



**AR
KUS**

RISK BASED
GOVERNANCE

MARKET RISK REPORT

On the verge of a new era
March 2022

Executive Summary

- **Region's volatility results were mixed.** Region volatility spanned a range that goes from 17.1% (Asia ex-Japan) to 22.3% (North America).
- **Realized volatility** (of the Euro Stoxx 50 index over 30 days) increased from 21.2% to 25.5% (high).
- **Equity price sector results were mixed**, with only energy increasing (+4.5%) and IT losing the most (-4.8%). **Sector volatilities** spanned a range that goes from 17.2% (Consumer Staples) to 30.5% (IT).
- **Sovereign bond price movements were all downwards**, with Italy losing the most (-3.2%). **Volatility** moves were mixed and spanned a range that goes from 1.4% (Japan) to 7.8% (Italy).
- **€ price results were mixed**, with the EUR losing the most against Swiss Franc(-1.3%) and gaining only against the British Pound(+0.2%). **FX volatility results were all upwards**; ended ranging between 6%(€/£) and 11.1% (€/Yen).
- **Options' implied volatility increased in both observed markets**, with the VIX going up from 24.8 to 30.2, and the VSTOXX from 27 to 35.3.
- **Commodities price changes were mixed; with** Iron Oil Brent gaining the most (+10.7%). **Volatility changes were also mixed** and spanned a ranged between 11.8% (Gold) to 46.9% (Iron Ore).
- **Real Estate (equity) prices movements were all downwards**, with US losing the most (-3.5%). **Volatility moves were mixed**, ranging between 15.4% (Japan) to 25.6% (Europe).
- **The average PE Funds** lost -1.4%, while the **average Hedge Fund** -0.5%. **Volatility** for the average hedge fund increased from 3.4% to 3.6%, while for the average PE fund went up from 22.2% to 28.8%.

The Arkus Risk Team



Summary volatility matrix and outlook

Soaring geopolitical tensions after the Russian attack on Ukraine resulted in a stir-up in markets. The war in eastern Europe has prompted many countries to impose restrictions and sanctions over Russian, consequently markets reacted vigorously and the selloff among the riskier asset classes didn't take long.

The pandemic has moved to the backrow in terms of attention for now. More and more countries are lifting their Covid-19 restrictions, while local outbreaks in China have prompted several lockdowns.

Rising inflation and specifically considerable increases in energy prices and commodities was also on the menu. Brent reaching levels not seeing in quite some time. Several Central Banks have declared war on inflation and have now a less accommodative monetary policy.

Both realized and implied volatility increased considerably, and the ratio of Implied/Realized ended up the month at 138%. This may be an indication that the future may be more turbulent and that a new resiliency test to market participants may be around the corner. Also, most asset types moved to their high volatility regimes

ASSET CLASS	AREA	LATEST VOLATILITY	LATEST, Z-SCORE	REGIME
EQUITIES	North America	22.3%	2.1	high
	Asia ex-Japan	17.1%	0.8	high
	Europe	21.8%	2.5	high
	Japan (Nikkei)	18.7%	0.0	medium
	Energy	22.5%	-0.3	medium
	Consumer Staples	17.2%	4.3	high
	Financials	21.2%	2.4	high
	IT	30.5%	1.8	high
VOLATILITY OF VOLATILITY	Volatility of VIX	141%	0.2	medium
	Volatility of VSTOXX	162%	0.5	high
GOVERNMENT BONDS	Germany	5.8%	2.0	high
	US	5.9%	2.1	high
	Japan	1.4%	0.7	high
	Italy	7.8%	2.2	high
FX VS €	€//\$	8.8%	2.0	high
	€/Yen	11.1%	3.4	high
	€/CHF	9.9%	4.6	high
	€/£	6.0%	0.8	high
COMMODITIES	Oil (Brent)	29.4%	-0.1	medium
	Gold	11.8%	-0.8	low
	Copper	19.8%	-1.5	low
	Iron Ore	46.9%	0.5	high
PROPERTY	US	20.5%	1.6	high
	Europe	25.609%	3.1	high
	Japan	15.381%	0.5	high
ALTERNATIVES	The average hedge fund	3.6%	1.1	high
	An average PE fund	28.8%	3.7	high
KURTOSIS	ZCF 1% left (vs -2.33 for normal curve)	-2.71	0.5	low
CORRELATION	Average market correlation with euro equities	34%	1.2	high

Note: Throughout the text we refer to volatilities as being "low", "medium" or "high". We define this by defining three equal "sized" regimes over the last 12 months. i.e. "high" volatility implies that volatility is in the upper third of its statistical range over the last 12 months. The table shows the "z-score" of the volatility of each market, i.e. how many standard deviations above (or below) the mean over the last 12 months each market's volatility is.

Table of contents

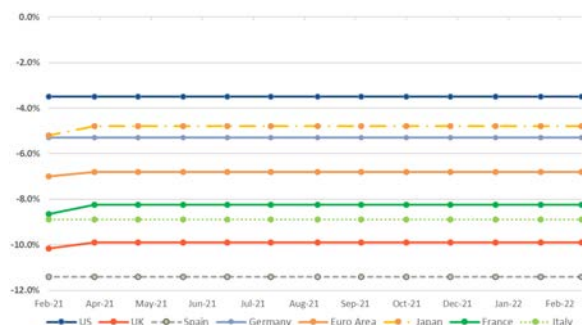
1. Summary volatility matrix	p. 4
2. Key News	p. 5
3. Kurtosis & correlation in the equity markets	p. 6-7
4. Equities	p. 8-9
5. Equity Implied Volatility	p. 10
6. Fixed Income	p. 11
7. Foreign Exchange	p. 12
8. (Equity) Options	p. 13
9. Commodities	p. 14
10. Real Estate (Real Estate Share Prices) & Alternatives 15-16	p.

Key News

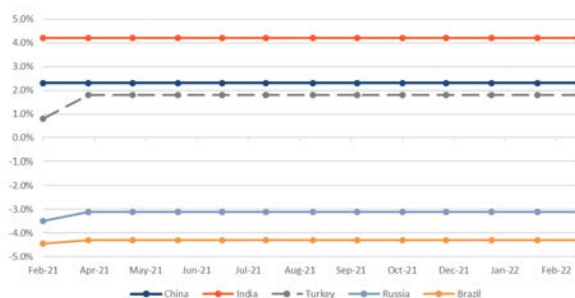
Major Volatility-Driving Events

- ▶ The European Central Bank has confirmed that they will discontinue its net pandemic emergency purchase program (PEPP) as of the end of March 2022.
- ▶ EU annualized inflation rate went from 5.6% in January to 6.2% in February; with Energy being the sector that experienced the biggest increase (+3.12%) and Lithuania the country with the biggest annualized inflation (+14%).
- ▶ The cost of insuring Russia`s government debt increased to new records, signaling around 56% likelihood of default and a 25% recovery rate.
- ▶ Labor markets in the US continue strengthening, with jobless claims decreasing by 18 thousand - as of week that ended on the 26th of February.
- ▶ Manufacturing PMI increased for its 21st consecutive month and it stands at 58.6%, which represents an increase of 1% from its 57.6 % January levels.

GDP ESTIMATES FOR 2022, DEVELOPED COUNTRIES



GDP ESTIMATES FOR 2022, DEVELOPING COUNTRIES



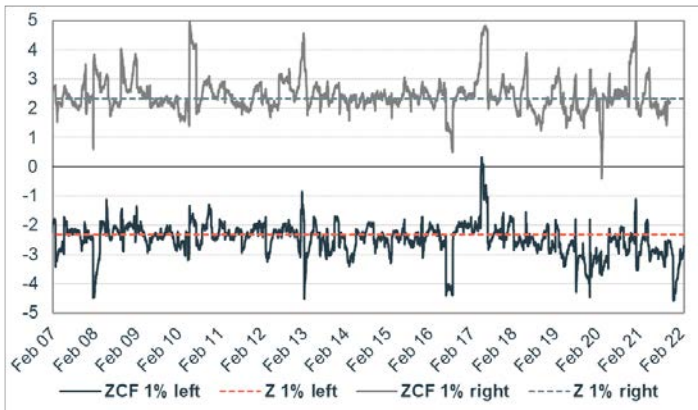
Kurtosis

Correlation in the equity markets

Kurtosis (against normal +/- 2.33)

The distribution of risks in European equity market displays denormalization on the left side with the ZCF 1% left at -2.71 and the right ZCF 1% at +2.37 (both as of 28th of February).

Cornish-Fischer expansion of Eurostoxx50 (60 days)



Methodology

To capture a measure of both Skewness and Kurtosis we look at the Cornish-Fischer expansion, which gives a good measure of the tails of the equity market. (We use a 60-calendar day rolling basis). The underlying market we plot is the Euro Stoxx 50, but other equity markets normally show very similar results.

We plot on the chart the expected Z-scores for 1% left tail (i.e. a 99% VaR) and a 1% right tail assuming a normal distribution: +/-2.33.

We also show the Cornish-Fischer expansion result for the same market. This indicates how far from a normal distribution each tail was.

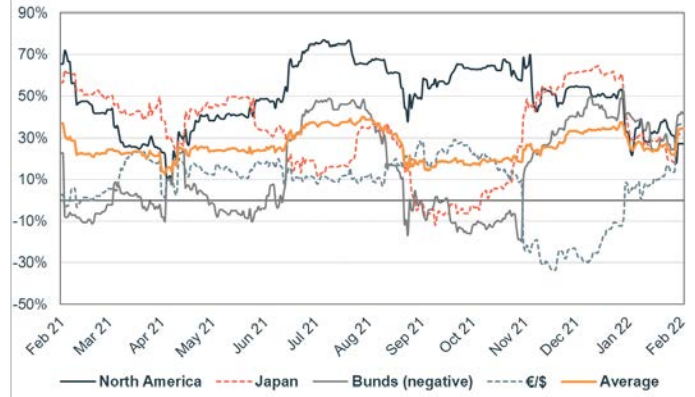
On a long-term basis, on average, the tails are slightly fatter than the normal distribution would suggest, which should not come as a surprise. What is perhaps more surprising is how much variation in fat-tailedness there has been: a daily 99% VaR has varied between -1 and -4.5 standard deviations over time.

Inter-market correlations

in the equity markets

 **34.3%** AVERAGE CORRELATION

Inter-market correlations (with EU equities)



Correlation with euro equities increased after our last report, leading our average correlation indicator to go up from 26.9% to 34.3% (medium up to high).

 **15%** AVERAGE VOLATILITIES

Multi-asset portfolio volatility



 **6.3%** PORTFOLIO VOLATILITY

We also look at a hypothetical multi-asset portfolio consisting of equities, bonds, gold, oil and hedge funds.

The average asset volatility increased, moving from 13.32% to 15.08%, while the benefit of multi-asset diversification decreased, moving from -6.7% to -8.8%.

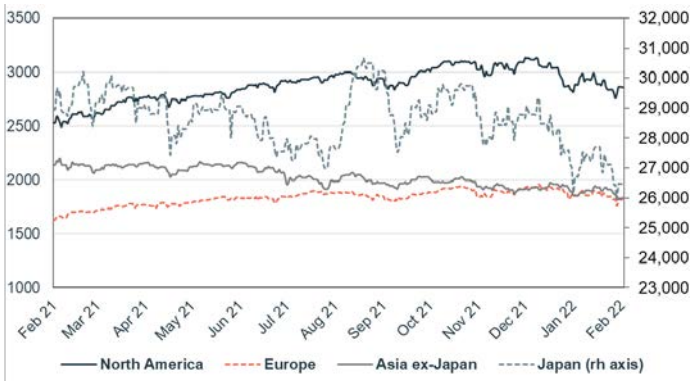
In combination, multi-asset portfolio volatility decreased from 6.6% to 6.3%.

Note: The chart shows 30-day correlation over time between different markets and the pan-Euro equity market. Higher levels of correlation will in general lead to less ability to diversify risks, and higher portfolio volatility for given position holding volatility.

Equities

Stock price

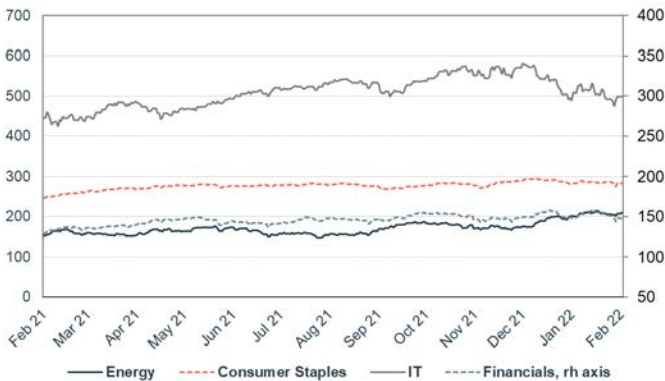
STOCK PRICE PERFORMANCE: REGIONS (LOG SCALES)



-3.2%
Europe

Equity region price movements were all downwards. North America lost -2.9%, Asia ex-Japan lost -2.2%, Europe lost -3.2%, Japan (Nikkei) lost -1.8%.

STOCK PRICE PERFORMANCE: SECTORS (LOG SCALES)



-2.8%
FINANCIALS

-4.8%
IT

4.5%
ENERGY

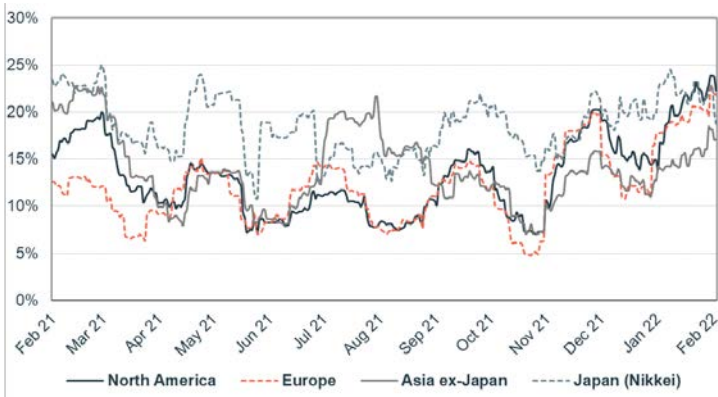
-0.9%
CONSUMER
STAPLES

Equity price sector results were mixed. Energy gained +4.5%, Consumer Staples lost -0.9%, Financials lost -2.8%, IT lost -4.8%.

Equities

Volatility

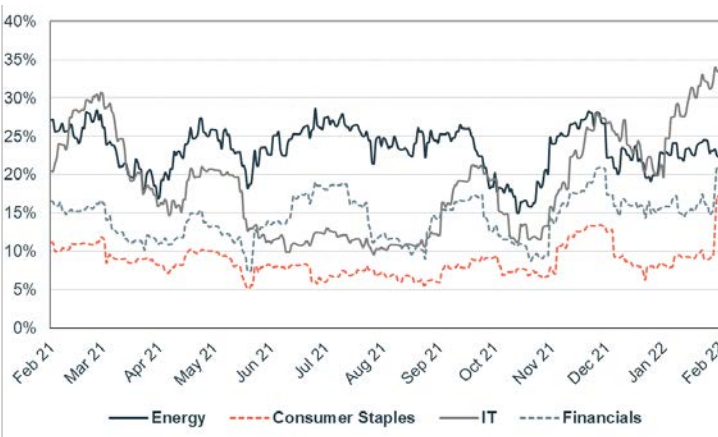
EQUITY VOLATILITY: REGIONS



21.8% EUROPE

Region's volatility results were mixed. North America rose from 18.5% to 22.3% (high), Asia ex-Japan rose from 14.2% to 17.1% (medium up to high), Europe rose from 18.1% to 21.8% (high), Japan (Nikkei) fell from 23.4% to 18.7% (high down to medium).

EQUITY VOLATILITY: SECTORS



Volatility results were mixed. Energy fell from 22.6% to 22.5% (medium), Consumer Staples rose from 8.0% to 17.2% (medium up to high), Financials rose from 16.2% to 21.2% (high), IT rose from 27.4% to 30.5% (high).

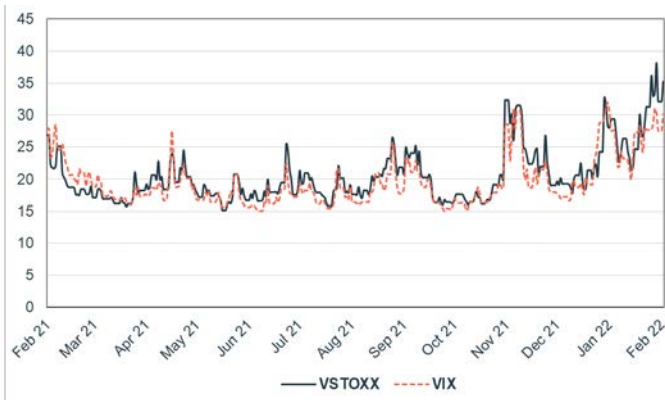
Equity Implied Volatility

Market-Implied Near Term Outlook

Implied Volatility

Implied volatility increased in both observed markets. VIX rose from 24.8 to 30.2 (high), VSTOXX rose from 27.0 to 35.3 (high).

IMPLIED VOLATILITY



30.2% VIX

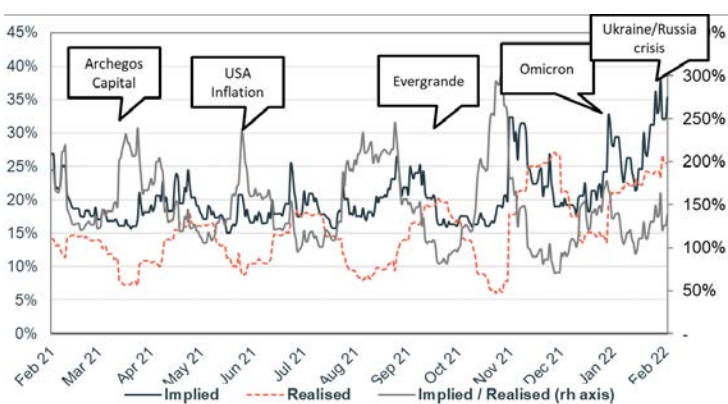
35.3% VSTOXX

Implied vs Realised Volatility

The realised volatility (of the Euro Stoxx 50 index over 30 days) increased from 21.2% to 25.5% bringing the ratio of implied/realised volatility to move down from 139% to 138%.

This ratio is suggesting that the market is anticipating future volatility to be higher than current.

IMPLIED VS. REALISED VOLATILITY



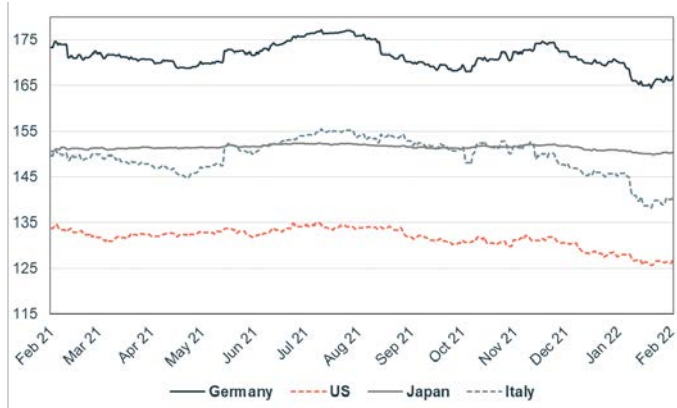
138% IMPLIED/REALISED VOLATILITY

Note: the implied/realised volatility ratio gives an indication as to whether the market sees an event in the next 30 days (the implied volatility period) which will increase realised volatility (implied/realised >100%, e.g., within 30 days prior to the Greek elections during the Greek crisis) or a period of relative calm after high realised volatility (implied/realised <100%, e.g., immediately after Draghi's calming "whatever it takes" comments).

Fixed Income

10-Year Government Bond Futures

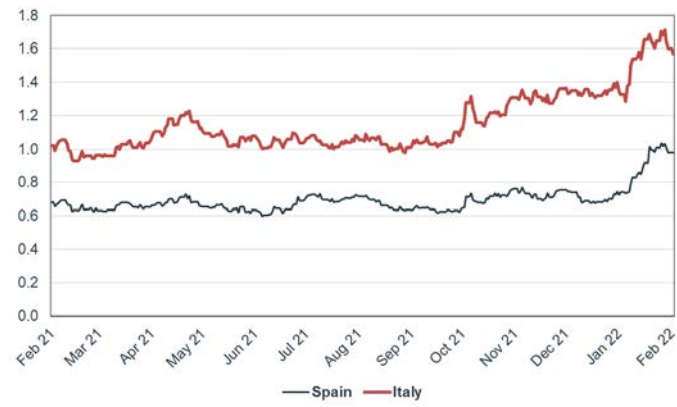
PRICES OF 10Y BOND FUTURES



Prices

Government bond prices movements were all downwards. Germany lost -1.2%, US lost -0.4%, Japan lost -0.1%, Italy lost -3.2%.

10 YEAR BOND SPREADS OVER GERMANY, %



Italian spreads over Germany increased from 1.33% to 1.57%, while the Spanish spreads against Germany from 0.74% to 0.98%.

VOLATILITY OF 10Y BOND FUTURES

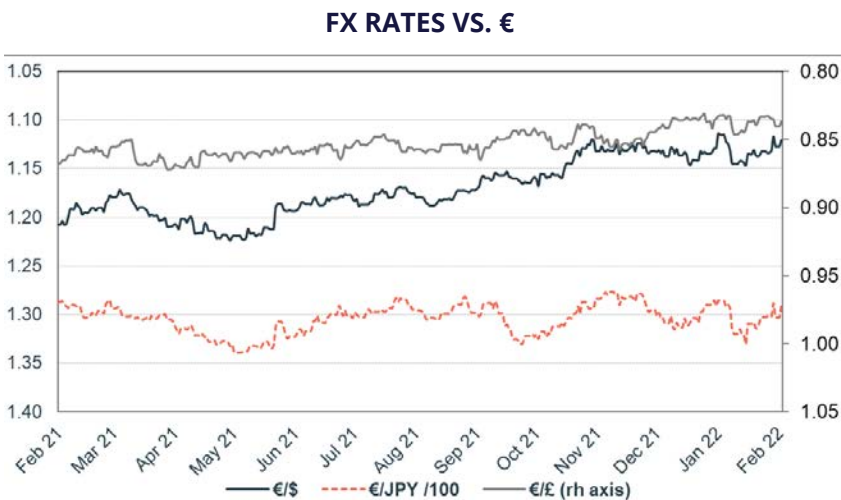


Volatility results were mixed. Germany rose from 3.7% to 5.8% (medium up to high), US rose from 5.0% to 5.9% (high), Japan fell from 1.5% to 1.4% (high), Italy rose from 4.3% to 7.8% (low up to high).

Foreign Exchange

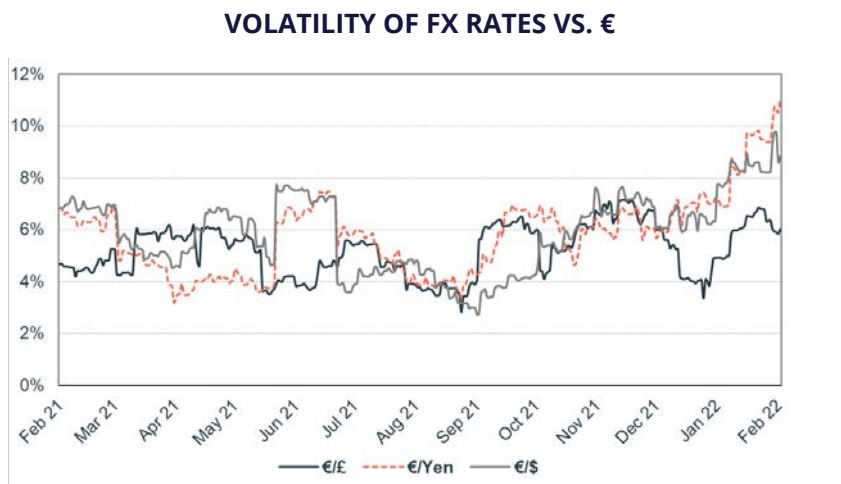
Prices

Euro results were mixed. Euro lost 0.1% against the US Dollar, Euro lost 0.1% against the Japanese Yen, Euro lost 1.3% against the Swiss Franc, Euro gained 0.2% against the British Pound.



Volatility

FX volatility moves were all upwards. €/£ rose from 7.8% to 8.8% (high), €/Yen rose from 6.9% to 11.1% (high), €/CHF rose from 4.6% to 9.9% (high), €/£ rose from 4.9% to 6.0% (medium up to high).



Note: The charts show currencies vs. the €. Axes on the first chart are inverted to show conventional currency quotations, but with higher on the chart representing a stronger currency vs. the euro.

8.8% € vs. \$

6% € vs. £

11.1% € vs. ¥

Option volatility is mainly driven by the volatility of volatility and moves in prices of the underlying instruments affecting options' deltas.

(Equity) Options

Implied volatility

Volatility of implied volatility results were mixed. Volatility of VSTOXX fell from 178.4% to 162.5% (high) Volatility of VIX rose from 129.6% to 140.9% (medium).

VOLATILITY OF VOLATILITY



-2.9% US

-3.2% EUROPE

Major (Regional Equity) price moves

Regions price movements were all downwards. North America lost -2.9%, Asia ex-Japan lost -2.2%, Europe lost -3.2%, Japan (Nikkei) lost -1.8%.

CHANGE IN PRICES OF EQUITY INDICES, 30 DAYS



Note on Treatment: Options show more complex behaviour than the other instruments we look at in this report, so we make some simplifying assumptions. As Calls and Puts are in effect polar opposites and in and out of the money options behave very differently, it is hard to generalise all options' behaviour. However, we look at the two key drivers: volatility of implied volatility and major price movements of the underlying security.

Implied volatility (via an option's Vega) drives option prices, so a big indicator of option price volatility is the "volatility of implied volatility".

Usually, the biggest driver of individual option prices is the movement of the underlying (via the option Delta): a move in either direction will cause the option to go more in or out of the money (and a corresponding change in the option's Delta and price volatility). As a proxy for this, we look at the 30-day price swing of equity market indices; options on bonds or FX could of course behave differently. The 30-day period is relatively close to the time to maturity of many options. Calls and Puts will respond in opposite fashions: calls becoming more volatile (relative to the size of the underlying notional) as prices rise.

Note on Convertibles: Convertibles are in effect a combination of a bond and a call option, with the bond portion usually making little contribution to the instrument volatility unless the option is significantly out of the money. As such, convertible portfolios' volatilities will tend to behave similarly to call option portfolios, and this commentary can be applied to convertibles as well as options.

Commodities

+10.7% OIL

+5.9% GOLD

+2.8% COPPER

Prices

Commodities price movements were mixed. Oil (Brent) gained +10.7%, Gold gained +5.9%, Copper gained +2.8%, Iron Ore lost -4.7%.

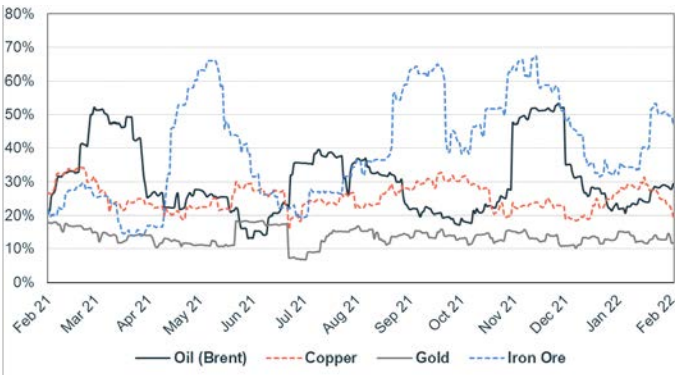
COMMODITIES PRICES, \$



Volatility

Volatility movements for Commodities were mixed. Oil (Brent) rose from 20.6% to 29.4% (low up to medium), Gold fell from 15.0% to 11.8% (medium down to low), Copper fell from 27.6% to 19.8% (high down to low), Iron Ore rose from 34.3% to 46.9% (medium up to high).

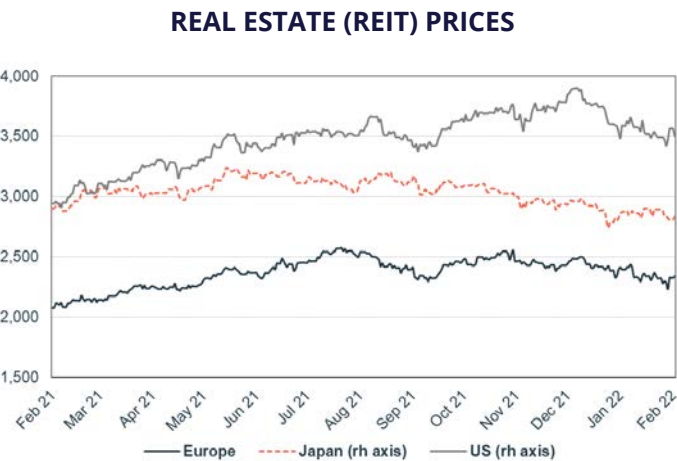
COMMODITIES VOLATILITY



Note: all prices refer to near futures rather than spot with the exception of iron ore which is a spot price.

Real Estate

Real Estate Share Prices



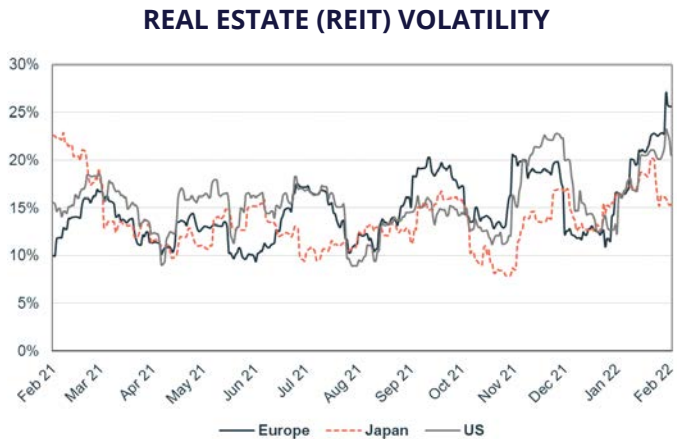
Prices

Real Estate prices movements were all downwards. US lost -3.5%, Europe lost -3.2%, Japan lost -1.8%.

-3.5% US

-3.2% EUROPE

-1.8% JAPAN



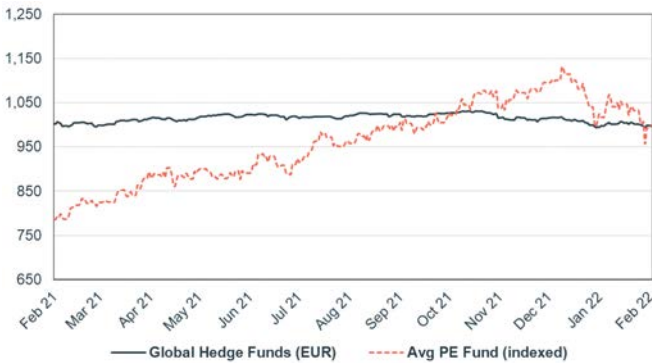
Volatility

Volatility results were mixed. US rose from 16.7% to 20.5% (high), Europe rose from 16.5% to 25.6% (high), Japan fell from 16.4% to 15.4% (high).

***Note:** Note that for property we look at indices of the share prices of REITs, and not the underlying property directly, for which little real-time data is available. This is usually consistent with funds which tend to invest in property indirectly, e.g. via REITs or property companies. As REITs are usually focused on commercial property, residential property may also follow a slightly different pattern to that discussed in this article.*

Alternatives

ALTERNATIVES PRICES



The average hedge fund lost -0.5%, an average PE fund lost -1.4%.

AI VOLATILITY



Volatility results for Alternative Investments were all upward. The average hedge fund rose from 3.4% to 3.6% (high), An average PE fund rose from 22.2% to 28.8% (high).



3.6%

HFRX
volatility



28.8%

AVERAGE
PE FUND

Definitions

To avoid repetitions, the term volatility refers to annualised, 30-day average realised volatility in local currency unless otherwise specified. As such, it may be lower than, and lag, shorter-term market volatility in times of high market volatility.

Charts show data up to 28th February 2022, and news and events are included up to that date. The commentary was written on or before March 17th, 2022.

Disclaimer

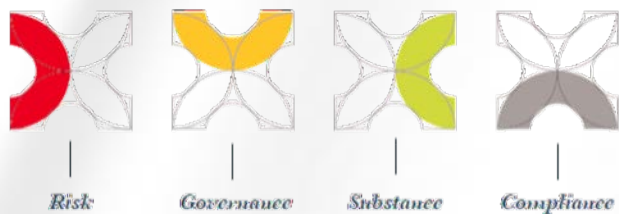
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