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CENTRAL BANK OF MALTA WORKING PAPER



Economic Policy Uncertainty: An Index for Malta

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WP/07/2024

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The views expressed are those of the authors and do not necessarily reflect the views of the Central Bank of Malta. Any errors are the authors' own.

Abstract

We construct an Economic Policy Uncertainty (EPU) index for Malta based on the methodology of Baker, Bloom and Davis (2015) using articles published between 2004 and 2022 from four Maltese news portals. The index spikes during general elections and other significant local or international events. Using the 95% threshold zscore, we conclude that Malta experienced notably elevated EPU during four key events: Malta's accession to the European Union, the 2011/2012 and 2019 political crises, and the COVID-19 pandemic. To validate our index, we first analyse the behaviour of the time series by assessing the contents of the flagged articles through a bigram analysis, which shows that our index reflects the timeline of suggested instances where Malta experienced economic policy uncertainty. We use a vector auto-regressive model with exogenous variables to show that innovations to the EPU index exhibit countercyclical properties and reflect developments in the local economy beyond those attributable to negative sentiment. Furthermore, we highlight that, despite positive correlations, the behaviour of our index differs in timing and magnitude from foreign EPU indices, underscoring the need for a Maltese-specific index rather than relying on foreign-based proxies. Finally, the Toda and Yamamoto (1995) test supports the hypothesis that our EPU index may be used as a leading indicator for this measure.

JEL Classification: E22, E66, L50

Keywords: Economic Policy, Uncertainty, EPU, Natural Language Processing, Malta

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1 Introduction

Economic policy uncertainty (EPU) has emerged as an area of interest in economic research due to its potential impact on economic decision-making and macroeconomic stability. Baker, Bloom and Davis (2015) pioneered the construction of EPU indices, revealing how uncertainty in economic policies can adversely affect investment, consumption, and employment. These findings are supported by subsequent research, such as Caldara and Iacoviello (2018), who demonstrated that EPU can lead to contractions in economic activity and increased financial market volatility. Furthermore, Huang and Luk (2020) extended these insights by showing that EPU indices could predict economic downturns and influence central bank policy decisions. Despite the extensive research on larger economies, there remains a notable gap concerning small states like Malta. This paper aims to fill this gap by constructing an EPU index for Malta and analysing the relationship between ambiguity in economic policies and the real economy, using articles from Maltese news portals between 2004 and 2022.

The development of a Maltese EPU index contributes several novel aspects to the literature. Firstly, this is the first attempt to create an EPU index for Malta using news portal data, which provides a new tool for researchers and policymakers to measure and analyse economic policy uncertainty in the Maltese context. This follows the methodological framework established by Baker et al. (2015), thus ensuring comparability with other countries' indices. Secondly, using online news articles is a cost-effective and efficient method for data collection and processing relative to printed newspaper articles, as highlighted by recent studies like Azqueta-Gavaldón (2017), which underscores the benefits of utilizing digital news sources for EPU index construction. Additionally, we develop natural language processing (NLP) tools specifically for the Maltese language, enabling the inclusion of Maltese-language news portals in our analysis. This effort represents a rare application of NLP techniques to Maltese texts, expanding the linguistic capabilities of EPU research. Furthermore, given that literature suggests small countries may derive significant benefits from having their own EPU indices (Rice, 2020; Armelius et al., 2016), our work provides a crucial contribution to understanding and managing the unpredictability of economic policy in Malta.

The global economy has experienced multiple turbulent events over the last two decades. These include the 2008 global financial crisis, the European Sovereign Debt Crisis, Brexit, the COVID-19 pandemic, and Russia's invasion of Ukraine. These events have raised considerable interest in how to measure uncertainty and its impact on the global economy with new approaches. Furthermore, each country also experiences specific events at a local level which leads to heightened local uncertainty. Notable examples of such country-specific events are the yellow vest protests in France and the attempted coup d'etat in Turkey.

In such events, policy action – or inaction – can influence economic uncertainty. Moreover, policy-related uncertainty is in many cases a direct consequence of major economic shocks and disruptions. For example, policymakers were faced with extraordinary and complicated challenges when faced with the COVID-19 pandemic. Consequently, in the literature, understanding and capturing uncertainty has been shown to be crucial for measuring economic performance. Literature on the adverse effects of policy uncertainty on economic activity dates back to Friedman (1968) and Rodrik (1991). The latter found that economic uncertainty leads to a significant decline in capital investment and productivity, with later studies (Gulen and Ion, 2015) backing this finding. Stock and Watson (2012) find that liquidity risk and uncertainty shocks are among the most important factors behind

the decline in the United States of America's (US) Gross Domestic Product (GDP) during the 2008 financial crisis. Further literature also shows that increased economic uncertainty may lead to harmful effects on economic activity, including the labour market, investment, consumption, output growth, financing costs and asset prices, amongst others. A highly influential paper by Bernanke (1983) shows that on the back of high uncertainty levels, firms tend to delay investment and hiring. Once uncertainty recedes, firms increase investment and hiring to meet pent-up demand. Furthermore, Arnold and Vrugt (2008), Bernal et al. (2014) and Liu and Zhang (2015) find that economic policy uncertainty is positively related to stock market volatility and dampens returns. Meanwhile, Giavazzi and McMahon (2012) show that uncertainty induces precautionary spending cutbacks by households, whilst Panousi and Papanikolaou (2012) find that uncertainty leads to under-investment by risk-averse management. Literature also suggests that heightened uncertainty may exert contractionary effects on the economy through increased cost of finance (Pastor and Veronesi, 2013; Gilchrist et al., 2014) and intensification of monopoly pricing distortions (Fernandez-Villaverde et al., 2015).

Although uncertainty is inherently unobservable, various empirical methods have been developed to estimate and measure it. Common proxies for economic uncertainty are stock market volatility and other survey-based indicators such as the European Commission (2024) Economic Sentiment Index (ESI) and the Economic Uncertainty Indicator (EUI). More recently, a broad and expanding line of literature in economics has turned to textual analysis to develop real-time measures of economic, political, and policy uncertainty. In turn, such measures are analysed with economic and financial variables to illustrate their relevance for economic and policy analysis and forecasting.

In particular, Baker et al. (2015) constructed an EPU index for the US based on news articles from ten major newspapers. Specifically, the authors obtain a monthly count of articles that contain a trio of terms "uncertainty" or "uncertain"; "economic" or "economy"; and one or more of the following policy terms: "congress," "deficit," "Federal Reserve," "legislation," "regulation" or "White House" (including variants like "uncertainties," "regulatory" and "the Fed"). Thus, to meet their EPU criteria, an article must contain terms in all three categories pertaining to economy (E), policy (P) and uncertainty (U). Their index spiked near tight presidential elections, the Gulf Wars, the 9/11 attack, the Lehman Brothers bankruptcy, government shutdowns and other major battles over fiscal policy. Similarly, the authors also construct monthly newspaper-based EPU indices for thirteen other countries (Australia, Brazil, Canada, China, France, Germany, India, Italy, Japan, Russia, South Korea, Spain, and the United Kingdom). Using firm-level data, the authors also find that policy uncertainty raised stock price volatility and reduced investment and employment in policy-sensitive sectors. At the macroeconomic level, policy uncertainty foreshadowed declines in investment, output, and employment in the US and another twelve major economies, in a panel vector auto-regression (VAR) setting.

This landmark paper gave rise to numerous studies and further country applications concerning the influence of economic uncertainty on macroeconomic indicators. For example, Ghirelli et al. (2019) refined the EPU index for Spain by expanding the headline newspaper coverage from two to seven, and by using a richer set of keywords to form the search expressions (i.e., the terms searched in articles to identify economic policy uncertainty) over a longer sample period. Their index resulted in a more consistent chronology of economic policy events. At the same time, the macroeconomic effects of uncertainty shocks identified from the new index yielded greater negative responses of GDP, private consumption, and private investment, compared to mute responses obtained

using the original index. Moreover, Cerda et al. (2016) created two EPU indices for Chile. One follows the methodology of Baker et al. (2015), whilst the second adds a condition to ensure that articles include words starting with the string "Chile". The indices had similar behaviour with the second index being a better reflection of local events. Similarly, in this paper, we propose the first EPU index tailored specifically to Malta, which we argue more accurately captures the uncertainty arising from unique local economic and political events—such as national elections, political crises, and policy changes—than broader indices like the European EPU.

In this paper, we use NLP techniques on online news articles from four Maltese news portals to construct an EPU index for Malta based on the influential methodology of Baker et al. (2015). Our study makes several significant contributions to the literature. Firstly, it provides the first comprehensive analysis of articles from prominent Maltese news outlets since 2004, identifying their value and potential issues for economic analysis. Secondly, it pioneers the creation of a set of EPU keywords in the Maltese language, opening new avenues for research using NLP methods in this linguistic context. By constructing an EPU index for Malta, we offer a new tool for researchers and policymakers to measure and analyse economic policy uncertainty within the local context, following a robust and comparable methodology. Our approach to using online news articles is both costeffective and efficient, echoing the advantages noted by Azqueta-Gavaldón (2017). Moreover, the development of Maltese-specific NLP tools represents a pioneering effort in expanding the linguistic scope of EPU research.

Our results indicate that the Maltese EPU index spikes during significant local and international events, such as general elections, domestic political crises, and global political developments. Using the z-score approach, where a score exceeding 2 in absolute terms (the 95% threshold) signals abnormal levels of EPU, we identify four periods of particularly elevated EPU: Malta's accession to the European Union (EU), the 2011/2012 and the 2019 political crisis, and the COVID-19 pandemic.

To validate our index, we first ensure that it appropriately responds to significant economic and political events. This process involves several steps, including a manual analysis of articles and bigram analysis. Then, we also estimate a vector auto-regressive model with additional endogenous variables (VARX) to assess the relationship between the index and real economic indicators. This model was then used to determine that the EPU index has countercyclical properties. We also investigate the behaviour of the Maltese EPU index relative to foreign-based indices to assess the need for a local index and confirm that the information sets of the analysed indices are significantly different. Lastly, we use the Toda and Yamamoto (1995) approach and find that the EPU index can be used as a leading indicator for measures of the real economy, particularly for developments in household consumption.

The rest of the paper is organised as follows: Section 2, explains the data and methodology behind the construction of Malta's EPU index, and presents the main results. Section 3 outlines the testing procedures undertaken to validate the EPU index while Section 4 concludes.

2 Developing Malta's EPU Index

The process of constructing Malta's EPU Index is divided into three stages. First, we collect and clean news articles from several local online news portals. Second, we use the cleaned texts to calculate the index in line with the methodology described by Baker et al. (2015). Lastly, we display the resulting index and describe its behaviour relative to a timeline of pre-established events related to Malta's economic policy formulation.

2.1 Textual Data

The methodology described by Baker et al. (2015) uses information contained in news articles. This is based on the assumption that newspapers and online news portals form a considerable proportion of economic agents' information set regarding the development of economic policies. For this assumption to hold, the sources of news articles need to be chosen judiciously to reflect what is being read by citizens properly. When making this selection, a complicating factor for Malta is its bilingual nature, with Maltese and English being the official languages due to historical reasons. It is crucial to consider this linguistic context in our analysis. Bilingualism is not unique to Malta; countries like Canada and Switzerland have also navigated the complexities of bilingualism/multilingualism in various research contexts. In Canada, economic policy uncertainty indices have been developed considering both English and French language sources, highlighting the need to capture a complete picture of media sentiment in a bilingual country (Mertens & Recker, 2020). Similarly, Switzerland's multilingualism, involving German, French, Italian, and Romansh, has been shown to contribute significantly to its economic performance, demonstrating the economic value of multilingual capabilities (Hogan-Brun, 2017).

To strengthen our choice of news sources whilst considering this bilingual nature, we used Google Trends to identify the most popular terms related to 'news', 'newspaper', and 'ahbarijiet' (the Maltese word for 'news') between 2004 and 2022 in Malta.² This provided us with a snapshot of the most popular news portals read online by the Maltese population. We also considered readership surveys (Broadcasting Authority, 2023) to ensure our selected sources were representative of the population's preferences. To avoid potential political bias, we excluded news portals owned by the two main political parties in Malta. We select news portals which form part of different media firms to ensure a diverse range of perspectives and avoid redundancy in viewpoints. If a media group owns multiple news portals, we choose the portal linked to the group's most read newspaper. Additionally, we prioritized news portals that focus on high-quality reporting, emphasising hard news over adverts, sponsored content, and entertainment, increasing the reliability and relevance of our data. Finally, the longevity of the news articles available online was considered to guarantee a consistent and long-term dataset for our analysis.

Based on the above criteria, we selected four news portals: Times of Malta, The Malta Independent, Malta Today, and TVM (see Table 1). These sources collectively provide a broad and unbiased perspective on economic policy uncertainty in Malta, strengthening the robustness and reliability of our EPU index given their readership and reputation.

 $^{^2}$ The end date of 2022 was chosen based on the last full year of data at the start of the project. To obtain an updated version of the index kindly contact publications@centralbankmalta.org.

Newsportal	Data Period
Times of Malta	2004-2022
Malta Independent	2005-2022
Malta Today	2004-2022
TVM News	2015-2022

Table 1 – Chosen News Portals for Malta's EPU Index

Source: Analysis of news articles from online portals, including archives.

As illustrated in Table 1, news portals with available articles dating back to 2004 were selected to construct an index of sufficient length for economic analysis. However, the data periods for each news portal vary. For instance, online news articles are available from 2004 for the Times of Malta and Malta Today, from 2005 for The Malta Independent, and from 2015 for TVM News. Given these varying sample periods, it is natural to question whether these discrepancies might impact the computation of our EPU index. Fortunately, this will not adversely affect the construction of the EPU index. The standardised methodology established by Baker et al. (2015) involves aggregating and averaging the frequency of articles containing key terms related to economic policy uncertainty across sources. This approach mitigates fluctuations in data availability from individual sources by averaging and normalising the data – as we show in more detail in the next subsection. This methodology enables us to create a comprehensive and consistent index that reflects economic policy uncertainty over time.

After obtaining the set of articles from each shortlisted news portal, the subsequent step is to determine which of these articles should be used for constructing the EPU index. After a thorough analysis, we observed that the share of total articles by month and news portal is unstable over time for certain categories, specifically those considered as "soft news" such as entertainment, motoring, sport, and art. This instability arises due to the significant fluctuations in the proportion of articles within these categories over time. For instance, sports reporting experiences spikes during events like the World Cup or the Olympics, leading to disproportionate coverage during these periods.

These fluctuations can bias our index. Since the EPU index is calculated based on the number of articles containing key terms related to economic policy uncertainty relative to the total number of articles, an increase in the denominator (total number of articles) due to a surge in soft news content can artificially lower the EPU index during certain periods. To address this, we decided to exclude articles from these soft news categories (highlighted in red in Table 2) from our analysis. By focusing only on categories that consistently reflect "hard news," we ensure that our EPU index reflects more accurately the level of economic policy uncertainty in Malta.

Similarly, categories for opinion and editorial articles (blue categories, Table 2) are also inconsistent across news sources. Opinion and editorial pieces often reflect the viewpoints of individual authors, introducing another source of potential bias into the EPU index. To maintain the objectivity and reliability of our index, we exclude these articles to avoid the influence of personal opinions and editorial biases. Furthermore, we restrict our analysis to locally relevant articles by excluding categories that report exclusively on foreign events (green categories, Table 2). This focus ensures that our EPU index accurately reflects economic policy uncertainty within Malta. As a result of these careful exclusions, the final dataset consists of almost 600,000 news articles.

Newspapers	News Categories		
Times of Malta	Business, Community, Entertainment, Motoring, National, Opinion, Sport, Tech, World		
Malta Independent	Art, Business, Debate, Life, Local, Sport, World		
Malta Today	National, Opinion, Interview, Arts, Business, Editorial, Sports, Europe, Blogs, Environment, Election, Data and Surveys, Gourmet, World, Budget, XTRA, Tech, Lifestyle, Property, Court and Police, Law Report, Letters, Skinny		
TVM News	National, European Union, World, Entertainment, Sport		
	Source: News categories based on subsections of respective portals.		

Table 2 – News Article Database

Note: Colours indicate category distinctions: hard news (black), soft news (red), opinion (blue), and foreign news (green).

2.2 Calculating the EPU Index

After determining the relevant news articles, it is essential to distinguish between those expressing EPU and those that do not. This involves some text preprocessing steps, which are crucial components of NLP. This process involves cleaning and transforming unstructured text data into a structured and consistent format for analysis. Firstly, all capital letters, stop words, and special characters were removed. Then, to capture economic and policy uncertainty in the articles, we established a list of keywords for each category: "economic", "policy", and "uncertainty". These keywords, shown in Table 3, were derived from the literature (Baker et al., 2015; Cerda et al., 2016; Tobback et al., 2018; Andres-Escayola et al., 2022) and through consultations with local economic experts.³ Although Table 3 does not include an exhaustive list of terms, relying on the terms present in the literature enhances the consistency of our EPU index with indices for other economics calculated using the methodology of Baker et al. (2015). Moreover, including an overly broad range of economic terms could dilute the focus of the EPU index, reducing its specificity to policy uncertainty⁴.

Economic	Policy			Uncertainty
Economic(s)	Political	Deficit	Exchange Rate(s)	Uncertain
Economy	Politics	Debt	Fiscal	Uncertainty
Economies	Central Bank	Castille	Monetary	Uncertainties
Industry	ECB	Parliament	Legislation(s)	Unstable
Industries	Policy	Government	Reform(s)	Instability
Industrial	Policies	MP	Rule(s)	Instabilities
Business(es)	Tax(es)	Member(s) Parliament	Norm(s)	
Commerce	Taxation	MEP	Normative	
	Spending	Member(s) European Parliament	Regulation(s)	
	Budget	Minister(s)	Law(s)	
	Ministry	Tariff(s)	Currency	

Table 3 – Economic, Policy and Uncertainty terms for Malta's EPU Index

Source: Keywords obtained by consulting relevant research papers and local economic experts. The letters between brackets indicate the plurals of respective keywords.

³ Further detail on the selection of the keywords used to flag articles, related tests, and their Maltese-language translation can be found in section one of the appendix.

⁴ However, future research could develop subindices, such as a monetary policy-focused EPU index using terms like "interest rates" and "monetary policy," for more targeted analysis.

Subsequently, to identify EPU-relevant articles, we iterate through each article, and flag it as EPUrelevant if it contains at least one 'Economic' term, one 'Policy' term, and one 'Uncertainty' term. Articles not meeting the above criteria are marked as non-EPU relevant. After classifying the articles, we compute the index, using the methodology outlined by Baker et al. (2015). The first step involves aggregating the counts of flagged articles monthly. Given that the raw counts of flagged articles depend on the overall volume of articles – which varies across news portals and time – we normalize these counts by computing the ratio of flagged articles over total articles for each news portal per month as follows:

$$X_{j,t} = \frac{\sum_{i} X_{i,j,t}}{N_{j,t}} \tag{1}$$

where $X_{i,j,t}$ refers to individual flagged articles for an article (*i*) from a news portal (*j*) in a month (*t*), $\sum_i X_{i,j,t}$ indicates the frequency of flagged articles by news portal and month, and $N_{j,t}$ refers to the total number of articles for the news portal *j* at time *t*. Then, the EPU article ratios are divided by the standard deviation of the number of news articles per month for each of the news portals (σ_j).

$$\tilde{X}_{j,t} = \frac{X_{j,t}}{\sigma_j} \tag{2}$$

Such scaling serves to adjust for differences in the overall volume of articles across news portals and across time.⁵ We then proceed to obtain the average EPU score across the different news outlets for each period. This is shown in the below equation where J_t denotes the total number of news portals in each month which varies due to the differing series lengths shown in Table 1.

$$Y_t = \frac{\sum_i \tilde{X}_{j,t}}{J_t} \tag{3}$$

(**a**)

Finally, we normalise the index with a mean of 100, such that the index can be consistently described as deviations from its mean (\overline{Y}).

$$EPU_t = \frac{Y_t * 100}{\bar{Y}} \tag{4}$$

2.3 Malta's EPU Index

The outcome of the procedure outlined in the previous section is shown in Figure 1 together with a timeline of events expected to generate ambiguity around economic policy. These results show that the periods with the highest levels of EPU, as measured by our index, coincide with the 2011/12 political crises, Malta's accession into the EU and the subsequent inaugural MEP elections, and the 2019 political crises, respectively. Conversely, 2005, 2006, 2014 and 2015 are characterised by consistent below-average economic policy uncertainty.

⁵ Due to the COVID-19 pandemic, we assess if the scaling procedure was impacted by changes in reporting behaviour due to the pandemic. Section two of the appendix describes how we tested for this concern.

Several spikes were experienced between 2007 and 2008, a time characterised by Malta's process of adopting the euro, a general election, and the global financial crisis. The index rises again during the 2016 Brexit referendum and the US presidential election. Moreover, between 2017 and 2019 the index shows a high level of economic policy uncertainty following the 2017 general election and culminating in the 2019 political turmoil. Unsurprisingly, between 2020 and 2021, the index remained elevated for a prolonged period due to the COVID-19 pandemic. After a brief period of stability during mid-to-late 2021, the index shows an increase in EPU in early 2022. This resurgence in economic and political uncertainty is likely driven by several factors, such as a resurgence in COVID-19, Russia's full-scale invasion of Ukraine, and the 2022 general election.

Furthermore, to account for the inherent volatility of the index, we test for periods in which the EPU has persistently remained high, or spiked to unusually elevated levels. We apply the z-score approach to standardize the index, and identify periods where EPU significantly deviated from its historical average. Specifically, we label as abnormal those periods where the z-score exceeds 2 in absolute terms, indiciating that the EPU is more than two standard deviations from its mean. This reveals that between 2004 and 2022, Malta experienced particularly high economic policy uncertainty during four key periods: (i) Malta's accession to the EU, (ii) the 2011/2012 political crisis, (iii) the 2019 political crisis, and (iv) the COVID-19 pandemic.



Figure 1 – Malta's EPU Index

Source: Authors' calculations

Note: Y-axis shows EPU Index values, with higher values indicating greater economic policy uncertainty and lower values suggesting more stability. X-axis represents time in months.

3 Validating Malta's EPU Index

When validating the computed EPU index for Malta, our objective is to ensure that the index possesses the correct properties. According to Lolić et al. (2021), an EPU index should fulfil four criteria. That is, it should:

- 1. adequately react to important economic or political events,
- 2. exhibit countercyclical properties,
- 3. be highly correlated with other plausible proxies for uncertainty, and
- 4. display leading characteristics vis-à-vis economic activity.

Moreover, the index must show that it can meet these criteria while accounting for the criticisms of the methodology, with Baker et al. (2015) noting that their "approach to measuring policy uncertainty raises potential concerns related to newspaper reliability, accuracy, bias, and consistency."

The following subsections describe the methods employed to test whether our EPU index for Malta satisfies the criteria and present the results of these validation tests. These tests are crucial for demonstrating that our index not only adheres to the theoretical standards but also remains robust in the face of methodological critiques.

3.1 Reactions to Important Economic or Political Events

A thorough analysis of the EPU index necessitates more than a mere correlation analysis between periods of elevated EPU scores and concurrent events. In this context, all event spikes identified in Figure 1 undergo further scrutiny via a bigram analysis. This contrasts with most of the literature which relies on manual article analysis. Bigrams identify the two most prominent words or phrases in the articles flagged as EPU-relevant within a specific period. We compute these bigrams by measuring the importance of words in the collections of articles using tf-idf (Term Frequency-Inverse Document Frequency). This measure offsets the number of times a word appears in an article by the frequency of the word in the collection of articles. This helps to adjust for the fact that words may appear more frequently in general. For example, Figure 2 shows that the words "Malta," "government," "people," "US" and "EU" are among the most common in the EPU-flagged articles. The latter two words highlight that our index reflects events abroad despite restricting articles to local reporting. In equation 5, tf(t,d) defines term frequency as the ratio between $f_{t,d}$, the number of times a term t appears in document d, and the total number of individual terms in a document, $\sum_{t' \in d} f_{t',d}$. Conversely, idf(t, D) reflects the proportion of documents in the full collection of documents D by taking the logarithm of the number of documents in the collection N divided by the number of documents in the collection containing the term.

$$tf(t,d) = \frac{f_{t,d}}{\sum_{t' \in d} f_{t',d}}$$
(5)

$$idf(t,D) = \log \frac{N}{|\{d: d \in D \text{ and } t \in d\}|}$$
(6)

$$tfidf(t, d, D) = tf(t, d) * idf(t, D)$$
⁽⁷⁾

Figure 2 – Word Cloud for EPU Relevant Articles



Source: Term frequency in EPU-flagged articles.

These bigrams are then analysed to determine their relevance to the economic or political events initially identified as contributing to increased uncertainty. As an example, consider the bigram analysis conducted for the period between December 2021 and March 2022, which was characterised by an elevated EPU index. Table 4 lists the top ten bigrams by month. In December 2021, the first seven bigrams pertain to increased uncertainty arising from the enforcement of additional COVID-19-related restrictions in response to concerns surrounding the Omicron variant. In January 2022, bigrams showed a rise in economic concerns related to COVID-19, with phrases highlighting risks such as cancellation of investment, supply chain disruptions and cost pressures. To a lesser extent, this period was also characterised by uncertainty related to Malta's greylisting by the FATF as well as rumours of early elections. In February 2022 however, bigrams clearly show a shift in the sources of uncertainty, with all top ten phrases related to Russia's full-scale invasion of Ukraine. Finally, in March 2022 the primary source of uncertainty was the general election. Similarly, all labelled spikes in our index were identified as being related to key events⁶.

December 2021	January 2022	February 2022	March 2022
additional restrictive	cancelled investment	border Ukraine	election campaign
concern omicron	chain disruption	gas pipeline	fiscal stimulus
coronavirus variant	concern omicron	invade Ukraine	general election
covid measure	cost pressure	monetary policy	high inflation
economic survival	covid recovery	Nord Stream	PM speaks
existing vaccine	drop tourism	possibility sanction	prime minister
extension wage	early election	sanction Russian	restriction removal
FATF greylisting	easing measure	energy price	PN concerned
greylisting impact	election uncertainty	gas supply	cost living
higher inflation	FATF grey	inflationary pressure	electoral pledge

Table 4 – Monthly Bigrams for December 2021 – March 2022 Period for EPU-flagged articles

Source: TF-IDF on EPU-flagged articles from the referenced months.

⁶ Bigrams for other events or periods are available upon request.

Furthermore, we manually analyse the EPU-flagged articles to identify broad themes driving our index. Figure 3 shows that local events are the primary drivers of Malta's EPU index. As one may expect, this is particularly evident during general elections and unusual local events. For example, local events accounted for approximately 80% of Malta's EPU during the 2008 general election, the 2011/12 government crisis, the 2017 general election and the 2019 political crisis. Conversely, significant international events also impact and can occasionally be the main drivers of Malta's EPU. This is evident during the Arab Spring (where "war" is the main driver), Brexit (where "UK" is the main driver), the COVID-19 pandemic (where "health" is the main driver) and Russia's full-scale invasion of Ukraine (where "war" again is the largest driver). However, a manual review of articles that delve into international events reveals that the conversation primarily focuses on the potential spillover effects for Malta, either directly or indirectly via the EU.



Figure 3 – Themes Driving Malta's EPU Index (% of Total EPU Relevant Articles)

Source: Authors' analysis of the monthly share of articles by pre-defined topics.

We also analyse articles that are not flagged as EPU-relevant to determine whether they are true negatives or if our index misses articles that should be flagged. To achieve this, we first extract common topics from these articles using Latent Dirichlet Allocation (LDA) techniques. The resulting topics provide reassurance, as they do not pertain to EPU relevant topics and instead focus on broader news categories, such as court updates, police reports, and day-to-day political events.⁷

Furthermore, to gain deeper insights into the content of non-flagged articles, we conducted another bigram analysis on articles not identified as relevant to EPU. Table 5 presents the top ten bigrams for the period from December 2021 to March 2022, allowing for direct comparisons with the bigrams listed in Table 4. The resulting bigrams provide intriguing contrasts and suggest that the article selection process is performing as expected, minimizing overall false negatives. In December 2021, both flagged and non-flagged articles predominantly feature COVID-19-related terms. However, unlike the flagged articles, the non-flagged articles do not address Malta's FATF greylisting. In January 2022, the focus shifts significantly, with non-flagged articles

Note: Y-axis represents the percentage share of each category, totaling 100% across all categories for each time period. This shows the relative contribution of each category to the total over time. X-axis represents time in months.

⁷ A comprehensive list of identified topics can be found in appendix three.

dominated by bigrams related to abortion and court cases. By February 2022, while flagged articles highlight the escalating situation surrounding Russia's invasion of Ukraine, the bigrams from non-flagged articles primarily revolve around COVID-19 and early discussions about the upcoming general election, notably excluding any mention of the Russia-Ukraine war. This trend continues into March 2022, where the primary topics in non-flagged articles again focus on COVID-19, with less emphasis on the broader national and international uncertainties evident in the flagged articles.

December 2021	January 2022	February 2022	March 2022
active case	abortion given	dei hospital	covid case
booster dose	active case	european union	dei hospital
covid case	allegations woman	general election	electoral campaign
dei hospital	answer allegation	health authority	general election
education minister	approves candidate	labour party	health authority
health authority	asks testify	mater dei	labour government
health minister	booster dose	nationalist party	labour party
mater dei	build defines	new case	mater dei
motorbike rider	charged abortion	old man	nationalist party
old man	classroooms public	press conference	old man

Table 5 – Monthly Bigrams for December 2021 – March 2022 Period for non-EPU flagged articles

Source: TF-IDF on non-EPU-flagged articles from the referenced months.

3.2 Countercyclical Properties

Research investigating the adverse effects of policy uncertainty on economic activity has a long history, tracing back to influential work by Friedman (1968) and Rodrik (1991), with the latter highlighting that economic uncertainty correlates with significant declines in capital investment and productivity. As this literature shows, any indicator of policy uncertainty must exhibit countercyclical properties with real economic measures.

As a first check, we compute the correlations between our EPU index and the growth rates of Malta's real GDP, household consumption, and the Central Bank of Malta's business conditions index (BCI). All these measures exhibit negative correlations.⁸ Nevertheless, for a more rigorous analysis, we estimate a VARX model, whose general expression is:

$$Y_{t} = \sum_{p=1}^{\infty} A_{p} Y_{t-p} + \sum_{s=1}^{\infty} B_{s} X_{t-s} + \varepsilon_{t}$$
(8)

Our model uses four endogenous variables for Malta: the EPU index, the ESI, real GDP growth and the growth rate of the Harmonised Index of Consumer Prices (HICP). In a separate specification, we replace the growth rate of real GDP with that of real household consumption to separately assess the impact on this component of GDP. Given that Malta is a small and very open economy, we add the growth rates of CMD and WDR as exogenous variables to account for the effects of foreign conditions. These variables were chosen because they reflect foreign countries' prices on imports and global demand for Malta's exports, respectively.

⁸ The referenced correlations are made available in section four of the appendix.

The variables in our VARX were selected in the spirit of Ghirelli et al. (2019), who used a VAR model with only four endogenous variables: an EPU index, the sovereign bond spread, GDP growth, and CPI growth. Apart from the inclusion of exogenous variables to account for Malta's openness, we differ from Ghirelli et al. (2019) in the inclusion of the log (*ESI*) instead of the sovereign bond spread. The inclusion of financial variables in this context is motivated by the concern that the EPU index may reflect broadly defined "bad news" rather than narrowly defined economic policy uncertainty.⁹ Similarly, Jurado et al. (2015) and Altig et al. (2020) incorporate the log of the S&P 500 index in their VAR model when analysing economic uncertainty. Due to the small size and activity of the Maltese capital markets, we address the aforementioned concern by including the ESI, which according to the European Commission (2022), can reflect general economic expectations and incorporate information from a variety of sources.¹⁰

All variables in the model are at a quarterly frequency,¹¹ with the optimal lag lengths for all variables chosen using the Bayesian information criterion (BIC). The resulting optimal lag structure across all the VARX specifications was one. We use a recursive identification scheme, by applying a Cholesky decomposition to the reduced form variance-covariance matrix, to identify the structural shocks in the models. The EPU index is ordered first, followed by the ESI, GDP and inflation. This, in turn, implies that the EPU is allowed to respond contemporaneously only to its own shock, but affects economic sentiment, GDP (or private consumption) and inflation contemporaneously. This follows existing literature that indicates that EPU has short-term impacts on economic variables (De Santis and Van der Veken, 2022).

We assess the countercyclicality of our EPU index by computing the impulse response functions (IRFs) of the real growth rates of GDP and household consumption following a unit standard deviation shock from Malta's EPU index. The IRFs in Figures 4 and 5 display a negative response of economic activity from a unit shock in EPU. Figure 4 shows that Malta's real GDP growth decreases by 0.70% in the first quarter and then converges to zero within three years. Only the first two quarters have a statistically significant effect. Conversely, the response of real household consumption growth in Figure 5 is more severe on impact, with a 0.91% decline, but the response also converges to zero within three years. These results indicate that the effects of an economic uncertainty shock on output and private consumption growth are sizeable on impact, but are extremely short-lived. Cumulatively, results show that economic output and private consumption levels are between 0.9% and 2.2% lower than pre-shock levels. Further testing indicates that these responses are robust to the inclusion of the COVID-19 pandemic period within our dataset.¹²

⁹ The reasoning is that capital markets being forward-looking and risk-sensitive capture second-moment developments beyond those related to policy uncertainty.

¹⁰ Our analysis also indicates that movements of the EU and EA aggregates of ESI coincide with those of the VSTOXX index, such that the indicators tend to move together in opposing directions. This reflects the fact that higher economic sentiment is associated with lower market volatility.

¹¹ An augmented Dickey-Fueller (ADF) test at the 95% confidence level indicated that Malta's EPU index exhibits a unit root. Therefore, we include Malta's EPU index in log levels and add a trend to the exogenous component of the model. The inclusion of a trend component is discussed in section five of the appendix.

¹² We augmented our VARX by adding a dummy for the COVID-19 pandemic period as an exogenous variable to assess for any impacts from the period that potentially influenced the model's IRFs. More detail is available in section two of the appendix.



Figure 4 – IRF of Real GDP Growth following a



Source: Authors' calculations following a shock in Malta's EPU index.

Note: Y-axis represents the response of the variable measured in percentage points, showing the magnitude and direction of the change following a shock in Malta's EPU index. X-axis represents the time period following the shock, measured in quarters.

3.3 Correlations with Other Plausible Uncertainty Proxies

The economic literature has developed several indices to measure different types of economic uncertainty, such as the VIX, which proxies the stock market's expectation of volatility through S&P 500 index options. Although our index specifically measures economic policy uncertainty, it must align with broader measures of economic uncertainty due to overlapping information sets and also because a-priori one expects all uncertainty measures to have countercyclical properties. The VIX which measures the implied volatility of the S&P 500 index is frequently used in VAR models for uncertainty analysis, such as Baker et al. (2015) and Ghirelli et al. (2019). For our analysis, we also consider the VSTOXX, the European Commission's EUI for the EU, Euro Area (EA), and Malta, as well as information from the Central Bank of Malta's business dialogue survey.¹³ These measures are chosen to provide a representative mix of local and foreign-based measures of uncertainty acknowledging that the content of EPU-flagged articles references both types of sources.

As a first check, we calculated the correlations between our EPU index and the aforementioned measures of economic uncertainty. Malta's EPU index is positively correlated with all listed measures, with the highest correlation being with the portion of uncertain responses of non-financial corporations to the Central Bank of Malta's Business Dialogue survey (0.61). The second and third highest correlations are with the EUI measures for the EA (0.45) and the EU (0.42), respectively.¹⁴ This confirms that, despite the prominence of local events, foreign events significantly influence Malta's EPU index.

A potential criticism of indices created for small open economies is that their exposure to external events allows foreign-based indices to act as proxies for locally tailored variables – seemingly rendering a local index redundant. For Malta, potential proxies include the Global and European EPU indices, as well as indices from

¹³ VSTOXX is the European equivalent of VIX, using the same methodology with the Euro Stoxx 50. In contrast, the European Commission's EUI is a composite indicator that measures the difficulty sectors have in predicting their future financial situations based on survey data. Similarly, the Central Bank of Malta's business dialogue survey collects firms' expectations for business activity, using the percentage of firms reporting 'uncertain' as an indicator of local business uncertainty.

¹⁴ The correlations' values and the respective confidence intervals are available in the fourth section of the appendix.

large EA economies.¹⁵ Figures 6 and 7 below compare Malta's EPU index with the Global and European EPU indices. The correlation between the Maltese and Global EPU indices is 0.48, indicating a moderate positive relationship. The correlation between the Maltese and European EPU indices is slightly higher at 0.52.¹⁶

The fact that these indices are positively correlated, does not automatically imply that any one measure can serve as a proxy for the other estimates. These correlations merely suggest that while Malta's EPU index is influenced by broader international and European events, it is also significantly driven by local factors. To assess the validity of these potential surrogates and reinforce the need for a tailored EPU index for Malta, we separately regress Malta's EPU index against the Global EPU index and the European EPU index, as follows:

$$EPU_{Maltat} = c_1 + EPU_{Globalt} + \varepsilon_{1t}$$
⁽⁹⁾

$$EPU_{Malta,t} = c_2 + EPU_{Europe,t} + \varepsilon_{2,t}$$
(10)



Figure 6 – Malta vs Global EPU Index





Source: Maltese EPU is calculated by the authors. Global and European EPU index is taken from https://www.policyuncertainty.com/.

Note: Y-axis shows EPU Index values, with higher values indicating greater economic policy uncertainty and lower values suggesting more stability. X-axis represents time in months.

¹⁵ The full list of tested EPU measures is the Global, European, American, German, Italian, British, French, and Spanish indices as found available in <u>Economic Policy Uncertainty Index</u>.

¹⁶ To further illustrate this point, additional charts comparing Malta's EPU index with those of specific countries such as the US, UK and Italy, amongst others, can be found in section 6 of the appendix.

The residuals $\varepsilon_{1,t}$ and $\varepsilon_{2,t}$ of equations 9 and 10, shown in figures 8 and 9, quantify the difference between Malta's EPU index and the Global and European indices, respectively. Positive residuals (teal) show periods when Malta's EPU index exceeds the Global or European EPU index. This is especially notable during Malta's EU accession in 2004, the adoption of the Euro in 2008, and the 2011/12 political crisis, which led to higher levels of EPU in Malta compared to the global and European indices. On the other hand, negative residuals (dark red) highlight periods where Malta's EPU index trails developments in its EU and Global counterparts. Indeed, negative residuals are notable during the Brexit referendum, the US Presidential elections, COVID-19, and the Russian-Ukraine war.



Figure 8 – Residuals of Malta vs Global EPU Index

Source: Authors' calculations of regression residuals from equation 9.



Figure 9 – Residuals of Malta vs European EPU Index

Source: Authors' calculations of regression residuals from equation 10.

Note: Y-axis represents figures of regression residuals. Positive residuals (teal) indicate periods when Malta's EPU index exceeds the Global or European EPU index. Negative residuals (red) show periods when Malta's EPU index is lower than EU and Global counterparts.

This analysis demonstrates that while foreign-based indices can be useful for examining the impacts of EPU-related events abroad, they fail to account for local events due to Malta's small size. Therefore, the distinctive advantage of our index lies in its ability to capture local events, as evidenced by the two largest spikes corresponding to the 2011/12 Maltese government crisis and Malta's accession to the EU. Relying on foreign proxies alone may mislead analysts and policymakers on the magnitude and duration of local EPU-related shocks, as highlighted by Armelius et al. (2016).

3.4 Leading Characteristics vis-à-vis Economic Activity

A benefit of our EPU index is that its frequency can be adjusted to match desired frequencies due to the high frequency of online news content. For example, our index's frequency can be adjusted to capture weekly and minute levels of economic policy uncertainty. High-frequency indicators have increasingly gained interest to aid nowcasts and forecasts of lower-frequency measures and obtain real-time insights when standard economic measures have delayed information (Clements & Galvão, 2008; Varian, 2014).

The shape of the IRFs in Figures 4 and 5 indicates that the responses of real economy variables following a shock in EPU require around three years to converge to zero, potentially suggesting the presence of leading characteristics. To assess the remaining criteria of having leading characteristics vis-à-vis economic activity we borrow from Čižmešija et al. (2017) who used Granger causality tests between multiple country measures of EPU and the respective country's Industrial Production level. The reasoning behind this approach is that if Malta's EPU index Granger causes an economic activity measure, then the EPU index is useful for forecasting the variable and can be considered as a leading indicator. Given that the EPU index is non-stationary at low frequencies, Čižmešija et al. (2017) use the Toda and Yamamoto approach to determine Granger causality.

Toda and Yamamoto (1995) propose the estimation of an augmented VAR to correct for observed unit roots, given that these lead to spurious conclusions when conducting Granger causality tests. In the model, we use lag length (p) to estimate a $(p + d_{max})^{\text{th}}$ order VAR, where d_{max} is the maximum order of integration that we suspect might occur in the process. The VAR setup has the following form:

$$EPU_{t} = a_{1} + \sum_{i=1}^{p+d_{max}} \beta_{1,i} EPU_{t-i} + \sum_{j=1}^{p+d_{max}} \gamma_{1,j} X_{t-j} + \varepsilon_{1,t}$$
(11)

$$X_{t} = a_{2} + \sum_{i=1}^{p+d_{max}} \beta_{2,i} X_{t-i} + \sum_{j=1}^{p+d_{max}} \gamma_{2,j} EPU_{t-j} + \varepsilon_{2,t}$$
(12)

where X represents a variable for economic activity or inflation, a_1 and a_2 are constant terms, β s and γ s are autoregressive parameters, and $\varepsilon_{1,t}$ and $\varepsilon_{2,t}$ are white noise error terms. This approach is used to evaluate the null hypotheses:

$$H_0: X \text{ does not Granger cause EPU if } \gamma_{1,1} = \gamma_{1,2} = \dots = \gamma_{1,p} = 0$$
(13)

$$H_0: EPU \text{ does not Granger cause X if } \gamma_{2,1} = \gamma_{2,2} = \dots = \gamma_{2,p} = 0$$
(14)

For our testing procedure, p is determined using the BIC, whilst d_{max} is set to one based on the characteristics of the tested variables. These economic variables are chosen to mimic those in the IRFs presented in Figures 4 and 5, i.e. the growth rates of real household consumption and GDP at a quarterly level, whilst the monthly variable Turnover and Volume of Sales in Wholesale and Retail Trade is used to capture household consumption at the monthly time-frequency. We also assess higher frequency measures because the Toda and Yamamoto (1995) approach is sensitive to the number of degrees of freedom when testing.

As shown in Table 6, when aggregating our EPU index to quarter averages and applying the Toda-Yamamoto approach to the listed variables we find no indication of leading characteristics. Conversely, when using monthly data for Turnover and Volume of Sales in Wholesale and Retail Trade the obtained p-value suggests that our EPU index Granger causes the variable at the 5% significance level. This suggests that the leading characteristics of the Maltese EPU index are present at higher frequencies. This is in line with observations by Baker et al. (2015) who computed a daily index of US EPU and advocated its potential uses, such as for nowcasting and forecasting purposes.

p-values from Toda-Yamamoto Approach				
Frequency Variables	Monthly	Quarterly		
Real GDP		0.6891		
Real Household Consumption		0.8799		
Turnover and Volume of Sales in Wholesale and Retail Trade	0.0162**	0.4162		
Retail Ifade	0.01			

Table 6 - Leading Characteristics Test Results

* p < 0.1, ** p < 0.05, *** p < 0.01

Source: Authors' calculations.

4 Conclusion

In this paper, we construct an EPU index for Malta, drawing on the methodology developed by Baker, Bloom, and Davis (2015). We do so to fill the gap in the literature concerning small states like Malta by providing a measure of economic policy uncertainty able to account for local events. By analysing articles from four Maltese news portals spanning from 2004 to 2022, we aim to capture the fluctuations in economic agents' level of uncertainty regarding economic policy and their impacts on the Maltese economy. This study contributes novel insights into the dynamics of economic policy uncertainty in a small, open economy and extends the application of EPU indices to the Maltese context, providing a valuable tool for researchers and policymakers.

The index shows pronounced spikes during events such as Malta's accession to the European Union, the 2011/2012 and the 2019 political crisis, and the COVID-19 pandemic. These findings, together with a bigram analysis aimed at identifying the most relevant keywords at each peak of our index, confirm that the EPU index captures both global and local sources of economic policy uncertainty. Additionally, our VARX model suggests that Malta's EPU index exhibits countercyclical properties. The IRFs from our VARX model indicate that real GDP and household consumption growth declined by 0.70% and 0.91% in the first quarter following a unit shock to our EPU index, respectively. Moreover, we confirm that our index captures locally relevant events by using a linear regression exercise to filter out global and European EPU. Lastly, the application of the Toda and Yamamoto (1995) approach indicated that our Maltese EPU index can serve as a leading indicator for real economy measures within a high-frequency context, with potential nowcasting applications for household consumption.

Several limitations need to be acknowledged. Our study does not include a fully exhaustive list of newspapers and news portals, which may limit the extent to which the index captures the full spectrum of economic policy uncertainty conveyed to the Maltese population. It is essential to continually review and update the criteria for selecting news portals to ensure that the index remains comprehensive and relevant. Additionally, the largest Maltese language news portals, owned by political parties, were excluded due to their significant bias. Research should aim to integrate unbiased Maltese language news portals when using textual analysis to enhance the representativeness of the data in a bilingual context.

Furthermore, the keyword list used in constructing the EPU index is not exhaustive. Future research should focus on refining and expanding the keyword selection process, potentially creating subindices for different areas of economic policy uncertainty, such as health, monetary policy, fiscal policy, and housing.

Finally, despite its widespread use, the methodology of Baker et al. (2015) has inherent limitations, including susceptibility to Type I and Type II errors due to the breadth of shortlisted keywords. Future research should explore advanced methods, such as text-embedding techniques, the use of different machine learning classifiers, and LDA-based methods, to improve the accuracy and predictive power of the EPU index.

Despite its limitations, our Maltese EPU index is a valuable tool for understanding the country's economic policy uncertainty. It provides real-time insights, aiding researchers and policymakers in immediate analysis and decision-making, as well as opening avenues for further research. Continuous improvements aim to maintain its relevance and effectiveness in capturing Malta's economic policy nuances.

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Appendix

1. Testing Different Specifications of EPU Terms

Our construction of the EPU index requires the creation of lists of words concerning the three categories 'Economic,' 'Policy' and 'Uncertainty.' We created the lists for these categories by looking through the current literature, such as Baker et al. (2015), Cerda et al. (2016), Tobback et al. (2018), and Andres-Escayola et al. (2022). We reviewed and adjusted the lists used in these papers by consulting local experts to better reflect the terminologies of the Maltese context. The full list of English-language keywords is available in Table 3.

Nevertheless, a prominent criticism of the methodology is that the list of uncertainty-related terms is not sufficiently exhaustive. To test the validity of this criticism for our index we collected the thesaurus terms by using the website <u>Thesaurus.com</u> and providing the search terms 'uncertain' and 'uncertainty' in the spirit of Tobback et al. (2018). Following this adjustment in the search terms, we recalculated the EPU index using the methodological steps described in section 2.2. The resultant index (Figure 10) shows muted deviations around the mean of the series. The thesaurus-enhanced index would imply that Malta only experienced a notable degree of economic policy uncertainty during its accession into the EU in 2004. This is contrary to apriori expectations of further events, such as the 2011/12 government crisis, having pronounced impacts on the formulation and execution of economic policy. Hence, this expanded set of uncertainty-related terms was not considered.





Source: Authors' calculation of EPU index using an expanded set of uncertainty terms.

Note: Y-axis shows EPU Index values, with higher values indicating greater economic policy uncertainty and lower values suggesting more stability. X-axis represents time in months.

Moreover, we translated the list of keywords in Table 3 to Maltese as shown in Table 7. This translated list was part of an exercise to check for potential political biases in the utilised news portals. In this exercise, we used news articles from partisan news outlets as the benchmark narrative of the two large political parties in Malta, whose articles are only available in Maltese. Separate indices for each of the two largest political parties, as of the date of publication, were created by using the articles from the respective partisan news outlets, the terms in Table 7 and the methodology described in section 2.2. The partisan indices exhibited erratic behaviours due to a low number of articles being flagged. This is because partisan outlets are likely to present events as part of a set narrative that benefits a political agenda. These indices showed little resemblance to the EPU index presented in this paper. This decreased concerns that the index is swayed by partisanship during politically charged periods.

Economic	Policy			Uncertainty
Ekonomiku/a	Politiku/a/i	Djun	Fiskali	Incert(i/a)
Ekonomiċi	Bank Ċentrali	Kastilja	Monetarju/a/i	Inċertezza/i
Ekonomija/i	ECB	Parlament	Leģislazzjoni(jiet)	Instabbli/à/a
Industrija/i	BCE	Gvern(ijiet)	Riforma/i	Instabbilitajiet
Industrijali	Taxxa/i	MP	Regola/i	+
Negozju/i	Tassazzjoni	Membru/i Parlamentari	Normi	Т
Kummerċ(jali)	Infiq	MEP	Normattiv	
	Baġit	Membru/i Parlament Ewropew	Regolament(i)	Kliem mit-
	Ministeru	Ministru/i	Liġi(jiet)	Teżawru għal 'Inċert' u
	Defiċit	Tariffa/i	Munita	'Inċertezza'
	Dejn	Rata/i Kambju		

Source: Authors' Maltese translation of EPU terms of each category.

2. COVID-19 and Malta's EPU Index

The COVID-19 pandemic was a disruptive period to the key economic variables referenced in this paper as it brought about pronounced uncertainty worldwide. However, not all this uncertainty was related to economic policy. Our index shows that the upward shift in the EPU index during the pandemic was not as large as other events, such as Malta's accession in the EU and the 2011/12 government crisis. Nevertheless, we sought to confirm that the pandemic had no considerable influence on the construction of the index due to changes in reporting behaviour or on the IRFs obtained from our VARX.

Concerning the former point Malta's EPU index was computed twice, once using the standard deviation of monthly article counts per news outlet of the full period, and the second using data till the year-end of 2019. As shown in Figure 11, the two indices approximately mirror each other, thus easing doubts that changes in reporting behaviour due to the pandemic affected the index. Thus, we decide to scale the index over the whole time series.





Source: Authors' calculations.

Note: Y-axis shows EPU Index values, with higher values indicating greater economic policy uncertainty and lower values suggesting more stability. X-axis represents time in months.

To assess for potential impacts on the IRFs from our VARX model, we augment the model with an additional exogenous variable which takes the form of a dummy where we flag the pandemic period. When comparing the IRFs of the growth rates of real GDP and household consumption after a one standard deviation shock in the EPU index from the original VARX model versus the pandemic dummy augmented model, we note that the behaviour of the response functions is largely unchanged. Hence, we determined that there was no significant impact on the shape of our IRFs due to the pandemic period. This robustness is partly interpreted by the fact that during the pandemic several activities were forced to closed down and supply issues due to domestic and foreign restrictions, respectively. Hence, contraction in activity were largely due to supply factors rather than demand factors that are typically impacted by uncertainty.

3. Topic Outcomes from Latent Dirichlet Allocation Analysis

Table 8 presents the top 8 topics produced by a LDA analysis conducted on non-flagged articles.

Topic 1	project, case, accused, found, number, given, gozo, man, first, police
Topic 2	reported, old, home, environment, police, mr, man, publications, hill, birkirkara
Topic 3	number, around, case, given, first, time, people, man, public, work, old, court, dr, government, police
Topic 4	housekeeper, officers, visitation, sorrowful, pathologist, psychotherapists, penal, plunging, tribunal, help, exposition, speculating
Topic 5	irresponsibility, traits, manipulation, healed, albums, ailments, anonymity, barren, echo, apologise, queuing, laughed, preoccupation, donates, perseverance, enriching
Topic 6	political, case, mepa, report, development, may, prime, told, gonzi, general, people, european, first, news, eu, public, time, labour, party, government
Topic 7	skips, bout, robes, gripped, hotter, hovering, edifices, divides, distracted, relays, carelessly, beware, sculptors, backyard
Topic 8	online, registered, house, office, ltd, government, standard, part, statement, found

Table 8: Topic Outcomes from Latent Dirichlet Allocation Analysis

Source: Authors' calculations.

4. Correlation Checks

Before conducting the tests described in the third section of the paper we conducted correlation-based tests to obtain some indications on the behaviour of our index. We use correlation-based observations as follows:

- a. To test for negative correlations between our EPU index and real economy measures to check for the potential of countercyclical properties. Table 9 shows that the index is negatively correlated with the growth rates of real GDP and household consumption, and the Central Bank of Malta's BCI.
- b. To assess the direction of the relationship between economic sentiment and Malta's EPU index. As a measure of economic sentiment, we use the ESI. The negative correlation shown in Table 9 was one of

the factors we used to decide on the inclusion of ESI into our VARX model. This is because it provided a further indication that part of the impact of economic policy uncertainty on the real economy is potentially due to uncertainty's impact on economic sentiment.

c. To check for positive correlations with other measures of economic uncertainty. This was done for two categories of uncertainty measures: (1) variables for economic uncertainty, and (2) economic policy uncertainty indicators of other countries. All these measures had a positive correlation with our EPU index as shown in Table 9.

Economic Activity			
Real GDP Growth	-0.258	**	
	(-0.457	0.0347)	
BCI	-0.180	0.011)	
Household Consumption	-0.340	-0.011) 7*	
Growth	(-0.382	, -0.017)	
Other Uncertainty Mea	sures	0.017)	
	0.222*	***	
VIX	(0.054	0.377)	
VETOVV	0.278*	***	
VSIOXX	(0.113	0.428)	
Maltasa EUI	0.35	1	
Manese EOI	(-0.032	0.645)	
EU EUI	0.419*	***	
20 201	(0.049	0.688)	
EA EUI	0.450	**	
	(0.088	0.708)	
Business Dialogue Survey	0.013	0 000	
EDI	(0.042	0.882)	
El O	0.480*	***	
Global	(0 337	0.601)	
	0.515*	***	
Europe	(0.379	0.630)	
C	0.359*	***	
Germany	(0.202	0.499)	
Italy	0.510*	***	
italy	(0.373	0.626)	
UK	0.367*	***	
	(0.210	0.506)	
France	0.485*	(** 0 (05)	
	(0.343	0.605)	
Spain	(0.427)	0.557)	
	0 492*	***	
US	(0.351	0.611)	
Economic Sentimer	nt		
ESI	-0.223	**	
LOI	(-0.343	-0.096)	

Table 9: EPU Index Correlation Checks

* p < 0.1, ** p < 0.05, *** p < 0.01

Source: Calculated Pearson correlations of listed variables with the Maltese EPU index and confidence intervals calculated using Fisher's Z-transformation (Cohen et al., 2003).

5. Stationarity of the EPU Index

The Maltese EPU index estimated using the methodology of Baker et al. (2015) has a unit root when aggregating to a quarterly frequency, according to the ADF test at the 5% significance level. When taking a deeper look at the drivers of this non-stationarity we observed a trend in the index which became more pronounced when reducing the number of observations through quarterly aggregation. Figure 12 shows the trend of the Maltese EPU index as determined by an HP filter with the lambda parameter being set using the Ravn-Uhlig (2002) frequency rule for quarterly data.



Figure 12 - Trend Component of the EPU Index as Determined by an HP Filter

Source: Extracted trend component using HP filter with lambda parameter set for quarterly values using Ravn-Uhlig (2002) frequency rule.

With data from online news portals, we expect an upward trend over time due to increased use of internet sources between 2004 and 2022, but this does not solely explain the upward shifts and dips shown in Figure 12. When we scrutinised the amount and types of published articles, we determined that the main driver of the trend component of the index is industry dynamics.

For the three long-established newspapers in our sample (Times of Malta, Malta Independent, and Malta Today) we first note that between 2004 and 2007 only the digital versions of the articles published in weekly and bi-weekly newspapers were available on the outlets' respective online web pages. Since 2008 we observe an increase in the frequency of published news articles and a start in online content around 2010. This marks the first upward trend in Figure 12. In the following years, a downturn occurs between 2014 and 2016. This dip in the trend coincides with a period of increased competition in the local online content market due to new entrants. This pushed the portals of the long-standing outlets to diversify their breadth of content to gain back readers. Following this period, we see a restoration of the upward trend due to widely increased reporting across topics.

6. Comparing Malta's EPU Index with International Indices

In this section, we present additional charts that provide a detailed comparison of Malta's Economic Policy Uncertainty (EPU) index with those of specific countries. These comparisons offer further insights into how Malta's EPU index aligns with or diverges from the EPU trends in these countries.





Figure 14- Malta vs UK EPU Index



Figure 15 – Malta vs Italy EPU Index











Figure 18 – Malta vs Spain EPU Index



Source: Authors' Calculations, https://www.policyuncertainty.com/.

Note: Y-axis shows EPU Index values, with higher values indicating greater economic policy uncertainty and lower values suggesting more stability. X-axis represents time in months.