I3E Economic Uncertainty Index

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Abstract

We outline the methodology employed in the construction of the I3E Economic Uncertainty Index. 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. We also define four subindexes and a global I3E, computed as a GDP-weighted average of national indexes. The paper further introduces the I3E Forward, a forward-looking version based on one-month option-implied volatilities for the same underlying markets. We compare realized and implied uncertainty using a GARCH model to derive a conditional uncertainty measure closer to the variance of forecast errors emphasized in the literature.

Keywords: Economic uncertainty, I3E Index, Volatility, Implied Volatility.

1. Measuring Economic Uncertainty

Uncertainty is a central concept in economics, business, and finance, yet it is inherently latent and cannot be observed directly. At its core, uncertainty concerns the dispersion of possible future outcomes and therefore must be measured through indirect proxies.

The empirical literature has developed a broad range of indirect measures that differ in both level of aggregation and information content (Cascaldi-Garcia et al., 2023). One first distinction is between micro and macroeconomic uncertainty.

Micro uncertainty refers to uncertainty at the level of individual firms, plants, or households, and is often proxied by the cross-sectional dispersion of firm-level outcomes such as profits, sales growth, productivity, stock returns, or managers' subjective forecasts (Bachmann & Bayer, 2013, 2014; Bachmann et al., 2013; Fernández-Villaverde et al., 2020). When firms face more heterogeneous and less predictable idiosyncratic conditions, the distribution of firm-level outcomes widens.

Macro uncertainty concerns the conditional dispersion of aggregate outcomes such as GDP, productivity, aggregate financial markets, or inflation. It is typically measured from surveys, textual information, from realized asset-price volatility, from option-implied volatility, or from model-based estimates of conditional forecast dispersion.

Survey-based uncertainty infers uncertainty directly from the expectations of firms, households, or professional forecasters. Unlike news-based indexes, which capture uncertainty as reflected in public discourse, survey-based measures are especially useful for identifying the uncertainty perceived by specific agents regarding sales, spending, or aggregate economic conditions (Altig et al., 2022; Leduc & Liu, 2016; Scotti, 2016).

Text-based uncertainty track the frequency of words appearing in newspapers, reports, or other written sources. The Economic Policy Uncertainty (EPU) index of (Baker et al., 2016) uses newspaper coverage to quantify uncertainty related to economic policy. The World Uncertainty Index (WUI) of (Ahir et al., 2022) extends this approach to a global panel by mining Economist Intelligence Unit country reports, making it possible to compare uncertainty across countries. A further refinement is provided by the Geopolitical Risk (GPR) index of (Caldara & Iacoviello, 2022), which focuses on adverse geopolitical events. The Monetary Policy Uncertainty counts the share of news discussing US

moneteraty policy actions (Husted et al., 2020).

Volatility-based uncertainty infers uncertainty from movements in asset prices rather than from textual narratives. The simplest approach uses realized or spot volatility (Andersen et al., 2003). Volatility is often used as a proxy for uncertainty because periods of heightened uncertainty are typically associated with a wider dispersion of possible future outcomes. This approach is attractive because it is directly observable in financial markets. However, spot volatility conflates at least two components: the realization of shocks that have already occurred, and expectations about future variation. As a result, realized volatility is informative about financial turbulence, but it need not coincide with ex ante uncertainty.

This limitation motivates the use of *option-implied volatility* measures, of which the VIX is the best-known example (Whaley, 1993). The VIX extracts from option prices the market-implied expected volatility of the S&P 500 over the subsequent 30 days. Relative to spot volatility, implied volatility is forward-looking and therefore closer to the idea of uncertainty. Option-implied volatilities are widely used in studies of macroeconomic shocks, real activity, and financial conditions because they provide forward-looking market-based measures of expected variability (Bloom, 2009; Cremers et al., 2021; Dew-Becker et al., 2021).

Further refinements seek to distinguish *volatility* from *uncertainty*, understood as the conditional variance of future forecast errors (Jurado et al., 2015) - JLN. JLN make the central contribution in this area by defining macroeconomic uncertainty as the conditional volatility of the unforecastable component of future economic outcomes. Stock-market volatility often contain substantial variation that is not genuinely attributable to uncertainty. Berger et al. (2020) sharpen the distinction between forward-looking uncertainty and realized volatility by showing that shocks to realized volatility and shocks to forward-looking second moments have different economic implications. Realized volatility captures the magnitude of shocks that materialize, whereas true uncertainty concerns the dispersion of outcomes that agents anticipate ex ante.

These distinctions matter for empirical work. Realized volatility reflects turbulence that has already occurred or is ocurring in a time window. Option-implied volatility reflect the future volatility anticipated by the market. Model-based conditional-variance measures aim to isolate the ex ante variance of the unforecastable component of future

outcomes (uncorrelated innovations).

We introduce the I3E Economic Uncertainty Index (https://i3e-index.github.io) as a further measure of uncertainty that, we think, may contribute to investigate the different facets of uncertainty in new light. We describe the technical construction of the I3E and the underlying data in the following sections.

The I3E condenses volatility from several heterogeneous macro-financial variables—including equities, government bonds, exchange rates, and oil prices—into a single composite indicator. By combining signals from multiple asset classes, the index aims to capture the broader, common component of uncertainty rather than the idiosyncratic volatility of any one market. The I3E is computed and published daily for most major economies, which makes it particularly suitable for comparative analysis. While the I3E is a volatility measure of uncertainty that uses realized volatilities (I3E Spot or simply I3E), it is also computed and published daily for some countries using the one-month option-implied volatilities (I3E Forward). Comparing realized volatility with market-implied future volatility allows one to estimate, using econometric models such as GARCH, the conditional variance of future forecast errors, which has been argued to provide a conceptually more refined measure of uncertainty than realized volatility alone (Berger et al., 2020; Jurado et al., 2015).

A practical 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.

2. I3E Economic Uncertainty Index

The I3E index 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 and the starting years are shown in Table 1. Brent Spot Price Free on Board Daily (Dollars Per Barrel) 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 (Appendix A). Information about the index daily values and historical data can be downloaded from I3E Index.

3. Subindexes

In addition to the I3E index, the four subindexes $I_1(t), I_2(t), I_3(t), I_4(t)$ corresponding to stock market index, government bonds, exchange rate and Brent prices respectively can be computed for each variable as:

$$I_1(t) = 100 + 25 \times \frac{w_1(t) - \mu_1}{\sigma_1}$$

$$I_2(t) = 100 + 25 \times \frac{w_2(t) - \mu_2}{\sigma_2}$$

$$I_3(t) = 100 + 25 \times \frac{w_3(t) - \mu_3}{\sigma_3}$$

$$I_4(t) = 100 + 25 \times \frac{w_4(t) - \mu_4}{\sigma_4}$$

These four subindices for each country also have a mean of 100 and a standard deviation of 25. Needless to say, the overall I3E Index is not the arithmetic mean of these four partial subindices.

4. 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 1 shows the evolution of the I3E Global Weighted from 1990 to 2026 for 24 large economies where the required data is readily available: *Australia, Austria, Belgium, Brazil, Canada, China, Egypt, France, Germany, Greece, India, Israel, Italy, Japan, Mexico, Netherlands, Poland, Saudi Arabia, 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, the invasion of Ukraine by Russia, Trade and tariffs disputes in April 2025 and the military conflict in Iran in March 2026.

In addition to the GDP-weighted global I3E, we also publish on a daily basis the global I3E computed as the simple average across all countries.

Figure 2 compares the I3E of all 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 remaining countries are shown in different shades of grey in the background. Idiosyncratic spikes specific to some countries are labeled in the graph. Countries like Turkey, Mexico, China, Brazil or Egypt present unique and uncorrelated episodes of high uncertainty. Countries like Germany, USA and France rarely present those unique episodes.

Uncertainty spikes tend to be more synchronized within advanced economies and between economies with strong financial and trade links. Time-series correlation is 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 in the international economy. This warrants further investigation in future research.

5. I3E Forward Index

The I3E Forward is constructed using the implied volatility derived from one-month constant-maturity options written on each of the four underlying series. As such, the I3E Forward provides a forward-looking measure of economic uncertainty, reflecting market expectations of volatility over the next 30 days.

Implied volatility is inferred from option prices. For each underlying series, it takes the market price of a one-month constant-maturity option (or an interpolated constant-maturity price derived from nearby maturities) and compute the value of volatility that makes a standard option pricing model match that observed market price. In other words, implied volatility is the parameter σ that, when inserted into the pricing formula, reproduces the observed option premium.

For each underlying series, we use the one-month constant-maturity implied volatility reported daily by LSEG/Datastream. Such measures are broadly consistent with Black-Scholes-Merton-style implied-volatility inversion (Black & Scholes, 1973).

To illustrate, for a European call option with spot price S_t, strike K, risk-free rate r, time to maturity T (in years), and volatility σ, the model price is:

$$C_t = S_t\, N(d_1) - K e^{-rT} N(d_2),$$

where

$$d_1 = \frac{\ln\left(\frac{S_t}{K}\right) + \left(r + \frac{1}{2}\sigma^2\right) T}{\sigma\sqrt{T}}, \qquad d_2 = d_1 - \sigma\sqrt{T},$$

and $N(\cdot)$ denotes the standard normal cumulative distribution function. The implied volatility $IV(t)$ is the value of σ that solves $C_t^{\text{model}}(\sigma) = C_t^{\text{market}}$ (analogously for puts).

Let us call the annualized implied volatility of each series as $IV_1(t), IV_2(t), IV_3(t), IV_4(t)$. Then their natural logarithms are taken. We define:

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

for i = 1, 2, 3, 4

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

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

The I3E Forward is conceptually comparable to the VIX index, as both measures are derived from option-implied volatilities with a constant one-month maturity. The most well known VIX index is constructed from the implied volatility of S&P 500 index options and provides a forward-looking measure of expected equity market volatility over the subsequent 30 days.

However, an important distinction lies in the scope of the underlying information set. The VIX reflects uncertainty in a single market—e.g., the U.S. equity market—whereas the I3E Forward aggregates implied volatilities from four distinct financial segments: equity markets, government bond markets, foreign exchange markets, and the oil market. By condensing these four dimensions of market-implied uncertainty into a single composite indicator, the I3E Forward provides, we posit, a broader measure of forward-looking macro-financial uncertainty.

Figure 3 shows the evolution of the I3E Forward USA. The series fluctuates around its normalized mean of 100, but displays pronounced spikes during major stress episodes, especially around the global financial crisis and the COVID-19 shock. Relative to I3E Spot (USA), the forward version appears more reactive to changes in expected risk.

6. Volatility and Uncertainty

Observed volatility records the ex post magnitude of realized movements in a variable. By contrast, latent uncertainty is more naturally defined as the conditional volatility of the unforecastable component of future outcomes, given the information available at time t. Jurado et al. (2015) proposed the following formulation:

$$U_t(h) = \sqrt{\mathbb{E}\Big[(y_{t+h} - \mathbb{E}(y_{t+h} \mid I_t))^2 \mid I_t\Big]}.$$

Under this definition, h-period-ahead uncertainty in y at time t is the expected size of the future forecast error conditional on the information set I_t. A large realized movement in y_{t+h} does not necessarily imply high uncertainty if that movement was already predictable given I_t; uncertainty pertains only to the variation in the genuinely unforecastable component.

To the extent that the I3E Forward is a measure of what the economic agents expect will happen in one month time h, we can use that expectation to obtain a JLN-inspired simplified measure of latent uncertainty, separating realized volatility (I3E Spot) from the unforecastable uncertainty:

$$I3E_{t+h}^{\text{Spot}} = \alpha + \beta I3E_t^{\text{Forward}} + \sum_{j=0}^{p} \gamma_j I3E_{t-j}^{\text{Spot}} + \sum_{j=1}^{p} \delta_j I3E_{t-j}^{\text{Forward}} + u_{t+h}.$$

We then recover the fitted residuals $\hat{u}_{t+h}$ and model their conditional variance using a standard GARCH process:

$$u_t = U_t \varepsilon_t, \qquad \varepsilon_t \sim (0, 1),$$

$$U_t^2 = \omega + \alpha_1 u_{t-1}^2 + \beta_1 U_{t-1}^2.$$

The estimated conditional variance U_t^2, or equivalently the conditional standard deviation U_t, can then be interpreted as a measure of conditional uncertainty, since it captures the time-varying volatility of the unforecastable component of future realized I3E Spot after conditioning on I3E Forward and lagged values of both series.

Table 2 shows the results of conditional uncertainty estimates and Figure 4 compares the I3E Spot with the estimated conditional uncertainty. Periods of pronounced market

stress—such as the 2008 global financial crisis, the COVID-19 shock, Brexit, Ukraine war, and the tariff and trade disputes of 2025—are characterized by both elevated realized volatility and heightened conditional uncertainty. At the same time, the figure also reveals episodes in which realized volatility rises more sharply than conditional uncertainty, suggesting that not all large observed movements are associated with equally large increases in ex ante uncertainty.

A particularly striking contrast emerges between the COVID-19 episode and the 2008 financial crisis. During COVID-19, realized volatility and conditional uncertainty moved very closely together, consistent with an environment in which both the magnitude and the unpredictability of future outcomes increased sharply. By contrast, during the 2008 financial crisis, realized volatility rose substantially more than conditional uncertainty. One possible interpretation is that part of the financial distress had already been anticipated by markets, as early warning signals had accumulated since 2007 through mounting stress in U.S. financial institutions and the deterioration of mortgage-related balance sheets. In this sense, the COVID-19 episode shows more latent uncertainty than the 2008 crisis.

The previous finding is consistent with newer studies reporting that the COVID-19 episode generated an uncertainty shock larger than that associated with the 2008 financial crisis (Baker et al., 2020). This lends some support to our estimates, however further research is clearly needed in this area.

7. Conclusion

This paper introduces the I3E Economic Uncertainty Index, a daily composite measure of macro-financial uncertainty constructed from the volatility of four financial variables: equity prices, 10-year government bond prices, exchange rates, and Brent crude oil prices. The index is standardized to ensure comparability across time and countries.

The paper also defines a global I3E measure as a GDP-weighted aggregation of national indexes. The resulting series tracks major episodes of global stress and provides a compact indicator of the common international component of economic uncertainty. In addition, the four underlying subindexes allow the decomposition of aggregate uncertainty into its main financial sources.

A second contribution is the construction of the I3E Forward, based on one-month

option-implied volatilities for the same four markets. This forward-looking version complements the spot index by incorporating market expectations about future volatility.

We also show how the I3E Spot and I3E Forward can be used to estimate a conditional uncertainty measure closer to the variance of forecast errors emphasized in the literature. Because the I3E relies on widely available market data and can be computed at daily frequency, it provides a practical tool to further explore this issue.

Future research can extend this work in several directions. One is the study of cross-country heterogeneity in uncertainty dynamics and transmission, including differences in the comovement of national indexes across country pairs such as the ones reported in this paper between USA and China versus the USA and France. Such variation may help identify asymmetries in the generation, propagation, and international spillovers of uncertainty. A second line of research is to evaluate the relation between I3E and other leading uncertainty measures, including the VIX, WUI, and EPU, to clarify the extent to which these indicators capture common or distinct dimensions of uncertainty. A third direction is to examine more directly the macroeconomic consequences of I3E-based uncertainty, particularly its association with investment, output growth, and broader measures of economic performance in the global economy. The separation between volatility and conditional uncertainty in empirical settings also opens up intriguing possibilities.

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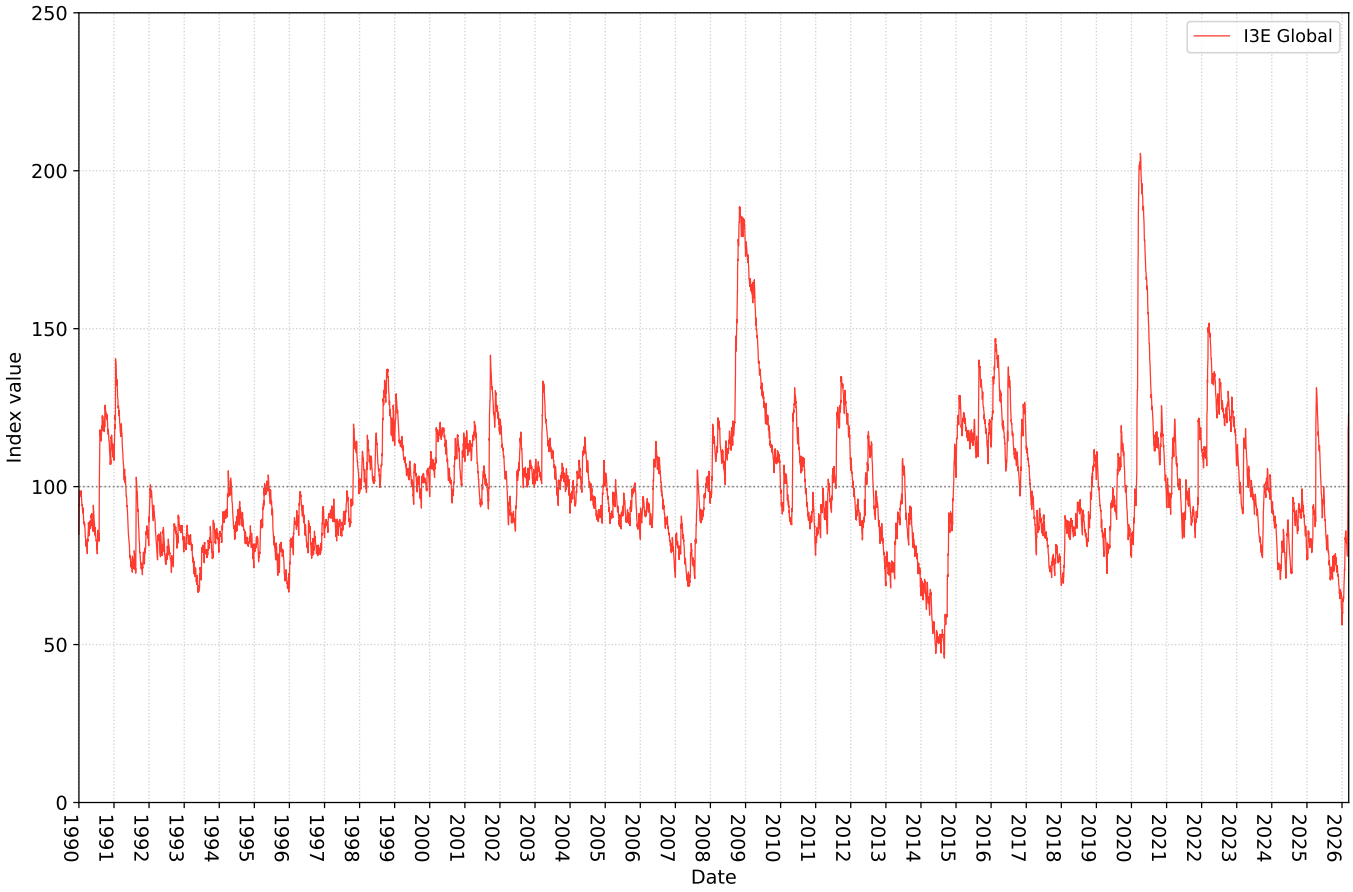

Figure 1: I3E global index

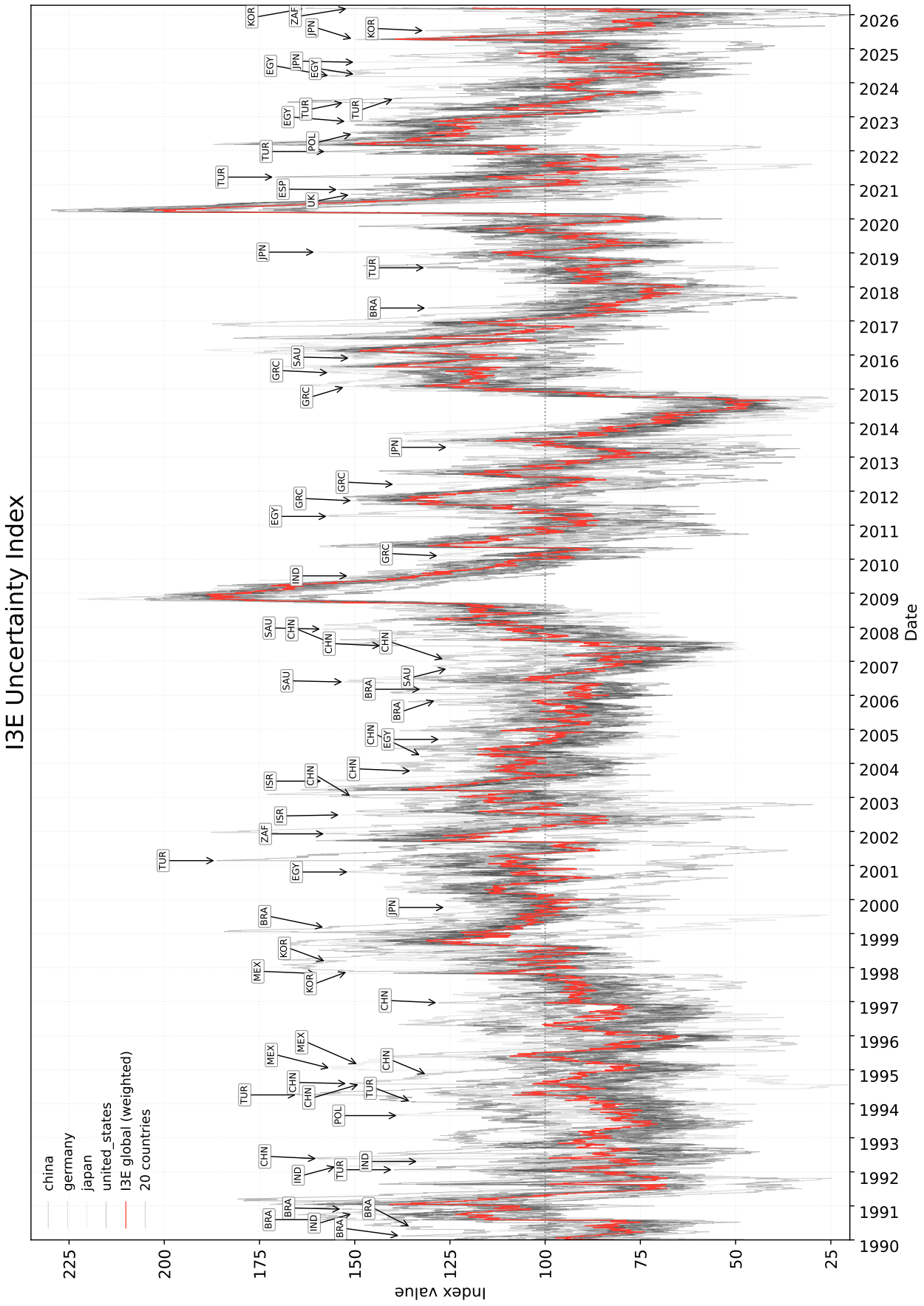

Figure 2: I3E index (all countries)

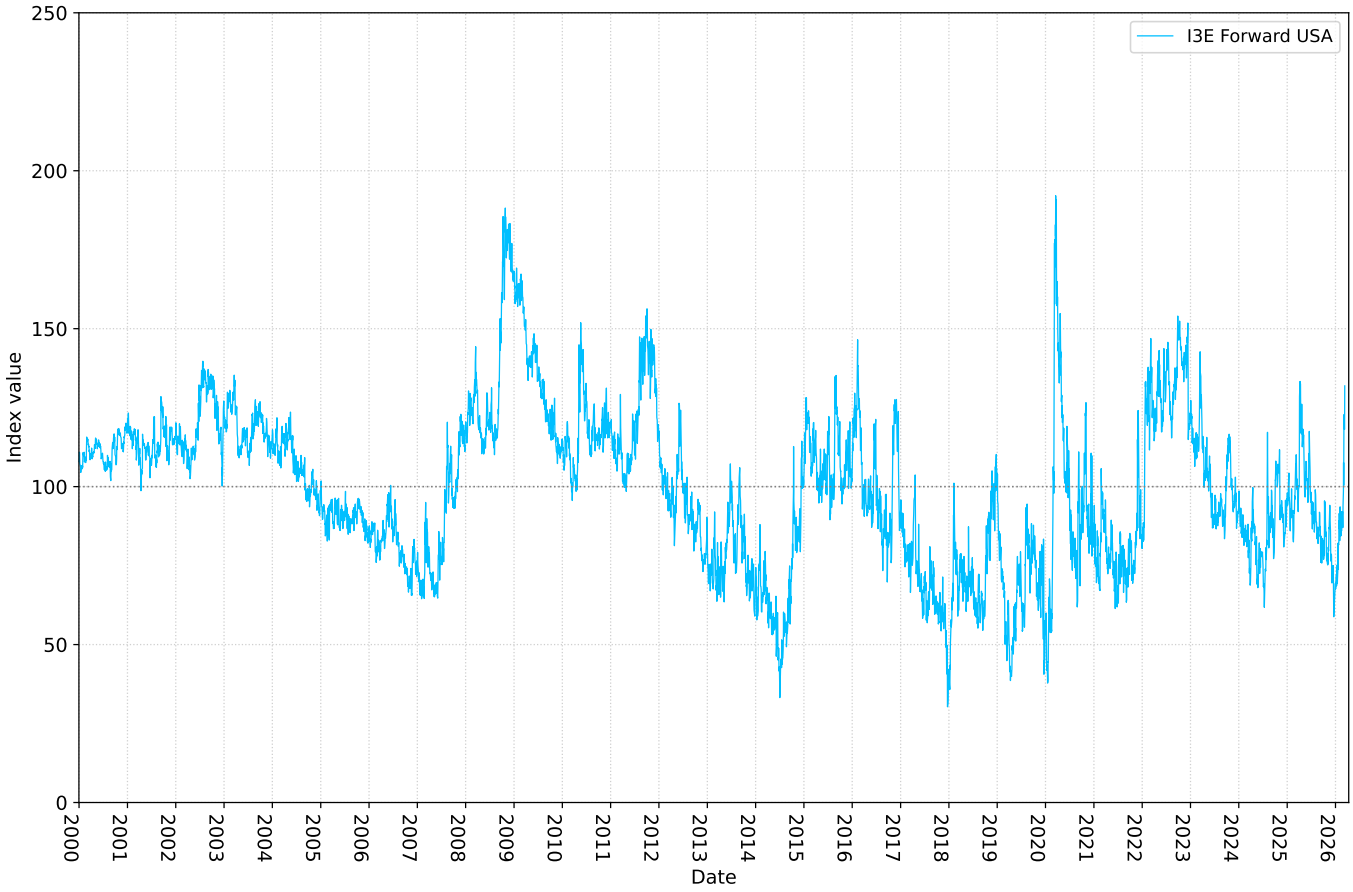

Figure 3: I3E Forward USA

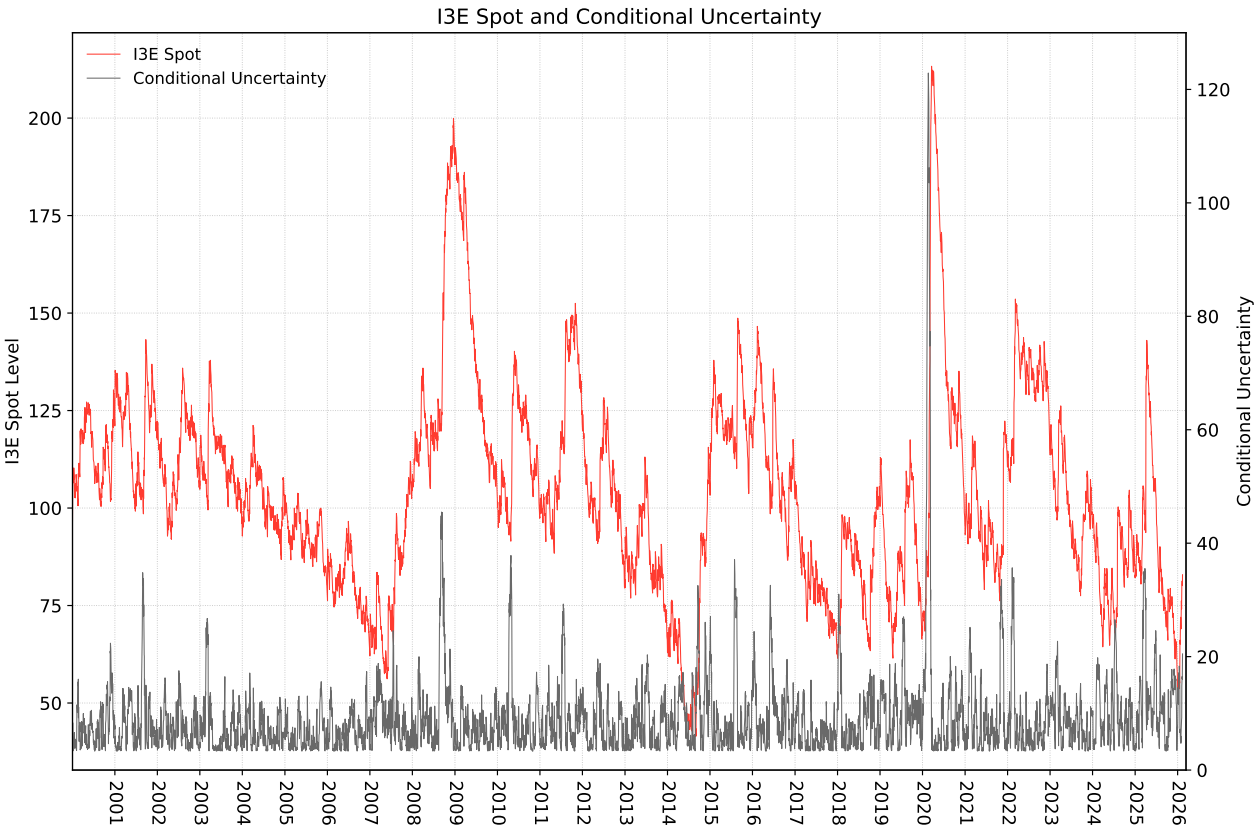

Figure 4: I3E Spot and conditional uncertainty (USA).

Table 1: I3E data inputs: 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
India	TRIN10T	IBOMSEN (SENSEX)	TDINRSP (Rupee)	1994-04-28
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 Zloty)	1999-11-25
Saudi Arabia	ICSAR10	TDWTASI (Tadawul)	TDSARSP (Saudi Riyal)	2001-02-07
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 (IBEX 35)	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&P 500)	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—were fully available for that country. Before that date, the I3E was computed using the time series available at the time.

Table 2: Mean and variance equations

Variable	Mean equation (OLS)	Variance equation (GARCH(1,1))
Constant	9.614***	
	(0.634)	
I3E Forward$_t$	0.351***	
	(0.040)	
I3E Spot$_t$	1.020***	
	(0.070)	
I3E Spot$_{t-1}$	-0.301***	
	(0.069)	
I3E Forward$_{t-1}$	-0.153***	
	(0.040)	
ω		0.065***
		(0.005)
α_1		0.740***
		(0.026)
β_1		0.150***
		(0.027)
$\alpha_1 + \beta_1$		0.890
Observations	6814	6814
R^2	0.782	
Adj. R^2	0.782	
Durbin–Watson	0.093	
Log-likelihood		-6362.45
AIC		12730.90
BIC		12751.38

APPENDIX A. I3E Index: Countries

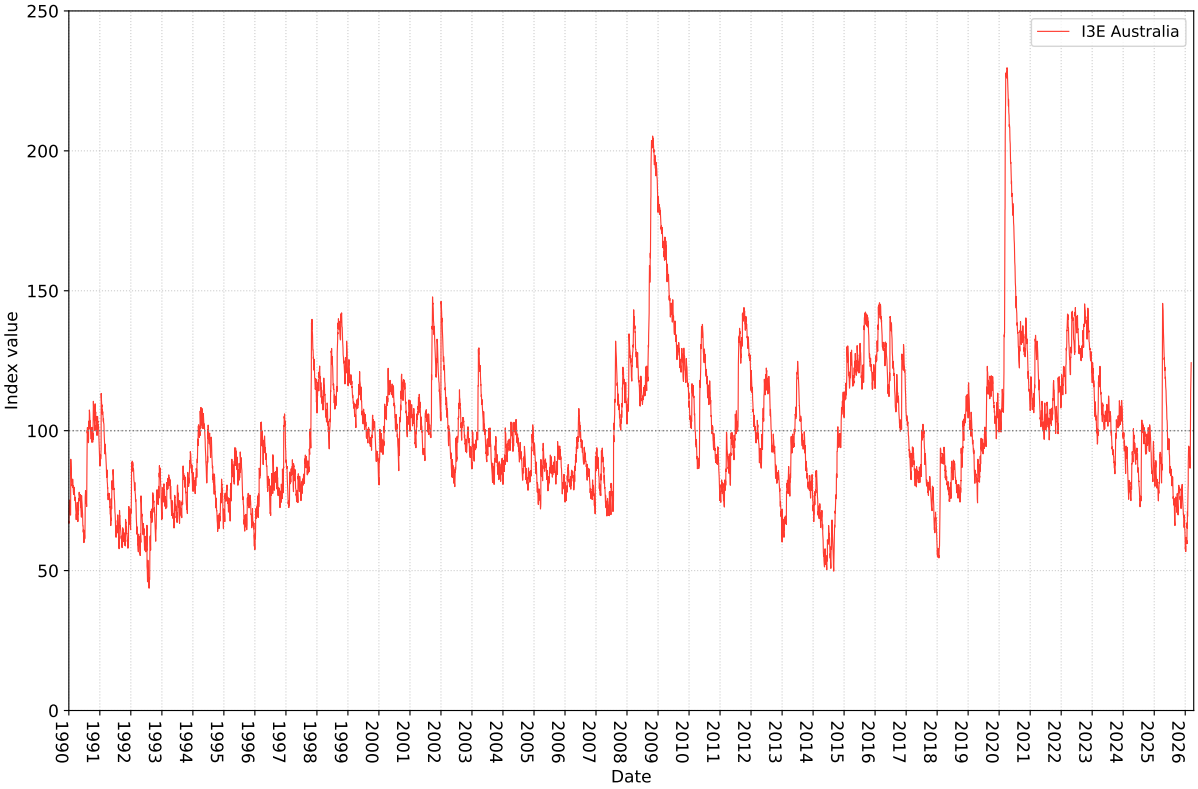

Figure: I3E AUSTRALIA

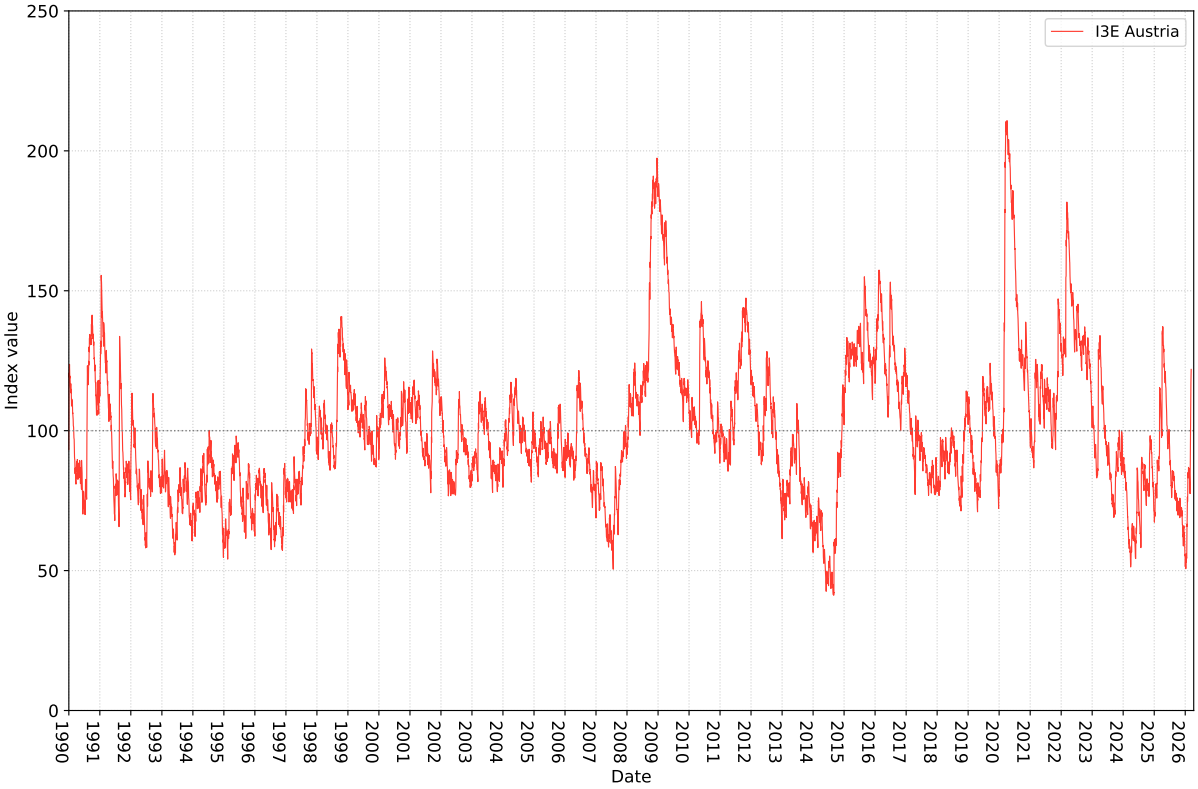

Figure: I3E AUSTRIA

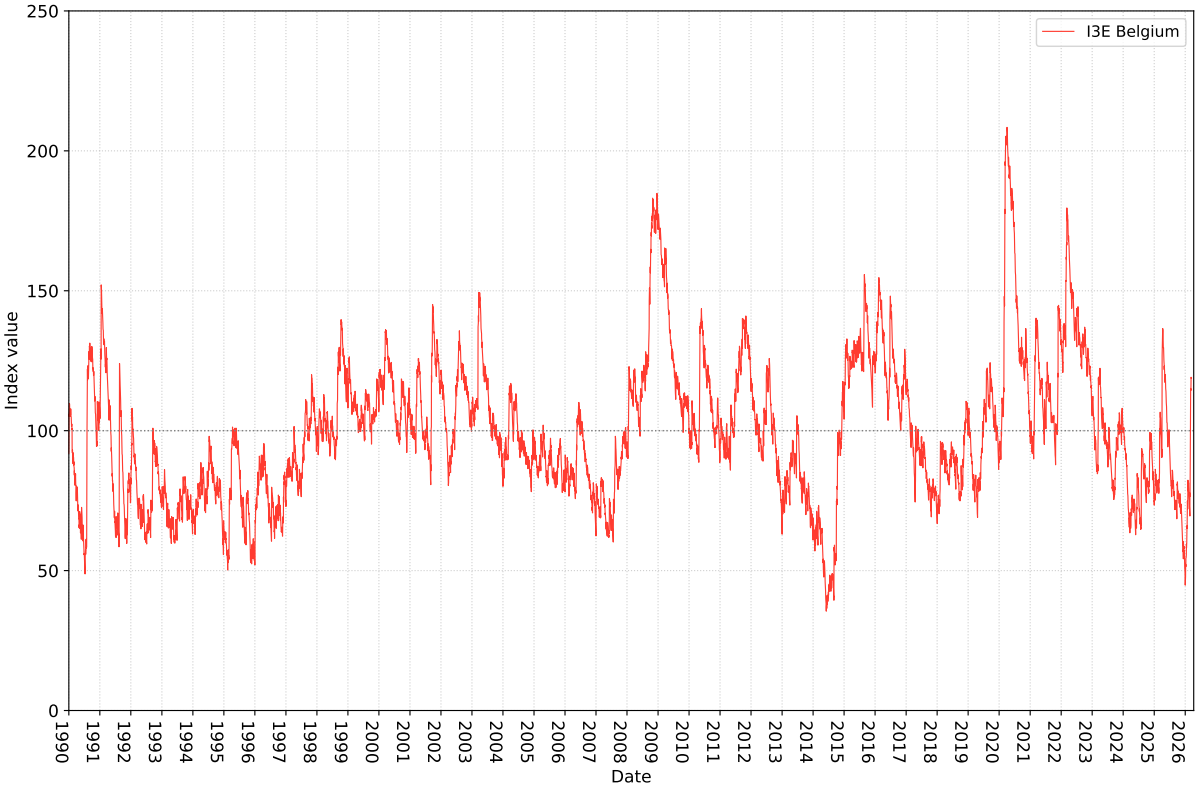

Figure: I3E BELGIUM

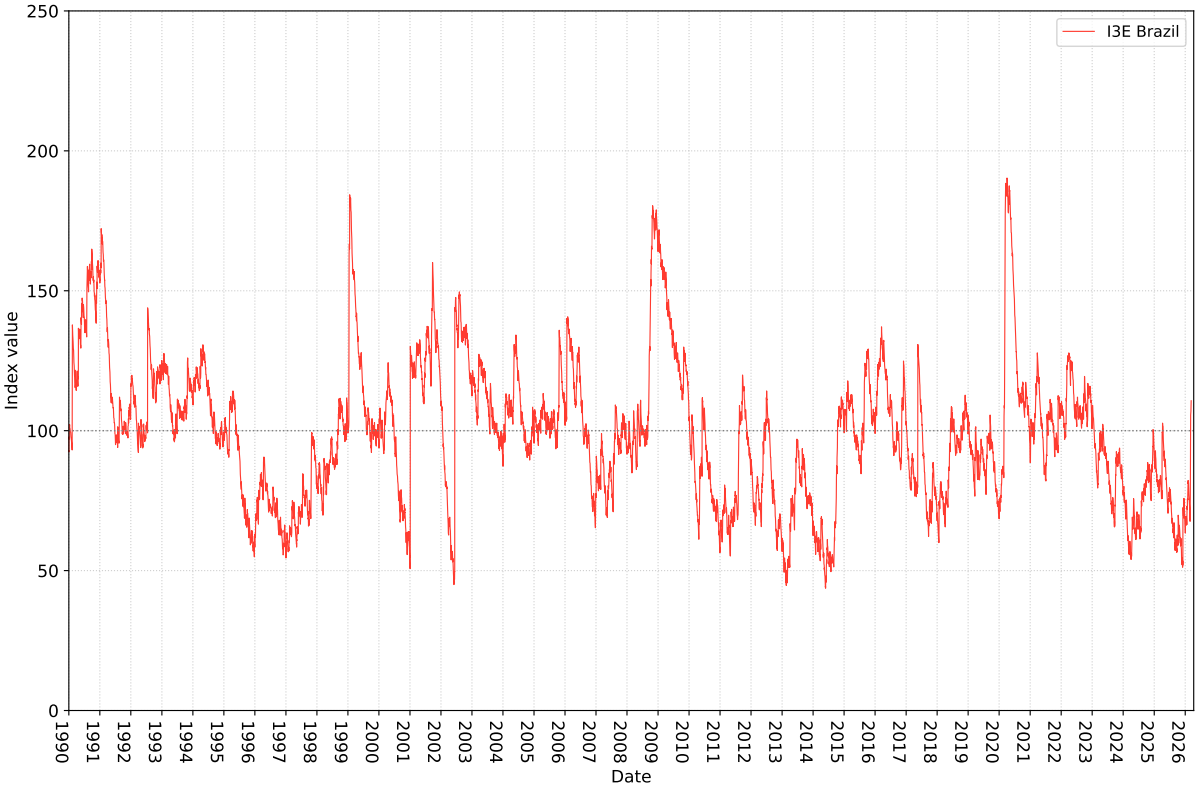

Figure: I3E BRAZIL

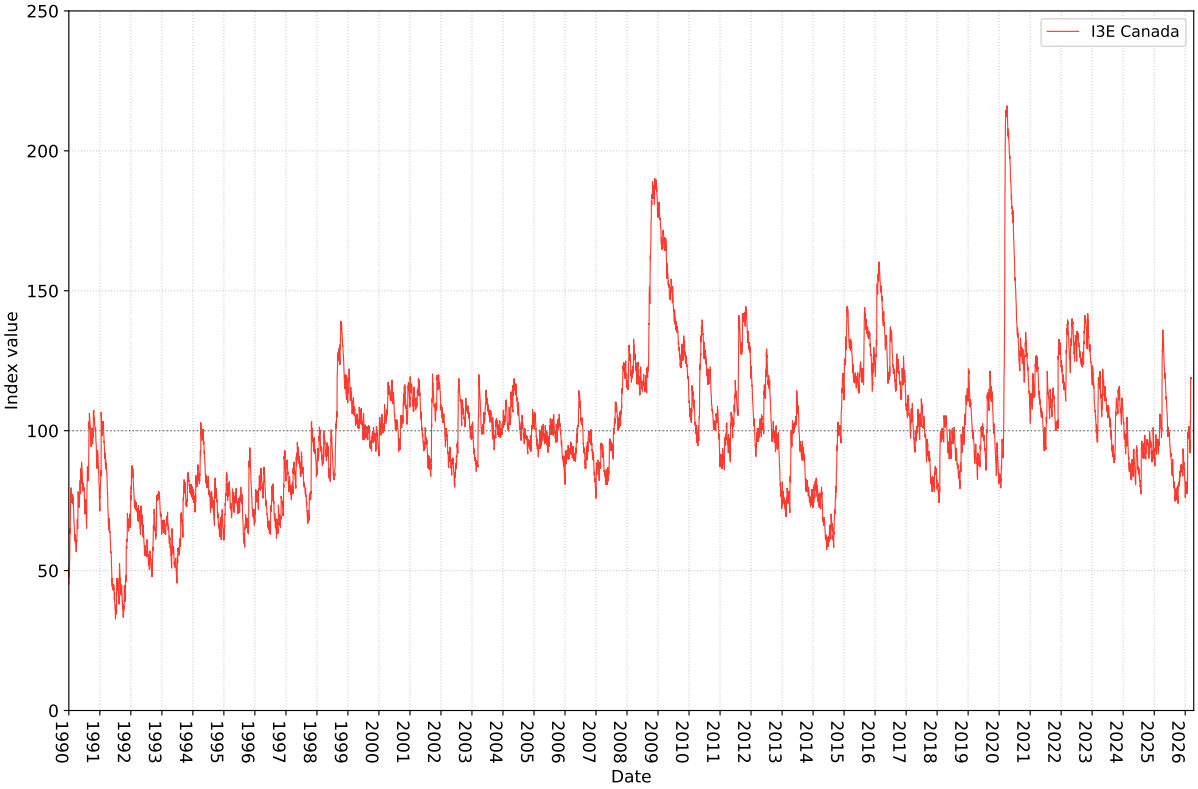

Figure: I3E CANADA

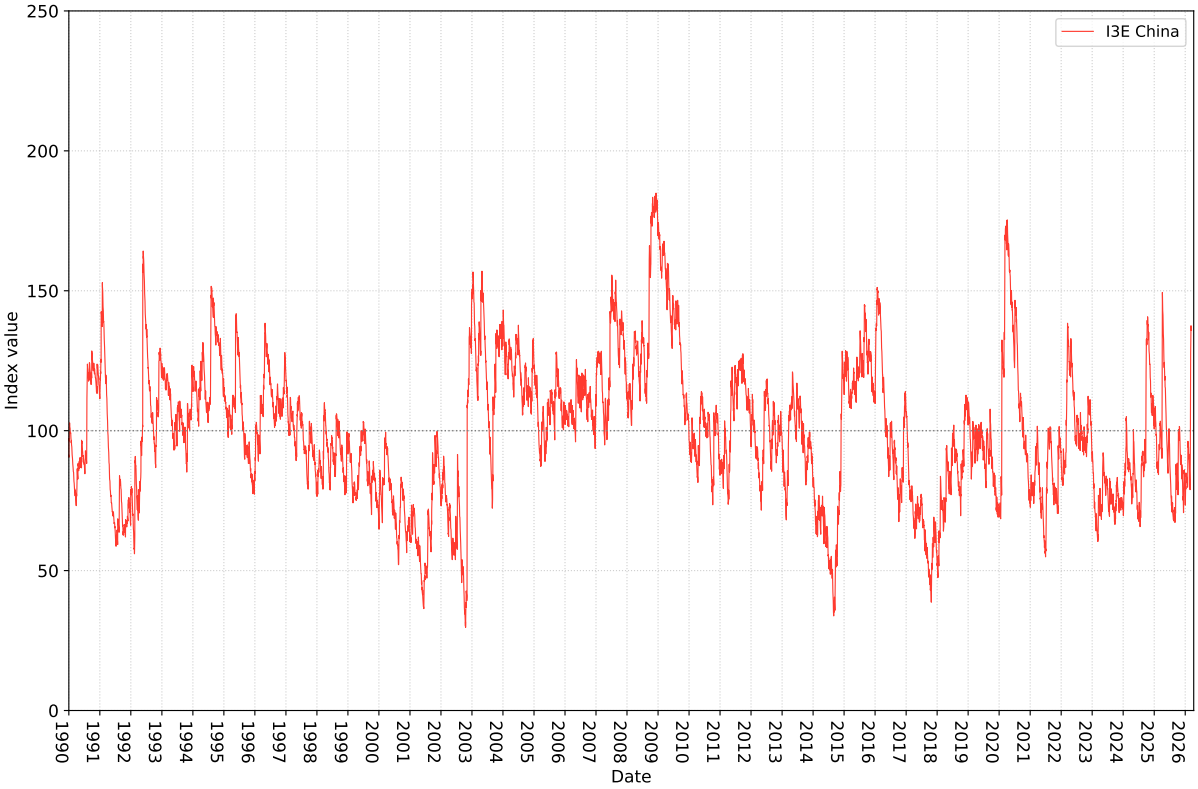

Figure: I3E CHINA

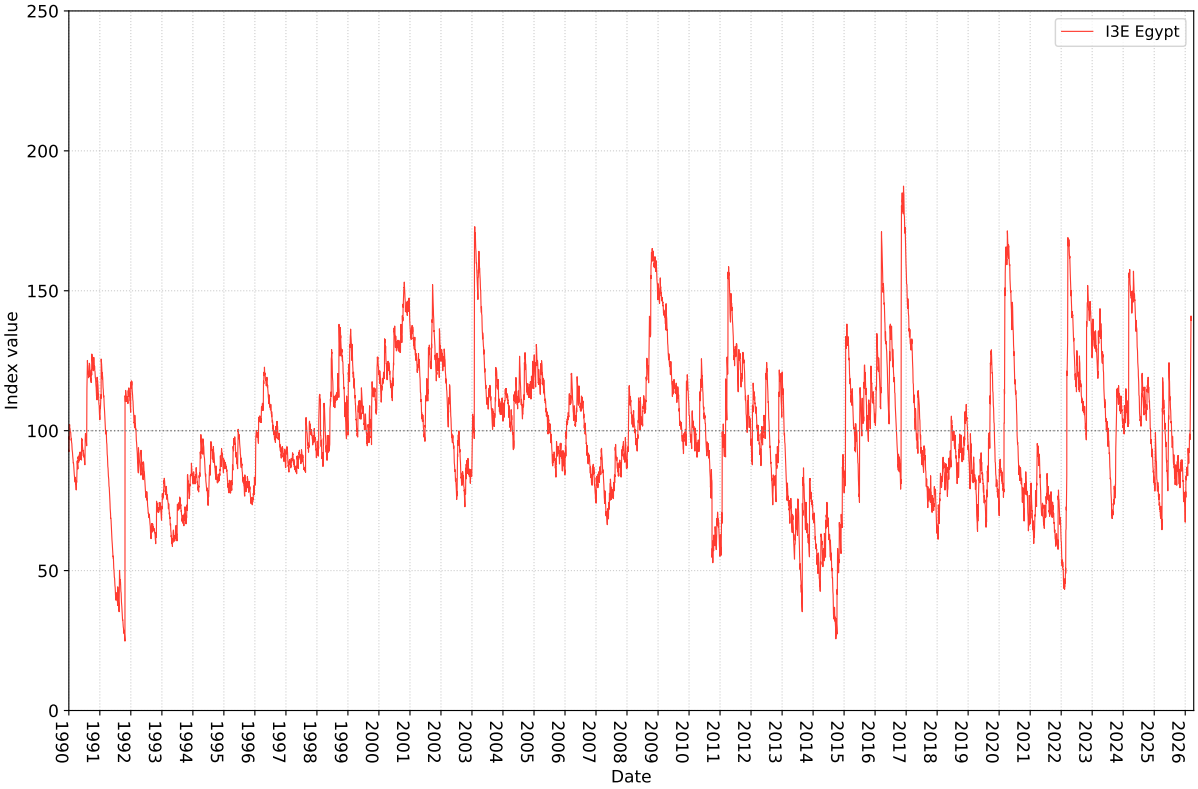

Figure: I3E EGYPT

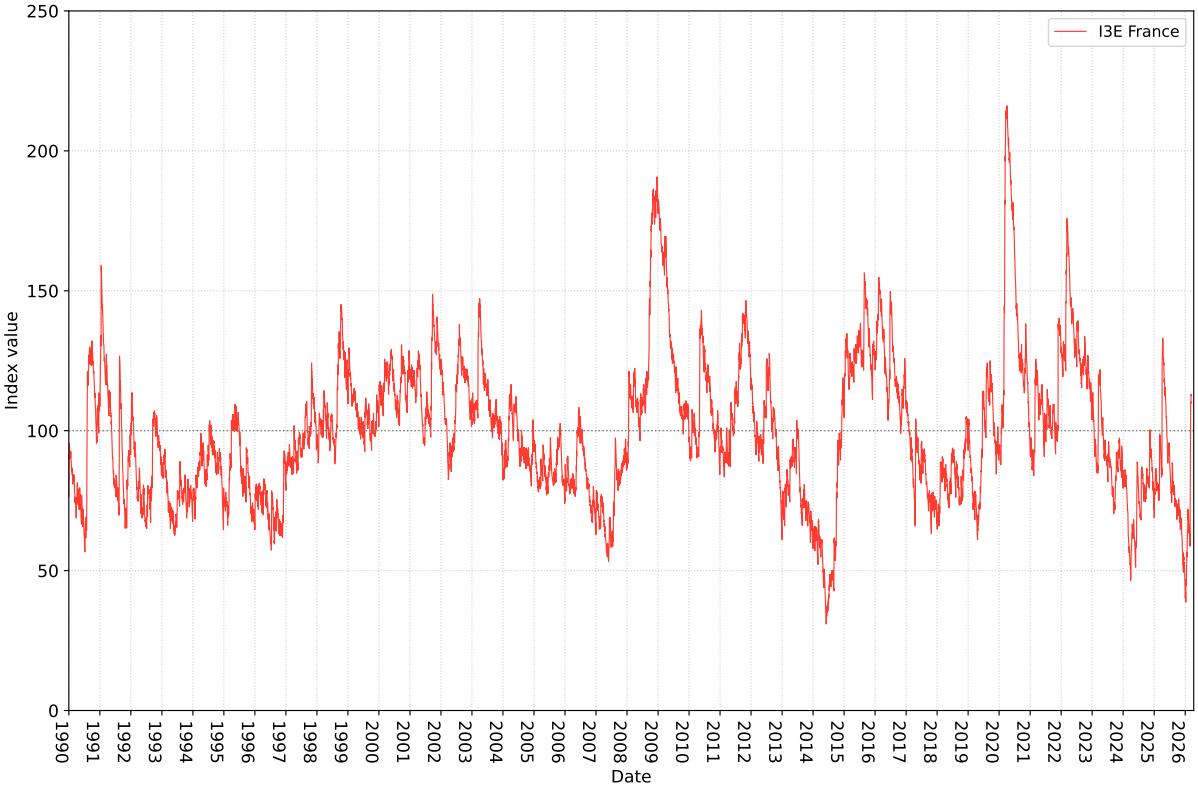

Figure: I3E FRANCE

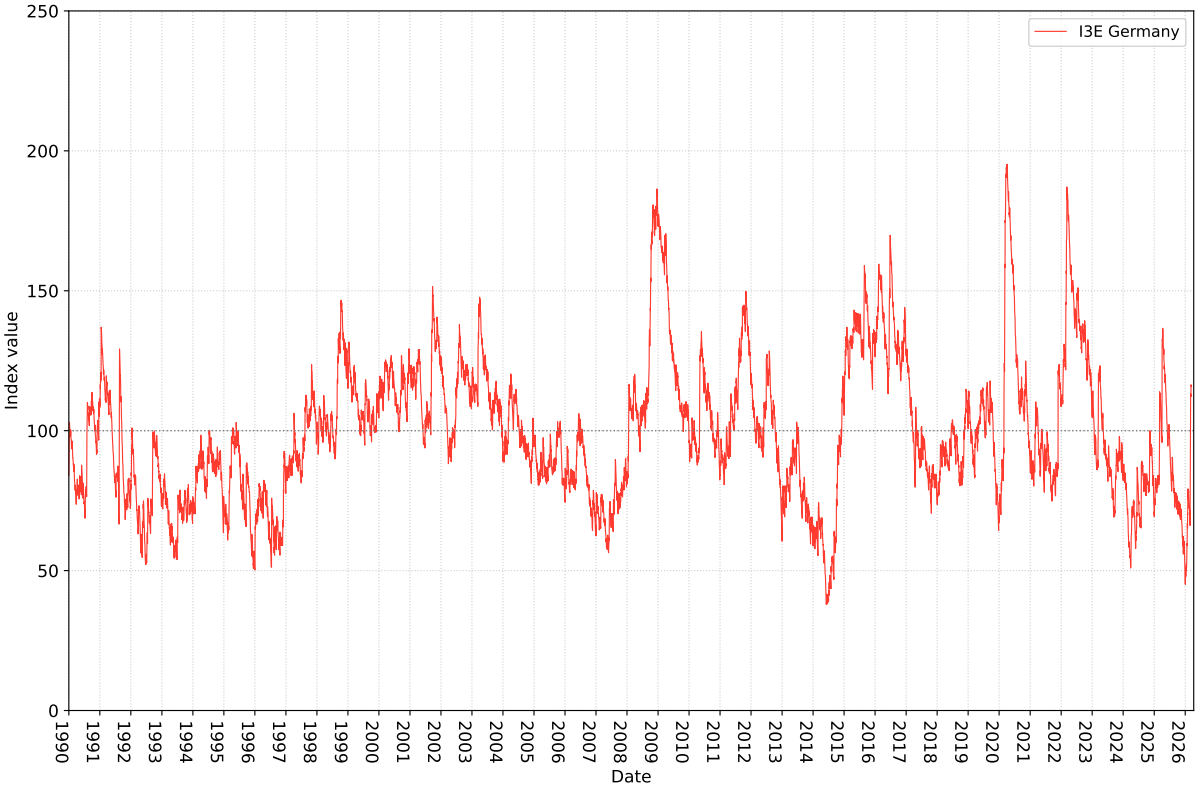

Figure: I3E GERMANY

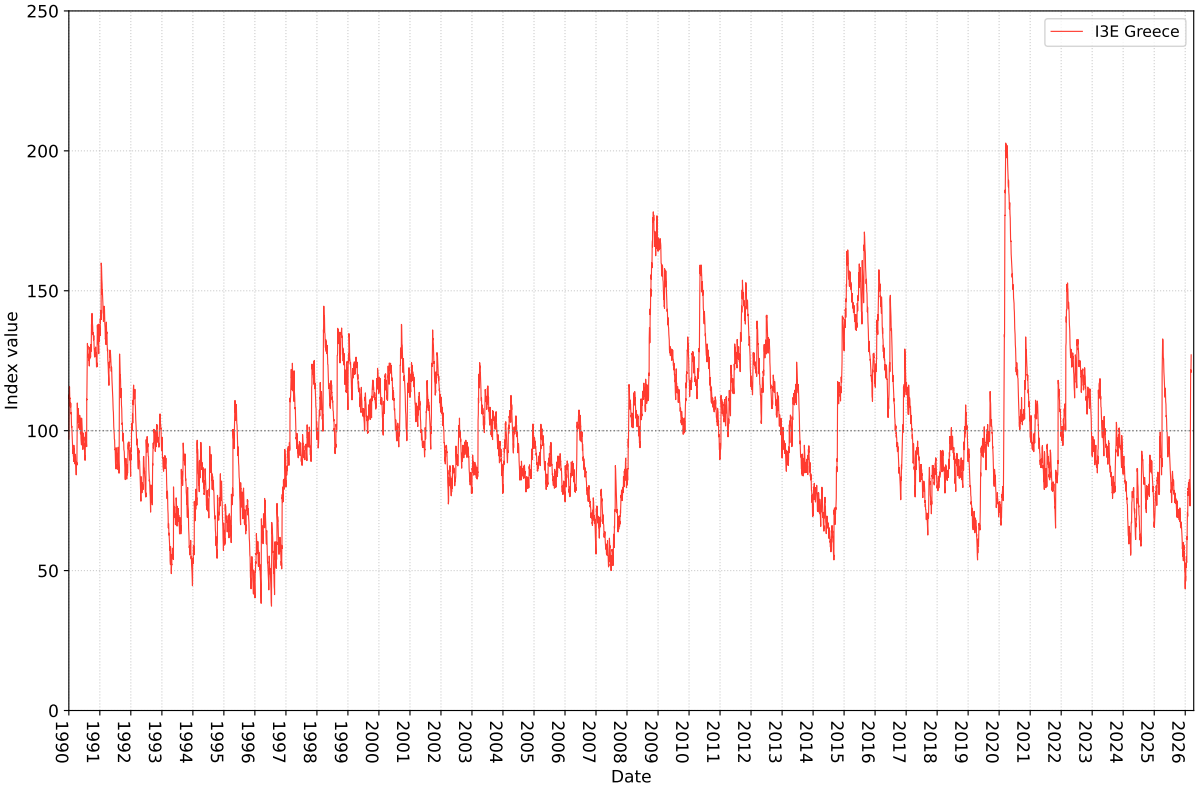

Figure: I3E GREECE

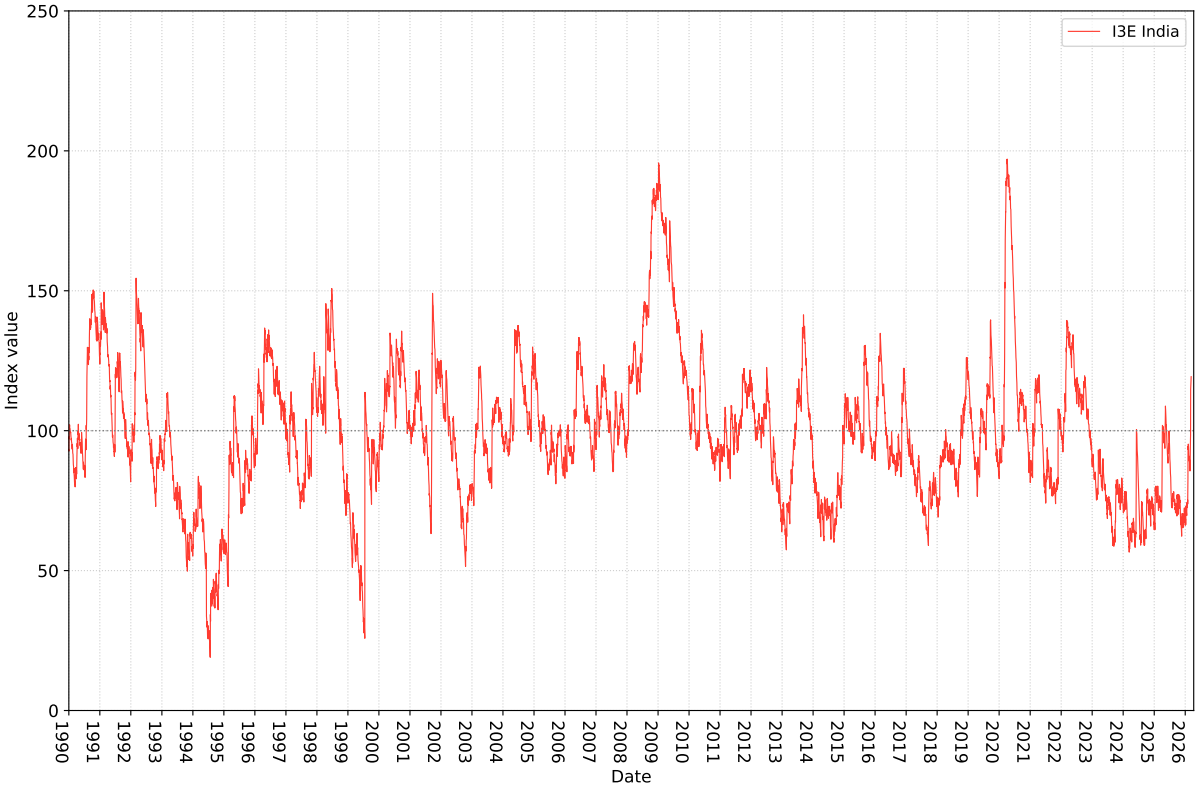

Figure: I3E INDIA

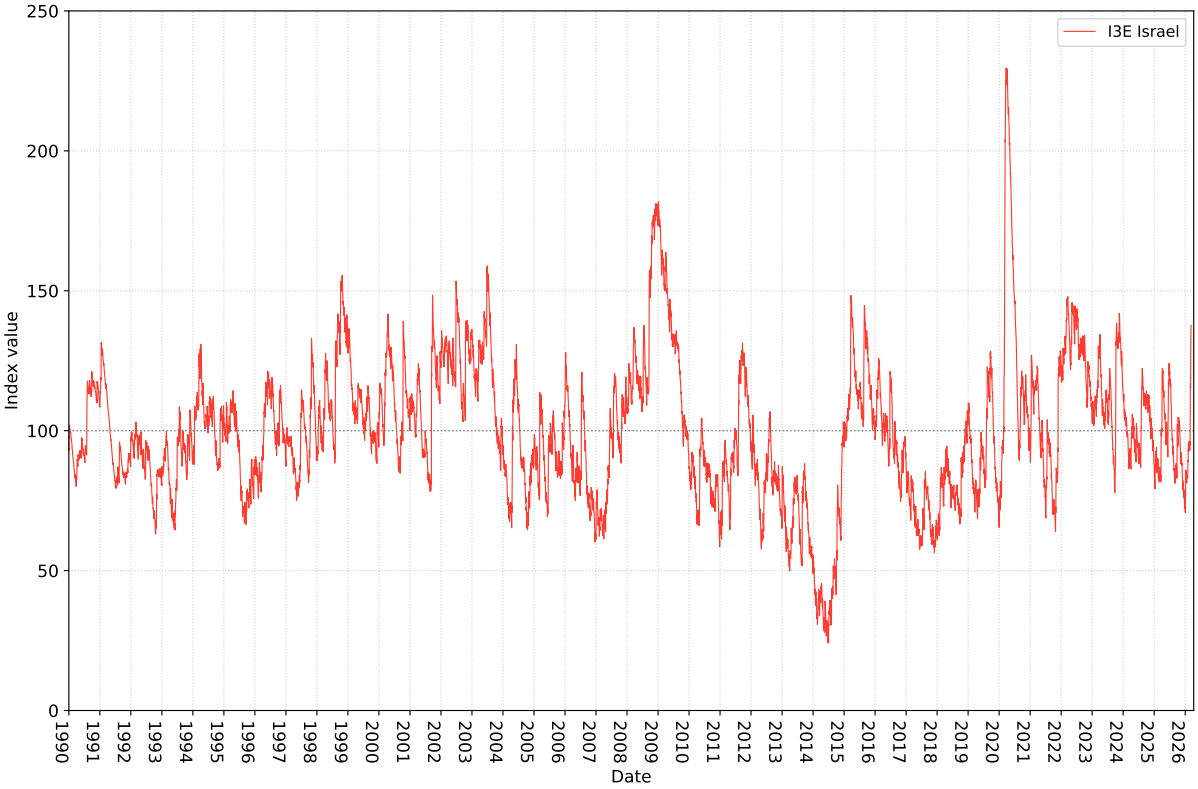

Figure: I3E ISRAEL

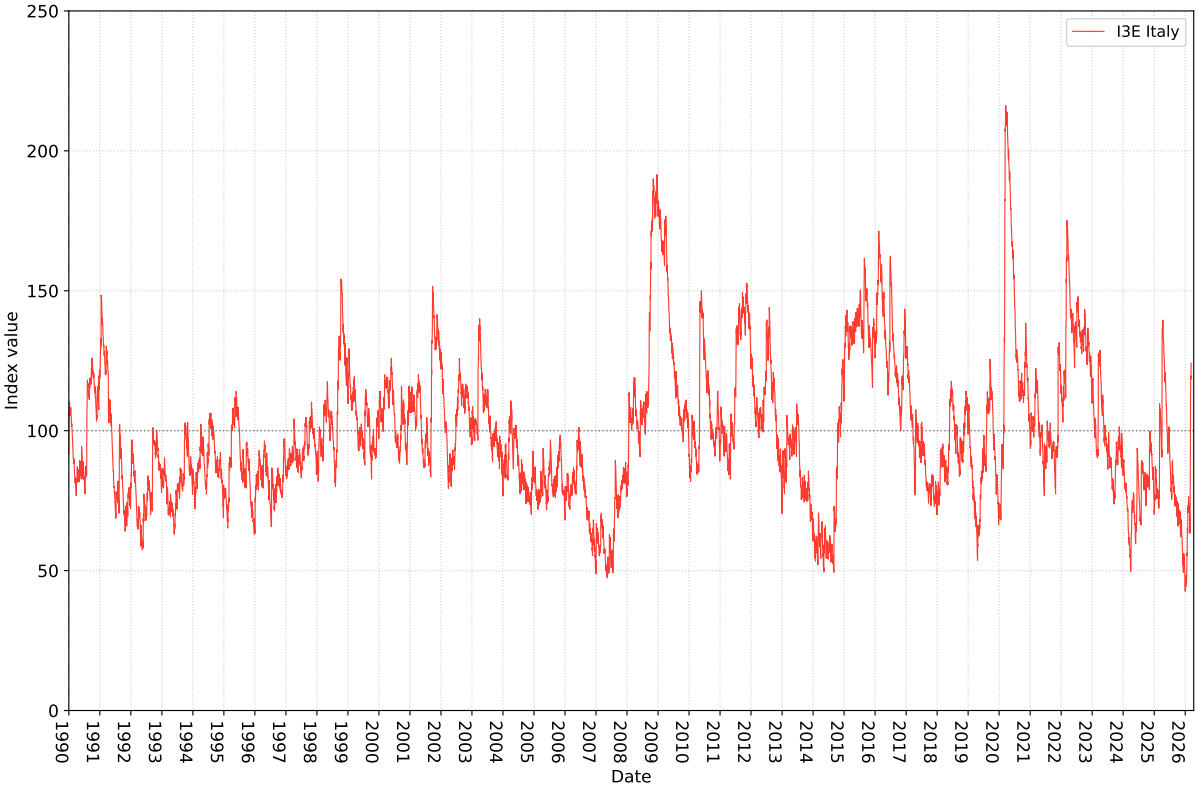

Figure: I3E ITALY

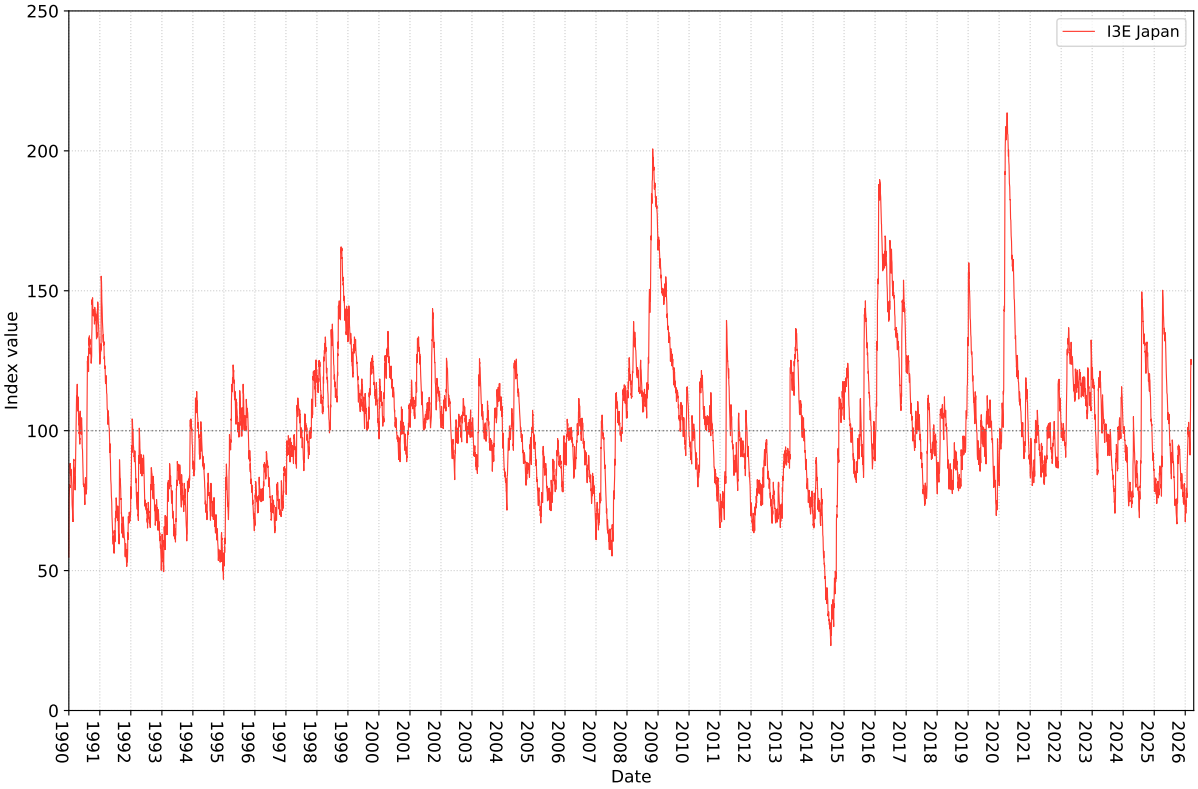

Figure: I3E JAPAN

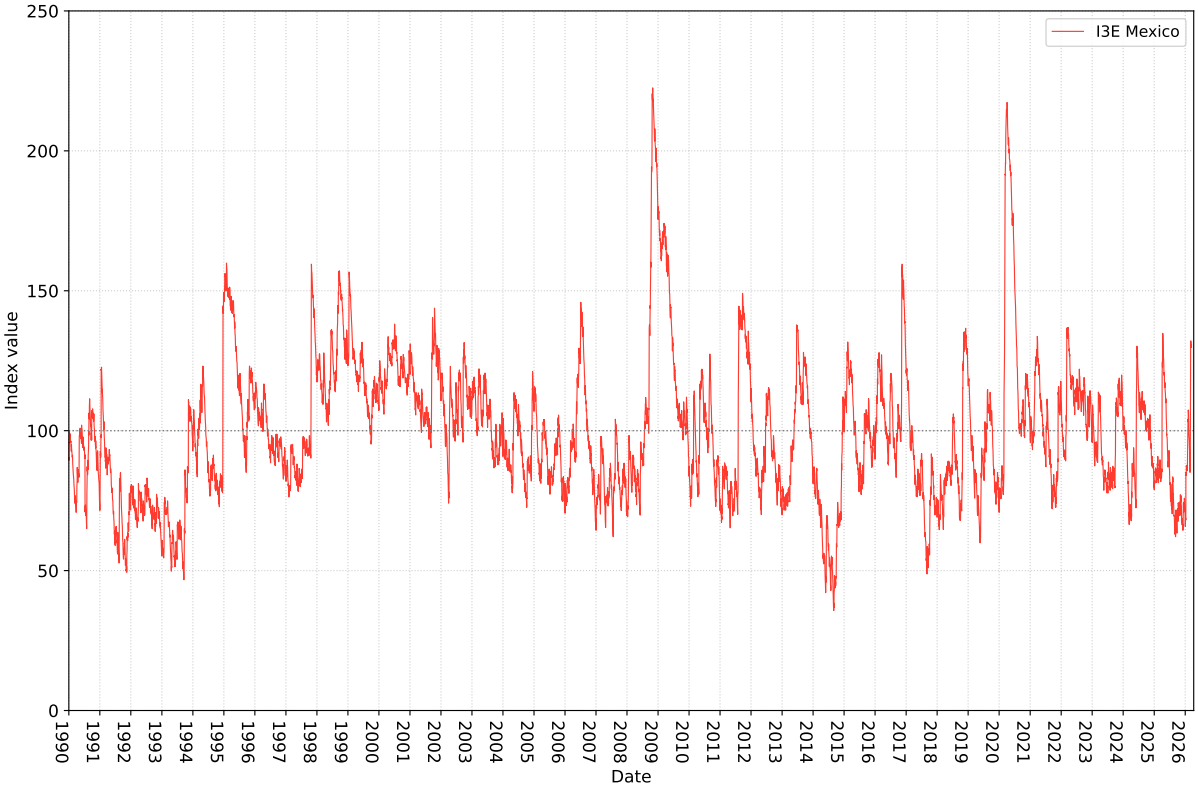

Figure: I3E MEXICO

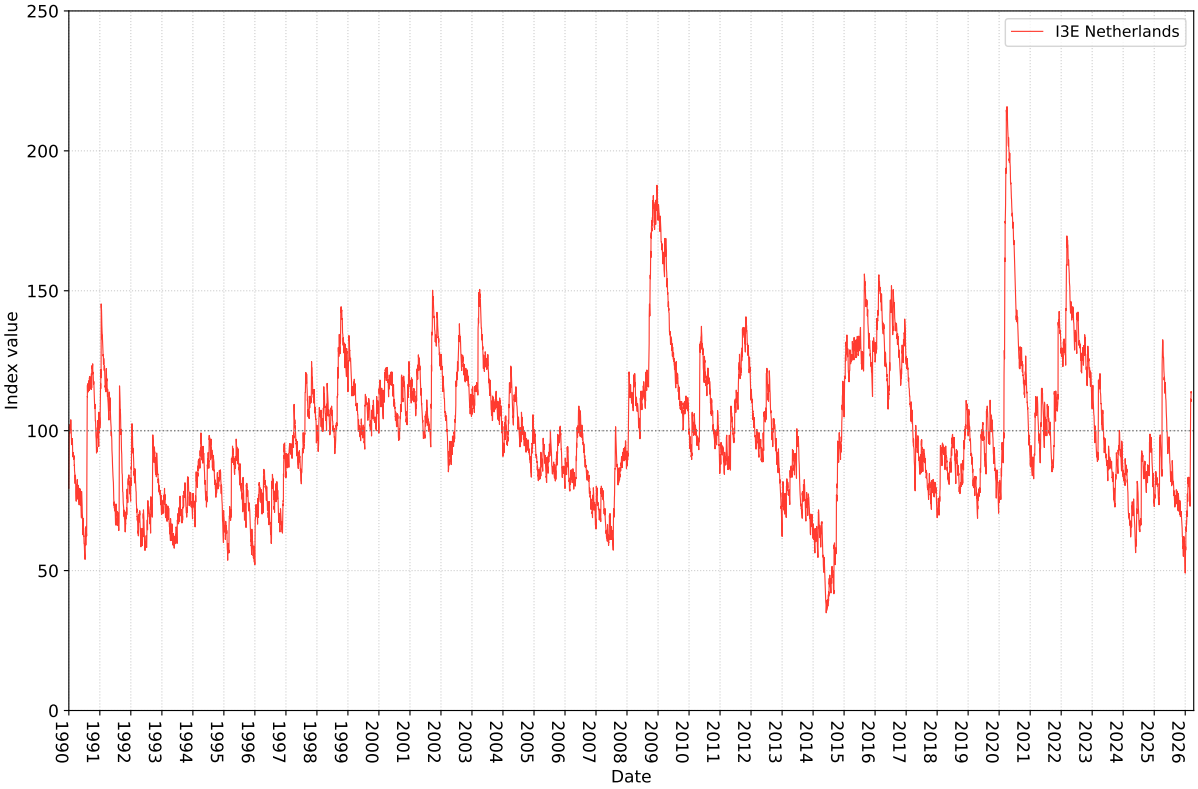

Figure: I3E NETHERLANDS

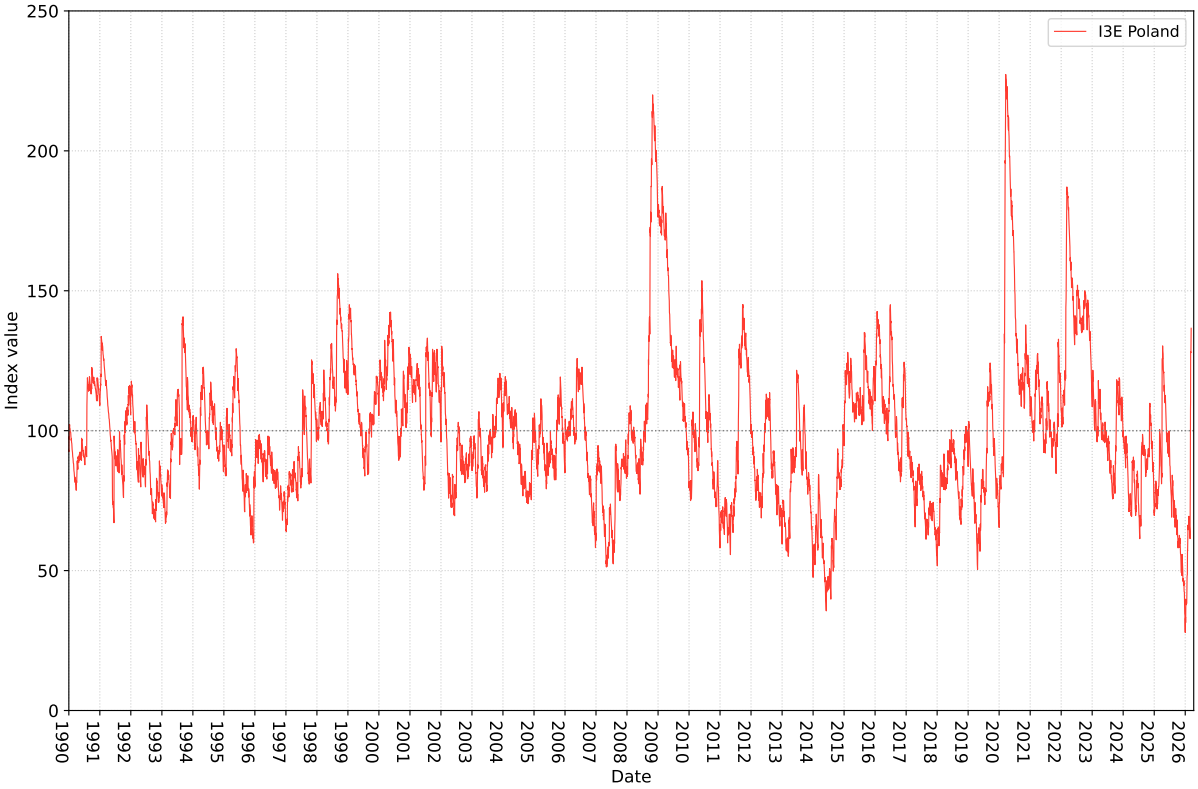

Figure: I3E POLAND

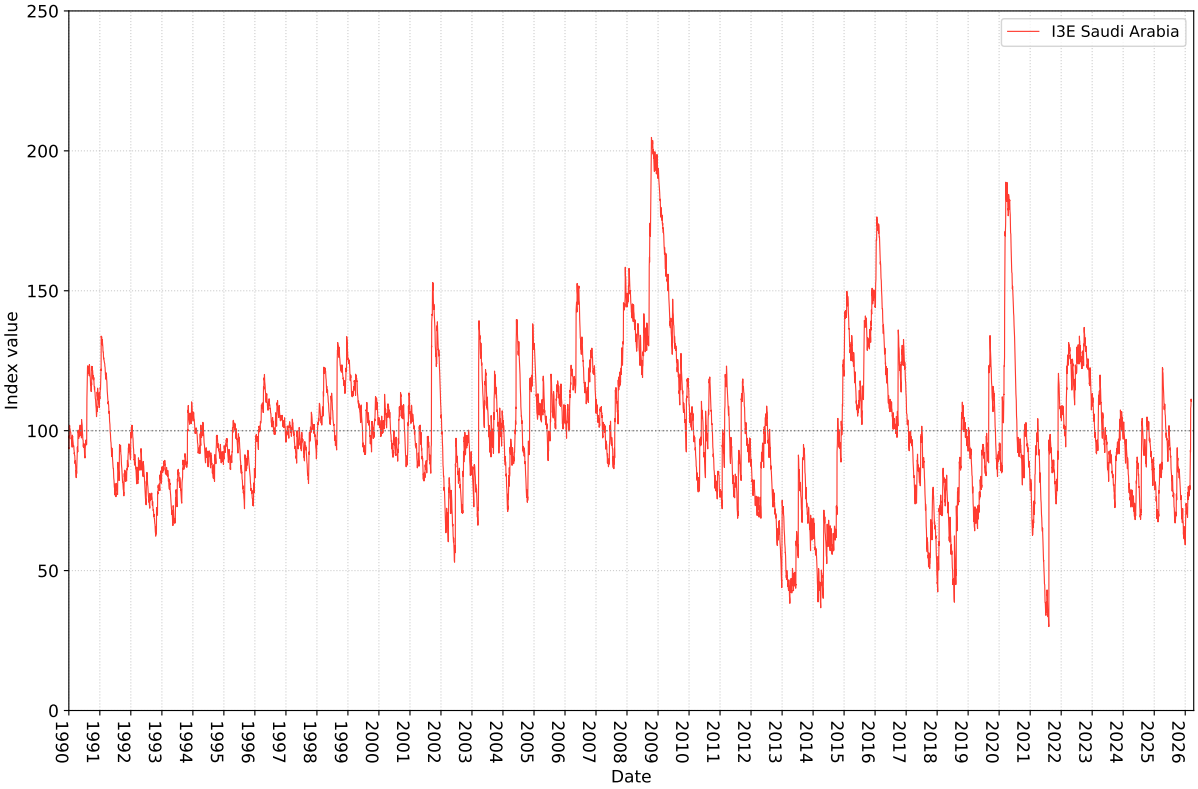

Figure: I3E SAUDI ARABIA

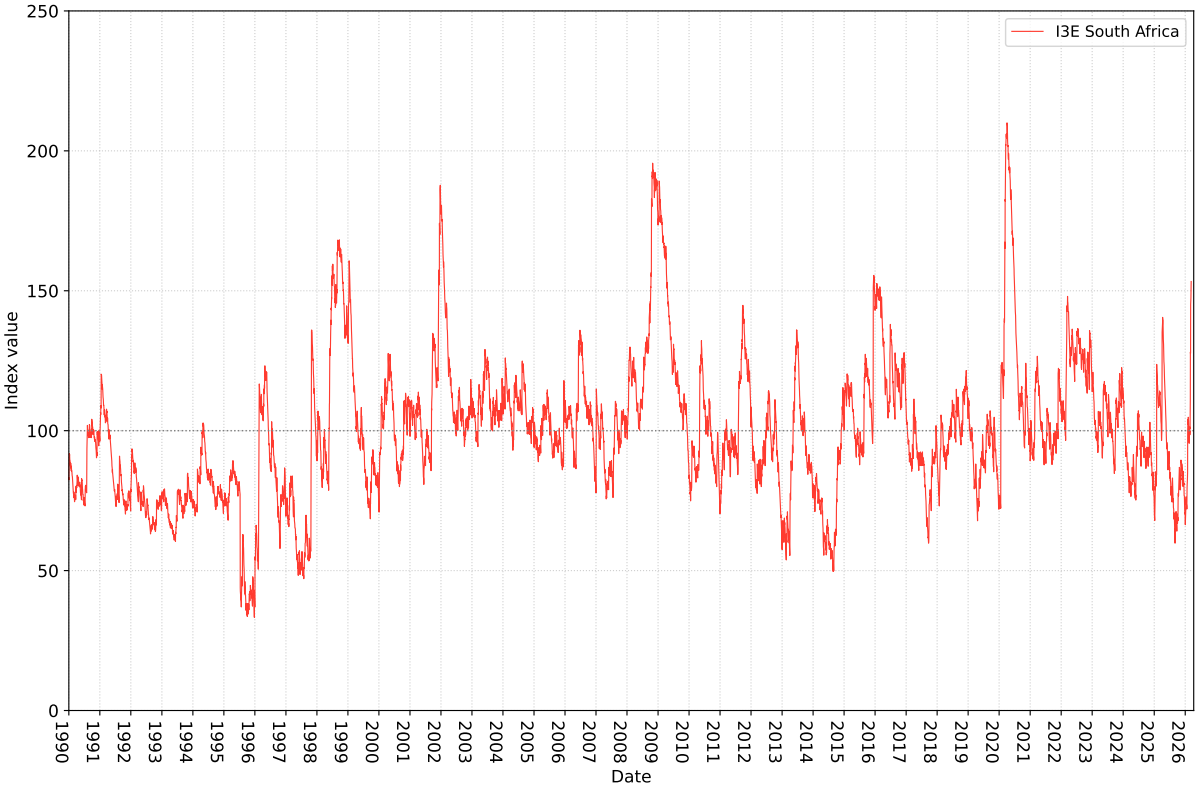

Figure: I3E SOUTH AFRICA

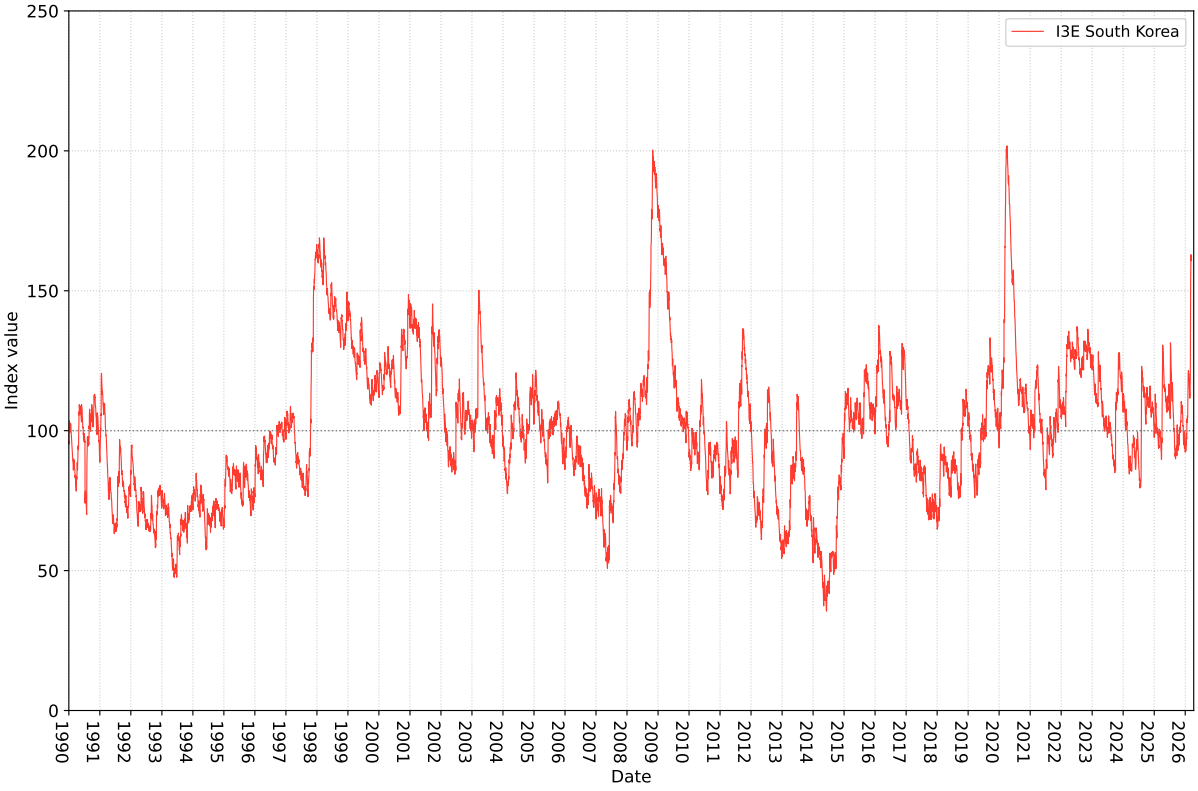

Figure: I3E SOUTH KOREA

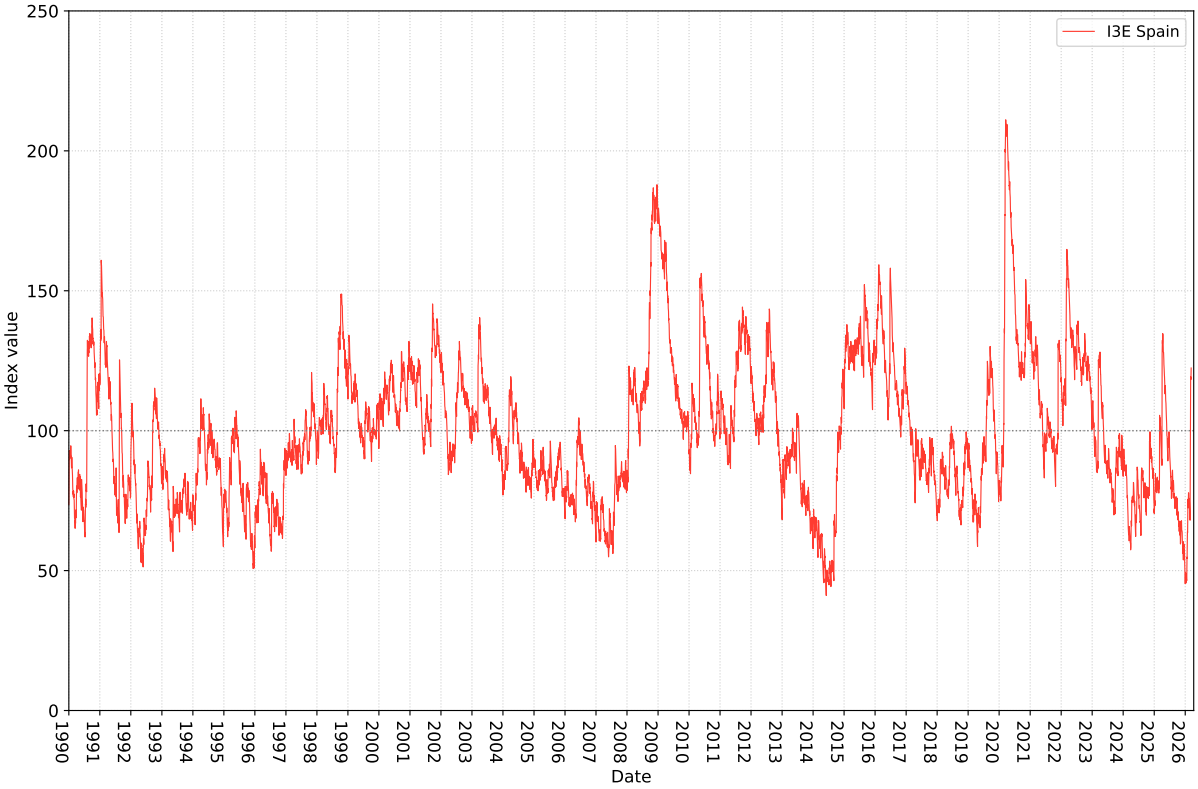

Figure: I3E SPAIN

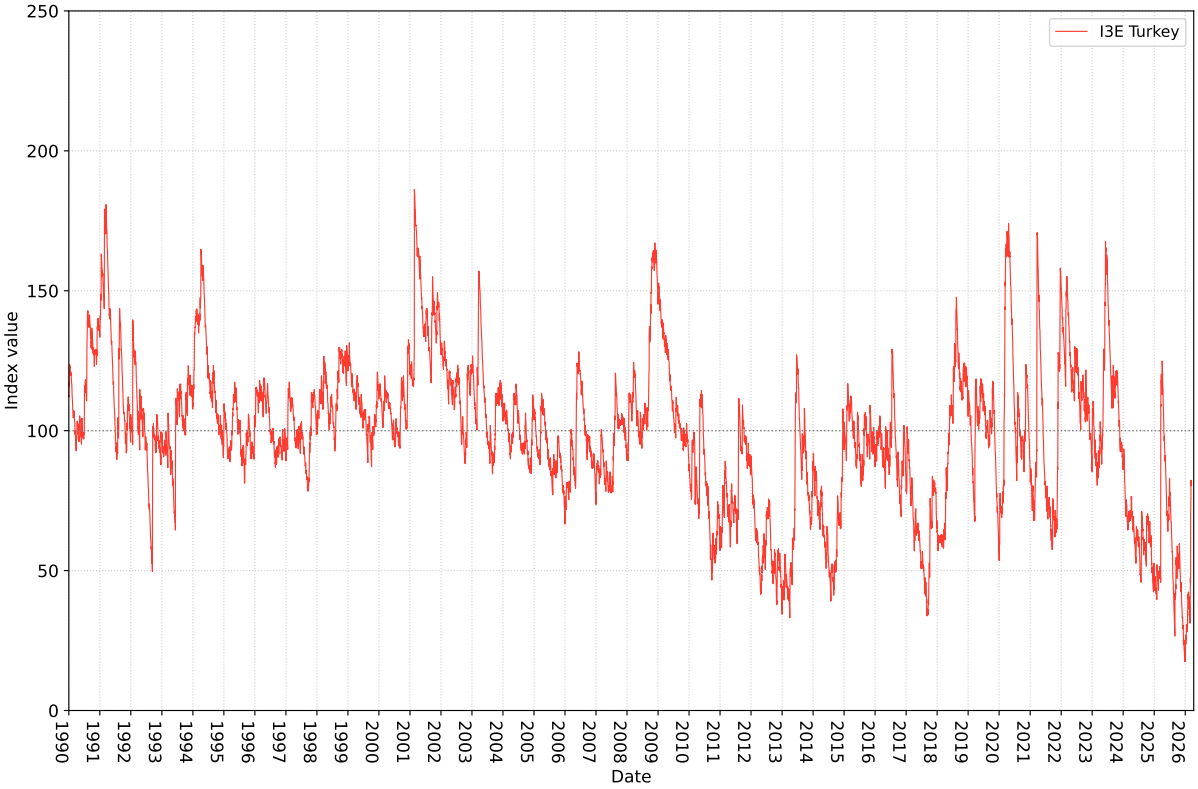

Figure: I3E TURKEY

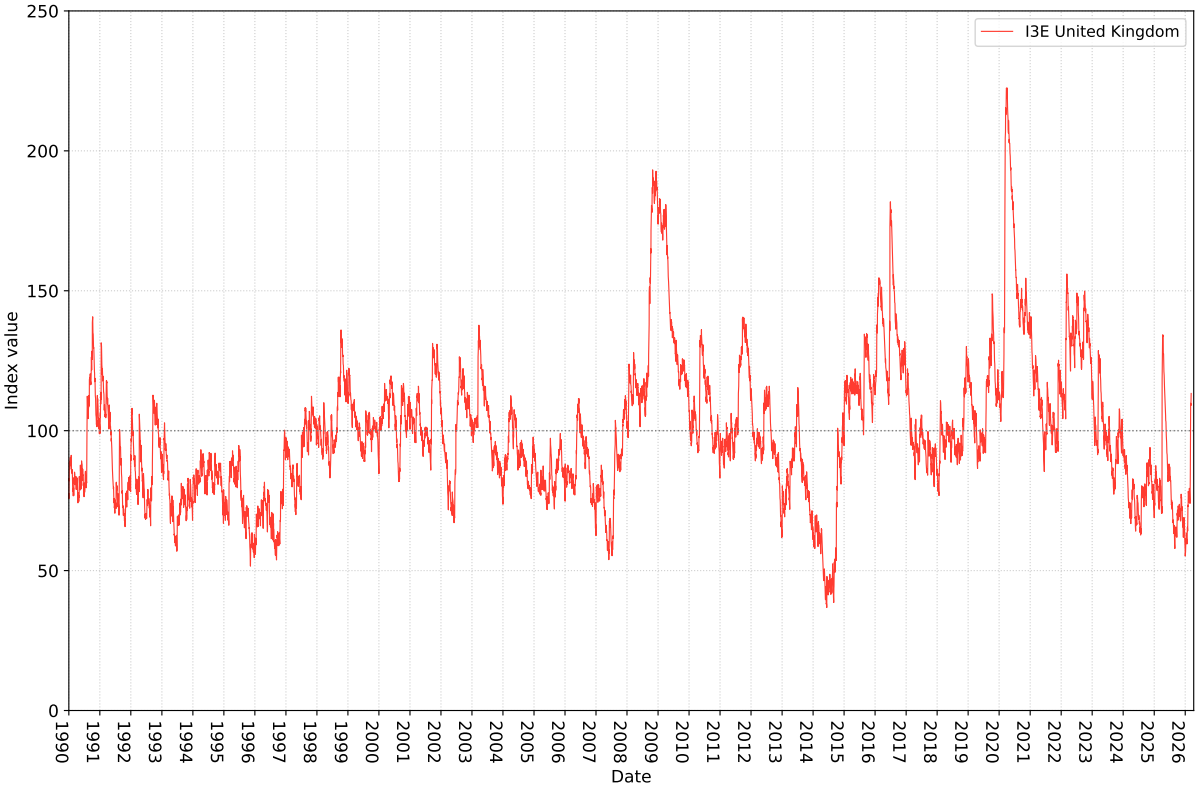

Figure: I3E UNITED KINGDOM

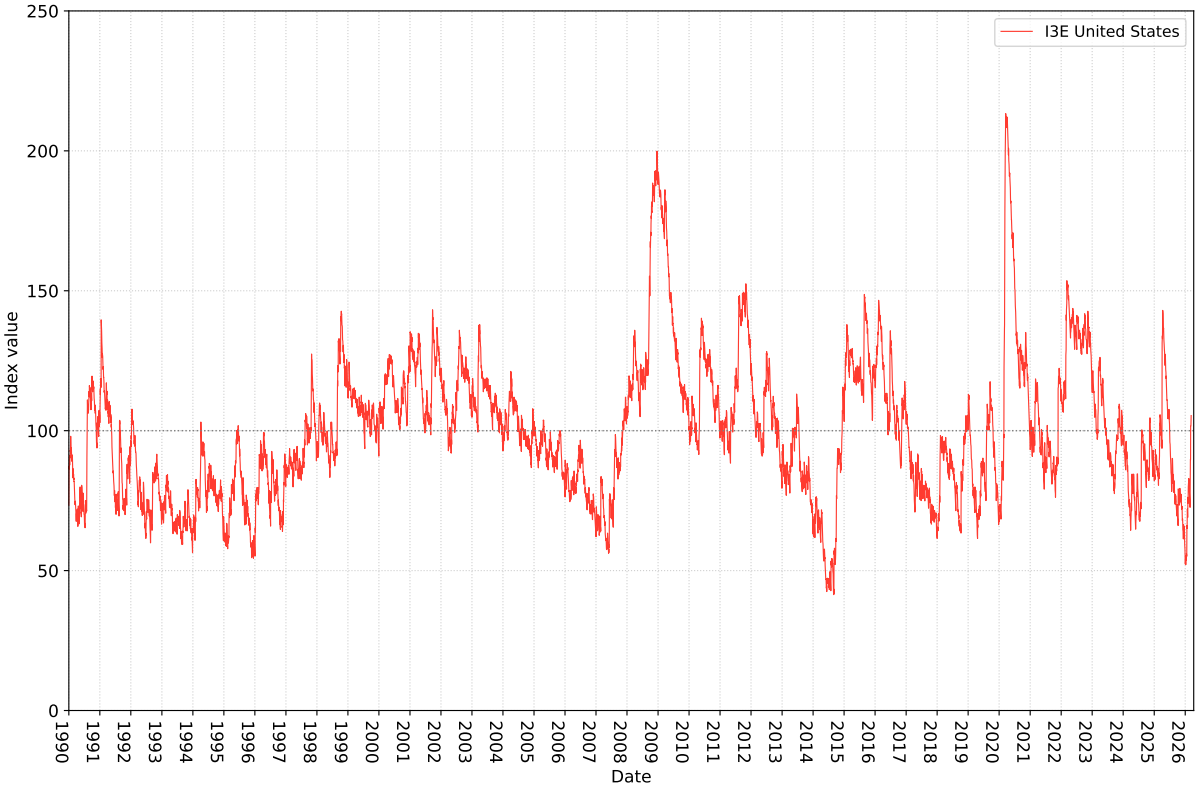

Figure: I3E USA