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Macroeconomic Uncertainty Indices for European Countries

Índices de Incerteza Macroeconómica para Países Europeus

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ABSTRACT
The present article seeks to develop a macroeconomic uncertainty index for the EU Member States based on Google Trends for a period of fifteen years (from January 2008 to December 2022). Monthly data were collected for the 12 countries for four different word-terms, as well as for unemployment rate, inflation and the 10-year Government Bond yield. For simplifying the research the keywords searched were in English and were not translated into the countries' own languages. Our findings were then compared to existing uncertainty indices. Lastly, we employed Impulse Response Functions (IRFs) with the existing economic indicators to highlight the effect that one standard deviation shock on the uncertainty index has on all three indicators and its ability to accurately depict the future precariousness of the country.
Keywords: Uncertainty; Google trends; European uncertainty index.

JEL:Classification: C32; E32

1. Introduction

In this paper we try to create a macroeconomic uncertainty index for each of the 12 core Eurozone countries (the countries in which euro currency went initially into circulation on the 1st of January 2002). The creation of the macroeconomic uncertainty index is based on data gained from Google Trends. Then we are interested in checking the impact of the uncertainty index of each country through Impulse Response Functions (IRFs) on three specific macroeconomic variables: unemployment rate, inflation and the 10-year Government Bond yield. Finally, we try to check with the tool of (IRFs) the effect of the uncertainty index of Germany (the biggest economy in EU and in Eurozone) both on the individual uncertainty index of each country and on the three macroeconomic variables of interest. The Google Trends tracks the most popular Google Search terms across various geographies and languages. In our paper we have used four common words all in the English language in order to create the uncertainty index. The dataset starts at January 2008 and ends at December 2022, which implies 15 years which includes the period of debt crisis for some countries such as Greece, Ireland, the covid pandemic and the war in Ukraine. All these events have created bank crisis as in Greece, a push both in energy and home prices. All the previous elements may increase income inequality and the minimum wage is of paramount importance for the wellbeing of the society. Under the previous justification and by taking into account the proposals from the literature, we have decided to use the following four words in order to construct the uncertainty index for each country: bank crisis, energy price, home price and minimum wages.

The Uncertainty Index was constructed utilizing Google Trends, obtaining monthly data for all 12 core Eurozone countries based on four benchmark words. The 12 core Eurozone countries in alphabetical order are the following: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain. The validity of our uncertainty index was assessed against the established Economic Policy Uncertainty index (Baker et al., 2016) and the Consumer Confidence Index. Utilizing the STATA econometric program, Vector Autoregressive (VAR) models were conducted for each country, followed by the depiction of Impulse Response Function (IRF) graphs illustrating the impact of a one standard deviation shock in country uncertainty on economic indicators such as unemployment rate, inflation, and long-term government bond yield. The structure of the paper is the following: in section 2 we provide the literature review, in section 3 we explain the construction of the uncertainty index for each country by using data from google trends and we provide the empirical results for each country. In the last section as usual there are the conclusions.

2. Literature Review

In the literature review, the significance of textual analysis has been extensively documented. Examples include Dergiades et al. (2015), Milas et al. (2021), and Bampinas et al (2019). Schütze (2020) employs Google Trends subject searches to develop an uncertainty index applicable to countries where Google operates. The uncertainty indicator generated

in this study consistently yields statistically significant results higher than those of the EPU on average. The study concludes that Google Trends serves as an effective instrument for obtaining timely information on economic participants' uncertainty. Notably, the primary enhancement lies in the independence of this uncertainty proxy from language.

Castelnuovo and Tran (2017) utilized publicly available, real-time Google Trends data to devise uncertainty indices for both the United States and Australia. The terms employed in crafting the uncertainty index were sourced from economic documents such as the Federal Reserve Beige Book for the US and the Reserve Bank Monetary Policy Statement for Australia. The authors demonstrate that several other proxies for uncertainty applicable to these two nations exhibit favorable correlations with the Google Trends Uncertainty (GTU) indices they developed, including VXO as used by Bloom (2009) and the EPU index constructed by Baker et al. (2016). Through investigations using VAR, it was revealed that GTU shocks in the United States exert a statistically and economically substantial impact on the dynamics of unemployment. Conversely, GTU shocks were found to have a significantly smaller and less significant impact on Australian unemployment dynamics compared to shocks related to monetary policy.

Donadelli (2015) proposed three distinct metrics of policy-related uncertainty by using the frequency of Google searches for terms such as "US stock market", "US politics", and "US Fed". He found out that a Google search-based uncertainty shock significantly and negatively affects US macroeconomic conditions in a VAR environment. Specifically, it leads to reductions in industrial production, consumer confidence, equity prices, long-term rates, and consumer credit. Another finding of this paper is that uncertainty shocks contribute to an increase in the unemployment rate. The empirical results suggest that a surge in the number of online searches related to themes linked to economic policy signals rising uncertainty. The proposed Google-search-based measures align well with common policy-related uncertainty indicators, such as the EPU index developed by Baker et al. (2016) and the VIX (Volatility Index).

Moore (2017) developed a monthly indicator of economic uncertainty for Australia. During the global financial crisis, economic uncertainty reached unprecedented levels and persisted until 2013. He finds out that the economic uncertainty index tends to rise faster than it falls, influenced by both domestic and international factors, and is particularly pronounced around recessions, elections, monetary policy shocks, and significant geopolitical events. He concludes that it hampers investment and job creation, consistent with the real options' channel of uncertainty. Similarly, akin to the 'precautionary savings' channel of uncertainty, uncertainty raises the household saving ratio and reduces consumption growth for durable goods.

Albert and Fernández (2018) utilize data spanning from January 2001 to June 2018 to employ a SVAR technique with sign restrictions. The aim is to estimate the effects of economic uncertainty shocks on key macroeconomic variables in Spain. The authors investigate both short-term and long-lasting shocks associated with economic uncertainty. Furthermore, they isolate uncertainty shocks originating solely from political sources to discern potential variations in their impact. Their findings suggest that increases in economic and political uncertainty lead to higher unemployment rates and decreases in both company and consumer confidence, the IBEX 35 Index, and industrial production. Moreover, these adverse effects

of uncertainty persist over a prolonged period, especially in the cases of industrial output and unemployment. Based on these results, the authors conclude that economic uncertainty shocks exert a significant negative impact on the Spanish economy. Moreover, the research suggests that political stability is crucial in mitigating uncertainty and achieving improved economic outcomes.

Bontempi et al. (2016) paper tries to investigate the impact of uncertainty index, which is constructed by internet searches, on the economic cycle. Moreover, they compare the macroeconomic consequences of various uncertainty indices. The findings suggest that uncertainty shocks, at times, convey relevant information regarding people's perceptions of uncertainty sooner than other indices. Bilgin et al. (2019) measures the level of economic and financial uncertainty in Turkey. The uncertainty index is measured with the use of internet search-based method and it provides the 'Turkish Economic and Financial Uncertainty Index' (TEFUI). They have used real-time monthly Google Trends data for the period from January 2004 to December 2018. In order to create the baseline TEFUI, the paper takes into account more than 400 possible terms. The results of the Vector Autoregression models, Impulse-Response shocks and correlation analysis showed that the TEFUI is substantially correlated with a number of domestic economic uncertainty indicators and global uncertainty indices.

Kropiński and Anholcer (2022) explore the correlations between the WIG20 index and phrases associated with economic policy uncertainty (EPU) measured through Google Trends search index. The examination covers two distinct timeframes: January 2015 to December 2019 and June 2016 to May 2021, allowing differentiation between a period of relative stability and the economic shock induced by the COVID-19 epidemic crisis and subsequent government-imposed restrictions. For their empirical analysis it is used a bivariate VAR model. The study found that twelve EPU-related keywords exhibited a stronger empirical association with changes in the WIG20 index during the post-COVID era compared to six terms in the pre-COVID period. Moreover, the severity of reversal relations increased notably throughout the post-COVID period.

Zayed et al. (2023) conducted a scoping review aiming to provide an overview of Google Trends' role as a monitoring and forecasting tool for the COVID-19 pandemic. The study focused on original English-language peer-reviewed research publications on the COVID-19 pandemic from 2020 that utilized Google Trends as a search engine. Articles not detailing the use of Google Trends during the COVID-19 epidemic, written in languages other than English, or available solely in abstract form were excluded. A total of 81 papers meeting the inclusion criteria were included, covering the first year following the emergence of the crisis. The findings suggested that health authorities could benefit from utilizing Google Trends to plan and manage pandemics earlier.

Bulczak (2021) with the utilization of Google Trends data tries to improve the real estate market forecasting. Online searches provide valuable information that precedes financial decisions. This study delves into the potential of Google search engine data in forecasting real estate markets. The findings indicate that Google data could serve as an additional source of insight for investors and decision-makers. Google Trends data has been identified as a reliable indicator of real estate market pricing and sales volume. However, Limnios and You (2021) investigate the use of Google Trends data to complement

linear pricing models for the housing market, commonly employed in literature. They found that augmenting models with Google Trends data did not significantly enhance their predictive abilities.

Ettredge et al. (2005) highlight the promising potential of web-based search data for forecasting macroeconomic statistics. Through the analysis of the vast amount of data generated by internet search activity, researchers gained valuable insights into consumer attitudes and behavior. Hayford (2000) demonstrates that concern about future unemployment, which serves as a proxy for uncertainty regarding future actual economic activity, rises with inflation as well as inflation uncertainty itself. His results show that a temporary slowdown in production growth occurs when both inflation uncertainty and unemployment uncertainty rise. Further impulse response functions illustrate that the impacts of inflation and unemployment uncertainty on real GDP growth are of similar magnitude.

3. **Data and Empirical Results**

By using Google Trends at monthly basis from January 2008 to December 2022 we have created the Uncertainty Index (UI) for each core country of the Eurozone. To keep the research simple, the terms that were selected and examined were in English rather than being translated into the native tongue of each nation. In order to create the uncertainty index, we selected terms and phrases that, during times of increasing uncertainty, people would be most likely to use to search for information on Google, the most widely used search engine worldwide. "Minimum wage," "energy price," "bank crisis," and "home price" were these four terms. We think that these four terms can capture better the uncertainty of the period since in this period the following types of crises have appeared: debt crisis in Greece, Covid pandemic crisis and the Ukrainian war. All these words can capture mainly uncertainty which is more related with increasing inflation, which is something that at the moment both Eurozone and in general the whole world is facing.

Instead of looking at the total number of searches, Google Trends data shows us the percentage of searches on a particular topic relative to all searches made at that time and place. Since Google Trends data is derived from an impartial, random sample of Google searches, we gathered the data for the words under investigation for each of the 12 countries on the same day, even though the results change daily. For the sake of simplicity in our analysis, we rounded all values that came close to 1 for each of the four terms we looked into. Greece was our primary focus, so we used Google Trends data to establish it as the benchmark country. We collected data for each country using the same four terms, and we added the term "home price" for Greece as the fifth search. By using this technique, we were able to rescale the required number of countries, allowing the index to accept values up to 100 and to be comparable the uncertainty index between each country. The detailed exploration of the methodology for the construction of the uncertainty index is presented in Castelnuovo and Tran (2017).

We gathered monthly data for the "unemployment rate," "inflation," and "long-term government bond yield 10 year" for each country from January 2008 to December 2022 after compiling the data and creating our monthly Uncertainty Index (UI).

Next, we looked at the relationship between these economic indicators and our Uncertainty Index. The Federal Reserve Economic Data (FRED) St. Louis FED website served as our primary source of data for these variables. We first determined the correlation between our Uncertainty Index and the economic indicators for each country. Next, we determined the correlation between our Uncertainty Index and the Consumer Confidence Index (CCI) and the widely used Economic Policy Uncertainty Index (EPU), as reported by Baker et al. (2016). These indices are widely used in numerous research fields and are easily and freely accessible via their websites. Only the following countries' EPU data could be located: Belgium, France, Germany, Greece, Ireland, Italy, Netherlands, and Spain. For each correlation, a significance test was conducted to ensure that the values obtained were legitimate.

In addition, we used Vector Autoregressive (VAR) models to generate Impulse Response Function (IRF) graphs. This enabled us to assess the relationship between our Uncertainty Index and the three variables we used (inflation, unemployment rate, and 10-year government bond yield). First differences were taken whenever necessary, and tests for unit-roots, such as Phillips Perron and Augmented Dickey Fuller, were utilized. The ideal lags for the VAR model have been determined. We began with 12 lags for each country, which translates to 12 months when we use monthly data, and we eventually reached 2 lags. In order to determine the ideal lag, we needed the majority of the tests to display optimal lags, all eigenvalues to fall inside the unit circle so that the VAR could meet the stability requirement, and the second lag to be larger than 0.05 in order to remove autocorrelation. The unit root tests, optimal lag tests, and VAR results are not provided here, but they are available upon request.

We were able to examine how one standard deviation shock affected the nation's level of uncertainty regarding its economic indicators by using Impulse Response Function (IRF) graphs. Twelve periods of forecasting were set for each IRF. Additionally, we investigated the potential impact of Germany's robust economy's level of uncertainty on the economic indicators and uncertainty of other European nations. The following section provides a brief presentation of the findings. Each country is shown and discussed independently, with numerous graphs and tables included.

3.1. Austria

The first graph for each country shows the variation of the uncertainty index together with the variation over time for the endogenous variable which has the highest correlation with the uncertainty index. For all the Eurozone countries the endogenous variable which has the highest correlation with the variable of a country's uncertainty index is inflation. We depict with bold colored line the uncertainty index and without bold the variable of inflation. The first table presents the correlations between all the variables (endogenous and the variable of uncertainty). As we can observe in Table 1.1., the negative correlation between the Uncertainty Index and the unemployment rate does not line up with the theory, as high uncertainty may induce a drop in the number of vacancies and in the job finding rate, ultimately resulting in a rise in unemployment, but it is considered to be a very weak correlation.

Figure 1.1. Austria – Depiction of the Uncertainty Index (UI) and the inflation index from January 2008 till December 2022

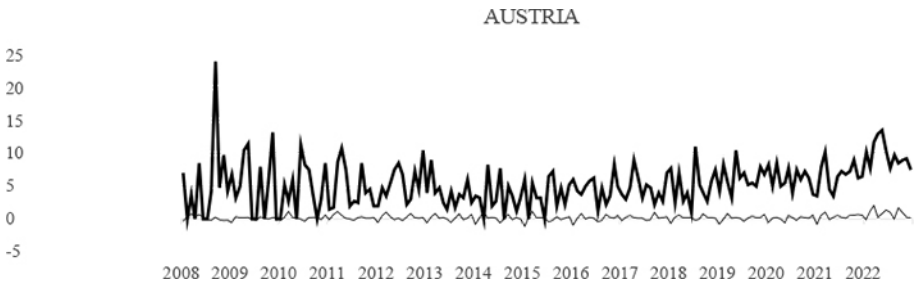


Table 1.1. Austria – Correlation between the Uncertainty Index (UI), unemployment rate, inflation and long- term government bond 10-year yield of the country

	Unemployment rate	LTGBY 10Y	Inflation	UI Austria
Unemployment rate	1			
LTGBY 10Y	-0.434895999	1		
Inflation	-0.16963067	-0.007424974	1	
UI Austria	-0.187562541	-0.061869347	0.137563423	1

We found data only for the Consumer Confidence Index (CCI) for Austria, which is relevant for examining the correlation between our Uncertainty Index and other existing uncertainty indices. The correlation coefficient of -0.2019 in Table 1.2.1 suggests a negative relationship between the two indices, which is in line with theory and is a desirable outcome. It indicates that a consumer's confidence decreases with each increase in uncertainty. The correlation's t-statistic is shown in Table 1.2.2 and was determined to be statistically significant at the 1% confidence level.

Table 1.2.1. Austria – Measures of uncertainty: Correlation between our constructed Uncertainty Index (UI AUT) and the Consumer Confidence Index (CCI AUT)

	UI AUT	CCI
UI AUT	1	
CCI AUT	-0.2019734	1

Table 1.2.2. Austria – *t*-statistic and *p*-value prices from correlations

	t-statistic	*p*-value
CCI/UI	-2.751364727	0.006548769

One of the largest economies in Europe, Germany, is compared in the following graph with Austria's Uncertainty Index, which is based on Google Trends. Throughout the analysis, the line that is not bold indicates each country's uncertainty index; in this case, it represents Austria's uncertainty index. The bold line represents Germany's uncertainty index. With a *p*-value of less than 0.01 and a *t*-statistic absolute value of 4.40, the table indicates a weak correlation of 0.3132, making it statistically significant at the 1% confidence level.

Figure 1.2. Austria – Google Trends based Uncertainty Index of Austria and Germany

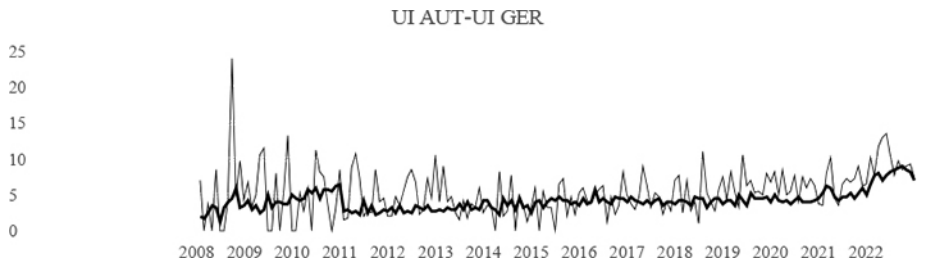


Table 1.3.1. Austria – Correlation between Austria's and Germany's Uncertainty Indices

	UI GER	UI AUT
UI GER	1	
UI AUT	0.31325174	1

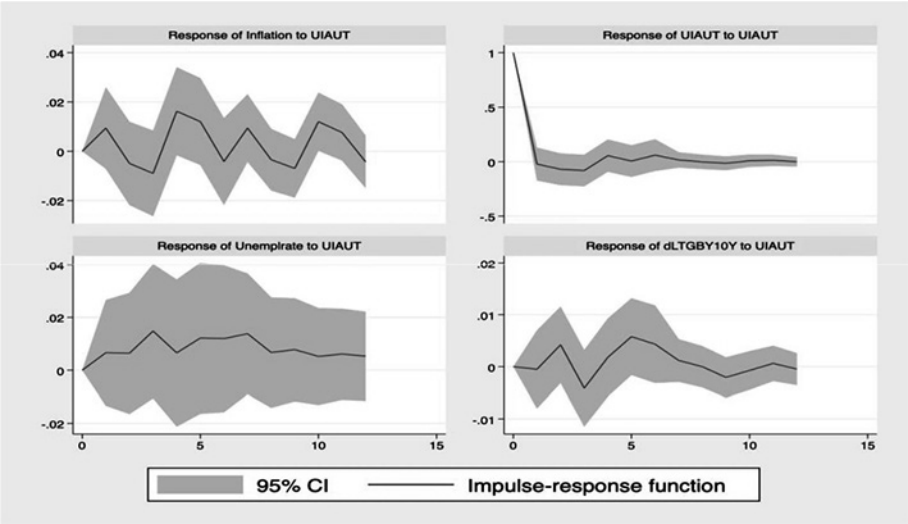
Table 1.3.2. Austria – *t*-statistic and *p*-value prices from correlations

	t-statistic	*p*-value
UI AUT/UI GER	4.400790665	1.85474E-05

We begin with the conduction of the VAR model with reference to the Impulse Response Function (IRF) graphs. We ran the Phillips Perron and the Augmented Dickey-Fuller tests,

with the alternative being that the variable was produced by a stationary process and the null hypothesis being that the variable contained a unit root. We have used solely stationary variables in all of the ensuing analyses. Since the variable LTGBY10Y for Austria was discovered to contain unit-root, the first differences were calculated. Six lags were determined to be the ideal values for the VAR model in order to satisfy every test. On the basis of this, IRF graphs were created. The first IRF graph shows the one-standard deviation impulse of our Austrian Uncertainty Index (UIAUT) to the country's dLTGBY10Y, the unemployment rate, the inflation rate, and the uncertainty index itself. The Austrian economic indices respond to such a shock in a minor and nearly insignificant way, with the inflationary response fluctuating between 0.01% and 0.04% in price level over the course of 12 periods. With respect to the UIAUT on UIAUT, the first shock occurs during the first period, but it soon fades away as the impact returns to 0.90% and then gradually drops to 0.85% after a year. In terms of the unemployment rate, the shock stays positive at the 0.01% level, and in terms of dLTGBY10Y, there is a slight decline during periods three and four, but the price level rises right away the following period.

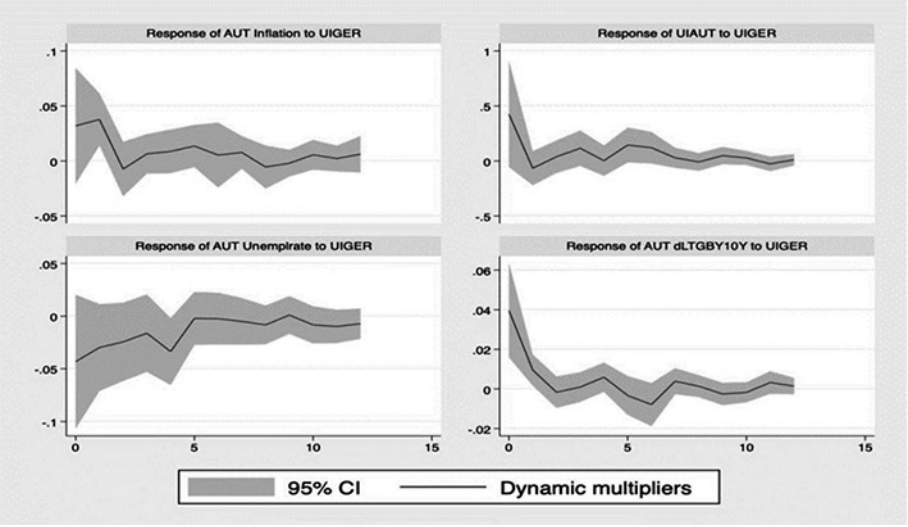
Figure 1.3.1. Austria – Impulse Response Functions to a UIAUT shock. Sample: 2008M1 – 2022M12. VAR (6) estimated with an exogenous variable (UIGER). 95% confidence interval



A dynamic-multiplier function, which gauges the long-term effects of a unit increase in an exogenous variable on the endogenous variables, was employed for the second IRF graph. The Uncertainty Index for Germany is the exogenous variable in this scenario. The UIGER one-standard deviation impulse to the AUT Inflation, UIAUT, AUT Unemplrate, and AUT dLTGBY10Y is shown in the following graph. More of an indication response appears to be produced by the UIGER shock than by the UIAUT shock. The AUT Inflation

spikes up to 0.03% very quickly before reverting to zero by the second period. Starting at 0.4%, the shock on UIAUT gradually decreases to approximately 0.1% and 0.02%. AUT Unemplrate shows a negative impact for all 12 periods, indicating that the shock to Germany's Uncertainty Index decreased Austria's unemployment rate. Finally, the AUT dLTGBY10Y fluctuates around zero after briefly remaining positive.

Figure 1.3.2. Austria – Dynamic-Multiplier Functions of a UIGER shock. Sample: 2008M1 – 2022M12. VAR (6) estimated with an exogenous variable (UIGER). 95% confidence interval



3.2. Belgium

Table 2.1 displays the correlations between the indicators. In this case, the unemployment rate and the Uncertainty Index have a moderately negative correlation (0f -0.50). Additionally, the weak 0.39 correlation between the 10-year government bond yield and the unemployment rate and the -0.22 correlation between inflation and unemployment rate are consistent with economic theory, since rising unemployment tends to drive down inflation and raise high-yield bond spreads.

Figure 2.1. Belgium – Depiction of the Uncertainty Index (UI) and the inflation index from January 2008 till December 2022

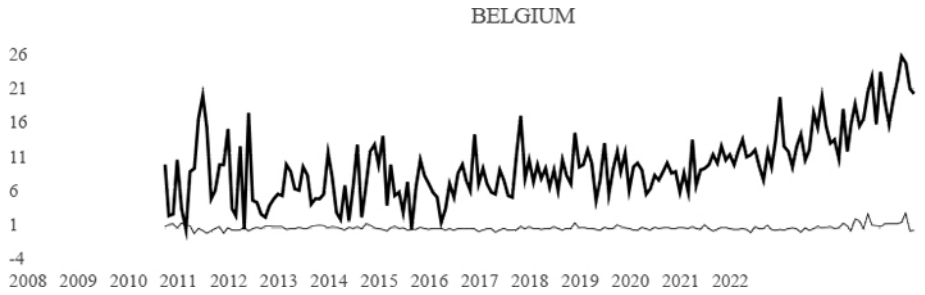


Table 2.1. Belgium – Correlation between the Uncertainty Index (UI), unemployment rate, inflation and long-term government bond 10-year yield of the country

	Unemployment rate	Inflation	LTGBY 10Y	UI Belgium
Unemployment rate	1			
Inflation	-0.228293421	1		
LTGBY 10Y	0.390578592	0.016806041	1	
UI Belgium	-0.506568979	0.28430013	-0.340880245	1

We use Table 2.2.1. to examine the relationship between our Uncertainty Index and other available measures of uncertainty. According to theory, the correlation signals between UI BEL, CCI BEL, and EPU BEL are timely. One can always anticipate a negative correlation between the Consumer Confidence Index and an uncertainty index. The correlations' *t*-statistics and *p*-values are presented in Table 2.2.2, where they are statistically significant at the 1% confidence level.

Table 2.2.1. Belgium – Measures of uncertainty: Correlation between our constructed Uncertainty Index (UI BEL), the Consumer Confidence Index (CCI BEL) and the Economic Policy Uncertainty index (EPU BEL)

	UI BEL	CCI BEL	EPU BEL
UI BEL	1		
CCI BEL	-0.3171053	1	
EPU BEL	0.36288483	-0.4453187	1

Table 2.2.2 Belgium – *t*-statistic and *p*-value prices from correlations

	t-statistic	*p*-value
CCI/UI	-4.460940427	1.44281E-05
EPU/UI	5.195654514	5.54546E-07
CCI/EPU	-6.635556658	3.75682E-10

It is noteworthy that the Uncertainty Index for each nation exhibits distinct patterns with respect to the duration of the COVID-19 pandemic crisis. From 2019 to 2022, the UIBEL nearly doubles, while the UIGER marginally rises. The correlation between UIBEL and UIGER is presented in Table 2.3.1. a *t*-statistic of 10.62, a *p*-value well below 0.01, and a positive and robust correlation of 0.622 between the nations.

Figure 2.2. Belgium – Google Trends based Uncertainty Index of Belgium and Germany

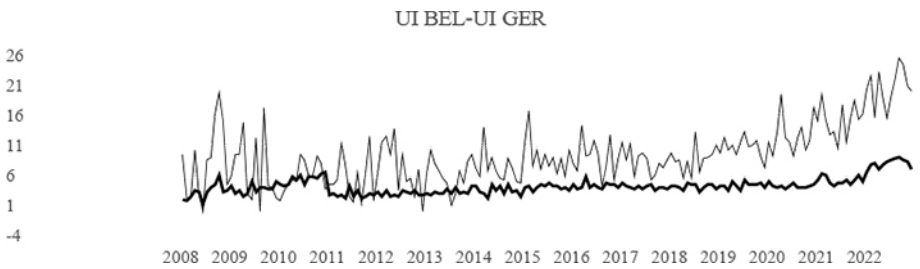


Table 2.3.1. Belgium – Correlation between Belgium's and Germany's Uncertainty Indices

	UI GER	UI BEL
UI GER	1	
UI BEL	0.62294019	1

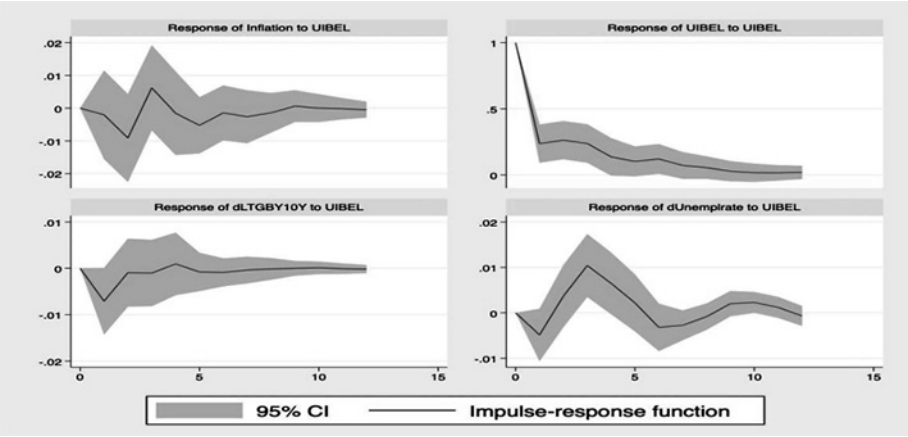
Table 2.3.2. Belgium – *t*-statistic and *p*-value prices from correlations

	t-statistic	*p*-value
UI BEL/UI GER	10.62429146	9.89426E-21

Four lags were required for the VAR model. The first IRF graph shows the one-standard deviation impact of our Uncertainty Index of Belgium (UIBEL) on the nation's

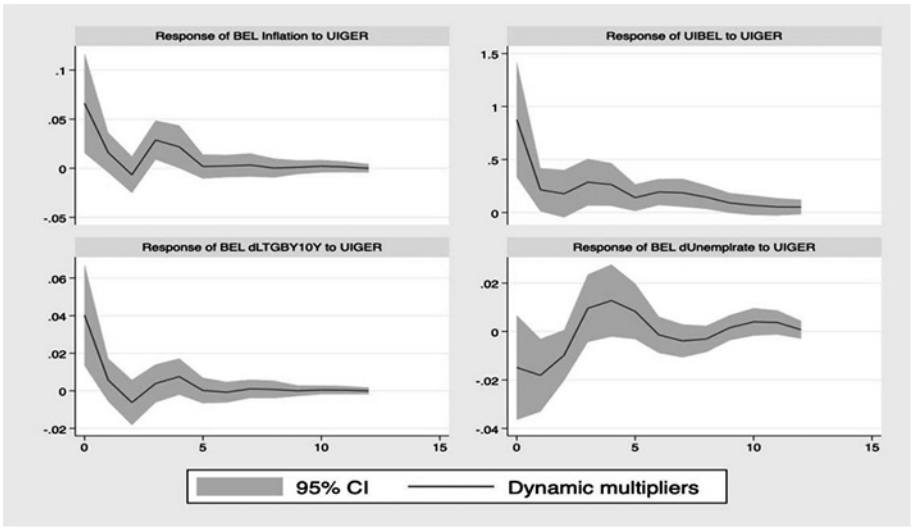
dLTGBY10Y, dUnemplrate, inflation, and uncertainty index itself. Despite three brief periods of slight improvement, it appears that the inflation's price levels stayed mostly negative. In reference to the UIBEL, it peaked at 0.26% during the second period and then varied between 10% and zero until the sixth period, when it eventually died out and converged to zero. The only variable that continued to be negative over the course of the 12 periods was the dLTGBY10Y. Currently, dUnemplrate was negative only during the first period before rising to a peak price of 0.01%.

Figure 2.3.1. Belgium – Impulse Response Functions to a UIBEL shock. Sample: 2008M1 – 2022M12. VAR (4) estimated with an exogenous variable (UIGER). 95% confidence interval



A dynamic-multiplier function was utilized to assess the long-term effects of a unit increase in an exogenous variable on the endogenous variables in the second IRF graph. Germany's Uncertainty Index is the exogenous variable, and the BEL Inflation, UIBEL, BEL dUnemplrate, and BELdLTGBY10Y are the endogenous variables. Once more, it seems that the UIGER has a bigger impact on Belgian economic metrics than the UIBEL. The graphs for BEL dUnemplrate, UIBEL, and BEL Inflation appear to be similar. Only UIBEL manages to stay positive over the course of all 12 periods, with all three starting out positively in the first period and the first few months. Around the third period, BEL Inflation and BEL dUnemplrate both turn negative and briefly turn positive before approaching zero. When comparing BEL dLTGBY10Y to UIBEL, which peaked at 0.007%, it is evident that UIGER has a larger influence because its range spans almost -0.02% to 0.01%.

Figure 2.3.2. Belgium – Dynamic-Multiplier Functions of a UIGER shock. Sample: 2008M1 – 2022M12. VAR (4) estimated with an exogenous variable (UIGER). 95% confidence interval



3.3. Finland

The inflation rate, unemployment rate, 10-year government bond yield, and our calculated Uncertainty Index for Finland are all shown in the graph below. The 2008 financial crisis is when the Uncertainty Index reaches its highest value. The COVID-19 crisis aftermath of 2021–2022 also represents a period of increased uncertainty. For a considerable amount of time, the unemployment rate seems to be constant, reaching its 2008 level in little more than a decade. Table 3.1 reports all correlations as weak and negative apart from inflation.

Figure 3.1. Finland – Depiction of the Uncertainty Index (UI) and the inflation index from January 2008 till December 2022

Table 3.1. Finland – Correlation between the Uncertainty Index (UI), unemployment rate, inflation and long-term government bond 10-year yield

	Unemployment rate	LTGBY 10Y	Inflation	UI Finland
Unemployment rate	1			
LTGBY 10Y	-0.133259754	1		
Inflation	-0.260016808	0.09665814	1	
UI Finland	-0.233854465	-0.215197104	0.19575778	1

Once more, the Consumer Confidence Index for Finland was discovered, but the Economic Policy Uncertainty Index had no data. In this scenario, the desirable result is a negative correlation. At the 5% confidence level, the correlation of -0.190 is statistically significant.

Table 3.2.1. Finland – Measures of uncertainty: Correlation between our constructed Uncertainty Index (UI FIN) and the Consumer Confidence Index (CCI FIN)

	UI FIN	CCI FIN
UI FIN	1	
CCI FIN	-0.1905386	1

Table 3.2.2. Finland – *t*-statistic and *p*-value prices from correlations

	t-statistic	*p*-value
CCI/UI	-2.589542738	0.010405644

The comparison of the two Uncertainty Indices between the two nations is shown in Figure 3.2. The p-value of the t-statistic is equal to 1, indicating that the correlation value is statistically insignificant, despite the assumption that the correlation between UIFIN and UIGER is strong at 0.475.

Figure 3.2. Finland – Google Trends based Uncertainty Index of Finland and Germany

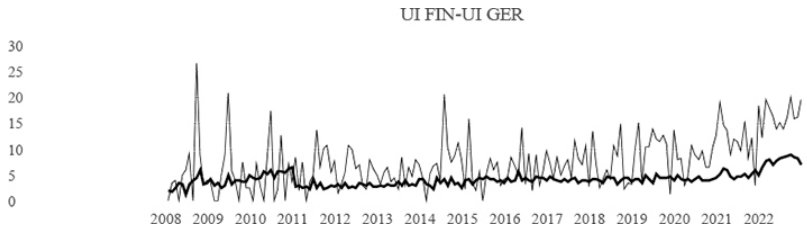


Table 3.3.1. Finland – Correlation between Finland's and Germany's Uncertainty Indices

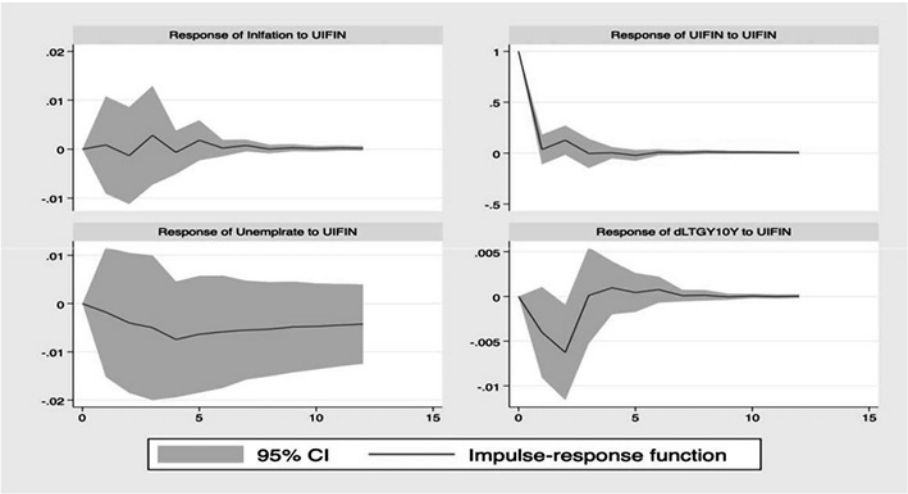
	UI GER	UI FIN
UI GER	1	
UI FIN	0.47522197	1

Table 3.3.2. Finland – *t*-statistic and *p*-value prices from correlations

	t-statistic	*p*-value
UI FIN/UI GER	7.205929379	1

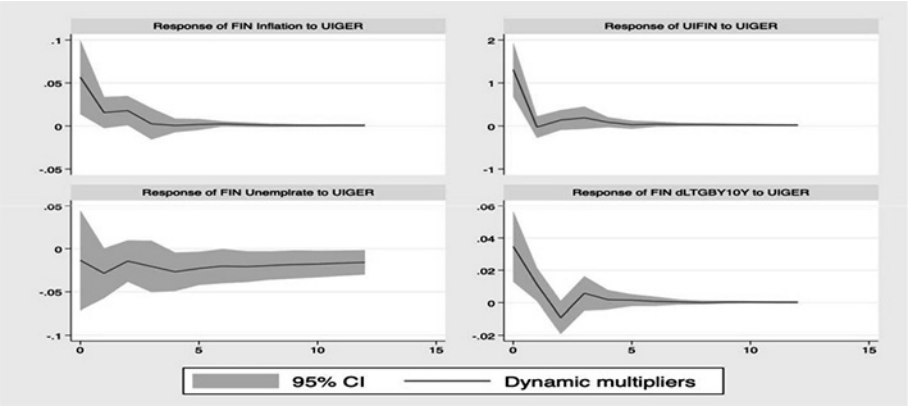
We created a new variable called dLTGBY10Y using the variable's initial differences. The four variables' reactions to a shock with a UIFIN one standard deviation are depicted in the following IRF graphs. Notably, dLTGBY10Y and Unemplrate both responded negatively. On the other hand, the latter reacts with a much smaller magnitude and, by the fourth period, returns and hovers around zero. Unlike Unemplrate, which shows a negative value throughout the course of the twelve periods. However, following the fifth period, the UIFIN response to UIFIN rapidly fades away.

Figure 3.3.1. Finland– Impulse Response Functions to a UIFIN shock. Sample: 2008M1 – 2022M12. VAR (2) estimated with an exogenous variable (UIGER). 95% confidence interval



The dynamic-multiplier function used to calculate the effects of a unit increase in an exogenous variable on the endogenous variables over time is the subject of the following set of IRF graphs. The exogenous variable is the German Uncertainty Index. It is evident that the Unemplrate in this instance stayed below zero for the entire duration. In contrast, dLTGBY10Y only twice recorded a negative value. Conversely, FIN Inflation showed positive numbers, reaching a maximum of 0.017% during the second period. Last but not least, UIFIN's response to UIGEIR increased to 0.19% after two periods, having dropped below zero in the first.

Figure 3.3.2. Finland – Dynamic-Multiplier Functions of a UIGER shock. Sample: 2008M1 – 2022M12. VAR (2) estimated with an exogenous variable (UIGER). 95% confidence interval



3.4. France

The economic indicators and our Uncertainty Index for France are shown in the following figure. It's also critical to note that uncertainty in the nation appears to have been heightened by the COVID-19 epidemic crisis. The unemployment rate and UIFRA have a strong correlation (-0.463), but the correlation between LTGBY10Y and the unemployment rate is very weak (-0.006).

Figure 4.1. France – Depiction of the Uncertainty Index (UI) and inflation index from January 2008 till December 2022

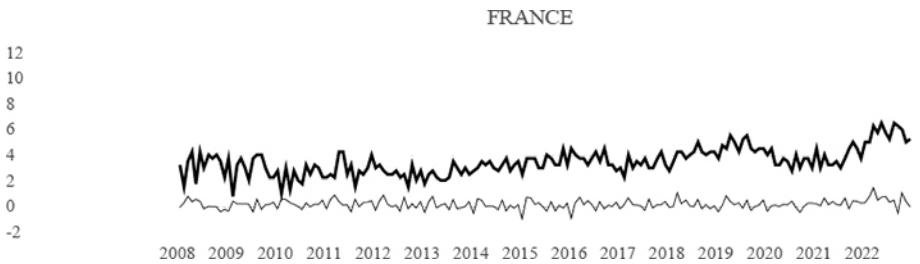


Table 4.1. France – Correlation between the Uncertainty Index (UI), unemployment rate, inflation and long-term government bond 10-year yield

	Unemployment rate	LTGBY 10Y	Inflation	UI France
Unemployment rate	1			
LTGBY 10Y	-0.006390864	1		
Inflation	-0.186177492	0.013406709	1	
UI France	-0.463433287	-0.379678472	0.169435258	1

According to data from Baker et al. (2016), France is one of the Eurozone countries included in the Economic Policy Uncertainty index (EPU). France's CCI data was also available. The positive correlation between CCI FRA and UI FRA is not desirable, whereas the correlation between EPU FRA and UI FRA, at 0.222, is. However, Table 4.2.1 suggests that the correlation between the *t*-statistic and *p*-value is statistically significant for EPU FRA/UI FRA and statistically insignificant for CCI FRA/UI FRA.

Table 4.2.1. Finland – Measures of uncertainty: Correlation between our constructed Uncertainty Index (UI FIN), Economic Policy Uncertainty index (EPU) and the Consumer Confidence Index (CCI FIN)

	UI FRA	CCI FRA	EPU FRA
UI FRA	1		
CCI FRA	0.10285576	1	
EPU FRA	0.22254198	0.05580796	1

Table 4.2.2. France – *t*-statistic and *p*-value prices from correlations

	t-statistic	*p*-value
CCI/UI	1.379583955	0.169445408
EPU/UI	3.045450743	0.002676319
CCI/EPU	0.74573333	0.456812169

The Germany and France Uncertainty Indices are shown in the following figure. With the two exceptions in 2010–2011 and 2022—two of the largest economies in Europe—the two indices have followed the same trajectory for the entire fifteen years. At the 1% confidence level, the correlation of 0.538 is statistically significant.

Figure 4.2. France – Google Trends based Uncertainty Index of France and Germany

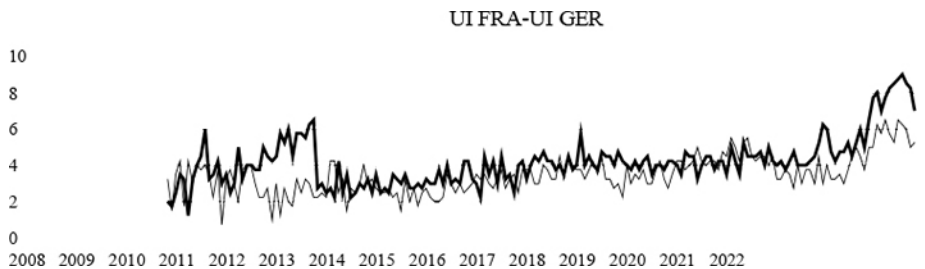


Table 4.3.1. France – Correlation between France's and Germany's Uncertainty Indices

	UI GER	UI FRA
UI GER	1	
UI FRA	0.53805842	1

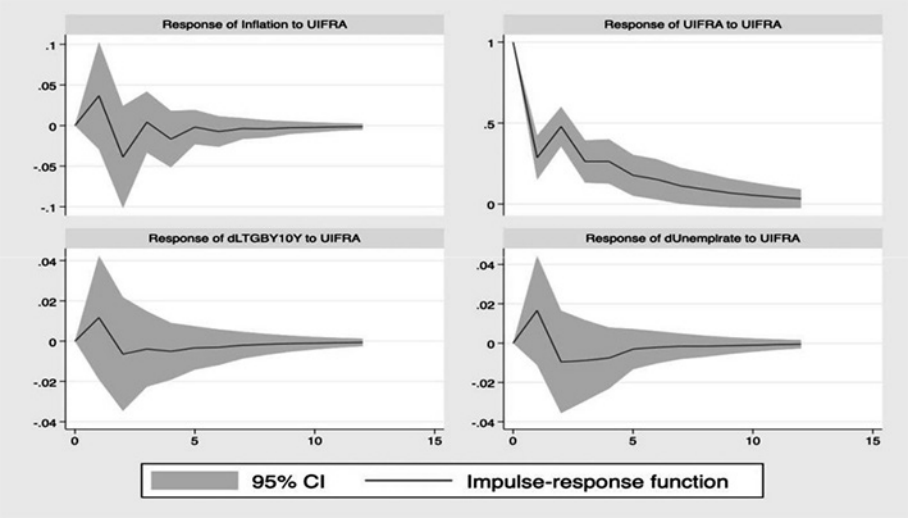
Table 4.3.2. France – *t*-statistic and p-value prices from correlations

	t-statistic	*p*-value
UI FRA/UI GER	8.516467387	6.73576E-15

The first set of IRF graphs shows how the variables LTGBY10Y, UIFRA, unemployment rate, and inflation react to a shock of one standard deviation. It has been noted that dLTGBY10Y and dUnemplrate have a tendency to move in tandem with a UIFRA shock.

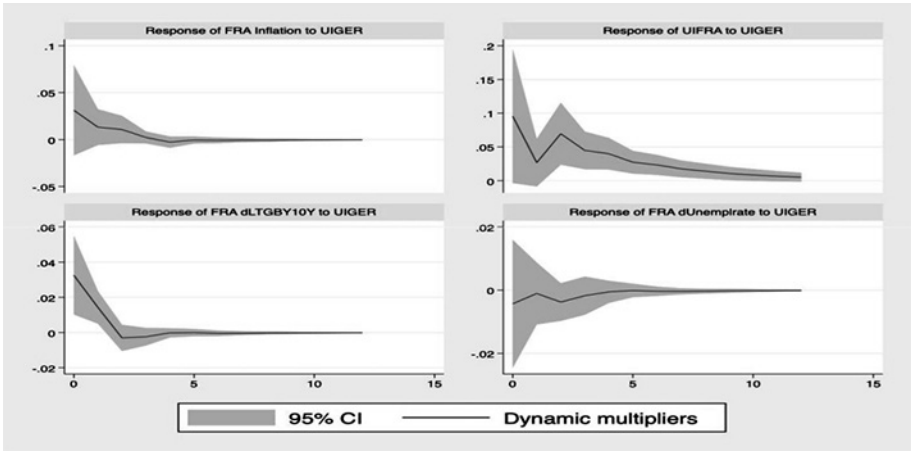
The first few periods see a slight increase in inflation, which quickly turns negative after the second period and stays below zero for the remaining periods. Unlike the other European countries examined thus far, which show a significant decline shortly after the first or second period, UIFRA appears to insist on remaining relatively high for the first five periods following a UIFRA shock.

Figure 4.3.1. France– Impulse Response Functions to a UIFRA shock. Sample: 2008M1 – 2022M12. VAR (2) estimated with an exogenous variable (UIGER). 95% confidence interval



The dynamic-multiplier function used to calculate the effects of a unit increase in an exogenous variable on the endogenous variables over time is displayed in the second IRF graphs. The exogenous variable is the German Uncertainty Index. For every relevant period, FRA dUnemplrate was able to move below zero. The dLTGBY10Y did the same, recording only positive values for the first two periods. It is noteworthy that UIGER's impact is now lower than that of another uncertainty index, in our case UIFRA, for the first time. UIFRA's response to UIGER is nearly ten times smaller than UIFRA's response to it.

Figure 4.3.2. France – Dynamic-Multiplier Functions of a UIGER shock. Sample: 2008M1 – 2022M12. VAR (2) estimated with an exogenous variable (UIGER). 95% confidence interval



3.5. Germany

The following figure shows the Uncertainty Index and Germany's economic indicators. Beginning in 2008, the unemployment rate reached its highest point of 8%. Despite the COVID-19 pandemic and the Russian invasion of Ukraine, the rate continued to decline, ending in 2022 at slightly over 3%. Given that there were a few precariousness periods in the time horizon under examination and that some people would have predicted the exact opposite result, this is an intriguing fact. The variables' correlations support the economic theory. The unemployment rate and the 10-year government bond yield show a very strong correlation of 0.894, while the unemployment rate and inflation show a negative correlation of -0.121. As was mentioned at the outset of the study, rising unemployment rates typically result in lower inflation and higher spreads on high-yield bonds.

Figure 5.1. Germany – Depiction of the Uncertainty Index (UI) and the inflation index from January 2008 till December 2022

Table 5.1. Germany – Correlation between the Uncertainty Index (UI), unemployment rate, inflation and long-term government bond 10-year yield

	Unemployment rate	LTGBY 10Y	Inflation	UI Germany
Unemployment rate	1			
LTGBY 10Y	0.894308655	1		
Inflation	-0.121393722	-0.04426441	1	
UI Germany	-0.383694292	-0.217736884	0.25633993	1

Both of Germany's current uncertainty indices were accessible online. As anticipated, the correlations are strong and positive for EPU GER/UIGER and negative and moderate for CCI GER/UI GER. Table 5.2.2 displays that all correlation values are statistically significant, with p-values significantly below 0.01.

Table 5.2.1. Germany – Measures of uncertainty: Correlation between our constructed Uncertainty Index (UI GER), the Consumer Confidence Index (CCI GER) and the Economic Policy Uncertainty index (EPU GER)

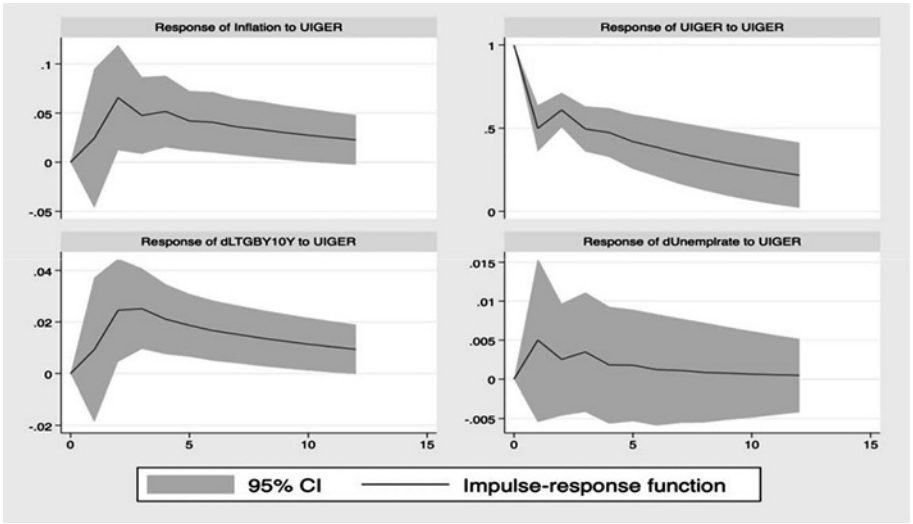
	UI GER	CCI GER	EPU GER
UI GER	1		
CCI GER	-0.3808019	1	
EPU GER	0.68906979	-0.5001428	1

Table 5.2.2. Germany – *t*-statistic and *p*-value prices from correlations

	t-statistic	*p*-value
CCI/UI	-5.4945047	1.33883E-07
EPU/UI	12.68580277	1.10373E-26
CCI/EPU	-7.705747471	8.77322E-13

As Germany is the exogenous variable used in the Dynamic-Multiplier Functions, as previously mentioned, we only have one set of IRF graphs for the country's impulse on the Uncertainty Index to the economic indicators and the Uncertainty Index itself. UIGER's reaction to a one-standard deviation of UIGER is crucial since it requires to remain significantly above 0.20% throughout the analysis period. The UIGER shock has had a positive impact on all economic indicators, with the exception of dUnemplrate, whose response has been less significant.

Figure 6.3.1. Germany– Impulse Response Functions to a UIGER shock. Sample: 2008M1 – 2022M12. VAR (2) estimated with an exogenous variable (UIGER). 95% confidence interval



3.6. Greece

Regarding Greece's economic indicators, it is of concern the levels of unemployment rate the country reached by 2013. It took nearly ten years for the reported 26% unemployment rate to drop. It's also critical to recognize that, in contrast to the COVID-19 pandemic crisis, the 2008 financial crisis had a profound impact on the nation's level of uncertainty. This statistic may indicate that public trust in the government has returned following years of mistrust. When the right signals are present, the correlations between inflation and the 10-year government bond yield appear to follow theory.

Figure 6.1. Greece – Depiction of the Uncertainty Index (UI) and the inflation index from January 2008 till December 2022

Table 6.1. Greece – Correlation between the Uncertainty Index (UI), unemployment rate, inflation and long-term government bond 10-year yield

	Unemployment rate	LTGBY 10Y	Inflation	UI Greece
Unemployment rate	1			
LTGBY 10Y	0.420297043	1		
Inflation	-0.1250371	-0.052882408	1	
UI Greece	-0.326040337	-0.17805485	-0.005446191	1

Below is a correlation between our Uncertainty Index and the current uncertainty indices. Greece possessed data pertaining to the EPU and CCI indices. The correlations' t-statistics and p-values are shown in Table 12.2.2. Statistically speaking, the CCI/UI is more significant than the EPU/UI. Even though the correlation is only 0.152, it is still valid. Even though a positive correlation defies economic theory, it may mean that people will save more and consume less because, in certain economies, the insurance industry offers no security, which encourages people to keep consuming.

Table 6.2.1. Greece – Measures of uncertainty: Correlation between our constructed Uncertainty Index (UI GRE), the Consumer Confidence Index (CCI GRE) and the Economic Policy Uncertainty index (EPU GRE)

	UI GRC	CCI GRC	EPU GRC
UI GRC	1		
CCI GRC	0.15205435	1	
EPU GRC	-0.0903901	-0.2117684	1

Table 6.2.2. Greece – t-statistic and p-value prices from correlations

	t-statistic	p-value
CCI/UI	2.052524498	0.041582465
EPU/UI	-1.210911222	0.227534737
CCI/EPU	-2.89090931	0.004319737

Greece's Uncertainty Index seems to be moving in a similar direction as Germany's Uncertainty Index. Greece's UI paradoxically fluctuates very close to Germany's UI for the remaining years of the analysis, despite the first three years of analysis. At the 1% confidence level, the 0.258 correlation is statistically significant but is regarded as weak.

Figure 6.2. Greece – Google Trends based Uncertainty Index of Greece and Germany

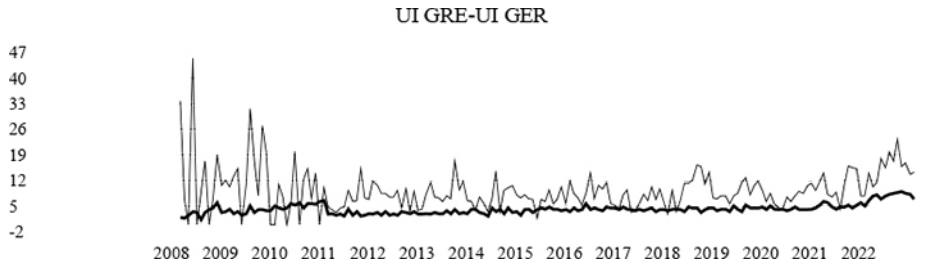


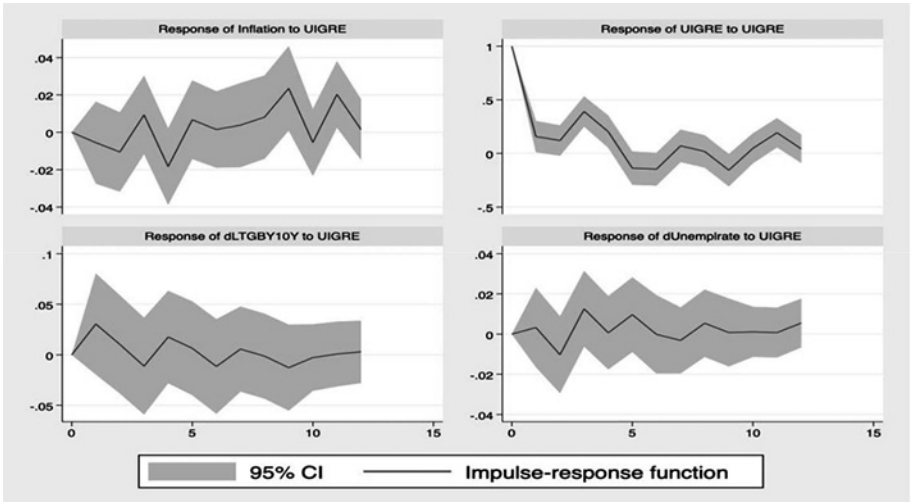
Table 6.3.1. Greece – Correlation between Greece's and Germany's Uncertainty Indices

	UI GER	UI GRC
UI GER	1	
UI GRC	0.25806665	1

Table 6.2.2. Greece– *t*-statistic and *p*-value prices from correlations

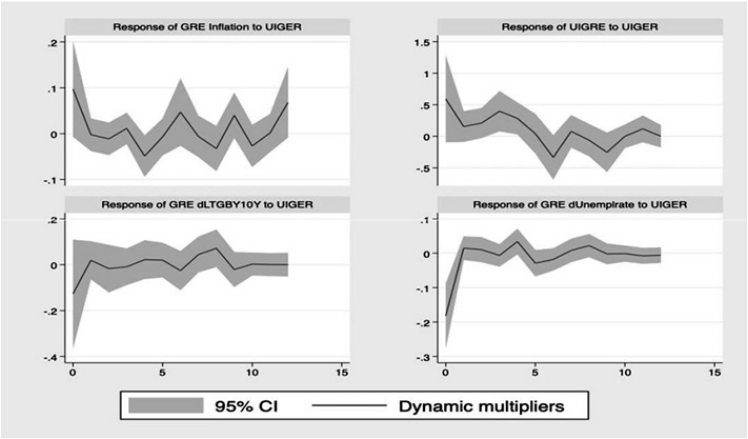
	t-statistic	*p*-value
UI GRC/UI GER	3.56375314	0.000469391

Figure 6.3.1. Greece– Impulse Response Functions to a UIGRE shock. Sample: 2008M1 – 2022M12. VAR (9) estimated with an exogenous variable (UIGER). 95% confidence interval



The dynamic-multiplier function used to calculate the effects of a unit increase in an exogenous variable on the endogenous variables over time is depicted in the following IRF graphs. The exogenous variable is the German Uncertainty Index. For nearly the entire twelve periods, the variables appear to oscillate around zero. Once more, Greece is the first nation whose UI gradually drops below zero following a one unit increase in UIGER.

Figure 6.3.2. Greece – Dynamic-Multiplier Functions of a UIGER shock. Sample: 2008M1 – 2022M12. VAR (2) estimated with an exogenous variable (UIGER). 95% confidence interval



3.7. Ireland

The created Uncertainty Index and economic indicators are shown for Ireland in the following figure. Ireland's unemployment rate peaked in 2010 at about 15%, and it didn't start to decline until after 2013, when it eventually returned to levels it was in 2008 by 2018. The correlations' signs seem to support the economic theory.

Figure 7.1. Ireland – Depiction of the Uncertainty Index (UI) and other economic indices from January 2008 till December 2022

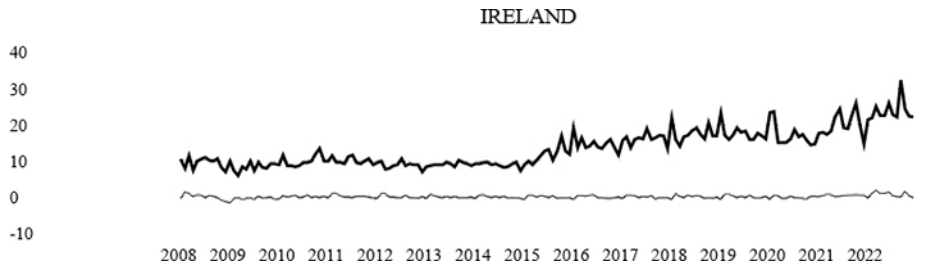


Table 7.1. Ireland – Correlation between the Uncertainty Index (UI), unemployment rate, inflation and long-term government bond 10-year yield

	Unemployment rate	LTGBY 10Y	Inflation	UI Ireland
Unemployment rate	1			
LTGBY 10Y	0.786847454	1		
Inflation	-0.149745054	-0.04827397	1	
UI Ireland	-0.763712695	-0.598559992	0.235645325	1

According to Baker et al. (2016), data on Economic Policy Uncertainty (EPU) are available for a number of Eurozone nations, including Ireland. At 0.397, the correlation between UI IRL and CCI IRL is statistically significant and positive. Once more, it is positive and statistically significant between EPU IRL and UI IRL, at 0.508. As was already mentioned, the ideal sign for CCI/UI is negative; however, certain nations exhibit a positive sign, possibly as a result of people's preference for consumption over saving money and the lack of significant security in the insurance industry.

Table 7.2.1. Ireland – Measures of uncertainty: Correlation between our constructed Uncertainty Index (UI IRL), the Consumer Confidence Index (CCI IRL) and the Economic Policy Uncertainty index (EPU IRL)

	UI IRL	CCI IRL	EPU IRL
UI IRL	1		
CCI IRL	0.39730098	1	
EPU IRL	0.5089474	-0.035703	1

Table 7.2.2. Ireland – *t*-statistic and *p*-value prices from correlations

	t-statistic	*p*-value
CCI/UI	5.776096057	3.3474E-08
EPU/UI	7.888271462	2.98666E-13
CCI/EPU	-0.476641189	0.634202247

Germany's and Ireland's Uncertainty Indices are displayed on the graph. Throughout the entire analysis period, the UIIRL was higher than the UIGER. UIIRL nearly doubled in value just after 2015, and by the end of 2022, it had tripled its 2008 level price. Germany's Uncertainty Index doubled only briefly between 2010 and 2022, in contrast to Ireland. The following table's *p*-value indicates that the correlation is statistically significant at 0.651.

Figure 7.2. Ireland – Google Trends based Uncertainty Index of Ireland and Germany

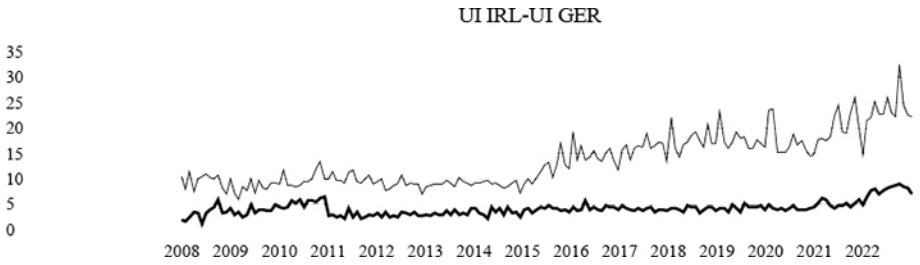


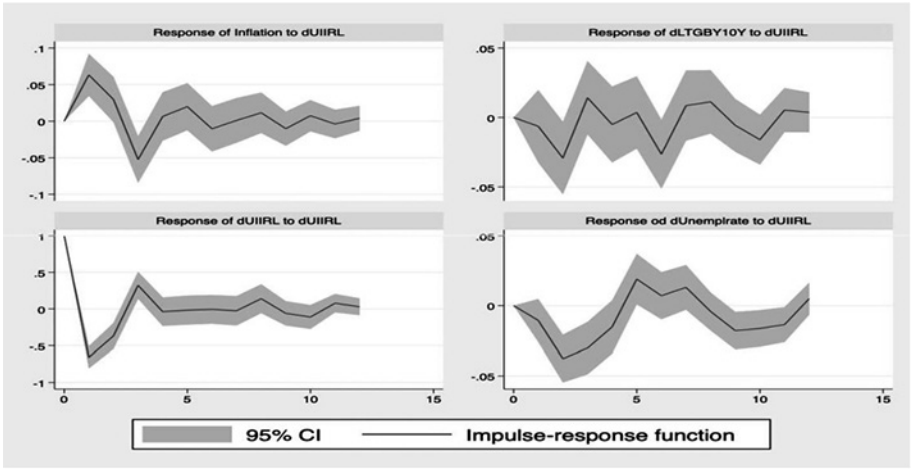
Table 7.3.1. Ireland – Correlation between Ireland's and Germany's Uncertainty Indices

	UI GER	UI IRL
UI GER	1	
UI IRL	0.65194655	1

Table 7.3.2. Ireland – t-statistic and p-value prices from correlations

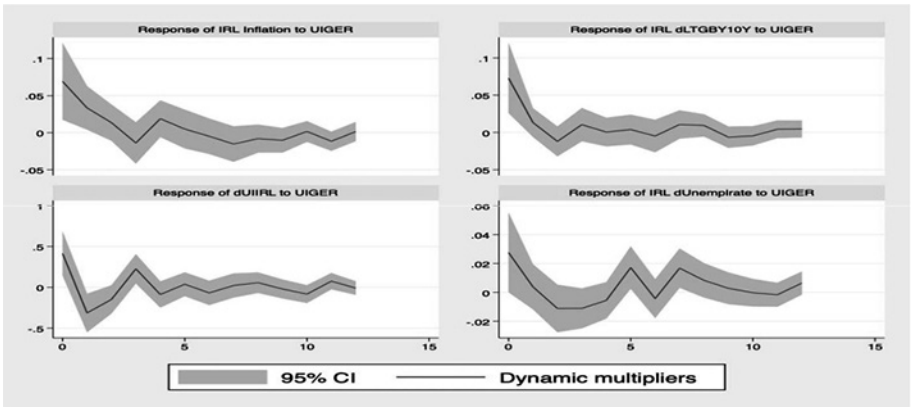
	t-statistic	p-value
UI IRL/UI GER	11.47099328	3.68837E-23

Figure 7.3.1. Ireland– Impulse Response Functions to a UIIRL shock. Sample: 2008M1 – 2022M12. VAR (7) estimated with an exogenous variable (UIGER). 95% confidence interval



About the second IRF graphs, they show how a unit increase in an exogenous variable affects the endogenous variables over time using a dynamic-multiplier function. The exogenous variable is the German Uncertainty Index. All variables produced values that were equally positive and negative, with the exception of dLTGBY10Y, for which the first, third, and seventh periods had higher levels of positive values.

Figure 7.3.2. Ireland – Dynamic-Multiplier Functions of a UIGER shock. Sample: 2008M1 – 2022M12. VAR (7) estimated with an exogenous variable (UIGER). 95% confidence interval



3.8. Italy

Italy is one of the few countries that recorded an Uncertainty Index level less than that of their unemployment rate. Italy's unemployment rate peaked in 2014 at 13% and briefly recovered to 2008 levels in 2020 and 2022. Unlike other Eurozone nations, the Uncertainty Index did not show sharp increases; instead, it varied between the 0 and 9 price levels. The Table displays the relationships between the Uncertainty Index and the economic indicators.

Figure 8.1. Italy – Depiction of the Uncertainty Index (UI) and the inflation index from January 2008 till December 2022

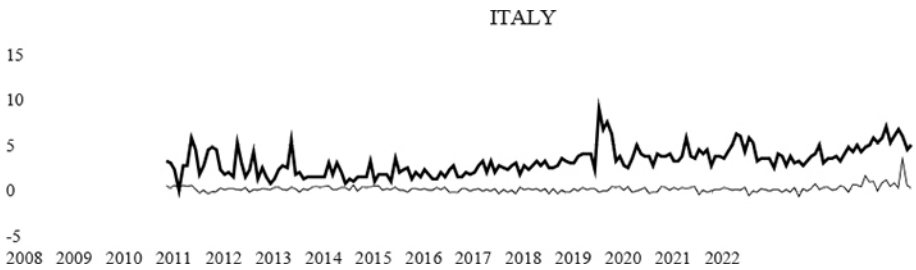


Table 8.1. Italy – Correlation between the Uncertainty Index (UI), unemployment rate, inflation and long- term government bond 10-year yield

	Unemployment rate	LTGBY 10Y	Inflation	UI Italy
Unemployment rate	1			
LTGBY 10Y	-0.302728159	1		
Inflation	-0.279655512	0.11117023	1	
UI Italy	-0.10675958	-0.440526252	0.155465839	1

For Italy there is data for the EPU and CCI uncertainty indices. There is a statistically significant correlation between CCI ITA and UI ITA, but there is a statistically insignificant correlation between EPU ITA and UI ITA, according to the results in Table 8.

Table 8.2.1. Italy – Measures of uncertainty: Correlation between our constructed Uncertainty Index (UI ITA), the Consumer Confidence Index (CCI ITA) and the Economic Policy Uncertainty index (EPU ITA)

	UI ITA	CCI ITA	EPU ITA
UI ITA	1		
CCI ITA	0.30312711	1	
EPU ITA	-0.0917678	-0.3688628	1

Table 8.2.2. Italy – t-statistic and p-value prices from correlations

	t-statistic	p-value
CCI/UI	4.243894768	3.52972E-05
EPU/UI	-1.229522926	0.220498535
CCI/EPU	-5.294598958	3.48443E-07

Again, Italy is among the few countries whose uncertainty index was able to nearly exactly match that of Germany. One possible explanation for the slight increase in UI ITA in 2017 could be the nation's series of earthquakes that year. At the 1% confidence level, the variables' 0.517 correlation is thought to be strong and statistically significant.

Figure 8.2. Italy – Google Trends based Uncertainty Index of Italy and Germany

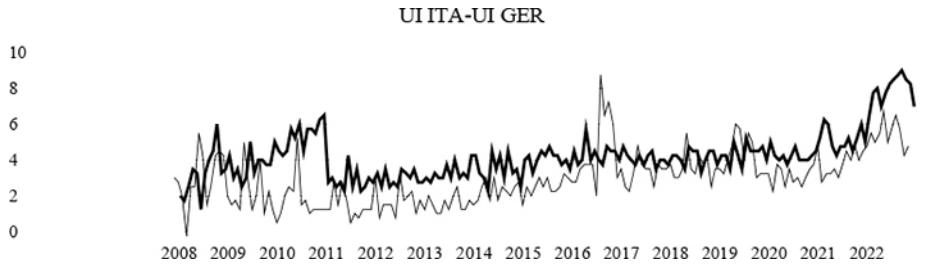


Table 8.3.1. Italy – Correlation between Italy's and Germany's Uncertainty Indices

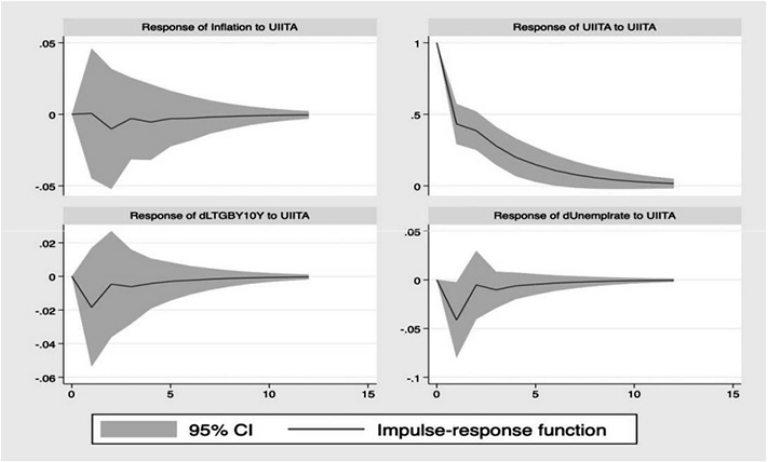
	UI GER	UI ITA
UI GER	1	
UI ITA	0.51783404	1

Table 8.3.2. Italy – *t*-statistic and *p*-value prices from correlations

	t-statistic	*p*-value
UI ITA/UI GER	8.075886092	9.75054E-14

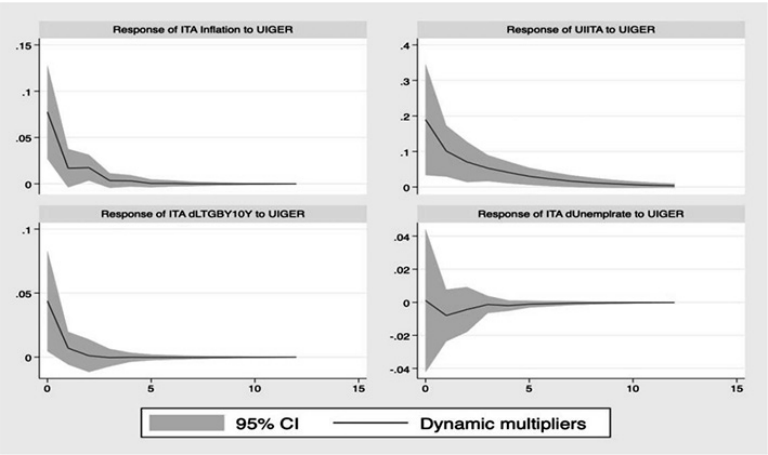
The variables' responses to a single UIITA standard deviation are displayed in the IRF graphs. It is evident that over the course of the year, negative values dominate for dLTG-BY10Y, dUnemplrate, and inflation. As opposed to UIITA, which appeared to maintain its high price during the first five months.

Figure 8.3.1. Italy– Impulse Response Functions to a UIITA shock. Sample: 2008M1 – 2022M12. VAR (7) estimated with an exogenous variable (UIGER). 95% confidence interval



The second set of IRF graphs shows how a dynamic multiplier function affects the endogenous variables over time in response to a unit increase in an exogenous variable. The exogenous variable is the German Uncertainty Index. With the exception of ITA dUnemplrate, all variables start out positively and appear to respond to UIGER shocks by creating a smooth downward slope that eventually converges to zero by the fifth period. Throughout the periods under examination, UIITA was able to stay below zero, with the fourth period seeing the lowest value at -0.002%.

Figure 8.3.2. Italy – Dynamic-Multiplier Functions of a UIGER shock. Sample: 2008M1 – 2022M12. VAR (7) estimated with an exogenous variable (UIGER). 95% confidence interval



3. 9. Netherlands

The Uncertainty Index and the economic indicators for the Netherlands are shown in Figure 9.1. The unemployment rate in the Netherlands peaked in 2014 at 9%. With the exception of the Uncertainty Index sign, the correlation signals appear to be consistent with theory. 2014 saw a modest increase in the Uncertainty Index, tripling its value from the previous year. After that, the index never went back to its 2013 levels; instead, it grew over time, reaching its all-time high of 2008 by the end of 2022.

Figure 9.1. Netherlands – Depiction of the Uncertainty Index (UI) and the inflation index from January 2008 till December 2020

Table 9.1. Netherlands – Correlation between the Uncertainty Index (UI), unemployment rate, inflation and long-term government bond 10-year yield

	Unemployment rate	LTGBY 10Y	Inflation	UI Netherlands
Unemployment rate	1			
LTGBY 10Y	0.099627988	1		
Inflation	-0.181130983	-0.037533865	1	
UI Netherlands	-0.499545797	-0.442901685	0.204133209	1

For Netherlands there is data both for the CCI and EPU indices. Nevertheless, the data was only accessible through December 2020. As a result, the 2008–2020 timeframe is covered in the correlation analysis between the indices that follows. Since one would anticipate the opposite signs for each variable, the correlations' results were not desirable. As shown in Table 9.2.2, they were discovered to be statistically significant nonetheless.

Table 9.2.1. Netherlands – Measures of uncertainty: Correlation between our constructed Uncertainty Index (UI NLD), the Consumer Confidence Index (CCI NLD) and the Economic Policy Uncertainty index (EPU NLD)

	UI NLD	CCI NLD	EPU NLD
UI NLD	1		
CCI NLD	0.29780402	1	
EPU NLD	-0.180406	-0.6367986	1

Table 9.2.2. Netherlands – *t*-statistic and *p*-value prices from correlations

	t-statistic	*p*-value
CCI/UI	4.162045502	4.90444E-05
EPU/UI	-2.447067666	0.015373568
CCI/EPU	-11.01896298	7.36809E-22

As previously mentioned, the global financial crisis causes the Netherlands' Uncertainty Index to spike in 2008, fall back in 2010, rise slightly in 2014, and stay there for the remaining six years, until December 2020. The Uncertainty Indices of the two nations have a statistically significant correlation of 0.338.

Figure 9.2. Netherlands – Google Trends based Uncertainty Index of Netherlands and Germany

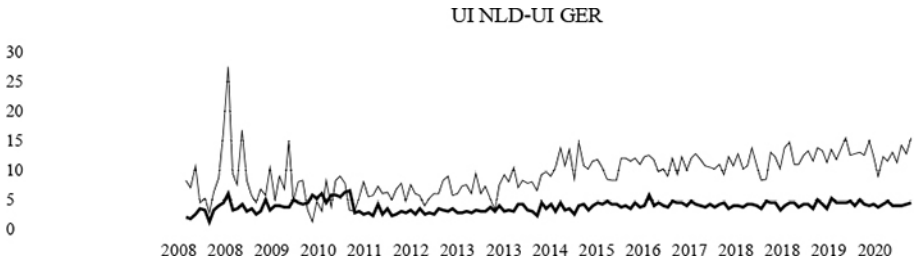


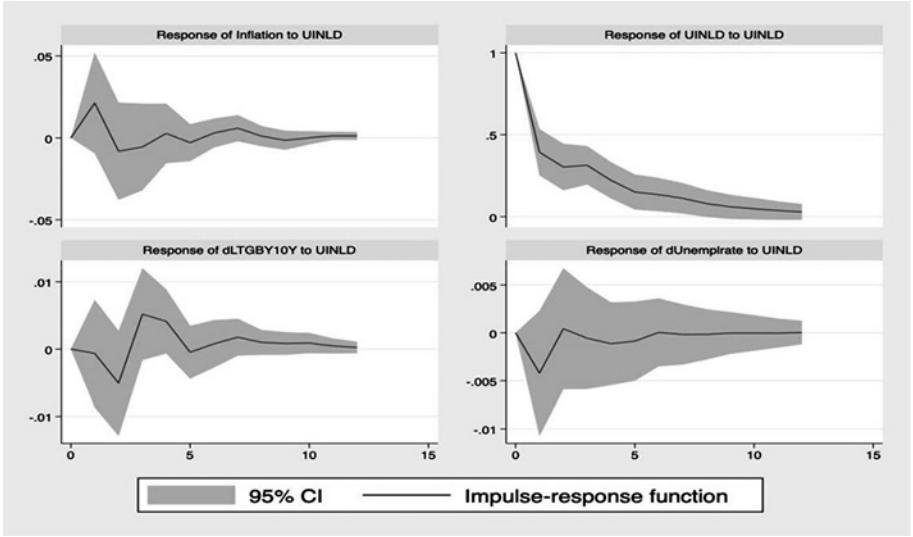
Table 9.3.1. Netherlands – Correlation between Netherlands's and Germany's Uncertainty Indices

	UI GER	UI NLD
UI GER	1	
UI NLD	0.33847303	1

Table 9.3.2. Netherlands – *t*-statistic and *p*-value prices from correlations

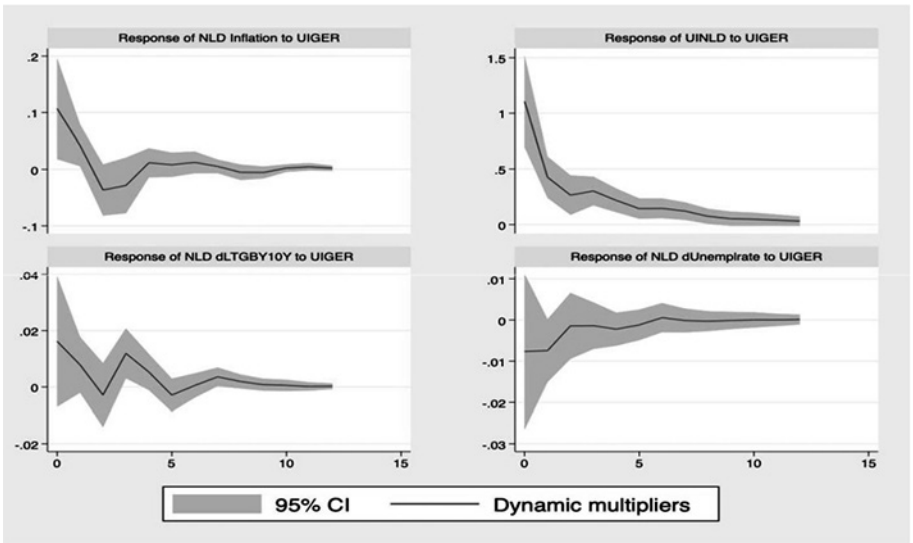
	t-statistic	*p*-value
UI NDL/UI GER	4.799052234	3.36197E-06

Figure 9.3.1. Netherlands– Impulse Response Functions to a UINLD shock. Sample: 2008M1 – 2022M12. VAR (3) estimated with an exogenous variable (UIGER). 95% confidence interval



A dynamic-multiplier function, shown in Figure 9.3.2, is used to calculate the time-dependent effect of a unit increase in an exogenous variable on the endogenous variables. The exogenous variable is the German Uncertainty Index.

Figure 9.3.2. Netherlands – Dynamic-Multiplier Functions of a UIGER shock. Sample: 2008M1 – 2022M12. VAR (3) estimated with an exogenous variable (UIGER). 95% confidence interval



3.10. Portugal

The economic indices and the Uncertainty Index for Portugal are displayed below. Portugal's unemployment rate peaked in 2013 at 19%, but it then steadily declined until shortly after 2017 when it finally reached the 2008 level. Ironically, during the 2008 financial crisis, our Uncertainty Index shows zero values. All of the variables' correlations are shown in Table 10.1.

Figure 10.1. Portugal – Depiction of the Uncertainty Index (UI) and the inflation index from January 2008 till December 2022

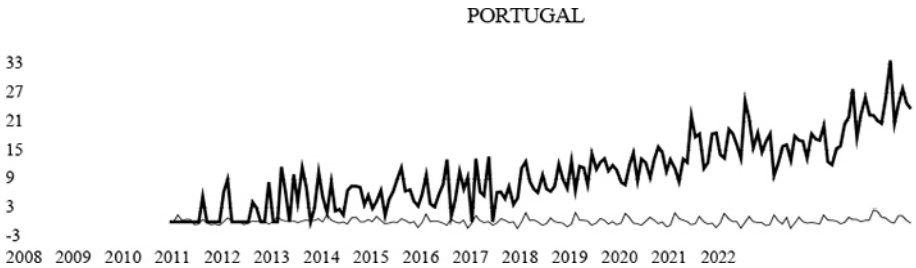


Table 10.1. Portugal – Correlation between the Uncertainty Index (UI), unemployment rate, inflation and long-term government bond 10-year yield

	Unemployment rate	LTGBY 10Y	Inflation	UI Portugal
Unemployment rate	1			
LTGBY 10Y	0.730216599	1		
Inflation	-0.085348002	0.011189386	1	
UI Portugal	-0.630545575	-0.557599162	0.132669325	1

We did not find data for the Economic Policy Uncertainty Index; instead, we only found data for the Consumers Confidence Index. At the 1% confidence level, the correlation that was provided was equal to 0.295 and was statistically significant

Table 10.2.1. Portugal – Measures of uncertainty: Correlation between our constructed Uncertainty Index (UI PRT) and the Consumer Confidence Index (CCI PRT)

	UI PRT	CCI PRT
UI PRT	1	
CCI PRT	0.29595466	1

Table 10.2.2. Portugal – *t*-statistic and *p*-value prices from correlations

	t-statistic	*p*-value
CCI/UI	4.133709677	5.48996E-05

The following figure illustrates how Germany's Uncertainty Index has remained relatively stable over the years, even with a few global crises. However, shortly after 2017, Portugal's Uncertainty Index started to rise. A portion of the unpredictability may be attributed to the four initial deadly wildfires that broke out in central Portugal in June 2017, resulting in numerous fatalities and injuries. The Russian invasion of Ukraine and the COVID-19 epidemic crisis prevented the UI PRT from ever reaching its 2015–2016 levels. With a correlation of 0.604, the relationship between UI PRT and UI GER is regarded as statistically significant and strong.

Figure 10.2. Portugal – Google Trends based Uncertainty Index of Portugal and Germany

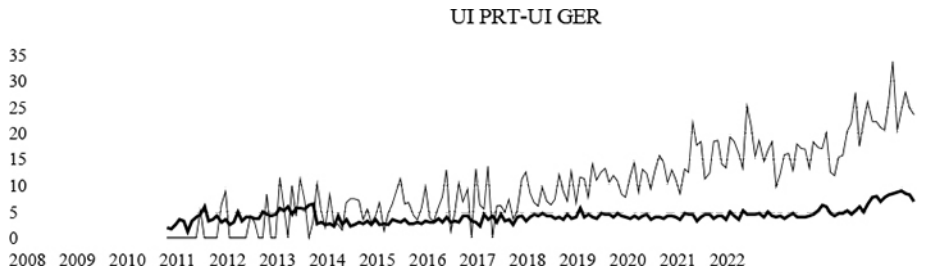


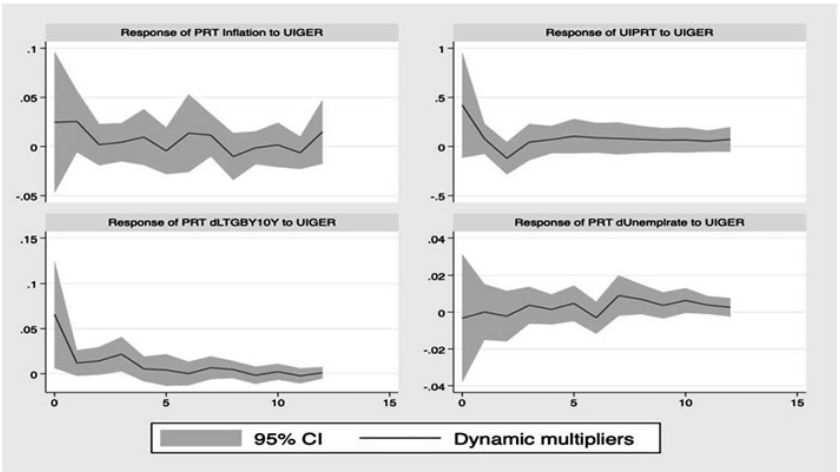
Table 10.3.1. Portugal – Correlation between Portugal's and Germany's Uncertainty Indices

	UI GER	UI PRT
UI GER	1	
UI PRT	0.6047231	1

Table 10.3.2. Portugal – *t*-statistic and *p*-value prices from correlations

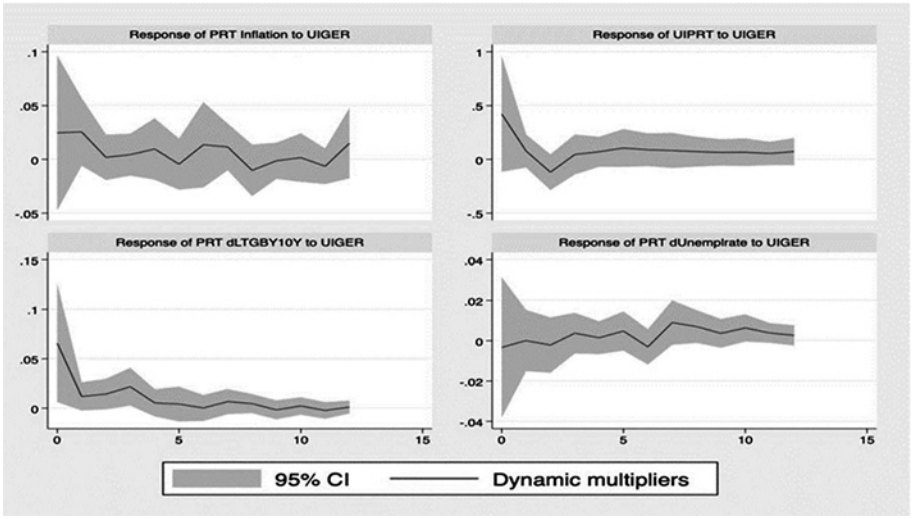
	t-statistic	*p*-value
UI PRT/UI GER	10.13014793	2.48491E-19

Figure 10.3.1. Portugal– Impulse Response Functions to a UIPRT shock. Sample: 2008M1 – 2022M12. VAR (7) estimated with an exogenous variable (UIGER). 95% confidence interval



A dynamic-multiplier function, as shown in Figure 10.3.2 of Portugal, is used to calculate the time-dependent effect of a unit increase in an exogenous variable on the endogenous variables. The exogenous variable is the German Uncertainty Index. Once more, it is seen that the variables are moving very near to zero over the course of the twelve periods, indicating that UIGER's impact on the Portuguese economy is not particularly noteworthy.

Figure 10.3.2. Portugal – Dynamic-Multiplier Functions of a UIGER shock. Sample: *2008M1 – 2022M12*. VAR (7) estimated with an exogenous variable (UIGER). 95% confidence interval



3.11. Spain

The following figure shows the Uncertainty Index and economic indicators for Spain. It is noteworthy that Spain became the second country to record an unemployment rate above 20% in the fifteen years of analysis in 2013, when it reached 26%, a level only Greece attained at roughly the same time. However, despite a high unemployment rate, the Uncertainty Index was relatively low during the first ten years. Following the COVID-19 epidemic crisis, the index slightly increased and remained there until the end of 2022. The correlations between the variables are shown in Table 11.1.1.

Figure 11.1. Spain – Depiction of the Uncertainty Index (UI) and the inflation index from January 2008 till December 2022

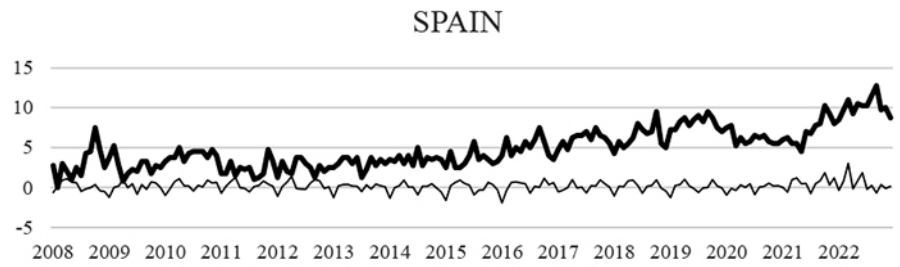


Table 11.1. Spain – Correlation between the Uncertainty Index (UI), unemployment rate, inflation and long-term government bond 10-year yield

	Unemployment rate	LTGBY 10Y	Inflation	UI Spain
Unemployment rate	1			
LTGBY 10Y	0.480545888	1		
Inflation	-0.097831779	-0.027478227	1	
UI Spain	-0.579663791	-0.636917648	0.11691803	1

Data for the CCI and EPU uncertainty indices were available for Spain. The correlations between the built Uncertainty Index and the current uncertainty indices were both found to be statistically significant at the 1% confidence level, which means that the correlations are accurate to their respective values. Still, we are confronted with the unwanted consequence of the positive correlation between CCI and UI. Once more, this may be because people are not feeling safe to invest into deposits and instead, they consume their income.

Table 11.2.1. Spain – Measures of uncertainty: Correlation between our constructed Uncertainty Index (UI ESP), the Consumer Confidence Index (CCI ESP) and the Economic Policy Uncertainty index (EPU ESP)

	UI ESP	CCI ESP	EPU ESP
UI ESP	1		
CCI ESP	0.299168	1	
EPU ESP	0.28150059	0.01256303	1

Table 11.2.2. Spain – *t*-statistic and *p*-value prices from correlations

	t-statistic	*p*-value
CCI/UI	4.182977347	4.51078E-05
EPU/UI	3.913962762	0.000129126
CCI/EPU	0.167624993	0.867068599

Spain's Uncertainty Index seems to take the same path as Germany's Uncertainty Index. Spain is the nation with the highest correlation between its Uncertainty Index and Germany's, with a statistically significant correlation as high as 0.720.

Figure 11.2. Spain – Google Trends based Uncertainty Index of Spain and Germany

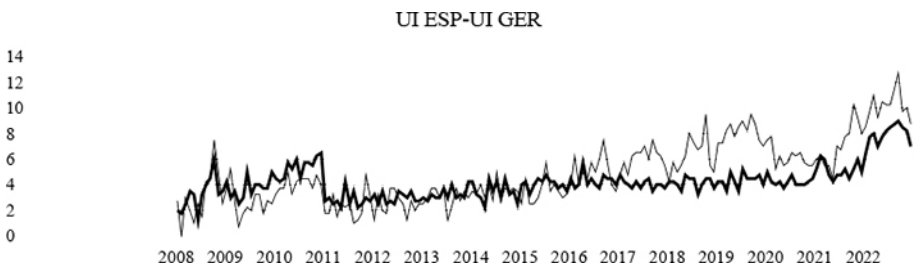


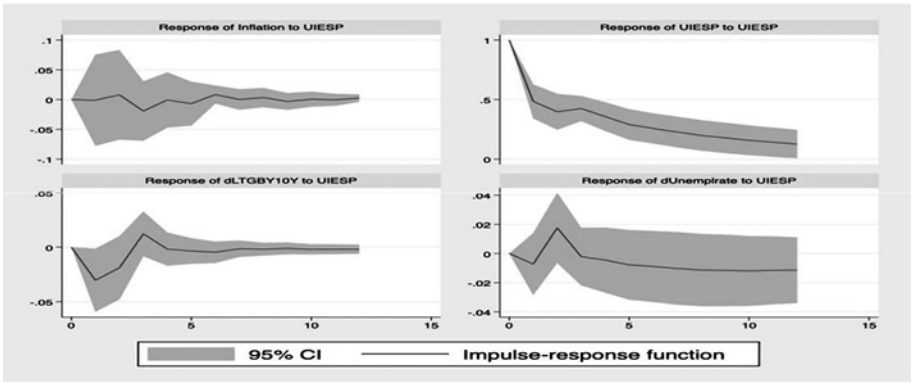
Table 11.3.1. Spain – Correlation between Spain's and Germany's Uncertainty Indices

	UI GER	UI ESP
UI GER	1	
UI ESP	0.72010589	1

Table 11.3.2. Spain – *t*-statistic and *p*-value prices from correlations

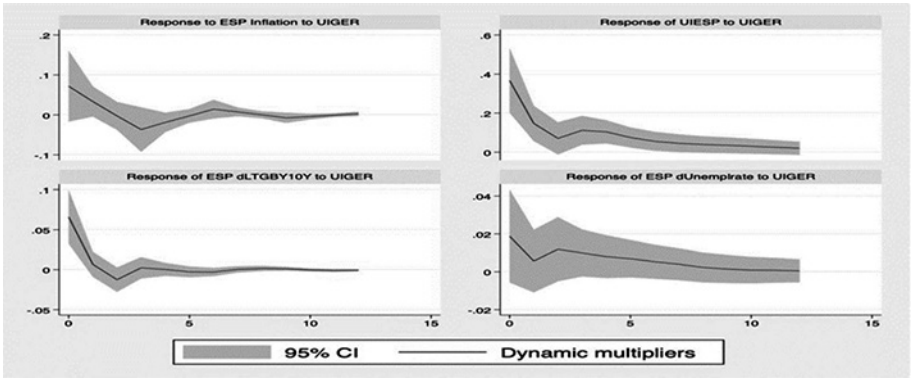
	t-statistic	*p*-value
UI ESP/UI GER	13.84624115	4.60646E-30

Figure 11.3.1. Spain – Impulse Response Functions to a UISVN shock. Sample: 2008M1 – 2022M12. VAR (3) estimated with an exogenous variable (UIGER). 95% confidence interval



A dynamic multiplier function, shown in Figure 11.3.2, is used to calculate the time-dependent effect of a unit increase in an exogenous variable on the endogenous variables. The exogenous variable is the German Uncertainty Index. It appears that every variable travels in the same direction. UIESP and ESP dUnemplrate are the two that are able to remain positive over the periods, while the other two only briefly fell below zero.

Figure 11.3.2. Spain – Dynamic-Multiplier Functions of a UIGER shock. Sample: 2008M1 – 2022M12. VAR (3) estimated with an exogenous variable (UIGER). 95% confidence interval



3.12. LUXEMBOURG

Figure 12.1 shows the inflation rate, unemployment rate, yield on 10-year government bonds, and uncertainty index for Luxembourg. The first nation in Europe to record a positive correlation, at 0.048, between the unemployment rate and the uncertainty index was Luxembourg.

Figure 12.1. Luxembourg – Depiction of the Uncertainty Index (UI) and the inflation index from January 2008 till December 2022

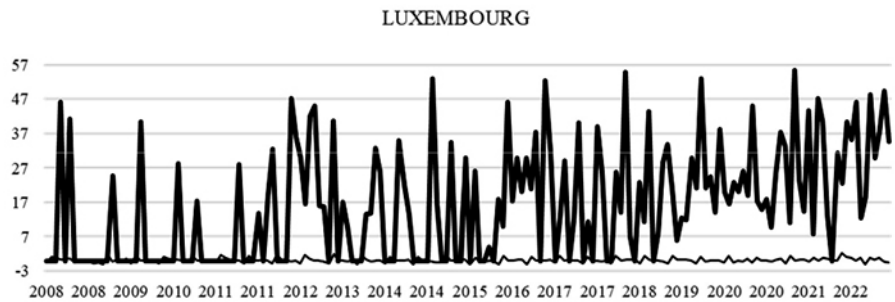


Table 12.1. Luxembourg – Correlation between the Uncertainty Index (UI), unemployment rate, inflation and long-term government bond 10-year yield

	Unemployment rate	LTGBY 10Y	Inflation	UI Luxembourg
Unemployment rate	1			
LTGBY 10Y	-0.603397165	1		
Inflation	-0.129985254	0.003647903	1	
UI Luxembourg	0.048737805	-0.30868969	-0.001107036	1

There were no online data available for Luxembourg's Economic Policy Uncertainty index. The Luxembourg Consumer Confidence Index and the Uncertainty Index we constructed using Google Trends had a negative correlation, measuring -0.022. The correlation is statistically insignificant, according to the *t*-statistic and *p*-value results.

Table 12.2.1. Luxembourg – Measures of uncertainty: Correlation between our constructed Uncertainty Index (UI LUX) and the Consumer Confidence Index (CCI LUX)

	UI LUX	CCI LUX
UI LUX	1	
CCI LUX	-0.0228705	1

Table 12.2.2. Luxembourg – *t*-statistic and *p*-value prices from correlations

	t-statistic	*p*-value
CCI/UI	-0.305210459	0.760562469

The graph below displays the uncertainty indices for Germany and Luxembourg. It's clear that, in contrast to UI GER, UI LUX reacts much more aggressively. Consecutive, sharp spikes that occur over the course of the research time horizon define UI LUX. At 0.238, the correlation coefficient between the variables is statistically significant but weak.

Figure 12.2. Luxembourg – Google Trends based Uncertainty Index of Luxembourg and Germany

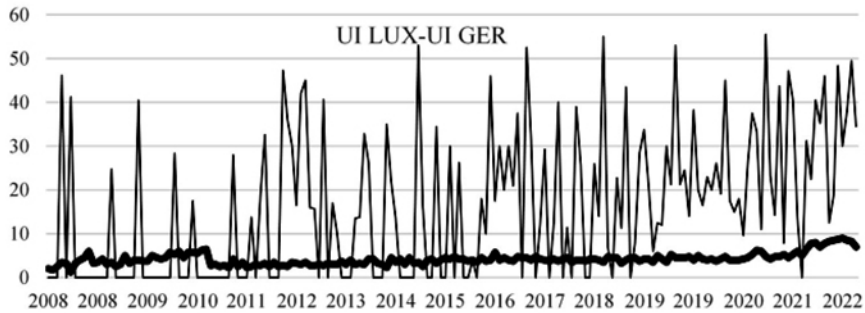


Table 12.3.1. Luxembourg – Correlation between Luxembourg's and Germany's Uncertainty Indices

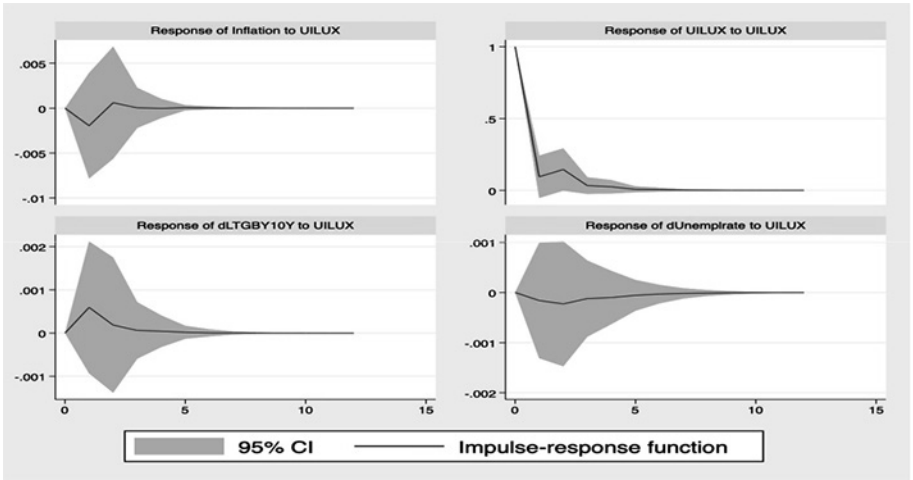
	UI GER	UI LUX
UI GER	1	
UI LUX	0.23839347	1

Table 12.3.2. Luxembourg – *t*-statistic and *p*-value prices from correlations

	t-statistic	*p*-value
UI LUX/UI GER	3.274987841	0.001269911

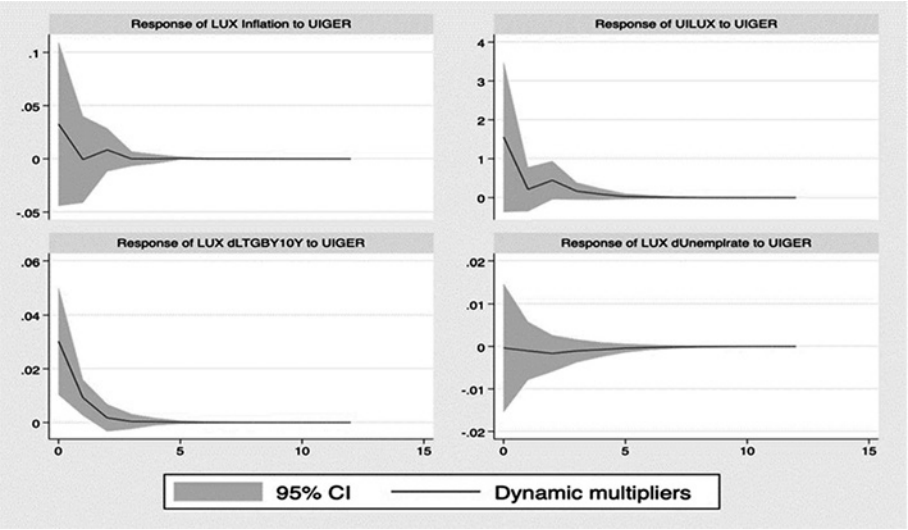
The following IRF graphs display the variables' response to a one-standard deviation of UILUX. It appears that the Luxembourg Uncertainty Index (UI) has very little effect on any economic indicator. Shortly after their initial small response in the first period, the variables converge to zero.

Figure 12.3.1. Luxembourg– Impulse Response Functions to a UILUX shock. Sample: 2008M1 – 2022M12. VAR (2) estimated with an exogenous variable (UIGER). 95% confidence interval



A dynamic-multiplier function is used in the following set of IRF graphs to calculate the time-dependent effect of a unit increase in an exogenous variable on the endogenous variables. The exogenous variable is the German Uncertainty Index. UIGER affects Luxembourg's economy more than UILUX does. All response values except for the LUX dUnemplrate ones were recorded as positive.

Figure 12.3.2. Luxembourg – Dynamic-Multiplier Functions of a UIGER shock. Sample: 2008M1 – 2022M12. VAR (2) estimated with an exogenous variable (UIGER). 95% confidence interval



4. **Conclusions**

Mixed results were obtained when a macroeconomic uncertainty index based on Google Trends was constructed. Our Uncertainty Index demonstrated encouraging correlations with other uncertainty indices, including the Economic Policy Uncertainty index (EPU) by Baker et al. (2016) and the Consumer Confidence Index (CCI), for the majority of Eurozone countries, and it was in line with economic theory. In contrast to theoretical expectations, some countries produced unfavorable results when our Uncertainty Index was correlated with the CCI and EPU.

A plausible rationale addressed in the piece concerned the feeble or unstable stability of the nation's insurance industry. In these situations, residents might choose to spend rather than save money even during times of great uncertainty. The narrow scope of the index's construction – only four terms were used, all of which were studied in English without translation into the local tongue – contributed to less desirable and indicative results. When writing about this particular subject, authors frequently concentrate on creating uncertainty indices for one country or, at most, two countries, utilizing forty or more keywords in the process.

Positive results were found for the Impulse-Response and Dynamic-Multiplier Functions. First, the effect of the Uncertainty Index on the economic indicators of each nation was looked at. The responses of each country's variables to a unit increase in the Uncertainty Index of Germany – the biggest economy in Europe – were then examined. When a shock to Germany's uncertainty index occurred, the responses of most European countries' variables

appeared more pronounced, explicit, and significant than when a shock occurred to their own uncertainty index. As explored in other papers on Google Trends, if a large number of words were employed in the analysis to create the macroeconomic uncertainty index, the outcomes would probably be more precise, trustworthy, and appropriate for making justified conclusions. For this reason, for future research it would be important the inclusion of more words for the construction of the uncertainty index. further research regarding the topic is suggested.

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