On the Measurement of Economic Uncertainty: I3E Index and Its Alternatives

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Abstract

The quantification of economic uncertainty has garnered significant scholarly interest over the past decade. A range of alternative uncertainty measures has emerged in the literature, each characterized by distinct methodological approaches and scope of applicability. Among the most recent contributions is the I3E Index of Economic Uncertainty. We assess the validity of the I3E index as a proxy for economic uncertainty. Furthermore, we benchmark its performance against three of the most widely utilized measures of economic uncertainty in academic research: the World Uncertainty Index (WUI), the Volatility Index (VIX), and the Economic Policy Uncertainty Index (EPU).

Keywords: Economic uncertainty; Economic index; I3E.

Uncertainty does not work in the way often supposed, namely the chance that something bad will happen. Instead, it reflects variance in future outcomes.

1. Introduction

Uncertainty permeates economic activity at all levels, shaping decisions under conditions of incomplete information. Economic uncertainty significantly influences investment decisions, consumer behavior, and policy-making worldwide.

Approximately one in every 3,000 words in economic reports corresponds to the term "uncertainty" or closely related variants such as "risk" (Ahir et al., 2022). Events such as the 2008 financial crisis, Brexit, and the COVID-19 pandemic have highlighted the relevance of accurately measuring economic uncertainty.

Uncertainty may not be directly observable, but it can be proxied through measurable indicators. A number of uncertainty indices and empirical approaches have emerged in the last years, each tailored to specific data sources, country coverage, or theoretical underpinnings. They can be roughly classified as (1) text-based indices, (2) volatility indices and (3) cross-sectional dispersion indices.

Text-based indices analyze the frequency of words related to uncertainty within a large corpus of text, such as newspapers, policy documents, financial reports or social media. These indices aim to quantify economic uncertainty based on the idea that the more economic agents talk about uncertainty, the more uncertain the environment is. Examples include the World Uncertainty Index (WUI) (Ahir et al., 2022), Economic Policy Uncertainty (EPU) (Baker et al., 2016), Geopolitical Risk Index (Caldara & Iacoviello, 2021) and the web-search measure EURQ (Bontempi et al., 2021).

Volatility-based indices are built typically using the annual, quarterly, monthly, daily or even real-time variability of a number of key economic and financial variables (Bloom, 2009; Fernández-Villaverde et al., 2011; Jurado et al., 2015; Leahy & Whited, 1996; Lensink et al., 1999; Ludvigson et al., 2021). These indices may use normal statistical variance, the variance of the unpredictable part of a stochastic process, the conditional variance estimated from General AutoRegressive Conditional Heteroskedastic (GARCH) models or variance estimates from the geometric Brownian motion.

The I3E (Ariño & Garcia-Castro, 2025) is a general volatility-based index providing

a measure of economic uncertainty using the daily volatility of four macroeconomic indicators available for most developed countries. The I3E is published daily since 1990 for most developed countries, making it a useful tool for historical and comparative studies of economic uncertainty.

Some volatility indexes measure anticipated or expected economic uncertainty. For instance, the VIX measures the *expected* 30-day volatility implied by stock index option prices like the S&P500. The VIX is published by the Chicago Board Options Exchange (CBOE) since 1990 and is one of the most frequently used measures of financial uncertainty (Whaley, 1993, 2009).

Cross-sectional dispersion indices seek to capture uncertainty by measuring the level of disagreement among forecasters, managers and other economic agents regarding sales, profits, consumption, and other related economic variables (Altig et al., 2020; Bachmann & Bayer, 2013). These type of indices use survey data and tend to be more idiosyncratic of a particular country, sector or firm – or time period – making the comparison across countries or time less straightforward. For this reason, the focus of this article will be on text-based and volatility indices.

The remaining of the paper is organized as follows. Section 2 reviews the most often used measures of economic uncertainty, their methodologies, and data used for its construction. Section 3 compares the evolution of the indices over the last decades and compares their applicability across different scenarios. Finally, section 4 offers some concluding remarks.

2. Measures of Uncertainty

Table 1 summarizes some commonly used metrics of economic uncertainty used in empirical studies.

2.1 World Uncertainty Index (WUI)

The WUI has emerged as one of the most often used uncertainty metric in the last years (Ahir et al., 2022). It uses the frequency of the term "uncertainty" (and its variants) in country-specific reports produced quarterly by the Economist Intelligence Unit (EIU).

Specifically, the index is computed as follows:

$$\text{WUI}_t = \left(\frac{\text{Number of mentions of uncertainty and related terms}}{\text{Total number of words in the report}} \right) \times 1,000 \qquad (1)$$

Thus, it measures the occurrence of the term "uncertainty" per thousand words, providing a normalized indicator suitable for cross-country comparisons. The WUI is available quarterly for 143 countries, extending back as far as 1952. The WUI is also available monthly for 71 countries from 2008 to the present.

WUI data and full methodology can be obtained from https://worlduncertaintyindex.com.

2.2 Economic Policy Uncertainty (EPU)

The EPU is another text-based index based on the frequency of a trio of terms related to the economy (E), policy (P) and uncertainty (U) in a selection of national newspapers (Baker et al., 2016). For instance, to compute the EPU index for the United States the following 10 leading newspapers are used: USA Today, the Miami Herald, the Chicago Tribune, the Washington Post, the Los Angeles Times, the Boston Globe, the San Francisco Chronicle, the Dallas Morning News, the Houston Chronicle, and the WSJ.

For each newspaper, it counts the term 'uncertainty' or 'uncertain', the terms 'economic' or 'economy' and one or more of the following policy terms: 'congress', 'legislation', 'white house', 'regulation', 'federal reserve', or 'deficit'. Then the raw count of policy uncertainty articles are divided by the total number of articles in the same paper and month. The resulting series for each paper are then normalized to have a unit standard deviation from January 1985 through December 2009. Next, all normalized values over papers in each month are summed to obtain a multi-paper index. Finally, the multi-paper index is re-normalized to an average value of 101.8 from January 1985 through December 2009.

The same methodology is followed in other advanced economies to produce national EPU indices using the leading newspapers in each country. EPU data and methods as well as the list of countries being covered are available here https://www.policyuncertainty.com/index.html.

2.3 CBOE Volatility Index (VIX)

The VIX is a forward looking measure of financial uncertainty. It measures volatility investors expect to see (Whaley, 1993, 2009). The value of the VIX is implied by the current prices of options on the S&P 500 Index and represents expected future stock market volatility over the next 30 calendar days, annualized.

The VIX is calculated in real time by the Chicago Board Options Exchange (CBOE) using a wide range of SPX options. It is constructed using the prices of a portfolio of out-of-the-money (OTM) SPX call and put options. Rather than assuming a specific model of volatility (e.g., GARCH or Black-Scholes implied volatility), the VIX reflects the full risk-neutral distribution as inferred from option prices.

The VIX is computed using the following formula:

$$\sigma^2 = \frac{2}{T}\sum_i \frac{\Delta K_i}{K_i^2} e^{RT} Q(K_i) - \frac{1}{T}\left(\frac{F}{K_0} - 1\right)^2 \tag{2}$$

$$\text{VIX} = 100 \times \sqrt{\sigma^2} \tag{3}$$

where σ^2 is the 30-day variance, and the terms are defined as follows:

- T is the time to expiration in years (i.e., number of calendar days to expiration divided by 365).
- K_i is the strike price of the i-th out-of-the-money option.
- ΔK_i is the interval between strike prices: $\Delta K_i = \frac{K_{i+1} - K_{i-1}}{2}$.
- $Q(K_i)$ is the average of the bid and ask prices of the OTM option with strike K_i.
- R is the risk-free interest rate corresponding to the time to expiration.
- F is the forward price of the S&P 500 index, computed from put-call parity using the near-the-money options.
- K_0 is the strike price closest to F (the forward price).

The VIX calculation uses a weighted average of two SPX options series with maturities that bracket the 30-day horizon. Specifically, CBOE uses:

- Near-term SPX options (with 23 to 37 days to expiration).
- Next-term SPX options (also within the 23 to 37-day window).

These are interpolated to obtain a 30-day constant maturity estimate of expected volatility. The final VIX value is quoted as an annualized standard deviation in percentage points (e.g., a VIX of 20 implies a 20% annualized implied volatility).

A higher VIX indicates that investors expect greater volatility in the near term, often due to macroeconomic uncertainty, geopolitical risk, or earnings announcements. Conversely, a low VIX suggests market complacency or confidence. The index is widely used in risk management, trading strategies, and as an input into derivative pricing models.

2.4 Economic Uncertainty Index (I3E)

The I3E is constructed using the daily closing prices of four financial variables for each of the countries covered: stock index price, 10-year government bond yields, exchange rate, international Brent crude oil price.

Daily growth rates (or returns) of these four economic-financial series $x_i(t)$ are calculated as:

$$y_i(t) = \frac{x_i(t) - x_i(t-1)}{x_i(t-1)}, \quad \text{for } i = 1, 2, 3, 4$$

Next, the volatility of each series is calculated using exponential smoothing (alpha = 0.05) of the squared returns $y_1(t), y_2(t), y_3(t), y_4(t)$:

$$z_i(t) \quad \text{for } i = 1, 2, 3, 4$$

This is the method followed by J.P. Morgan (Riskmetrics) to compute volatility (J.P. Morgan/Reuters, 1996).

Since the resulting series are right-skewed, their natural logarithms are taken. We define:

$$w_i(t) = \log(z_i(t))$$

for i = 1, 2, 3, 4

For the normalization, let μ_i and σ_i be the mean and standard deviation of $w_i(t)$ over

the period 2014-2024. The standardized values are:

$$s_i(t) = \frac{w_i(t) - \mu_i}{\sigma_i}$$

The composite standardized series is:

$$S(t) = \sum_{i=1}^{4} \frac{w_i(t) - \mu_i}{\sigma_i}$$

Its standard deviation σ is:

$$\sigma = \sqrt{4 + 2\sum_{i<j} \rho_{ij}}$$

where ρ_{ij} is the correlation between $w_i(t)$ and $w_j(t)$.

The I3E uncertainty index for a country at time t is then defined as:

$$I(t) = 100 + \frac{25}{\sigma} \sum_{i=1}^{4} \frac{w_i(t) - \mu_i}{\sigma_i}$$

The index will typically fluctuate between 0 and 200 — although it may exceed these bounds under extreme circumstances.

Using the above formula the I3E for each country can be computed using daily data for the four financial variables. Information about the index daily values and historical data can be downloaded from I3E Index.[1]

The I3E Global is simply a weighted sum of all available national indexes. Let $I3E_i(t)$ be the value of the index for country i at time t, then the I3E global is computed as:

$$I3E_{global}(t) = \frac{\sum_{i=1}^{n} w_i \times I3E_i(t)}{\sum_{i=1}^{n} w_i}$$

where n is the number of countries and w_i is the nominal GDP in US dollars of country i.

Figure 1 shows the evolution of the I3E Global from 2014 to 2025 using the 22 largest economies where the required data is readily available: *Australia, Austria, Belgium, Brazil, Canada, China, Egypt, France, Germany, Greece, Israel, Italy, Japan, Mexico, Netherlands, Poland, South Africa, South Korea, Spain, Turkey, UK, USA*.

[1] Additional information about the I3E Spain: https://blog.iese.edu/icdm/que-es-el-i3e/

3. Comparative Analysis

We compare now the I3E, WUI and WIX. Although all three aim to quantify uncertainty, their construction and applicability vary, making them better suited to different contexts and research questions.

The WUI is derived from text-based analysis of country reports produced by the Economist Intelligence Unit, making it well suited for cross-country comparisons and long-run analyses. Its broad coverage across economies and over time provides a unique perspective on global and national policy uncertainty. However, its reliance on qualitative assessments limits its frequency (monthly or quarterly updates) and responsiveness to fast-moving events. As a result, the WUI is most applicable in scenarios where researchers seek to study structural or persistent sources of uncertainty, such as the long-term effects of political transitions, trade disputes, or global crises.

By contrast, the VIX, often labeled the "fear index," is derived from option-implied volatility in U.S. equity markets. It provides real-time, high-frequency information on financial market sentiment and is particularly sensitive to sudden shocks. Its main applicability is in scenarios characterized by acute episodes of stress—such as the 2008 global financial crisis or the COVID-19 pandemic—where market expectations about risk and volatility shift rapidly. However, its narrow focus on U.S. equity markets makes it less suitable as a proxy for global or structural uncertainty, especially in cross-country analyses.

Finally, the I3E index—which focuses on financial and economic uncertainty indicators—is more responsive than the WUI and captures daily fluctuations in real economic conditions. It is particularly useful when studying the interaction between uncertainty and macroeconomic variables such as global investment, consumption, or financial markets. Because of its construction, the I3E allows researchers to bridge the gap between qualitative long-run perspectives (as in the WUI) and high-frequency market data (as in the VIX). Its main strength lies in contexts where both geoeconomic factors and financial market signals matter, such as during economic slowdowns or recovery phases.

Figure 2 presents a comparison of the standardized values of the I3E, WUI, and VIX indices. All three measures exhibit pronounced responses to major economic shocks, such

as the Great Recession and the COVID-19 pandemic, underscoring their sensitivity to episodes of heightened uncertainty.

The VIX and the I3E follow similar paths, although the VIX tends to have a higher floor during periods of low uncertainty compared to the I3E. In times of heightened uncertainty, like in 2008 and 2020, the VIX rises to a higher ceiling than the I3E and the WUI. Throughout the analyzed period, the WUI exhibits less pronounced peaks and troughs than those observed in the I3E and VIX.

There are periods—such as 1996, 2014, and 2015—where the trajectories of the three indices diverge notably. These episodes of decoupling suggest that the indices may be capturing different dimensions or sources of economic uncertainty. An investigation of the underlying factors contributing to such divergences would be a valuable avenue for future research.

4. Conclusion

This paper presents a brief examination of economic uncertainty measurement, including the recently developed and relatively less known I3E Index. Drawing on a review of leading uncertainty metrics such as the World Uncertainty Index (WUI), the Volatility Index (VIX), and the Economic Policy Uncertainty (EPU) Index, the study situates the I3E as an alternative volatility-based index that synthesizes daily data from four key financial indicators: domestic stock index prices, government bond prices, exchange rates, and international oil prices. The I3E offers extensive country coverage and a daily frequency since 1990, providing a tool for researchers interested in comparative or historical analyses of economic uncertainty.

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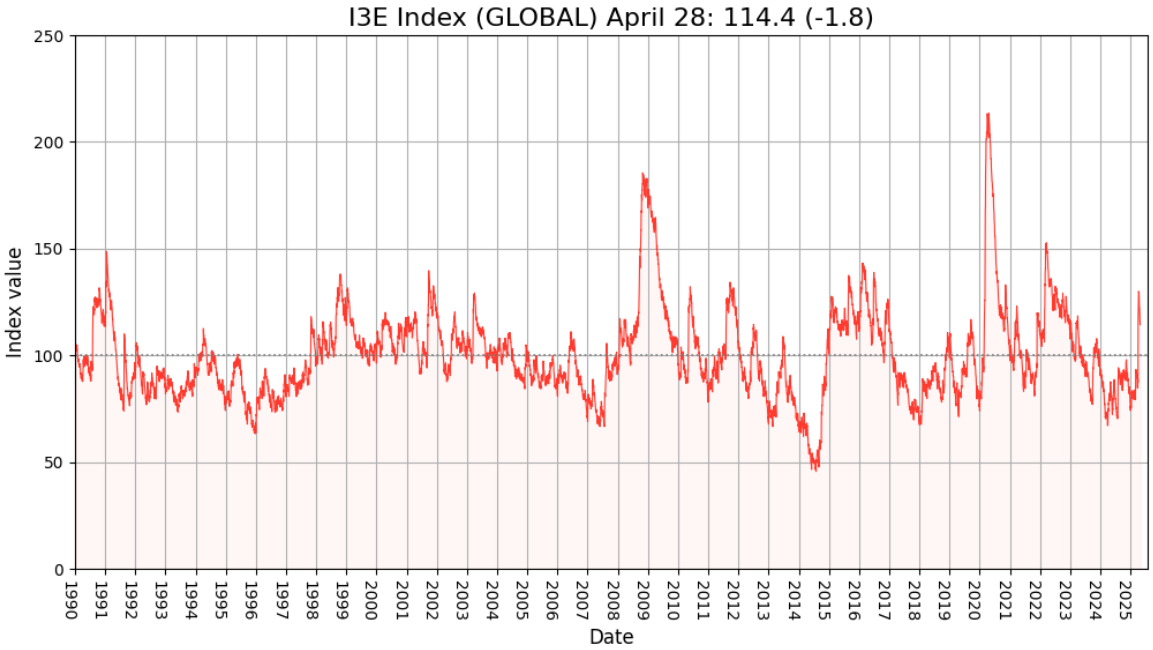

Figure 1: I3E global index

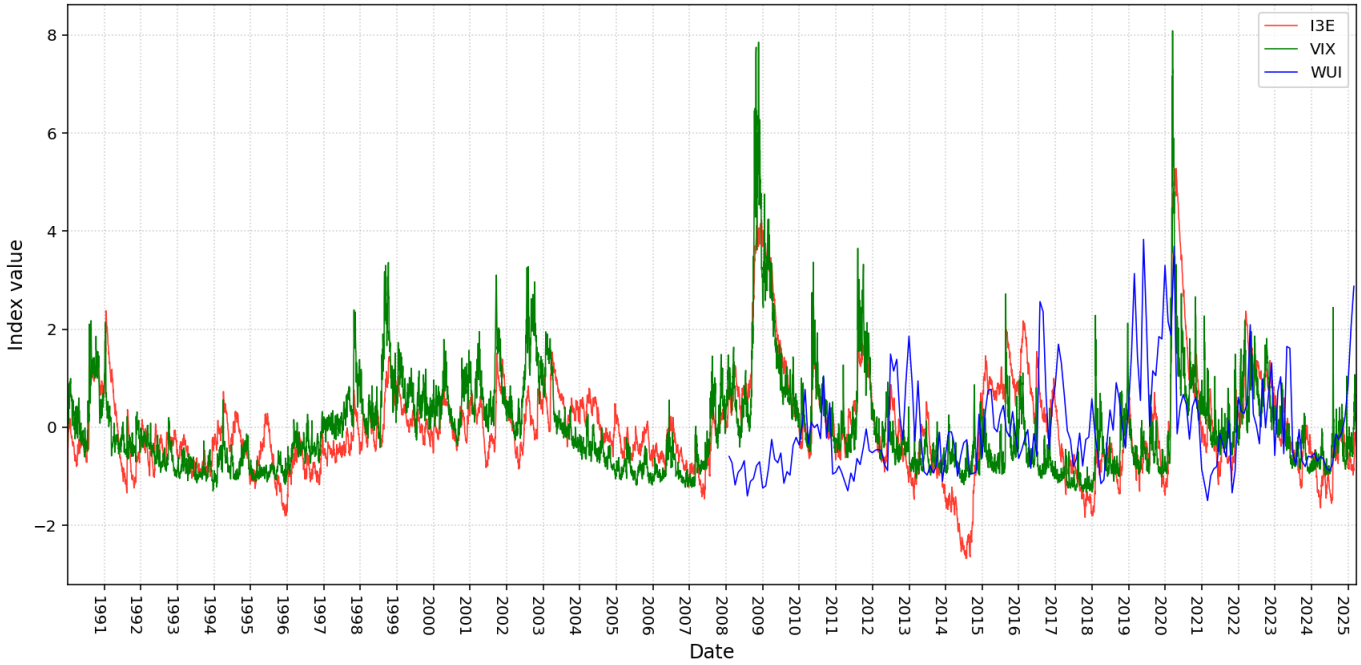

Figure 2: I3E, WUI and VIX

Table 1: Common Economic Uncertainty Metrics

Metric	**Description**	**Reference**
Economic Policy Uncertainty (EPU)	uncertainty keywords in newspapers	Baker et al. (2016)
Volatility Index (VIX)	Implied volatility S&P 500 options	Whaley (1993)
Conditional Volatility (GARCH)	Time-varying volatility GARCH models	Bollerslev (1986)
World Uncertainty Index (WUI)	Frequency of uncertain EIU reports	Ahir et al. (2018)
Forecaster Disagreement	Dispersion among professional forecasts	Bomberger (1996)
Stock Market Realized Volatility	Historical volatility using high-frequency stock returns	Andersen et al. (2003)
Survey-based measures	Uncertainty measures from firm or household surveys	Bachmann et al. (2013)
Macroeconomic Forecast Error	Deviation of outcomes from economic forecasts	Jurado et al. (2015)