{ext} is the logarithm of the US economic policy uncertainty index. Standard errors in parenthesis below coefficients. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% lever, respectively.

Table 9: Effects of a transitory shock in external economic policy uncertainty on domestic CDS volatility.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Country	de	fr	it	sp	gb	us	cn	jp
Variables	y_{m+3}	y_{m+3}	y_{m+3}	y_{m+3}	y_{m+3}	y_{m+3}	y_{m+3}	y_{m+3}
x^{dom}_{m+3}	0.541	0.0719	0.374	0.562	0.232	0.179	0.456	-0.0120
	(0.015)	(0.725)	(0.085)	(0.010)	(0.409)	(0.578)	(0.034)	(0.965)
x^{dom}_{m+2}	0.0170	0.180	0.264	0.670	-0.0950	0.652	-0.192	-0.157
	(0.945)	(0.336)	(0.228)	(0.000)	(0.798)	(0.225)	(0.155)	(0.509)
x^{dom}_{m+1}	-0.115	0.208	0.593	0.203	-0.183	0.216	0.163	-0.150
	(0.582)	(0.253)	(0.031)	(0.280)	(0.556)	(0.598)	(0.196)	(0.618)
x^{dom}_{m}	-0.129	0.502	0.313	0.479	-0.677	-0.359	-0.433	0.0975
	(0.501)	(0.017)	(0.077)	(0.019)	(0.020)	(0.487)	(0.031)	(0.751)
x^{ext}_{m+3}	0.377	1.185	1.033	0.462	0.207	0.690	-0.400	0.566
	(0.455)	(0.031)	(0.005)	(0.088)	(0.429)	(0.025)	(0.307)	(0.143)
x^{ext}_{m+2}	0.491	0.315	0.0266	-0.0794	0.604	-0.723	0.199	0.121
	(0.328)	(0.545)	(0.938)	(0.842)	(0.065)	(0.085)	(0.719)	(0.794)
x^{ext}_{m+1}	0.356	0.203	-0.0669	0.604	0.345	-0.914	0.0129	0.471
	(0.461)	(0.748)	(0.863)	(0.149)	(0.249)	(0.017)	(0.983)	(0.338)
x^{ext}_{m}	0.215	0.381	0.187	0.355	0.818	0.340	0.633	0.373
	(0.591)	(0.425)	(0.599)	(0.248)	(0.010)	(0.433)	(0.052)	(0.343)
N	67	68	68	68	68	56	68	68

Notes: The variables y_m and x^{dom}_m denote the logarithms of CDS volatility and the domestic economic policy uncertainty index in month m, respectively. The variable x^{ext}_m is the logarithm of the European Union economic policy uncertainty index in the case of the US. For all other countries x^{ext}_m is the logarithm of the US economic policy uncertainty index. The estimates for lagged volatility terms are not reported to conserve space. P-values based on HAC standard errors in parenthesis below coefficients.

Table 10: Effects of a permanent shock in external economic policy uncertainty on domestic CDS volatility.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Country	de	fr	it	sp	gb	us	cn	jp
Variables	y_{m+3}	y_{m+3}	y_{m+3}	y_{m+3}	y_{m+3}	y_{m+3}	y_{m+3}	y_{m+3}
Δx^{dom}_{m+3}	0.541	0.0719	0.374	0.562	0.232	0.179	0.456	-0.0120
	(0.015)	(0.725)	(0.085)	(0.010)	(0.409)	(0.578)	(0.034)	(0.965)
Δx^{dom}_{m+2}	0.558	0.252	0.638	1.233	0.137	0.831	0.264	-0.169
	(0.108)	(0.394)	(0.030)	(0.000)	(0.733)	(0.100)	(0.179)	(0.581)
Δx^{dom}_{m+1}	0.444	0.460	1.231	1.435	-0.0458	1.047	0.427	-0.319
	(0.232)	(0.145)	(0.005)	(0.000)	(0.926)	(0.024)	(0.106)	(0.366)
x^{dom}_{m}	0.314	0.961	1.544	1.915	-0.723	0.688	-0.00556	-0.222
	(0.363)	(0.012)	(0.000)	(0.000)	(0.029)	(0.053)	(0.980)	(0.612)
Δx^{ext}_{m+3}	0.377	1.185	1.033	0.462	0.207	0.690	-0.400	0.566
	(0.455)	(0.031)	(0.005)	(0.088)	(0.429)	(0.025)	(0.307)	(0.143)
Δx^{ext}_{m+2}	0.868	1.500	1.060	0.382	0.811	-0.0328	-0.202	0.688
	(0.110)	(0.014)	(0.005)	(0.338)	(0.007)	(0.942)	(0.701)	(0.130)
Δx^{ext}_{m+2}	1.224	1.703	0.993	0.986	1.156	-0.947	-0.189	1.159
	(0.015)	(0.009)	(0.021)	(0.014)	(0.002)	(0.082)	(0.655)	(0.047)
x^{ext}_{m}	1.439	2.084	1.180	1.342	1.973	-0.607	0.445	1.531
	(0.004)	(0.002)	(0.012)	(0.000)	(0.000)	(0.162)	(0.364)	(0.003)
N	67	68	68	68	68	56	68	68

Notes: The variables y_m and x^{dom}_m denote the logarithms of CDS volatility and the domestic economic policy uncertainty index in month m, respectively. The variable x^{ext}_m is the logarithm of the European Union economic policy uncertainty index in the case of the US. For all other countries x^{ext}_m is the logarithm of the US economic policy uncertainty index. Δ denotes the first difference operator. The estimates for lagged volatility terms are not reported to conseve space. P-values based on HAC standard errors in parenthesis below coefficients.