



**AR
KUS**

RISK BASED
GOVERNANCE

MARKET VOLATILITY RISK NEWSLETTER – January 2021

Harsh Winter

Member of the Profidata Group

Executive Summary

- **Volatility decreased in all observed markets.** Region volatility spanned a range that goes from 8.3% (North America) to 12.7% (Japan-Nikkei), with Europe and Japan changing from medium to low volatility regime, and all other observed markets settling in the low regime.
- **Realized volatility** (of the Euro Stoxx 50 index over 30 days) decreased from **26.1% to 13.7%**.
- **All observed equity sector markets increased in price during the last month.** Sectors **volatility** spanned a range that goes from 7.6% (Consumer Staples) to 27.3% (Energy), with all observed markets changing from medium to low.
- **Sovereign bond price movements were mixed. Volatility** moves were also mixed and spanned a range that goes from 0.6% for Japan and 3.6% for Italy, with the US changing from medium to low volatility regime.
- **The EUR closed the month appreciating against all other major currencies, with the exception of the pair EUR/CHF, in which case it depreciated by 0.1%. FX volatility results were mixed and** ended ranging between 3.2% (€/CHF) and 9.8% (€/£), with €/£ changing regime from low to high. All other pairs closed the month on medium and low volatility regimes.
- **Options' implied volatility increased in both observed markets**, with the VIX changing from 20.77 to 22.75 and the VSTOXX increasing from 21.3 to 23.4, with both observed markets settled on low volatility.
- **All commodities' prices were upwards trending**, with the Oil (Brent) gaining +8.8%, Gold +6.7%, Copper increasing +2.9%, and Iron Ore +23.7%. **Volatility changes were mixed.** It spanned a range between 14% (Gold) to 46.1% (Iron Ore).
- **Real Estate** (equity) prices increased in all observed markets, with US +2.8%, Europe +3.6%, and finally Japan +2.3%. **Volatility moves were all downwards**, ranging from 11.3% (Japan) to 17.6% (US).
- **The average PE Funds** gained +4.5%, while the **average Hedge Fund** increased +2.3%. **Volatility** for the average hedge fund decreased from 3% to 1.7%, while the average PE fund decreased from 17.9% to 16.9%, with both changing to medium volatility regime.

The Arkus Risk Team



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Summary volatility matrix and outlook

It did not take long for the new year to shape up as nasty as the last one. The rat race between vaccinations and the coronavirus (and unfortunately also its mutated siblings) has begun while the president of the US incites his supporters to storm the Capitol after all his attempts to challenge the election results failed for a lag of substance. Oh boy!

However, clarity on Brexit and the next US president has fueled markets even further that most of equities ended in positive territory for the year and had a decent start into the new year. Continued fiscal and central bank support is priced in, of course.

So, it's been a fairly bumpy start of the year on the political side (also Italy is running into yet another government crises), but asset prices keep on crawling up. The divergence continues while most countries are in lockdown again.

ASSET CLASS	AREA	LATEST VOLATILITY	LATEST Z-SCORE	REGIME
EQUITIES	North America	8.3%	-0.8	low
	Asia ex-Japan	10.8%	-0.8	low
	Europe	10.9%	-0.9	low
	Japan (Nikkei)	12.7%	-0.7	low
	Energy	27.3%	-0.5	low
	Consumer Staples	7.6%	-0.7	low
	Financials	12.0%	-0.8	low
	IT	11.9%	-0.9	low
VOLATILITY OF VOLATILITY	Volatility of VIX	85%	-0.7	low
	Volatility of VSTOXX	122%	-0.2	medium
GOVERNMENT BONDS	Germany	3.5%	-0.8	low
	US	2.7%	-0.7	low
	Japan	0.6%	-1.3	low
	Italy	3.6%	-1.1	low
FX VS \$	€/\$	5.6%	-0.4	medium
	€/Yen	4.8%	-1.2	low
	€/CHF	3.2%	-0.4	medium
	€/£	9.8%	0.6	high
COMMODITIES	Oil (Brent)	19.8%	-0.9	low
	Gold	14.0%	-0.6	low
	Copper	14.4%	-1.0	low
	Iron Ore	46.1%	3.4	high
PROPERTY	US	17.6%	-0.7	low
	Europe	15.4%	-0.6	low
	Japan	11.3%	-0.7	low
ALTERNATIVES	HFRX Global HF	1.7%	-0.7	low
	Avg PE Fund	16.9%	-0.1	medium
KURTOSIS	ZCF 1% left (vs -2.33 for normal curve)	-1.56	2.8	low
CORRELATION	Average market correlation with euro equities	40%	0.5	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.

Key News

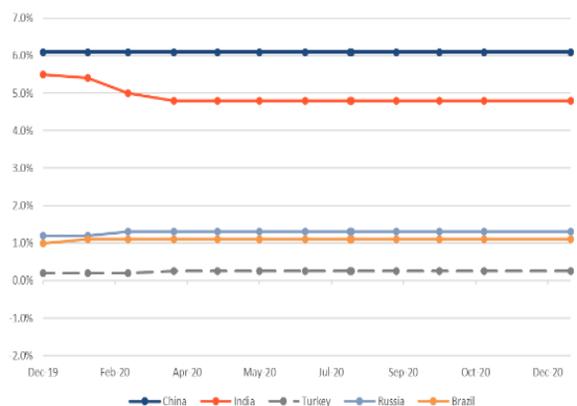
Major Volatility-Driving Events

- ▶ After arduous negotiations Boris Johnson and Ursula von der Leyen finally reached a deal between the EU and the UK only a few days before the end of the transition period. Subject to final approval by parliaments this deal seals the exit from the UK out of the European Union.
- ▶ The vaccine developed by Oxford-AstraZeneca was approved for use in the UK, giving a third option for vaccinations against COVID-19. This vaccine is potentially easier to store and transport.
- ▶ Jack Ma's Ant group is scrutinized by Chinese regulators as Executives are urged to improve corporate governance and transparency of the business model in a major shake-up of the company. Some see this as the first step in a major reformation of the financial markets by Chinese regulators, others just as a warning by the communist party to the founder who publicly criticized them a couple of months ago and has not appeared in public ever since.
- ▶ Crypto currency Bitcoin reaches ATH breaking through above the barrier of \$ 40,000 in the wake of new interest from institutional investors. However, quickly slumped from top levels after a negative comment from UK regulator.
- ▶ Italian spreads are starting to creep up again from their historically low levels amidst yet another government crisis.
- ▶ Tesla shares reach ATH valuing more than the rest of the top nine car makers, catapulting Elon Musk on top of the list of wealthiest persons in the world.

GDP ESTIMATES FOR 2021, DEVELOPED COUNTRIES



GDP ESTIMATES FOR 2021, DEVELOPING COUNTRIES



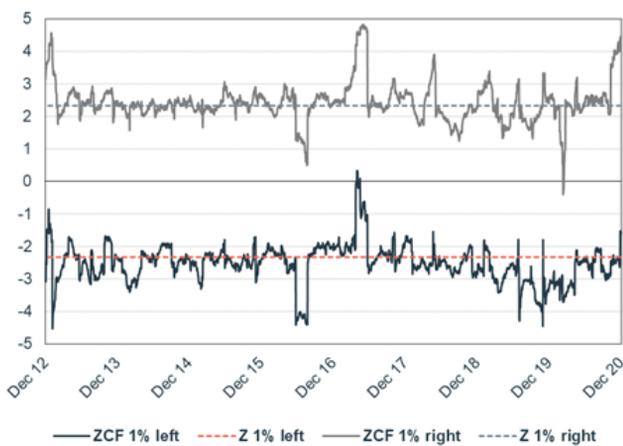
Kurtosis

Correlation in the equity markets

Kurtosis (against normal +/- 2.33)

The distribution of risks in European equity market displays denormalization with the ZCF 1% left at -1.56 and the right ZCF 1% at +4.47 (both as of 31st of December).

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 with EU equities



40% AVERAGE
CORRELATION

Inter-market correlations (with EU equities)



Correlation decreased during last month, leading our average correlation indicator to change from 46% to 40% (medium up to high).

Multi-asset portfolio volatility



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

The average asset volatility decreased, moving from 15.8% to 9.2%, while the benefit of multi-asset diversification decreased, moving from 7% to 4.4%.

In combination, multi-asset portfolio volatility decreased from 8.8% to 4.8%.



9.2% AVERAGE
VOLATILITIES



4.8% PORTFOLIO
VOLATILITY

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

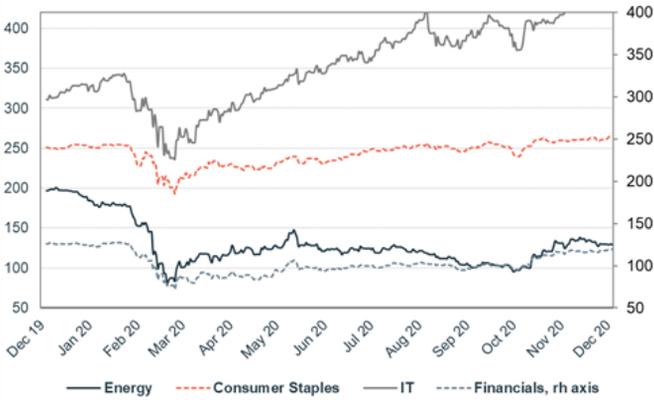
STOCK PRICE PERFORMANCE: REGIONS (LOG SCALES)



All equity regions closed the month increasing in price. North America gained +4.0%, Asia ex-Japan gained +5.8%, Europe gained +2.1%, Japan (Nikkei) gained +3.8%.

+2.1%
Europe

STOCK PRICE PERFORMANCE: SECTORS (LOG SCALES)



All equity sectors increased in price during the last month. Energy gained +3.6%, Consumer Staples gained +2.3%, Financials gained +5.1%, IT gained +5.7%.

+5.1%
FINANCIALS

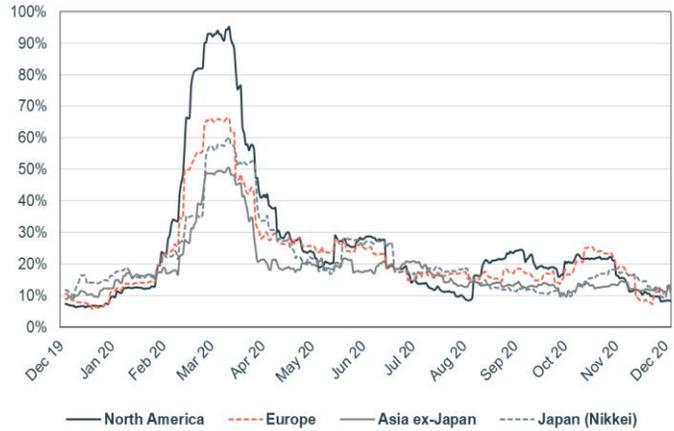
+5.7%
IT

+3.6%
ENERGY

+2.3%
CONSUMER
STAPLES

Equities Volatility

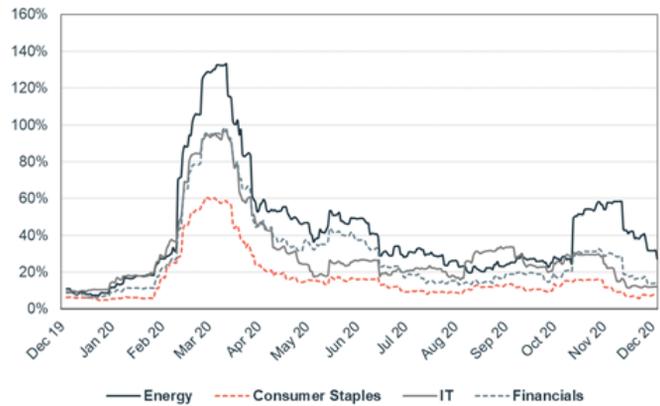
EQUITY VOLATILITY: REGIONS



Volatility decreased in all observed markets. North America fell from 15.5% to 8.3% (low), Asia ex-Japan fell from 14.2% to 10.8% (low), Europe fell from 19.2% to 10.9% (medium down to low), Japan (Nikkei) fell from 17.1% to 12.7% (medium down to low)

10.9% EUROPE

EQUITY VOLATILITY: SECTORS



Volatility in all observed sector decreased.

Energy fell from 57.9% to 27.3% (high down to low), Consumer Staples fell from 11.7% to 7.6% (medium down to low), Financials fell from 30.2% to 12.0% (medium down to low), IT fell from 22.1% to 11.9% (medium down to low).

Equity Implied Volatility

Market-Implied Near Term Outlook

Implied Volatility

Implied volatility in both, US and Europe, increased. We have that the VIX rose from 20.6 to 22.8 (low), and the VSTOXX rose from 22.9 to 23.4 (medium down to low).



22.8% VIX

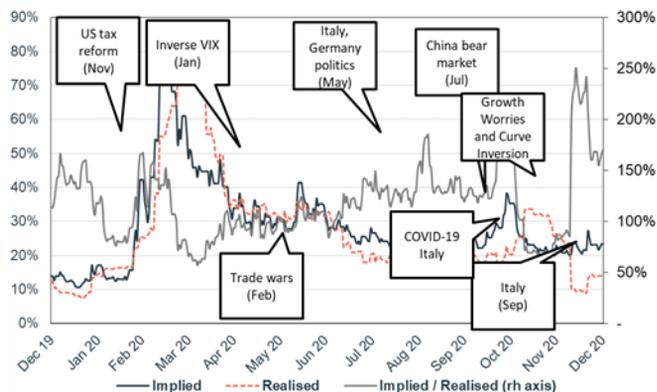
23.4% VSTOXX

Implied vs Realised Volatility

(European equity) implied volatility increased slightly to 23.4%. The realised volatility, on the other hand, decreased (of the Euro Stoxx 50 index over 30 days) to 13.7% bringing the ratio of implied/realised volatility to move up from 88% to 170%.

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

IMPLIED VS. REALISED VOLATILITY



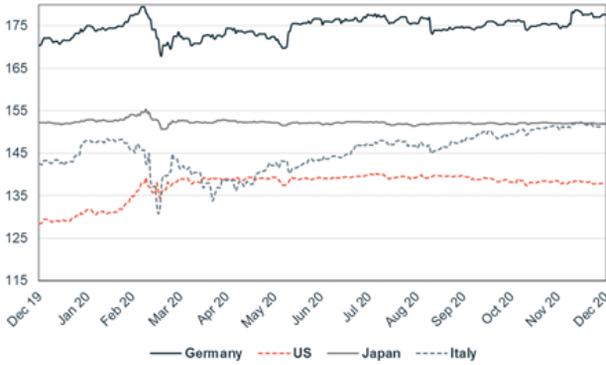
170% IMPLIED/REALISED VOLATILITY

Note: 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

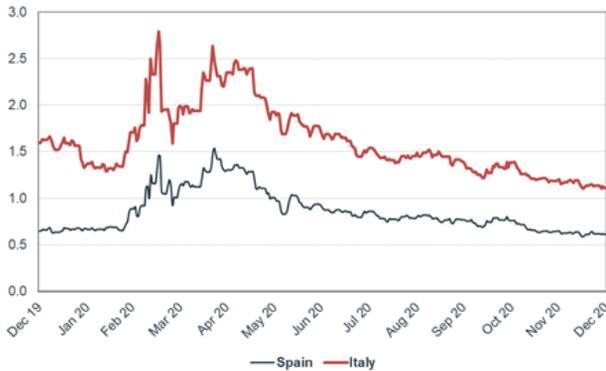
PRICES OF 10Y BOND FUTURES



Prices

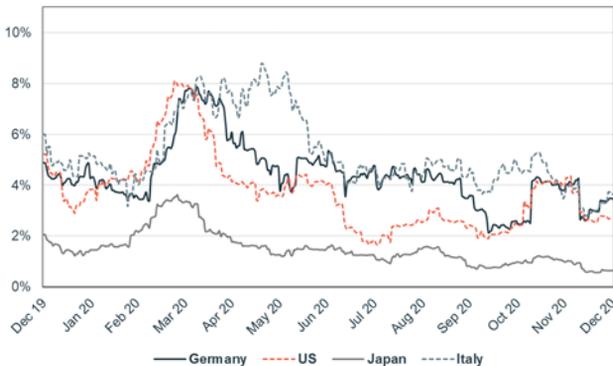
Government bond prices movements were mixed. Germany gained +1.4%, US lost -0.3%, Japan lost -0.1%, Italy gained +0.6%.

10 YEAR BOND SPREADS OVER GERMANY, %



Italian spreads over Germany decreased from 1.2% to 1.11%, while the Spanish spreads against Germany decreased slightly from 0.65% to 0.61%.

VOLATILITY OF 10Y BOND FUTURES



Volatility moves were mixed. Germany fell from 3.8% to 3.5% (low), US fell from 3.9% to 2.7% (medium down to low), Japan fell from 1.0% to 0.6% (low), Italy rose from 3.6% to 3.6% (low).

Foreign Exchange

Prices

Euro results were mixed. We have that Euro gained 2.3% against the US Dollar, Euro gained 1.3% against the Japanese Yen, Euro lost 0.1% against the Swiss Franc, and finally Euro gained 0.0094% against the British Pound.

FX RATES VS. €



Volatility

FX volatility moves were also mixed. €/€ rose from 5.2% to 5.6% (low up to medium), €/Yen fell from 6.3% to 4.8% (medium down to low), €/CHF fell from 3.4% to 3.2% (medium), €/£ rose from 5.8% to 9.8% (low up to high).

VOLATILITY OF FX RATES VS. €



↗ 5.6% € vs. \$

↗ 9.8% € vs. £

↘ 4.8% € vs. ¥

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.

(Equity) Options

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

Implied volatility

Volatility of implied volatility were mixed in US and Europe. Volatility of VSTOXX rose from 93.2% to 122.3% (low up to medium) Volatility of VIX fell from 87.4% to 84.6% (low).

VOLATILITY OF VOLATILITY



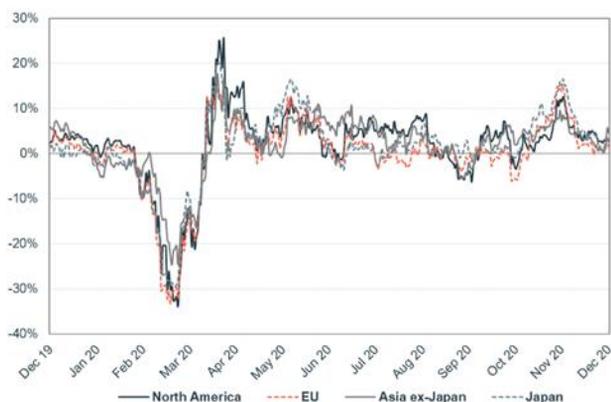
84.6% US

122.3% EUROPE

Major (Regional Equity) price moves

Price movements were all upward. We have that North America gained +4.0%, Asia ex-Japan gained +5.8%, Europe gained +2.1%, Japan (Nikkei) gained +3.8%.

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".

But 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

+8.8% OIL

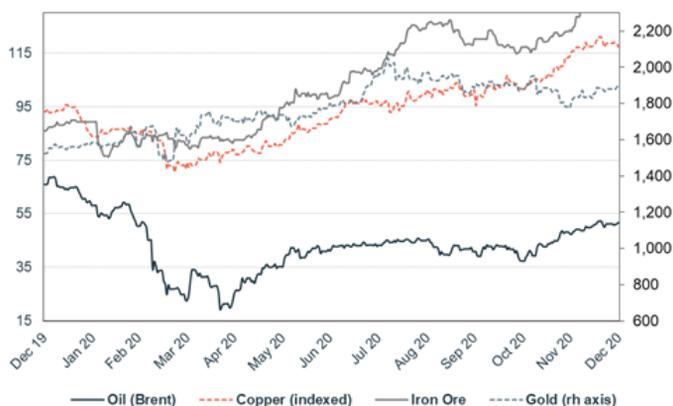
+6.7% GOLD

+2.9% COPPER

Prices

All observed commodities prices increased during the last month; we have that Oil (Brent) gained +8.8%, Gold gained +6.7%, Copper gained +2.9%, and Iron Ore gained +23.7%

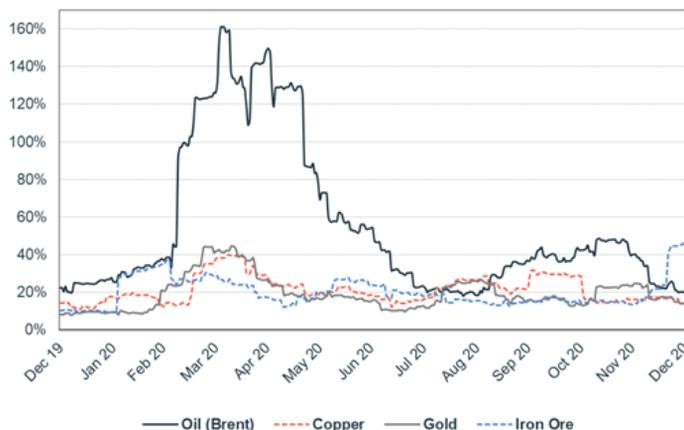
COMMODITIES PRICES, \$



Volatility

Volatility movements of Commodities were mixed during December. On this regard, we have that Oil (Brent) fell from 40.2% to 19.8% (medium down to low), Gold fell from 23.3% to 14.0% (high down to low), Copper fell from 16.0% to 14.4% (low), and Iron Ore rose from 13.4% to 46.1% (low up to high).

COMMODITIES VOLATILITY

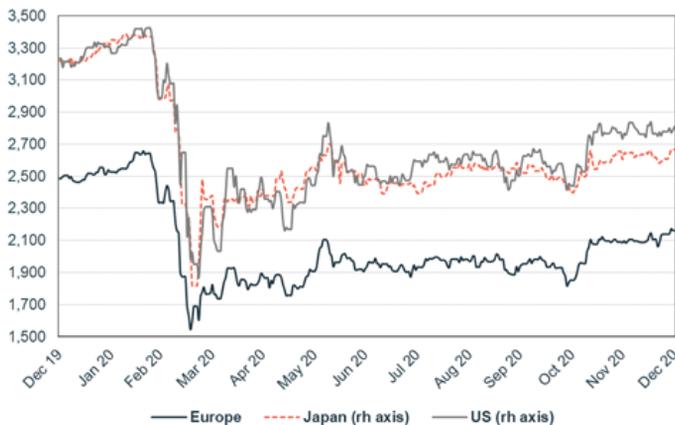


Note: all prices refer to near futures rather than spot with the exception of iron ore which is a spot price.

Real Estate and Alternatives

(Real Estate Share Prices)

REAL ESTATE (REIT) PRICES



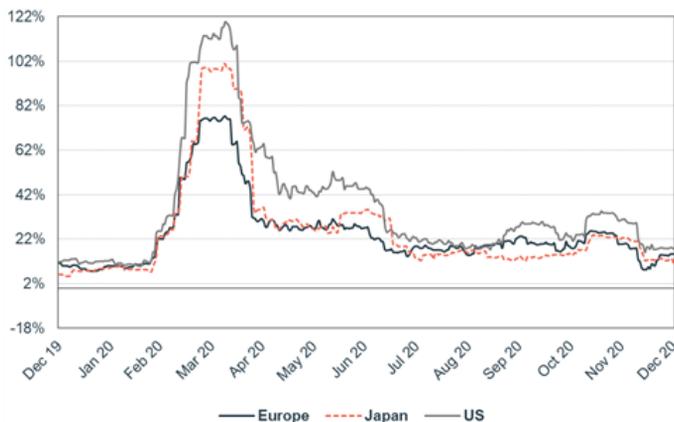
+3.6% EUROPE

+2.8% US

+2.3% JAPAN

Real estate regional prices movements were all upward. We have that US gained +2.8%, Europe gained +3.6%, Japan gained +2.3%.

REAL ESTATE (REIT) VOLATILITY



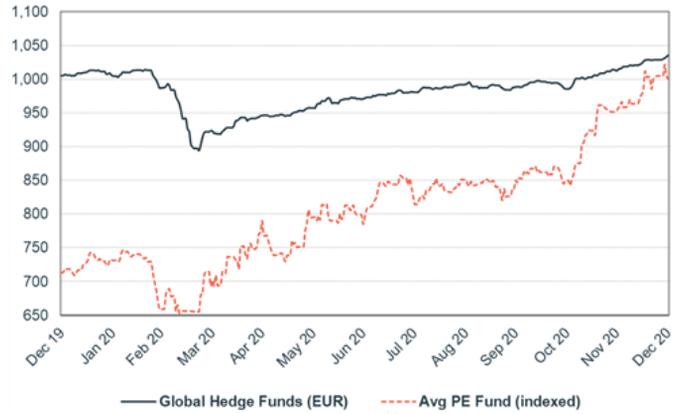
Volatility moves were all downwards, and all observed markets changed regime to low. We have that US fell from 30.7% to 17.6% (medium down to low), Europe fell from 19.8% to 15.4% (medium down to low), Japan fell from 22.3% to 11.3% (medium down to low).

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.

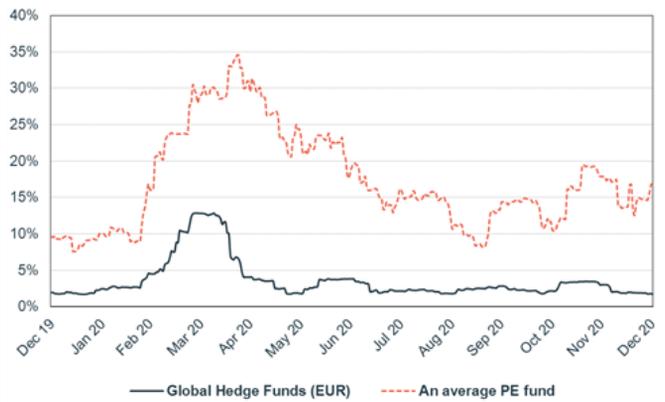
Alternatives

ALTERNATIVES PRICES



The average hedge fund gained +2.3%, an average PE fund gained +4.5%.

AI VOLATILITY



Volatility for Alternative Investments decreased. The results show that the average hedge fund fell from 3.0% to 1.7% (medium down to low), and the average PE fund fell from 17.9% to 16.9% (medium).



1.7%

HFRX
Volatility



16.9%

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 31st December 2020, and news and events are included up to that date. The commentary was written on or before 12th January 2021.

Disclaimer

The commentary does not constitute, and is not intended to constitute, investment advice.

Any views expressed in this report are based on historical market data and as such cannot be interpreted as being forward-looking, or to constitute forecasts. Past movements are not necessarily indicative of future movements.

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