

# An Analysis of G20 Stock Indices Valuation using Z-Scores

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## Abstract

This paper examines the valuation levels of major stock market indices across G20 nations using statistical z-score methodology. By analyzing current index values against their five-year historical means and standard deviations, we provide a quantitative assessment of market valuations. Our findings reveal a globally synchronized elevated market environment, with all 21 analyzed indices trading above their historical averages. Seven indices demonstrate significantly overvalued conditions ( $z\text{-score} > 1.5$ ), while 14 indices are classified as overvalued ( $z\text{-score } 0.5 - 1.5$ ). This analysis has important implications for portfolio risk management and investment strategy in the current market cycle.

The paper ends with “The End”

## 1 Introduction

Global equity markets have experienced substantial growth following the post-pandemic recovery period. Understanding current valuation levels relative to historical norms is crucial for informed investment decision-making and risk management. This paper employs z-score statistical analysis to evaluate the relative valuation of major stock indices across G20 economies.

The z-score, a standardized measure of distance from the mean, provides an objective framework for comparing valuations across markets with different scales and characteristics. A z-score indicates how many standard deviations an observation lies from its historical mean, enabling cross-market comparisons and identification of potential extremes.

### 1.1 Research Objectives

This analysis aims to:

1. Calculate z-scores for 21 major stock indices across G20 nations
2. Classify indices into valuation categories based on statistical criteria
3. Identify patterns in global market valuations
4. Provide investment implications based on current valuation levels

## 2 Methodology

### 2.1 Data Collection

Current index values were obtained as of January 29, 2026, representing closing prices in local currencies. Historical data spanning a five-year period (2021-2025) was utilized to calculate mean values and standard deviations for each index.

## 2.2 Z-Score Calculation

The z-score for each index is calculated using the formula:

$$Z = \frac{X - \mu}{\sigma} \quad (1)$$

where:

$Z$  is the z-score

$X$  is the current index value

$\mu$  is the five-year historical mean

$\sigma$  is the five-year standard deviation

## 2.3 Valuation Classification

Indices are classified into five categories based on their z-scores:

Z-Score Range	Classification	Interpretation
$Z < -1.5$	Significantly Undervalued	Trading at rare low levels, potential buying opportunity
$-1.5 \leq Z < -0.5$	Undervalued	Below average, may offer value
$-0.5 \leq Z \leq 0.5$	Fairly Valued	Trading near historical average
$0.5 < Z \leq 1.5$	Overvalued	Above average, caution advised
$Z > 1.5$	Significantly Overvalued	Trading at rare high levels, elevated risk

Table 1: Z-Score Valuation Classification Framework

## 3 Results

### 3.1 Summary Statistics

The analysis encompassed 21 major stock indices across G20 nations. Table 2 presents the comprehensive results, sorted by z-score from lowest to highest.

Table 2: G20 Stock Indices Z-Score Analysis Results

Country	Index	Current	Z-Score	Valuation
China	Shanghai	4,083.67	0.97	Overvalued
Canada	S&P/TSX	32,219.95	1.05	Overvalued
China (HK)	Hang Seng	26,710.45	1.06	Overvalued
Brazil	Bovespa	161,869.77	1.09	Overvalued
Australia	ASX 200	8,682.80	1.18	Overvalued
Indonesia	IDX	8,933.61	1.19	Overvalued
South Korea	KOSPI	4,525.48	1.21	Overvalued
Mexico	IPC	65,014.37	1.25	Overvalued
Argentina	MERVAL	3,130,197	1.26	Overvalued
Saudi Arabia	Tadawul	12,400.00	1.27	Overvalued
Turkey	BIST 100	10,500.00	1.33	Overvalued

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Table 2 – continued from previous page

Country	Index	Current	Z-Score	Valuation
France	CAC 40	8,252.63	1.39	Overvalued
Russia	MOEX	2,222.51	1.41	Overvalued
UK	FTSE 100	10,235.29	1.45	Overvalued
India	BSE SENSEX	85,063.34	2.01	Sig. Overvalued
Japan	Nikkei 225	52,518.08	2.09	Sig. Overvalued
South Africa	JSE All Share	120,169.74	2.10	Sig. Overvalued
USA	Nasdaq	23,709.87	2.24	Sig. Overvalued
USA	S&P 500	6,996.47	2.25	Sig. Overvalued
Germany	DAX	24,921.29	2.37	Sig. Overvalued
USA	Dow Jones	48,972.00	2.79	Sig. Overvalued

### 3.2 Valuation Distribution

The distribution of indices across valuation categories reveals a striking pattern:

- **Significantly Undervalued:** 0 indices (0%)
- **Undervalued:** 0 indices (0%)
- **Fairly Valued:** 0 indices (0%)
- **Overvalued:** 14 indices (67%)
- **Significantly Overvalued:** 7 indices (33%)

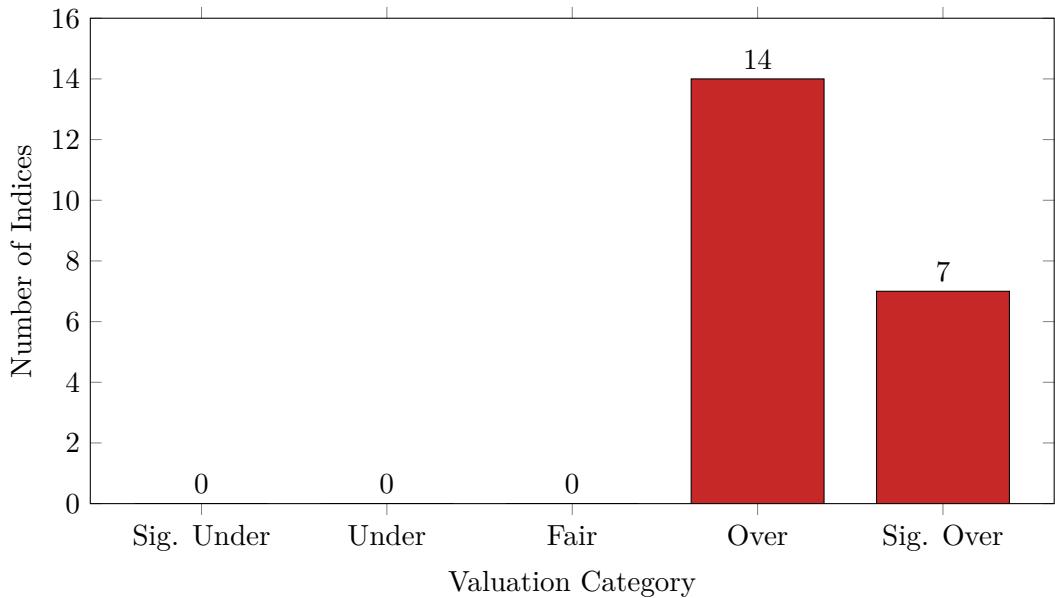


Figure 1: Distribution of Indices by Valuation Category

### 3.3 Z-Score Visualization

Figure 2 presents the z-scores for all analyzed indices, ordered from lowest to highest. The horizontal reference lines demarcate the classification boundaries.

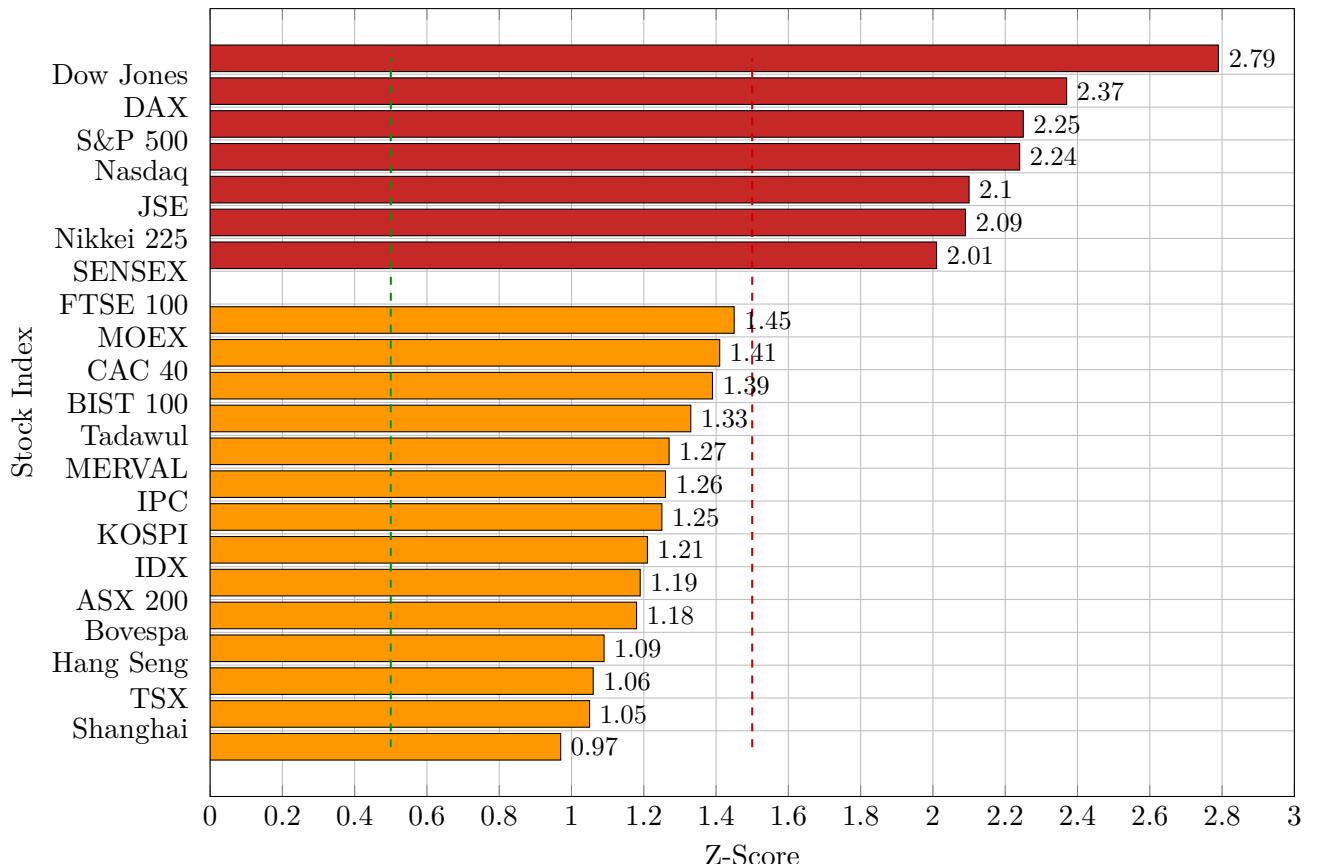


Figure 2: Z-Scores of G20 Stock Indices (Green line: Overvalued threshold; Red line: Significantly overvalued threshold)

### 3.4 Regional Analysis

Examining valuation patterns by region reveals important insights:

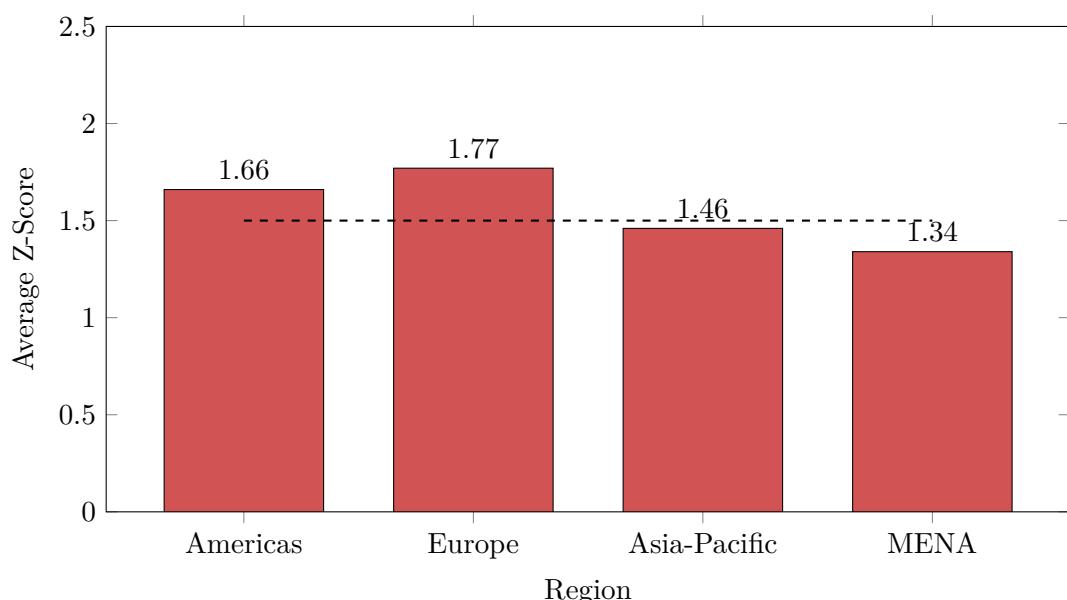


Figure 3: Average Z-Score by Region

## **Key Regional Findings:**

- **Europe** shows the highest average z-score (1.77), driven by elevated valuations in DAX, CAC 40, and FTSE 100
- **Americas** follows closely (1.66), with US indices showing extreme valuations
- **Asia-Pacific** (1.46) and **MENA** (1.34) show relatively lower but still elevated valuations

## **4 Analysis and Discussion**

### **4.1 Significantly Overvalued Markets**

Seven indices demonstrate z-scores exceeding 1.5, indicating valuations in approximately the top 7% of their historical distributions. These markets warrant particular attention:

#### **4.1.1 United States Equity Markets**

All three major US indices appear in the significantly overvalued category:

**Dow Jones Industrial Average (Z = 2.79)** The highest z-score observed, representing an extreme deviation from historical norms. Current value of 48,972 represents approximately 40% above the five-year mean.

**S&P 500 (Z = 2.25)** Broad US large-cap index showing extreme valuation levels at 6,996.47, driven by technology sector concentration and strong corporate earnings.

**Nasdaq Composite (Z = 2.24)** Technology-heavy index at 23,709.87, reflecting AI-driven optimism and growth stock premium.

#### **4.1.2 International Markets**

**DAX (Germany, Z = 2.37)** European industrial powerhouse showing second-highest z-score, potentially driven by manufacturing recovery and export strength.

**Nikkei 225 (Japan, Z = 2.09)** Japanese equities at multi-decade highs, supported by corporate governance reforms and favorable monetary policy.

**JSE All Share (South Africa, Z = 2.10)** African market showing surprising strength, possibly commodity-driven.

**BSE SENSEX (India, Z = 2.01)** Indian equities reflecting strong economic growth expectations and demographic tailwinds.

### **4.2 Moderately Overvalued Markets**

Fourteen indices fall in the overvalued category (z-score 0.5-1.5), representing above-average but less extreme valuations. The lower end of this range, including Shanghai Composite (Z = 0.97) and major commodity-exporting nations, may offer relatively better risk-reward profiles within the elevated global context.

### 4.3 Global Synchronization

The absence of any undervalued or fairly valued indices represents a remarkable degree of global market synchronization. This phenomenon suggests several contributing factors:

1. **Coordinated Monetary Policy:** Central bank policies across developed and emerging markets have supported asset prices
2. **Technology Diffusion:** AI and digital transformation driving valuations globally
3. **Cross-border Capital Flows:** Increased market integration and correlation
4. **Post-pandemic Recovery:** Synchronized economic rebound following COVID-19
5. **Risk-on Sentiment:** Broad-based investor optimism and high risk appetite

### 4.4 Statistical Implications

From a purely statistical perspective, having 100% of indices with positive z-scores is a rare event. Assuming normal distribution and independence (which may not hold), the probability of all 21 indices simultaneously exceeding their means approaches:

$$P(\text{all } Z > 0) = (0.5)^{21} \approx 0.00000048 \quad (2)$$

While markets are neither normal nor independent, this calculation illustrates the exceptional nature of current conditions.

## 5 Investment Implications

### 5.1 Risk Assessment

The universally elevated valuation environment presents several implications for investors:

**High Risk Environment**  
All markets trading above historical averages  
Limited margin of safety

#### 5.1.1 Downside Risk

Markets with z-scores exceeding 2.0 face significant mean-reversion risk. Historical analysis suggests that:

- Valuations at  $Z > 2$  typically precede periods of underperformance
- Drawdowns from extreme valuations average 20-30%
- Time to mean reversion varies from months to years

#### 5.1.2 Forward Return Expectations

Elevated valuations historically correlate with lower forward returns. The relationship between current z-score and expected 3-year annualized returns can be approximated:

$$E[R_{3\text{yr}}] \approx \mu_{\text{long-term}} - \alpha \cdot Z \quad (3)$$

where  $\alpha$  represents the mean-reversion coefficient.

## 5.2 Portfolio Positioning Strategies

Given the elevated valuation landscape, prudent strategies include:

1. **Geographic Diversification:** Despite universal elevation, lower z-score markets (China, Canada, Hong Kong) offer relatively better positioning
2. **Quality Focus:** In expensive markets, emphasize companies with strong balance sheets, consistent cash flows, and competitive moats
3. **Defensive Positioning:** Increase allocation to defensive sectors and lower-beta assets
4. **Systematic Rebalancing:** Implement disciplined rebalancing to capture mean-reversion opportunities
5. **Cash Management:** Maintain adequate cash reserves for deployment during corrections
6. **Hedging Strategies:** Consider protective options or tactical hedging for concentrated exposures

## 5.3 Relative Value Opportunities

While all markets are elevated, relative comparisons suggest:

Category	Z-Score	Markets
Most Attractive	0.97–1.18	Shanghai, TSX, Hang Seng, Bovespa, ASX 200
Neutral	1.19–1.45	IDX, KOSPI, IPC, Merval, Tadawul, BIST 100, CAC 40, MOEX, FTSE 100
Least Attractive	2.01–2.79	SENSEX, Nikkei, JSE, Nasdaq, S&P 500, DAX, Dow Jones

Table 3: Relative Attractiveness Based on Z-Scores

## 6 Limitations and Caveats

This analysis should be interpreted with awareness of several limitations:

### 6.1 Methodological Considerations

**Historical Window** The five-year lookback period may not capture full market cycles or structural changes

**Stationarity Assumptions** Markets may undergo regime changes that alter mean and variance characteristics

**Normality Assumptions** Index returns may exhibit fat tails and skewness not captured by z-scores

**Independence** Cross-market correlations violate independence assumptions

## 6.2 Economic Context

Z-scores provide statistical perspective but do not incorporate:

- Fundamental valuation metrics (P/E ratios, earnings growth)
- Macroeconomic conditions (GDP growth, inflation, interest rates)
- Monetary policy stance and trajectory
- Geopolitical factors and regulatory changes
- Structural economic transformations (e.g., AI revolution)

## 6.3 Timing Considerations

Statistical measures cannot predict timing of mean reversion. Markets can remain overvalued for extended periods, particularly in the presence of:

- Accommodative monetary policy
- Strong earnings growth
- Positive investor sentiment
- Lack of attractive alternatives

## 7 Conclusion

This analysis reveals an unprecedented global market environment, with all 21 major stock indices across G20 nations trading above their five-year historical averages. The universality of elevated valuations, combined with the extreme levels observed in seven indices (z-scores > 1.5), suggests heightened risk and potential for mean reversion.

Key conclusions include:

1. **Universal Elevation:** 100% of analyzed indices are overvalued, indicating synchronized global risk-on sentiment
2. **Extreme Valuations:** US indices (Dow, S&P 500, Nasdaq) and German DAX show particularly elevated levels
3. **Regional Patterns:** Developed markets (US, Europe, Japan) show higher average z-scores than emerging markets
4. **Risk Management Imperative:** Current conditions warrant defensive positioning, diversification, and disciplined risk management
5. **Relative Opportunities:** Within the elevated context, Asian markets and commodity exporters offer relatively better valuations

While elevated valuations indicate increased risk, they do not constitute market timing signals. Investors should maintain diversified portfolios, emphasize quality holdings, and prepare for increased volatility. The statistical rarity of current conditions all indices simultaneously elevated merits particular attention and prudent risk management.

Future research could extend this analysis by incorporating:

- Fundamental valuation metrics alongside statistical measures

- Regime-switching models to account for structural breaks
- Cross-sectional analysis of sector and factor exposures
- Integration with macroeconomic indicators and yield curve dynamics

As always, statistical analysis should complement, not replace, comprehensive fundamental analysis and alignment with individual investment objectives and risk tolerance.

## Glossary

**Z-Score** A statistical measurement describing a value's relationship to the mean of a group of values, expressed in terms of standard deviations from the mean.

**Standard Deviation ( $\sigma$ )** A measure of the amount of variation or dispersion in a set of values. A low standard deviation indicates values tend to be close to the mean, while high standard deviation indicates values are spread over a wider range.

**Mean ( $\mu$ )** The average value of a dataset, calculated by summing all values and dividing by the number of observations.

**Valuation** The analytical process of determining the current worth of an asset or company, or in this context, whether a market index is trading above or below historical norms.

**Mean Reversion** The financial theory suggesting that asset prices and historical returns eventually revert to their long-term mean or average level.

**Index** A statistical measure of change in a securities market, typically representing a basket of stocks selected to represent a particular market or sector.

**G20** The Group of Twenty, an intergovernmental forum comprising 19 countries and the European Union, representing the world's major economies.

**Overvaluation** A condition where an asset's current price exceeds its intrinsic value or historical average, potentially indicating elevated risk.

**Beta** A measure of a stock's or portfolio's volatility relative to the overall market, used to assess systematic risk.

**Drawdown** The decline from a historical peak in the value of an investment, typically expressed as a percentage.

**Risk-On Sentiment** Market environment characterized by investor willingness to take risks and invest in higher-risk, higher-return assets.

**Monetary Policy** Central bank actions that determine the size and rate of growth of the money supply, influencing interest rates and inflation.

**Normal Distribution** A probability distribution that is symmetric about the mean, forming a bell-shaped curve, often assumed in statistical analysis.

**Correlation** A statistical measure describing the relationship between two variables, ranging from -1 (perfect negative correlation) to +1 (perfect positive correlation).

**Volatility** The degree of variation in trading prices over time, often measured by standard deviation of returns.

**Portfolio Diversification** Risk management strategy involving spreading investments across various financial instruments, industries, and categories.

**Systematic Risk** Market-wide risk that affects all securities and cannot be eliminated through diversification.

**Capital Flows** The movement of money for investment, trade, or business operations between countries or sectors.

**P/E Ratio** Price-to-Earnings ratio, a valuation metric comparing a company's stock price to its earnings per share.

**Market Cycle** The natural fluctuation of markets between periods of growth (bull markets) and decline (bear markets).

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**The End**