I3E Economic Uncertainty Index

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Working Paper

19th May 2025

Abstract

We outline the methodology employed in the construction of national and global I3E Economic Uncertainty Indexes. The I3E is a composite indicator designed to quantify the level of economic uncertainty across countries by synthesizing information from four key financial market variables: equity index prices, 10-year government bond prices, exchange rates, and Brent crude oil prices. Each national I3E index aggregates these variables into a single synthetic measure of uncertainty specific to a country's macro-financial environment. The I3E global index is then derived as a GDP-weighted average of the national indexes.

Keywords: Economic uncertainty; Economic index; I3E.

1. Measuring Economic Uncertainty

Economic uncertainty plays a critical role in macroeconomic outcomes, influencing growth, investment, and policy responses. The measurement of economic uncertainty is pivotal for understanding its macroeconomic effects. 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).

Uncertainty can be measured. 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. These include text-based indices such as the World Uncertainty Index (WUI) (Ahir et al., 2022) and Economic Policy Uncertainty (EPU) (Baker et al., 2016), and statistical measures of variance (Lensink et al., 1999), often derived from autoregressive models or GARCH frameworks.

Volatility indexes like the VIX measuring the expected 30-day volatility implied by stock index option prices like the S&P500 and published by the Chicago Board Options Exchange (CBOE) since 1990 are also frequently used as a measure of financial uncertainty (Whaley, 2009).

We introduce the I3E Economic Uncertainty Index as an alternative index designed to measure uncertainty. A key advantage of the I3E lies in its ability to be computed efficiently on a daily basis using publicly available financial data available in most developed economies. This reliance on widely accessible and comparable inputs facilitates consistent cross-country analysis of economic uncertainty. The index is designed to have an average of 100 and its values are theoretically bounded between 0 and 200, thereby enabling meaningful comparisons over time and across national economies.

2. I3E Economic Uncertainty Index

The I3E is constructed using the daily closing prices of four financial variables for each of the countries covered:

- Domestic stock index price
- Domestic 10-year government bond price

- Domestic exchange rate
- Brent Spot Price FOB

The specific names of the time-series used for each country are shown in Table 1. Europe Brent Spot Price Free on Board (Dollars Per Barrel) Daily was used for all countries.

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 1990-2024. 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:

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

During the reference period, the standard deviation (σ) for each country ranged between 2 and 3. Under these parameters, the resulting index is normalized to have an average value of 100 and standard deviation of 25. 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 (Figure 1). Information about the index daily values and historical data can be downloaded from I3E Index.[1]

3. Global I3E

The I3E Global is 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 2 shows the evolution of the I3E Global Weighted from 1990 to 2025 for 22 large 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*. These countries, together, roughly represent 80% of the global GDP.

Over the past four decades, the I3E has exhibited notable spikes in response to major global events, including Gulf War I, the dot.com crisis, the 9/11 terrorist attacks, the downfall of Lehman Brothers, the Eurozone debt crisis, UK's Brexit, the 2016 U.S. presidential election, U.S - China trade wars, the COVID-19 pandemic and the invasion of Ukraine by Russia.

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

In addition to the GDP-weighted global I3E, we also daily publish the global I3E simply as the average I3E of all countries.

Figure 3 compares the I3E of the 22 countries and the global I3E (GDP weighted). The global I3E and the I3E for USA, China, Germany and Japan are highlighted. The I3E index for the other 18 countries are shown in different shades of grey in the background. Uncertainty spikes tend to be more synchronized within advanced economies and between economies with strong financial and trade links. Thus, pairwise correlations are generally high between countries like USA and France (correlation = 0.94) but much lower between USA and China (correlation = 0.4). These differences may point to persistent differences in how uncertainty generates and spreads internationally. This warrants further investigation in future research.

4. Conclusion

The I3E Index offers a practical, data-driven, and internationally comparable measure of economic uncertainty, leveraging publicly available financial market data. Its simplicity and adaptability make it a valuable tool for policymakers, researchers, and investors interested in understanding the dynamics of economic uncertainty across countries. The variation in correlation across countries (e.g., USA-China vs. USA-France) underscores the asymmetric nature of uncertainty transmission, pointing to avenues for future research.

Future research will address a number of questions related to the I3E such as how uncertainty is interconnected between countries, the relationship between I3E and other uncertainty metrics such as VIX or WUI, or the relationship between uncertainty and GDP growth in the global economy.

References

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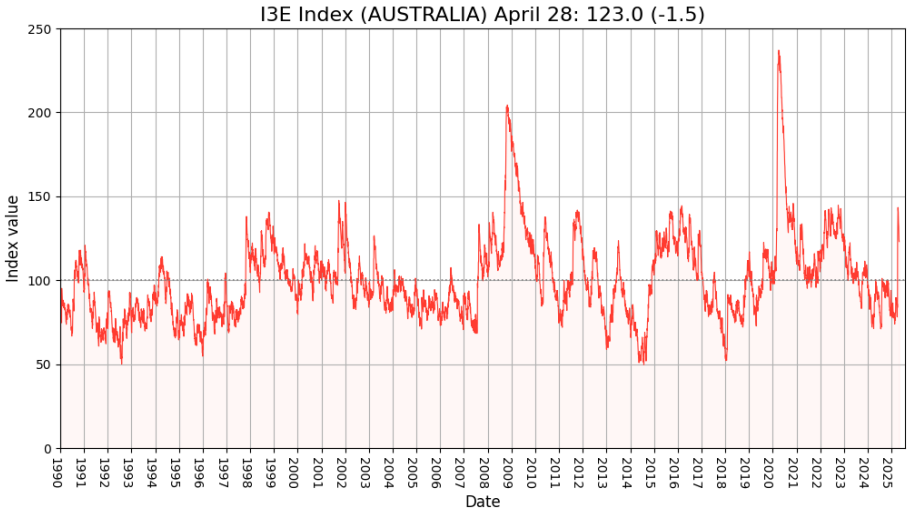
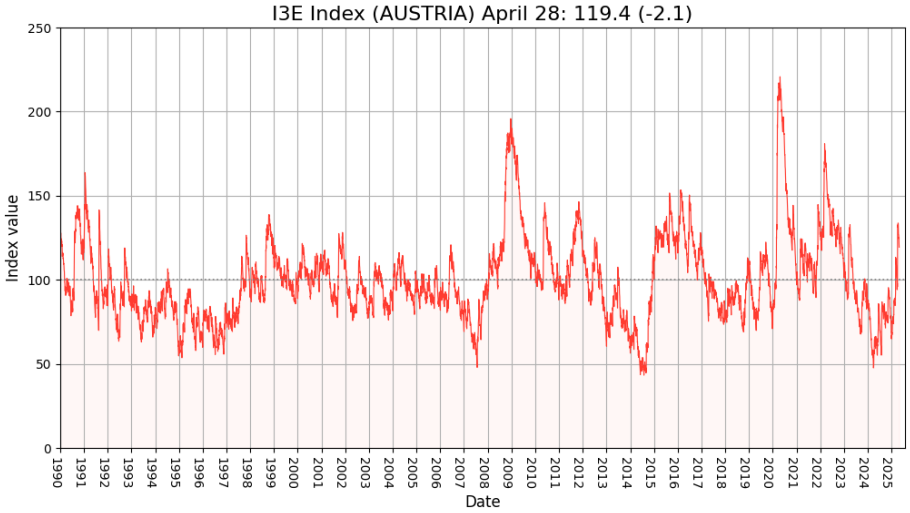


AUSTRALIA



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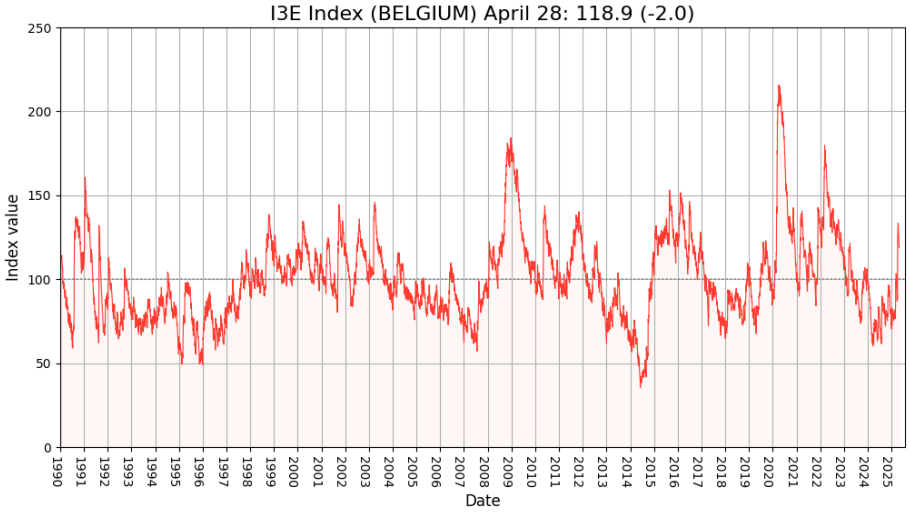
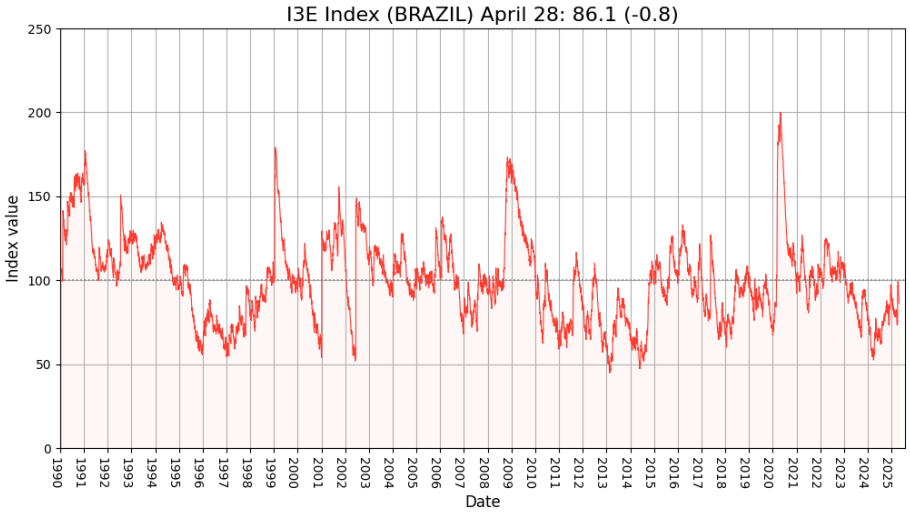
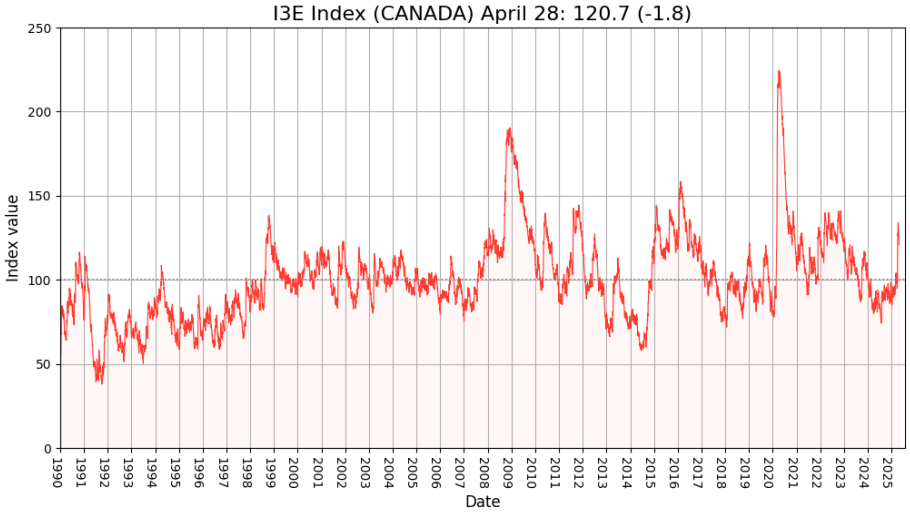


BELGIUM

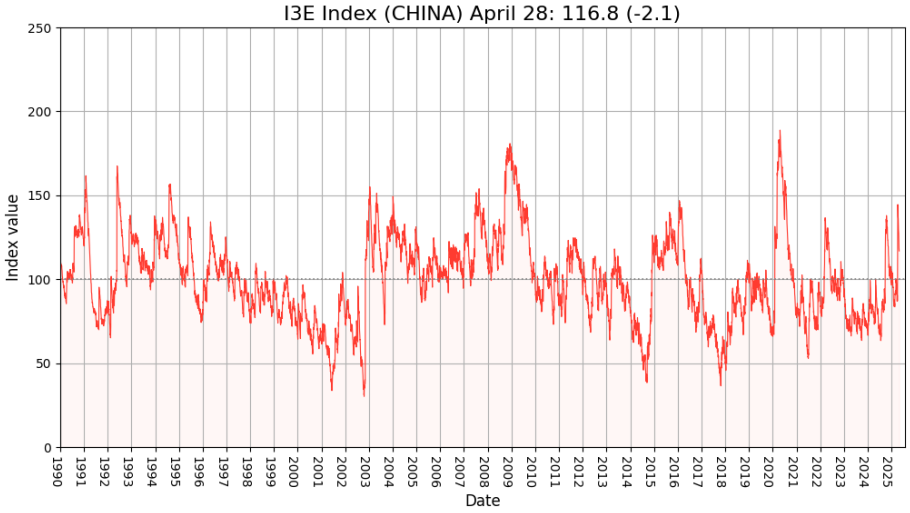
Figure 1: I3E country plots (AUSTRALIA to BELGIUM)



BRAZIL

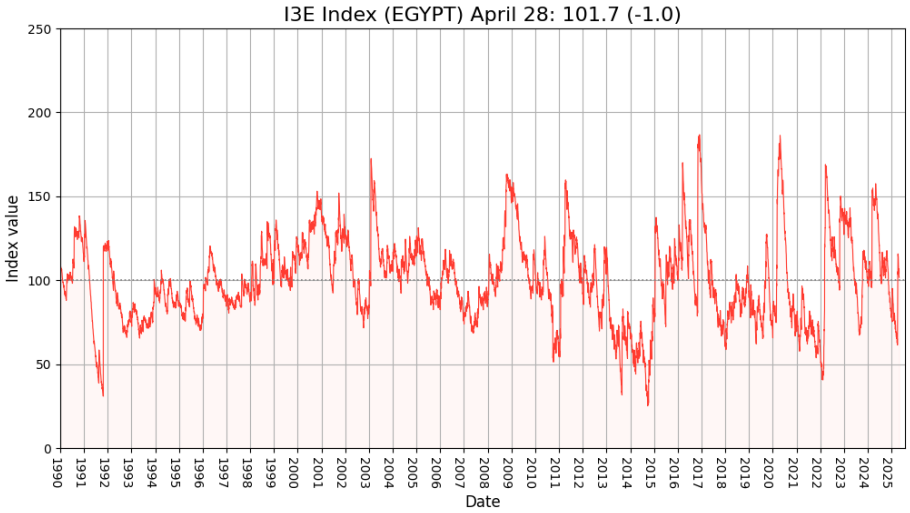


CANADA

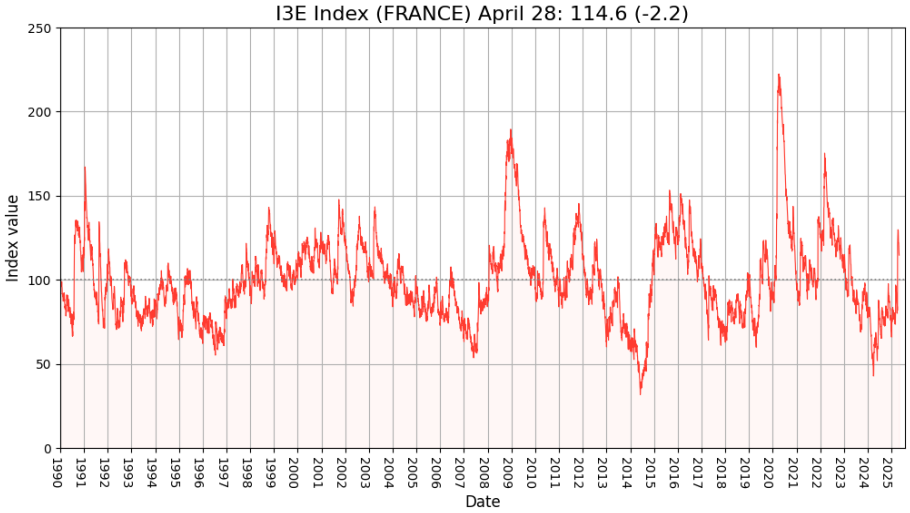


CHINA

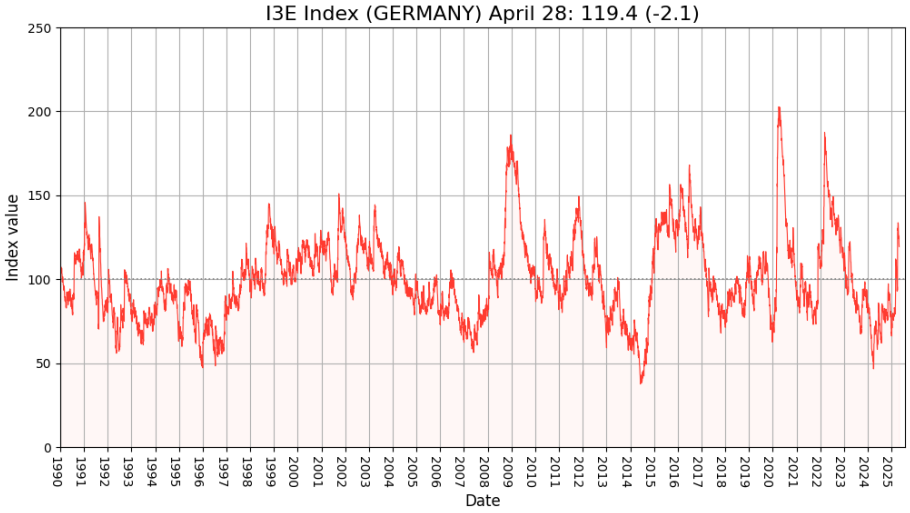
Figure 1: **(continued)** I3E country plots (BRAZIL to CHINA)



EGYPT

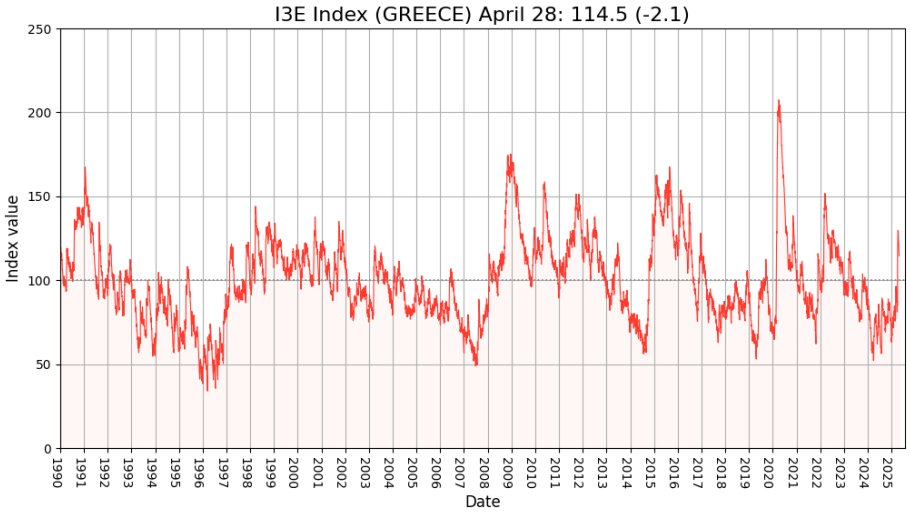


FRANCE

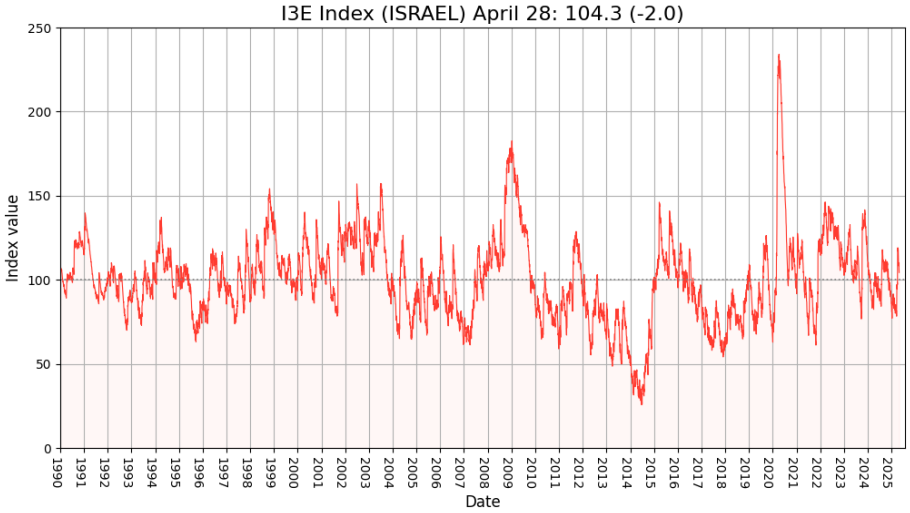


GERMANY

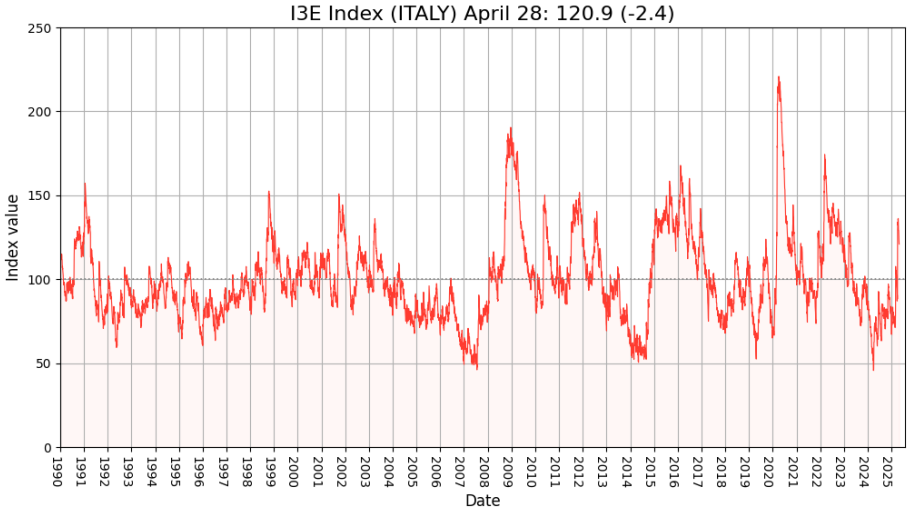
Figure 1: **(continued)** I3E country plots (EGYPT to GERMANY)



GREECE

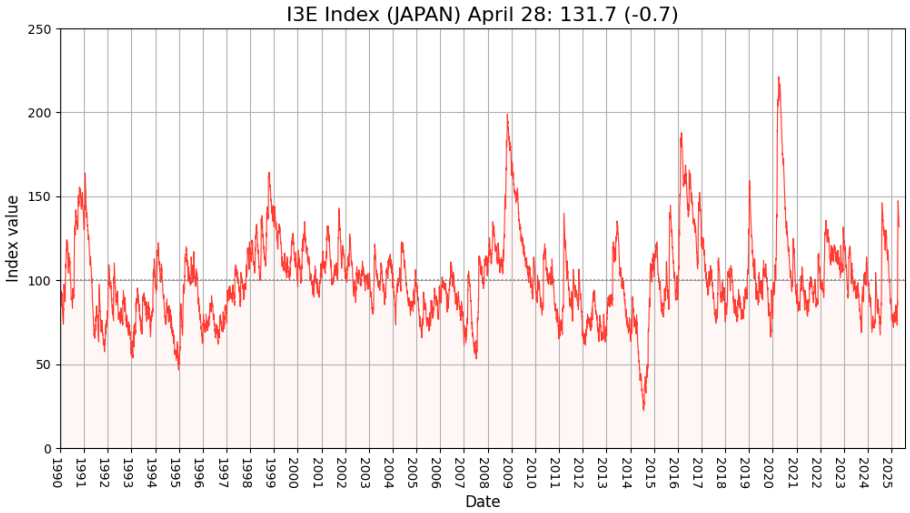


ISRAEL

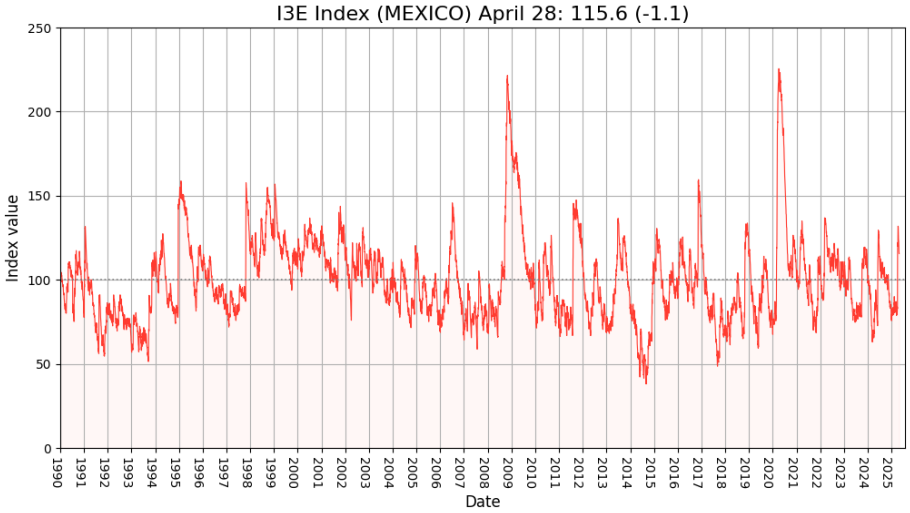


ITALY

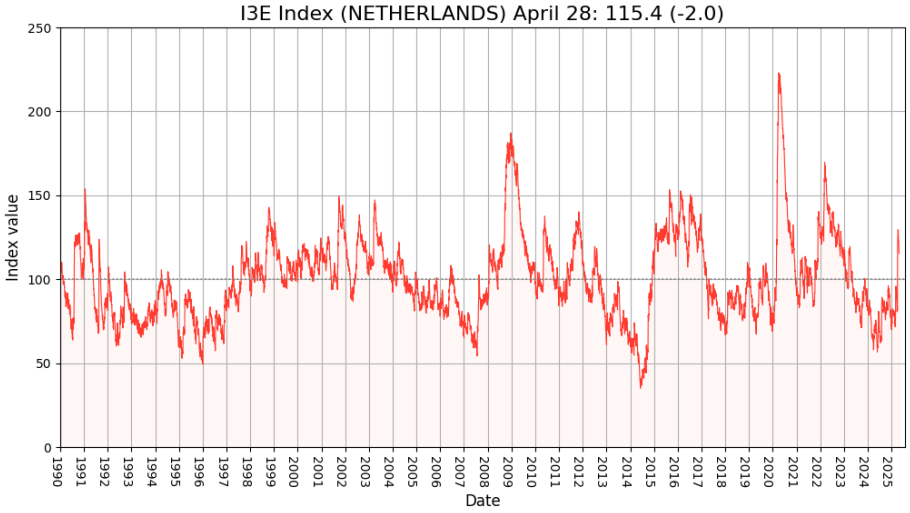
Figure 1: **(continued)** I3E country plots (GREECE to ITALY)



JAPAN

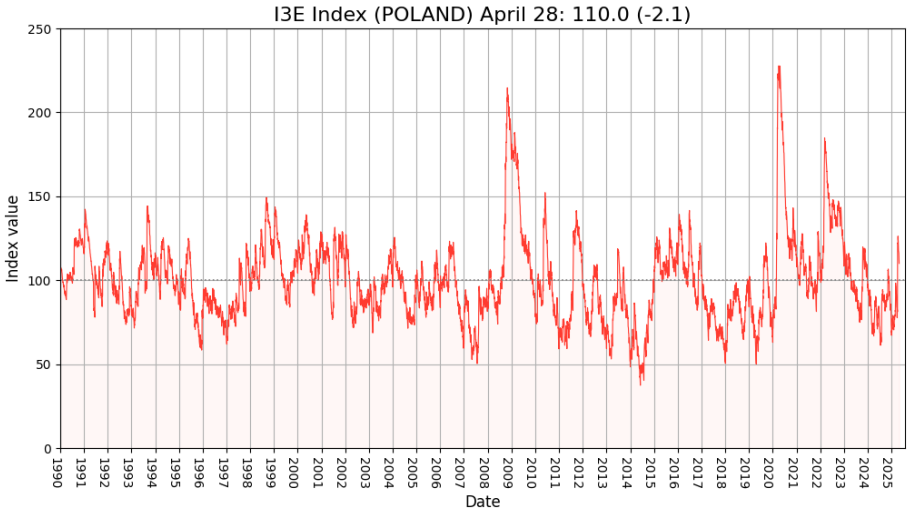


MEXICO

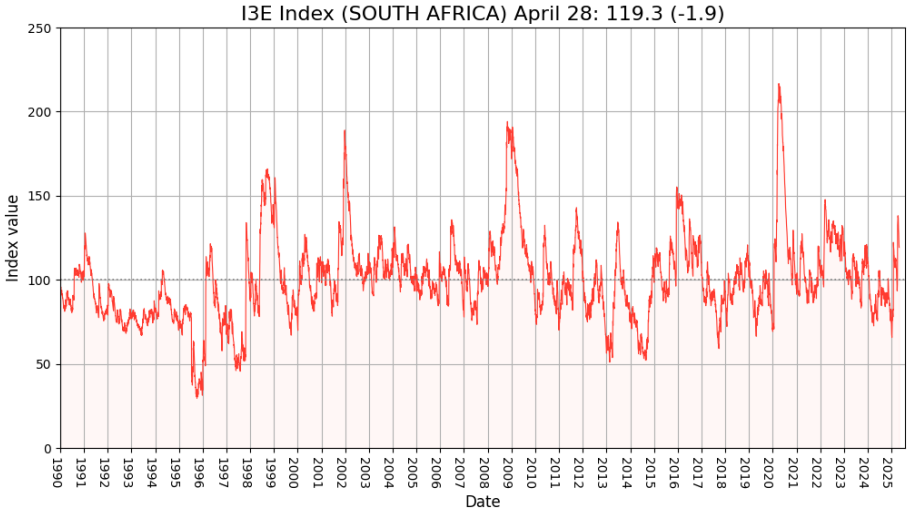


NETHERLANDS

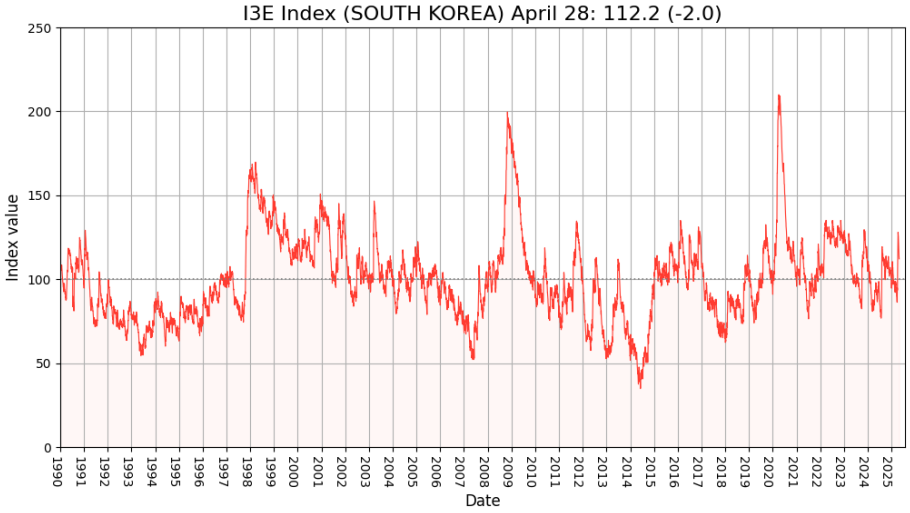
Figure 1: **(continued)** I3E country plots (JAPAN to NETHERLANDS)



POLAND

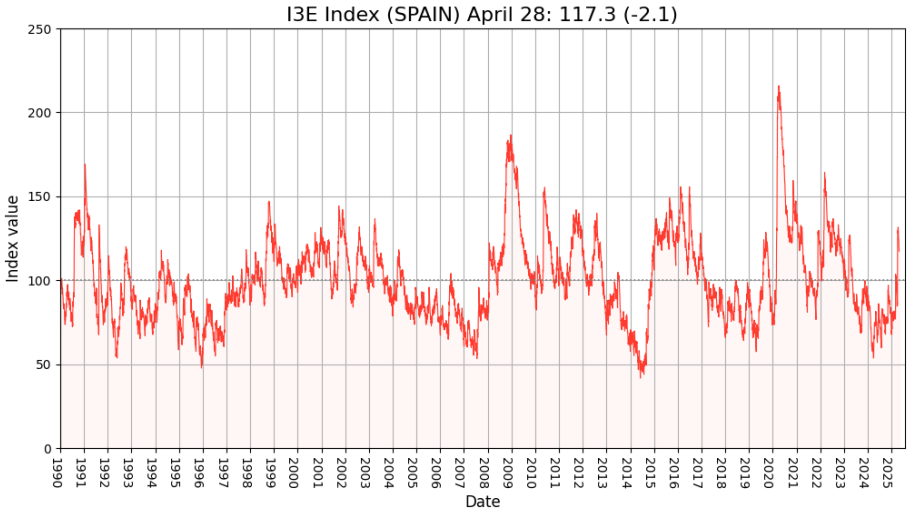


SOUTH AFRICA

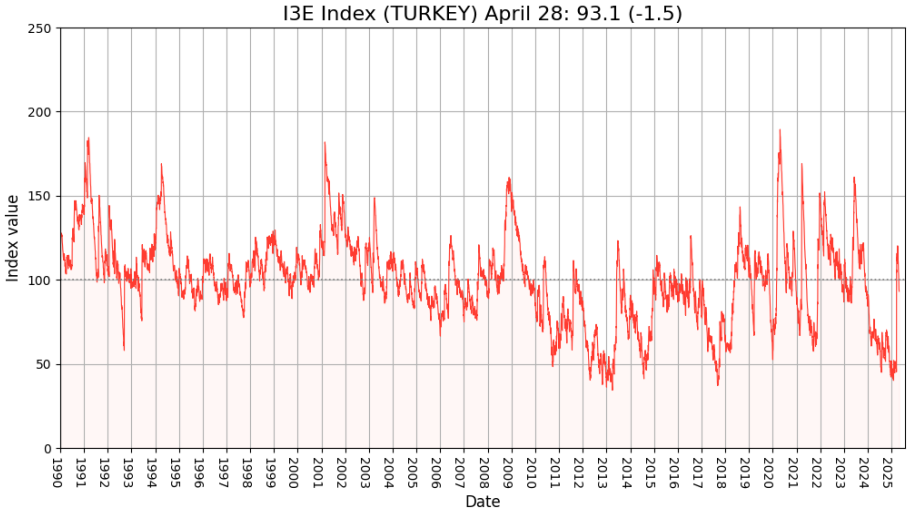


SOUTH KOREA

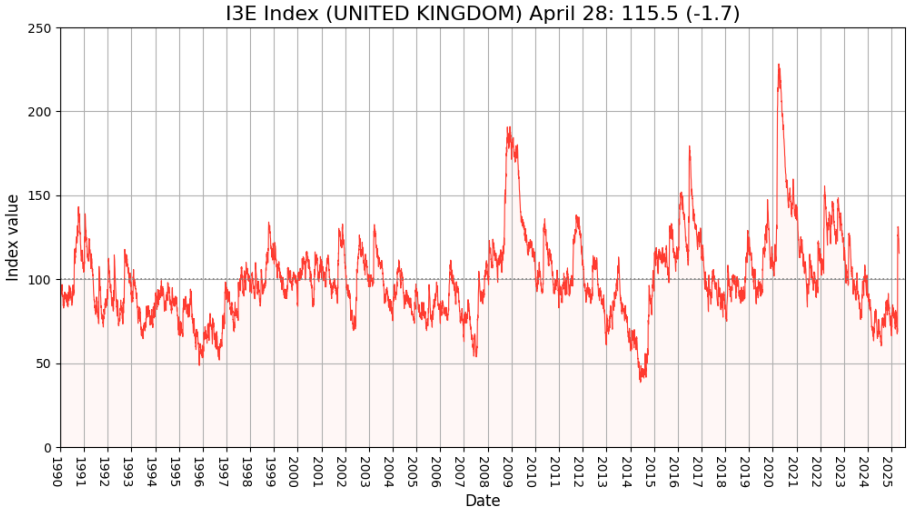
Figure 1: **(continued)** I3E country plots (POLAND to SOUTH KOREA)



SPAIN

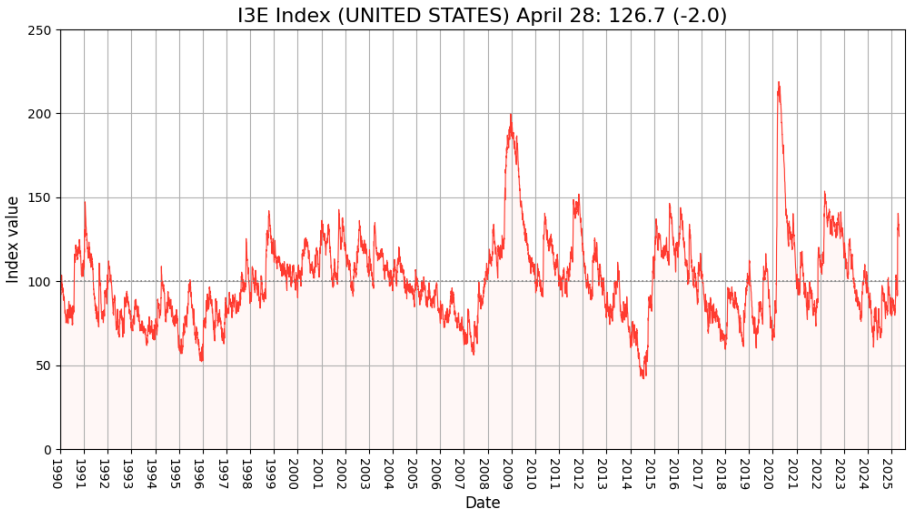


TURKEY



UNITED KINGDOM

Figure 1: **(continued)** I3E country plots (SPAIN to UNITED KINGDOM)



USA

Figure 1: **(continued)** I3E country plot (USA)

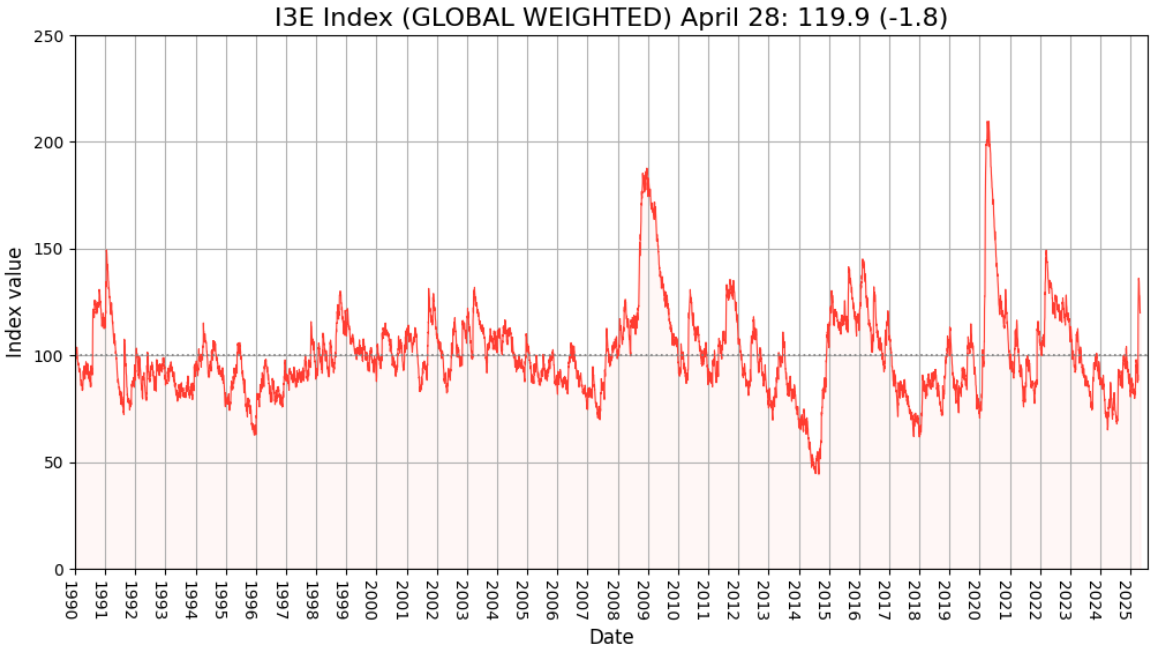


Figure 2: I3E global index

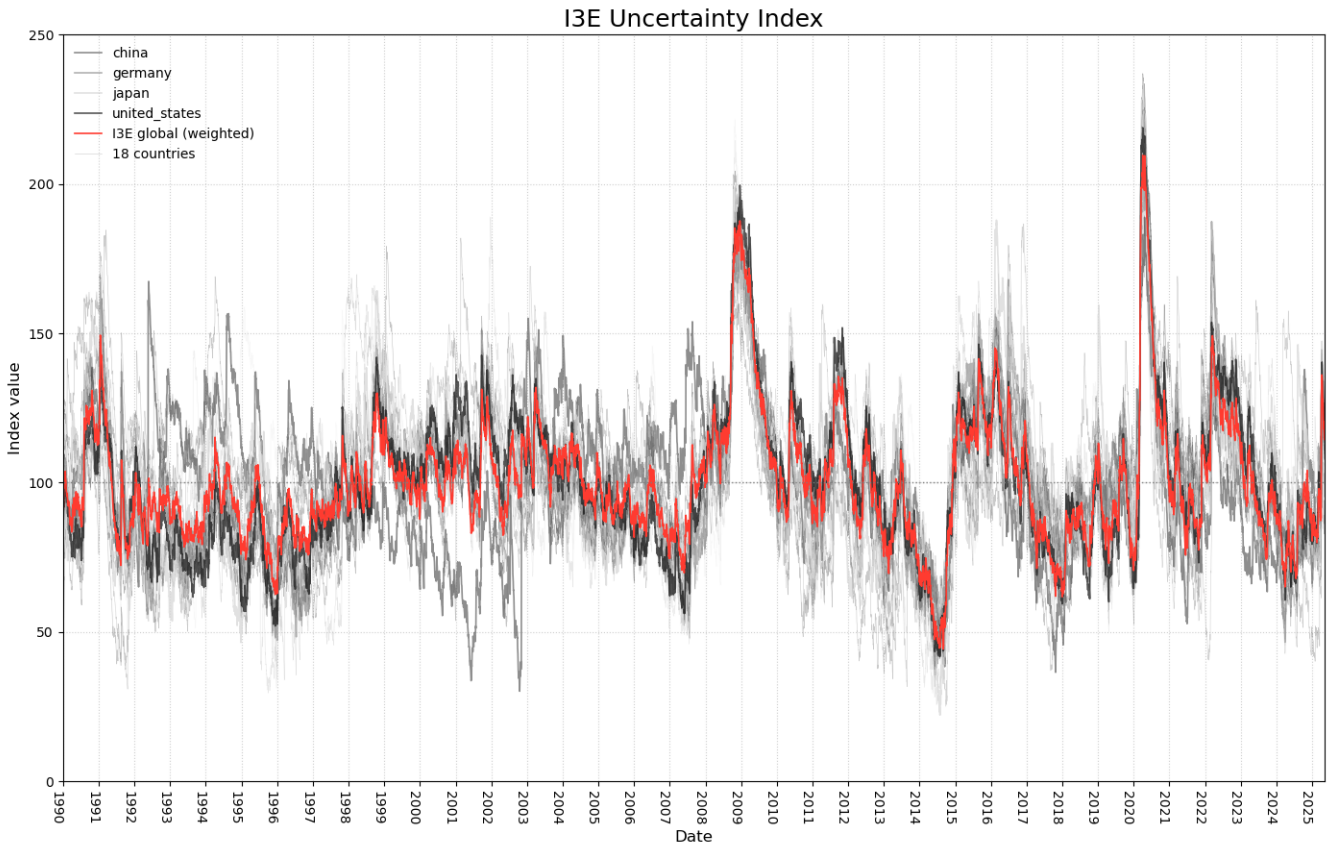


Figure 3: I3E index (all countries)

Table 1: I3E Financial indicators: Datastream Mnemonics

Country	**10Y Bond**	**Stock Index**	**Exchange Rate**	**Since**
Australia	TRAU10T	ASX200I (S&P/ASX 200)	TDAUDSI (Australian Dollar)	1992-05-29
Austria	TROE10T	ATXINDX (ATX)	EUDOLLR (Euro)	1990-01-01
Belgium	TRBG10T	BGBEL20 (BEL20)	EUDOLLR (Euro)	1990-01-02
Brazil	TRBR10T	BRBOVES (Ibovespa)	TDBRLSP (Brazilian Real)	1998-12-11
Canada	TRCN10T	TTOCOMP (S&P/TSX)	TDCADSP (Canadian Dollar)	1990-01-01
China	TRCH10T	CHSCOMP (Shanghai Composite)	TDCNYSP (Chinese Yuan)	2002-06-03
Egypt	TREG10T	EGCSE30 (EGX 30)	TDEGPSP (Egyptian Pound)	2010-08-18
France	TRFR10T	FRCAC40 (CAC 40)	EUDOLLR (Euro)	1990-01-01
Germany	TRBD10T	XETRDAX (DAX)	EUDOLLR (Euro)	1991-07-01
Greece	TRGR10T	GRAGENL (ATHEX Composite)	EUDOLLR (Euro)	1992-09-18
Israel	TRIL10T	ISTMAOF (TA-35)	TDILSSP (Israeli Shekel)	2002-04-09
Italy	TRIT10T	FTSEMIB (FTSE MIB)	EUDOLLR (Euro)	1997-12-31
Japan	TRJP10T	TOKYOSE (Nikkei 225)	TDJPYSP (Japanese Yen)	1990-01-01
Mexico	TRMX10T	MXIPC35 (IPC)	TDMXNSP (Mexican Peso)	2001-07-31
Netherlands	TRNL10T	AMSTEOE (AEX)	EUDOLLR (Euro)	1990-01-01
Poland	TRPO10T	POLWIGI (WIG)	TDPLNSP (Polish Złoty)	1999-11-25
South Africa	TRSA10T	JSEOVER (JSE Top 40)	TDZARSP (South African Rand)	1995-06-30
South Korea	TRKR10T	KORCOMP (KOSPI)	TDKRWSP (South Korean Won)	2000-10-25
Spain	TRES10T	IBEX35I (IBEX35)	EUDOLLR (Euro)	1991-06-03
Turkey	TRTK10T	TRKISTB (BIST 100)	TDTRYSP (Turkish Lira)	2010-01-27
UK	TRUK10T	FTSE100 (FTSE 100)	UKDOLLR (British Pound)	1990-01-01
USA	TRUS10T	S&PCOMP (S&P500)	EUDOLLR (US Dollar)	1990-01-01

Note: "Since" refers to the first date on which all four time series—10-year government bond, stock index, exchange rate, and Brent crude oil prices—became fully available for that country. Before that date, the I3E was computed with the time series available up to that point.