FX Market Analysis Framework

https://img.shields.io/badge/FX-Analysis-blue
https://img.shields.io/badge/Multi--Factor-Strategy-green
https://img.shields.io/badge/Institutional-Grade-orange

A comprehensive multi-factor FX analysis system that integrates DXY, commodities, volatility indices, currency futures, and global equity indices to generate professional trading signals.

📋 Overview

This framework provides institutional-grade analysis of foreign exchange markets by combining multiple data sources and analytical techniques. The system processes DXY trends, oil prices, volatility indicators, currency futures, and global market sentiment to generate actionable trading signals with confidence scoring.

🚀 Key Features

🎯 Multi-Factor Analysis

- **DXY Regime Detection**: Identifies USD strength/weakness cycles
- **Commodity Integration**: Special handling for oil-sensitive pairs (USD/CAD) and gold volatility
- **Volatility Analysis**: Incorporates VIX, VVIX, SKEW, MOVE, and GVZ (Gold Volatility) indices
- **Futures-Spot Divergence**: Compares spot FX with futures market positioning
- **Currency Strength Matrix**: Calculates relative strength across 8 major currencies
- **Global Equity Integration**: Analyzes regional indices for risk sentiment

📊 Data Integration

- **Local Data Support**: Reads from local CSV files in standardized formats
- **Flexible Formats**: Handles both factors (indices) and FX pair data
- **Technical Indicators**: Implements moving averages, RSI, MACD, Bollinger Bands, ADX
- **Automated Data Processing**: Standardizes column names and date formats

🌍 Global Market Coverage

- **Volatility Complex**: VIX, VVIX, SKEW, MOVE, GVZ, OVX, VXD, VXN
- **Regional Equity Indices**: DJI, NDX, SPY, QQQ, HSI, BSESN, IBEX, SSEC

- **Commodities**: Oil index, gold, silver, platinum, palladium, soybeans
- **Currency Analysis**: DXY and major FX pairs

📁 Data Structure

Factors Folder Structure

text

```
factors/
├── 📈 Volatility Indices
│   ├── VIX.INDX_daily.csv       # S&P 500 Volatility (Fear Gauge)
│   ├── VVIX.INDX_daily.csv      # VIX of VIX (Volatility of Volatility)
│   ├── SKEW.INDX_daily.csv      # Tail Risk Index
│   ├── MOVE.INDX_daily.csv      # Treasury Bond Volatility
│   ├── GVZ.INDX_daily.csv       # Gold Volatility Index
│   ├── OVX.INDX_daily.csv       # Oil Volatility Index
│   ├── VXD.INDX_daily.csv       # DJIA Volatility
│   └── VXN.INDX_daily.csv       # NASDAQ Volatility
├── 🌍 Equity Indices
│   ├── DJI.INDX_daily.csv       # Dow Jones Industrial Average
│   ├── NDX.INDX_daily.csv       # NASDAQ 100
│   ├── SPY_daily.csv            # S&P 500 ETF
│   ├── QQQ_daily.csv            # NASDAQ 100 ETF
│   ├── HSI.INDX_daily.csv       # Hong Kong Hang Seng
│   ├── BSESN.INDX_daily.csv     # India S&P BSE Sensex
│   ├── IBEX.INDX_daily.csv      # Spain IBEX 35
│   └── SSEC.INDX_daily.csv      # Shanghai Composite
├── ⛽ Commodities
│   ├── Global_Oil_Index.csv     # S&P Global Oil Index
│   ├── XAUUSD_daily.csv         # Gold
│   ├── XAGUSD_daily.csv         # Silver
│   ├── XPTUSD_daily.csv         # Platinum
│   ├── XPDUSD_daily.csv         # Palladium
│   └── SOYB_daily.csv           # Soybeans
└── 💵 Currency Index
    └── DXY.INDX_daily.csv       # US Dollar Index
```

FX Folder Structure

text

```
fx/
├── 🌏 Major Pairs
│   ├── AUDUSD1440.csv
│   ├── EURUSD1440.csv
│   ├── GBPUSD1440.csv
```

```
│   ├── USDCAD1440.csv
│   ├── USDJPY1440.csv
│   └── USDCHF1440.csv
├── 🔄 Cross Pairs
│   ├── AUDCAD1440.csv
│   ├── AUDCHF1440.csv
│   ├── AUDJPY1440.csv
│   ├── AUDNZD1440.csv
│   ├── CADCHF1440.csv
│   ├── CADJPY1440.csv
│   ├── CHFJPY1440.csv
│   ├── EURAUD1440.csv
│   ├── EURCAD1440.csv
│   ├── EURCHF1440.csv
│   ├── EURGBP1440.csv
│   └── EURJPY1440.csv
```

⚙️ Installation & Dependencies

bash
pip install pandas numpy ta datetime pathlib

🧠 Core Analysis Logic

DXY Influence Framework

python
Pseudo-code for DXY-based analysis
IF DXY_TREND == BULLISH:
  FOR pair in [EURUSD, GBPUSD, AUDUSD, NZDUSD]:
    SIGNAL = BEARISH (inverse correlation)
  FOR pair in [USDJPY, USDCHF]:
    SIGNAL = BULLISH (positive correlation)
ELSE IF DXY_TREND == BEARISH:
  # Reverse the signals

USD/CAD Oil Override Logic

python
Special handling for oil-sensitive pairs
IF OIL_TREND == BULLISH:
  USD/CAD_SIGNAL = BEARISH (CAD strengthens with oil)
ELSE IF OIL_TREND == BEARISH and DXY_BULLISH:
  USD/CAD_SIGNAL = BULLISH

Volatility Regime Detection

python
```
# Risk sentiment analysis
IF VIX > 30 OR VVIX > 120 OR SKEW > 140 OR MOVE > 150:
    RISK_REGIME = "EXTREME_RISK_OFF"
    SAFE_HAVENS = [JPY, CHF, USD, Gold]
ELSE IF VIX < 15 AND VVIX < 90 AND GVZ < 20:
    RISK_REGIME = "RISK_ON"
    RISK_ASSETS = [AUD, NZD, CAD, MXN]
```

💻 Usage Examples

Basic Analysis

python
```
from local_fx_analyzer import LocalFXAnalyzer

# Initialize analyzer
analyzer = LocalFXAnalyzer(factors_folder='factors', fx_folder='fx')

# Generate comprehensive report
report = analyzer.generate_comprehensive_report()

# Access specific components
signals = report['fx_signals']
strength_matrix = report['strength_matrix']
volatility_regime = report['volatility_analysis']['risk_regime']
```

Advanced Configuration

python
```
# Custom analysis with specific pairs
analyzer = LocalFXAnalyzer(factors_folder='factors', fx_folder='fx')

# Load data manually
analyzer.load_factors_data()
analyzer.load_fx_data()

# Run individual analyses
dxy_analysis = analyzer.analyze_dxy_regime()
volatility_analysis = analyzer.analyze_volatility_regime()
oil_analysis = analyzer.analyze_oil_impact()

# Generate custom signals
```

signals = analyzer.generate_fx_signals()

Volatility-Focused Analysis

python
# Specialized volatility analysis
vol_analysis = analyzer.analyze_volatility_regime()

print(f"VIX Level: {vol_analysis['current_values']['VIX']}")
print(f"VVIX Trend: {vol_analysis['metrics']['VVIX']['trend']}")
print(f"Gold Volatility (GVZ): {vol_analysis['current_values'].get('GVZ', 'N/A')}")
print(f"Risk Regime: {vol_analysis['risk_regime']}")

📊 Sample Output

text
COMPREHENSIVE FX ANALYSIS REPORT
==

📊 MARKET REGIME SUMMARY:
  DXY Regime: DXY_BULLISH (Strength: 68.2)
  Volatility Regime: NEUTRAL
  Oil Signal: BULLISH (Confidence: 72.5%)
  Global Risk: MODERATE

🎭 VOLATILITY METRICS:
  VIX: 16.8 (MODERATE_NEUTRAL) - Equity Fear
  VVIX: 88.3 (WEAK_BULLISH) - Volatility Stability
  SKEW: 135.2 (MODERATE_BEARISH) - Tail Risk
  MOVE: 98.5 (BOND_CALM) - Bond Volatility
  GVZ: 19.2 (LOW) - Gold Volatility

🌍 GLOBAL INDICES:
  SPY: STRONG_BULLISH (US Markets)
  HSI: WEAK_BEARISH (Asian Markets)
  IBEX: MODERATE_NEUTRAL (European Markets)

💪 CURRENCY STRENGTH MATRIX:
  USD: 🔥 78.4
  JPY: ✅ 65.1
  CHF: ⚖️ 54.3
  EUR: 🔻 42.7
  AUD: 🔻 38.9
  CAD: ✅ 61.2 (Oil Boost)

🎯 TRADING SIGNALS (Top 10):
  🟢 BUY USDJPY (Confidence: 82.1%)
    Reasoning: DXY bullish + Risk-off sentiment favors USD over JPY
  🔴 SELL EURUSD (Confidence: 76.8%)
    Reasoning: DXY bullish typically weakens EURUSD
  🟢 BUY USDCAD (Confidence: 68.3%)
    Reasoning: Strong USD overriding moderate oil bullishness

⚠️ RISK WARNINGS:
  - SKEW above 130 indicates elevated tail risk
  - Consider reduced position sizes

📈 Key Trading Insights

DXY Correlations Table

DXY Movement	USD Implication	EUR/USD	USD/JPY	GBP/USD	USD/CAD
↑ Rising	Strong USD	↓ Falling	↑ Rising	↓ Falling	*Oil Dependent*
↓ Falling	Weak USD	↑ Rising	↓ Falling	↑ Rising	*Oil Dependent*

Volatility Thresholds

Indicator	Low Volatility	Normal	Elevated	Extreme
VIX	< 15	15-20	20-30	> 30
VVIX	< 90	90-110	110-120	> 120
SKEW	< 125	125-135	135-145	> 145
MOVE	< 100	100-120	120-150	> 150
GVZ	< 18	18-25	25-35	> 35

Regional Market Correlations

Region	Index	Risk Sensitivity	FX Impact
US	SPY/DJI	High	USD, Risk Sentiment

Europe	IBEX	Medium	EUR, CHF
Asia	HSI/SSEC	High	AUD, NZD, JPY
Emerging	BSESN	Very High	Risk Currencies

Oil Impact Matrix (USD/CAD)

Oil Trend	DXY Trend	USD/CAD Signal	Confidence
↑ Bullish	Any	↓ Bearish	High
↓ Bearish	↑ Bullish	↑ Bullish	High
↓ Bearish	↓ Bearish	→ Neutral	Low

Gold Volatility (GVZ) Impact

GVZ Level	Market Implication	Safe Haven Demand
< 18	Calm Markets	Low
18-25	Normal Conditions	Moderate
25-35	Uncertainty	High (Gold, JPY, CHF)
> 35	Fear/Crisis	Very High

🔧 Advanced Features

1. Currency Strength Matrix

Calculates relative strength scores (0-100) for major currencies based on:

- Spot price trends across multiple pairs
- Futures index performance (when available)
- Technical indicator strength (ADX, trend consistency)
- Regional equity market correlations

2. Risk Management Integration

- Position sizing based on volatility regime
- Stop-loss recommendations using ATR
- Correlation analysis to avoid over-concentration

- VIX-based leverage adjustment

3. Multi-Timeframe Analysis

- Combines daily data with longer-term trends
- Futures-spot divergence detection
- Leading vs lagging indicator weighting
- Regional market opening/closing effects

4. Global Sentiment Engine

python
```
def calculate_global_sentiment(self):
    """Combines regional indices for global risk assessment"""
    us_sentiment = self.analyze_index_sentiment('SPY')
    eu_sentiment = self.analyze_index_sentiment('IBEX')
    asia_sentiment = self.analyze_index_sentiment('HSI')

    return self.combine_regional_views(us_sentiment, eu_sentiment, asia_sentiment)
```

🛠️ Extending the Framework

Adding New Factors

python
```
# Custom factor integration
def analyze_custom_factor(self, factor_data):
    """Add your custom analysis logic"""
    factor_data = self.add_technical_indicators(factor_data)
    trend, strength = self.calculate_trend_strength(factor_data)
    return {'trend': trend, 'strength': strength}

# Regional analysis enhancement
def analyze_regional_markets(self):
    """Enhanced regional market analysis"""
    regions = {
        'US': ['SPY', 'QQQ', 'DJI'],
        'Europe': ['IBEX', ' regional_eu_index'],
        'Asia': ['HSI', 'SSEC', 'BSESN']
    }
    return self.calculate_regional_strength(regions)
```

Custom Signal Generation

python

```
def custom_signal_generator(self, pair_analysis, custom_factors):
    """Implement your proprietary logic"""
    # Your custom signal generation
    return signal, confidence, reasoning
```

Volatility Composite Index

python

```
def create_volatility_composite(self):
    """Creates a composite volatility score across all volatility indices"""
    vix_score = self.normalize_vol_score(self.data['VIX'])
    vvix_score = self.normalize_vol_score(self.data['VVIX'])
    gvz_score = self.normalize_vol_score(self.data['GVZ'])
    move_score = self.normalize_vol_score(self.data['MOVE'])

    composite = (vix_score + vvix_score + gvz_score + move_score) / 4
    return composite
```

✅ Best Practices

Data Quality

- Ensure consistent date formats across all files
- Handle missing data with appropriate fallbacks
- Validate data ranges for alignment
- Regular data integrity checks

Risk Management

- Use confidence scores for position sizing
- Implement correlation checks between signals
- Consider volatility-adjusted position sizing
- Monitor VVIX for volatility regime changes

Performance Optimization

- Cache technical indicator calculations
- Use vectorized operations for large datasets
- Implement incremental updates for real-time analysis
- Parallel processing for multiple currency pairs

Model Validation

- Backtest signals against historical data

- Validate volatility regime classifications
- Monitor correlation stability
- Regular performance reviews

🌟 Pro Tips

Gold Volatility (GVZ) Insights

- GVZ > 25 often precedes safe-haven flows to JPY and CHF
- Combining GVZ with VIX provides cross-asset fear assessment
- Gold volatility spikes can signal currency market stress

VVIX Interpretation

- VVIX > 100 indicates unstable volatility expectations
- Rising VVIX with stable VIX suggests impending volatility breakouts
- VVIX divergence from VIX can signal regime changes

Regional Index Correlations

- Asian session (HSI) often sets tone for AUD and NZD
- European opens (IBEX) impact EUR and GBP
- US session (SPY) drives overall risk sentiment

🤝 Contributing

We welcome contributions to enhance this framework! Areas for improvement:

- Additional volatility indices
- Machine learning integration
- Real-time data feeds
- Backtesting capabilities
- Portfolio optimization
- Risk management systems

Please ensure proper testing of any modifications and maintain the code documentation.

📄 License

⚠️ Disclaimer

This framework is for analytical and educational purposes only. It should be used as part of a comprehensive trading strategy with proper risk management. Past performance is not indicative of future results. Always consult with qualified financial professionals before making investment decisions.

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