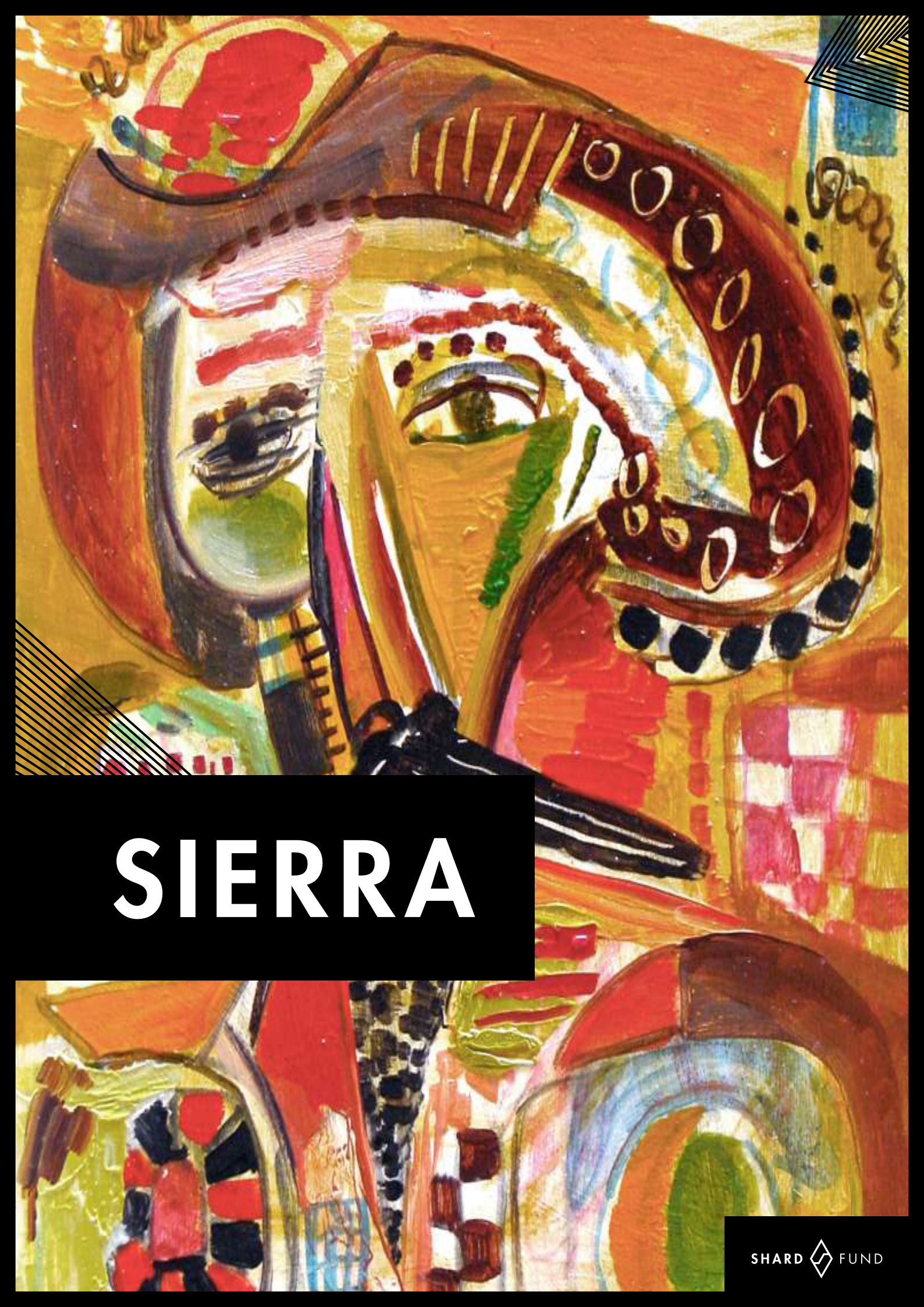


An abstract painting featuring a large, stylized face in the upper half. The face has a yellow and orange background, with a red flower on the left side. The right side of the face is decorated with a red and white checkered pattern. The lower half of the painting shows a red and white checkered pattern, a green and blue circular shape, and a red and white checkered pattern. The overall style is expressive and colorful.

SIERRA

A JOURNEY ACROSS FINANCIAL MARKETS

March 28th - April 24th, 2015 | Issue 4

TEAM:

Georgi Stanoev Research / Text

Harry Collins Research

Stelian Nenkov Edit

INTRO & HIGHLIGHTS

For our first issue of the monthly Sierra, dedicated to more thorough research on a specific subject, we decided to focus on a rather fun topic that also turned out to be quite interesting. To be honest, I just got tired of listening to pundits talk about ‘Sell in May and go away’. It feels like they are on auto-tune every year. So, the team and I concluded we should look into the topic and decide for ourselves and also present it to you and let you evaluate the results. What I mean by ‘Sell in May and go away’ is the general topic of stock market seasonality. Does it exist? If so, why and how does it help us?

We looked at what academia and market participants have done on the topic and also did our own homework. Our research went across continents, centuries and asset classes. We also took unexpected turns to explore how other concepts and events could be complementary to the study of seasonality. From Thomas Bayes and Daniel Kahneman to FBI, bank robberies and the establishment of Christmas as a holiday, this is a journey across financial markets at its finest. And, simply because we are not a research unit but a team with a running portfolio, we examine

how the analysed data could help in the investment process. Also, looking at some current market fundamentals we conclude with some interesting deductions (strictly NOT an investment suggestion or advice) about the next couple of months ‘out there’. So, enjoy and please send us a feedback via our website www.shardfund.com

There are two factors we tried to be careful with: data and explanations. It is amazing to see the hurdles all people go through to validate their data only to explain it afterwards with preposterous ‘arguments’ and stories. The truth is the market is a complex system that does not operate according to the neat stories people tell themselves. In fact, a statistically significant fact doesn’t have to be logical or fit a story in your brain. Accept it as it is without trying to explain it. For the sake of a good read, we will put the explanations we have found, but please take them with a bit of skepticism. There could be (and probably is) some truth, however, this surely cannot be the whole story. Having said that, I’d love to read a story about stock market seasonality from Steven Levitt and Stephen Dubner (the ‘Freakonomics’ guys). Now that would be a classic.

DATA ANALYSIS

Do you know that there have been 10-15% (on average) more US bank robberies on a Friday compared to other work days since 2005 ([source](#)). Also, the most busy time slot has been 9-11am. Who could have thought that robbers wake up early? Assuming the 10 year data is a reliable indicator (as opposed to a sampling outlier), this reveals a pattern (seasonality) in robberies, which will probably be found in many other human activities, as well. However, let's talk about markets. They move to a cadence governed by the passage of time, controlled by a calendar that is influenced by habitual human and cultural behavior. Recurring events such as the sector rotations, options and futures expirations, tax deadlines, holidays, weekly to annual portfolio adjustments and restructuring all have an influence on traders and investors. A consensus thesis is that 'markets are like crops – they have a growing season, a harvesting season, and a period where they may be fallow' ([Hirsch, 2012](#)). To test that hypothesis, we will look multiple factors across asset classes (stocks, FX, bonds, volatility) as well as rely on already published research by academics and market

practitioners. The narrative will mostly be focused on the US, however, we present data for other countries as well and will highlight any material divergences. You can find all the data used during the research at the end of this issue.

As mentioned before, most of the research we have looked at focuses on data. This is not very surprising. Other people from the team and I have an academic experience beyond a bachelor's degree (for better or worse) and we are fully aware of how the system works. 'Publish or perish' is a well-known motto of academics and data is their dogma. Everyone tries to find a richer, longer term sample to support a thesis, which is not a bad thing, don't get me wrong, but there should be a similar strive for a better usage of data. Let's start with the S&P 500 at the beginning of the year. Please have in mind that all returns mentioned throughout this issue do not include dividends. Looking back 50 years, the average January return has been 1%. In fact, if we look even further to 1926 that goes up to around 1.5% making January one of the best months on a roughly 100 year basis.

S&P 500	Average return (time horizon ends in 2014)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5yr	0.81%	3.05%	2.58%	1.19%	-2.45%	-0.63%	1.81%	-1.65%	0.94%	3.70%	0.95%	1.96%
10yr	-0.99%	-0.02%	2.07%	2.30%	-0.30%	-1.39%	1.60%	-0.15%	0.53%	0.07%	0.31%	1.26%
15yr	-0.96%	-0.97%	1.74%	1.80%	0.04%	-1.25%	0.21%	0.02%	-1.37%	1.14%	0.80%	1.05%
20yr	0.11%	-0.31%	1.69%	2.07%	0.38%	-0.15%	0.23%	-1.01%	-0.15%	1.47%	1.76%	1.40%
25yr	0.04%	0.01%	1.34%	1.60%	0.95%	-0.52%	0.60%	-0.94%	-0.52%	1.37%	1.37%	1.77%
50yr	0.99%	-0.08%	1.08%	1.48%	0.09%	-0.04%	0.23%	-0.03%	-0.57%	0.74%	1.05%	1.44%

However, it has transformed to one of the worst months in the past 25 years, with a slight rebound since the crisis. My point is that it is important to look across durations to understand the change in patterns. It is very similar to how correlations (or betas) should be looked at on a rolling basis as opposed to a static 3, 5, 10 etc. year basis. As fundamentals change, those sorts of averag-

es will change as well. August is probably the perfect example for this. In the first half of the twentieth century, money flows from harvesting made August a great stock market month. In fact, it was the best month from 1901 to 1951. In 1900, 37.5 percent of the population was farming. Now less than 2 percent farm, and August has become one of the worst months of the year and also the worst S&P 500 and best

US 10yr Yield	Average return (time horizon ends in 2014)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5yr	-7 bps	3 bps	11 bps	-18 bps	-14 bps	5 bps	-9 bps	-19 bps	-4 bps	2 bps	3 bps	14 bps
10yr	0 bps	3 bps	6 bps	-3 bps	1 bps	3 bps	-6 bps	-19 bps	0 bps	4 bps	-18 bps	9 bps
15yr	1 bps	-5 bps	5 bps	5 bps	-3 bps	1 bps	-3 bps	-21 bps	-8 bps	4 bps	-7 bps	2 bps
20yr	-1 bps	1 bps	6 bps	5 bps	-6 bps	-1 bps	-2 bps	-16 bps	-12 bps	0 bps	-6 bps	3 bps
25yr	1 bps	2 bps	9 bps	7 bps	-6 bps	-2 bps	-5 bps	-13 bps	-11 bps	2 bps	-4 bps	-3 bps
50yr	2 bps	6 bps	6 bps	4 bps	2 bps	-5 bps	2 bps	-3 bps	-4 bps	-6 bps	-5 bps	-3 bps

bonds (10 year treasuries) month in the past 25 years. Here we measure the performance of bonds in basis points (bps), where a drop in basis points means bond prices went up. On a 50 year basis numbers are much smoother as we jump past the 35 year bond bull market that started in the 1980s and August still seems like a good month for bonds. However, our multi-factor approach takes some of

the significance of that strength, as the frequency of yield decreases (# of months when bond yields went down versus total number of months) actually goes down to around 54% (from 72%) from 1965 to 1990. (Gain frequency for indices is based on months when index price went up, while in the case of bonds it is based on months when the yield went up and consequently the bond price went down.)

US 10yr Yield	Gain Frequency (time horizon ends in 2014)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5yr	40%	60%	80%	0%	20%	80%	40%	40%	60%	60%	40%	60%
10yr	50%	60%	70%	30%	50%	70%	30%	20%	50%	60%	20%	60%
15yr	53%	40%	67%	47%	47%	60%	33%	13%	47%	53%	33%	53%
20yr	50%	50%	65%	50%	45%	50%	45%	25%	35%	50%	40%	50%
25yr	48%	52%	72%	52%	48%	48%	40%	28%	32%	52%	44%	40%
50yr	54%	58%	64%	50%	60%	42%	52%	46%	42%	42%	44%	46%

Looking at gain frequency as a second factor is very important in order to confirm that certain seasonality is strong, as opposed to the average return being influenced by a skewed distribution with a few outliers (positive or negative). The FTSE 100 is a good example here. In a typical September in the past 10 years, the FTSE 100 index has been down an average 0.33%. Yet, 7 of those 10 months the index has actually recorded positive returns, which suggests there is a skew in the

data and the index has suffered abnormal losses in 3 of those 10 Septembers (especially in 2008 – -14%). So, I guess, we can accept that a given month has a relatively strong seasonality if both average returns and gain frequency support that hypothesis across multiple durations. In the case of the FTSE 100, those are April, October and December (similar to the DAX). Just for a reference, the index is already up 4.3% so far this April. Interestingly, based on more than 300 years

FTSE 100	Average return (time horizon ends in 2014)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5yr	-0.06%	2.89%	0.07%	0.58%	-2.47%	-1.75%	2.35%	-1.73%	-0.14%	2.74%	-0.09%	1.47%
10yr	-1.33%	0.89%	0.33%	1.85%	-0.80%	-1.53%	1.70%	0.07%	-0.33%	0.43%	-0.34%	2.16%
15yr	-2.34%	0.37%	0.19%	1.97%	-0.68%	-1.81%	0.57%	0.18%	-1.98%	1.55%	0.08%	1.53%
20yr	-1.28%	0.81%	0.56%	2.10%	-0.55%	-1.39%	0.89%	-0.24%	-1.26%	1.37%	0.88%	1.92%
25yr	-0.96%	0.76%	0.08%	1.75%	-0.07%	-1.48%	0.96%	-0.10%	-1.35%	1.56%	0.81%	2.03%

of data from the UK stock market, **Jacobsen and Zhang (2012)** illustrate that October and July have consistently underperformed in the full sample as well as the 50- and 100-year subsamples. Yet, on 25 year basis October has been strongly positive across factors, while July looks a bit skewed although still positive.

After further research of the data the authors (and we) conclude that all months have had their fifty years of fame at some point during the three centuries, suggesting the importance of studying these long time series. This should not come as a significant surprise and hopefully it will continue because if our habits

stay the same for more than 50 years I personally would be disappointed. In fact, our goal at Shard Fund is to escape the vicious circle called 'life' by the masses, but that is completely different topic. Back to the 50-year cycles topic, from changes in harvesting (mentioned above) to the **introduction of Christmas in the UK (1830s) and US (1870)** how we evolve turns out to have a great influence on our behavior on the market.

...winter returns (November through April) are on average a significant 0.56% higher than (often negative) summer returns.

I would like to continue my October quest, as after the research the team and I did, it looks (at least to us) as the most interesting month of the year. In fact, I would even dare to call it notorious. From the crash of 1929 to 'Black Monday' in 1987 (-25%) and the beginning of the crisis in 2008, October has seen some wild markets. Even last October (2014) had its panic moment as the S&P 500 dropped by roughly 8% in 2 weeks and I vividly remem-

ber 15 October when the 10 year treasury yield dropped by around 30 basis points (2.2% to 1.9%) in hours. Despite all those collapses (and many more) October has been a relatively positive month for the S&P 500 in terms of both frequency and average return. Even last year after the initial panic the index finished more than 2% up on the month. Looking back at history, twelve post-World War II bear markets have ended in October: 1946, 1957, 1960, 1962, 1966, 1974, 1987, 1990, 1998, 2001, 2002, and 2011 (Hirsch, 2012).

So it looks like October is a transition month in a larger pattern. Speaking more generally, across durations, factors and continents, there seems to be a somewhat clear divide in the heat map of historical monthly performance. Looking back at the 317-year data for the UK stock market (Jacobsen and Zhang, 2012) winter returns (November through April) are on average a significant 0.56% higher than (often negative) summer returns. Remarkably, and regardless of all changes that occurred in the world and the United Kingdom over these 300 years, this effect persists in all the 100- and 50-year subsamples, and in 24 out of 32 of the 10-year subsamples. Similar conclusion could be made for the other markets we looked at, even though we haven't used so long-term data. Overall, the best months of the year have been March, April, November and December although, each of the four countries observed tends to underperform (still positive) the others in one of the months. The worst ones vary more, but there is an almost consistent weakness for stocks in August and September. The same seasonal pattern is observable for US long term bonds and the volatility index (VIX), although the returns there are negatively correlated to stock markets (positive in the summer and negative in winter), which makes sense.

PRACTICAL APPLICATION & CONCLUSION

In conclusion, although clear patterns do exist in the historical returns detailed in this study, in many ways the trends we see are dependent upon the way we present and examine the data. That being said, there is undoubtedly great value in being familiar with these historical trends when making investment decisions.

All this is quite cool and interesting (at least to us), however, we are not academics, so we want our research to translate into investment themes or at least support our idea generation process. That being said, there seems to be a great value to think of seasonality in terms of **Bayes' theorem**. The concept is nothing fancy and the formula is part of every low-level statistics book and the CFA level 1 exam, and yet I, and probably many other students, struggled to understand how the concepts helps someone be a better trader. As it turns out, the habit of adjusting past beliefs to incorporate new evidence is essential not only to markets but also to life. Looking at our seasonality patterns, we could use them as our long-term beliefs, or base rate (**as Daniel Kahneman calls it**), which we adjust based on new evidence. For instance, probably the strongest seasonality across factors (avg. return and frequency) and countries is in December. Last December was particularly interesting, as it started with large amount of volatility, a currency crisis in Russia and oil getting absolutely battered (16 December was a day to remember). However, instead of having a panic attack and thinking the world is going to end, one could have simply adjusted the seasonal probability of a gain in December and still would have gotten pretty decent odds. Perspective is always important as the human brain tends to focus on current events

and circumstances a lot more than required. It is easy to say it in hindsight but the S&P 500 rebounded and finished positive in that particular December.

Another important point, which might not be that obvious is related to data modelling. Behavioural patterns and context lead not only to seasonality in markets but also in the general economy, as well as other aspects of our life. That is why it is important to model data (most of it) on a year-over-year basis as opposed to sequentially (Month-over-Month, Quarter-over-Quarter, etc.). By doing so we are comparing 'apples to apples' and are adjusting for seasonality without any unnecessary assumptions. Also, it allows us to use the non-seasonally adjusted data published by institutions. That leaves us with one less biased assumption (made by them) to think of.

Let's conclude with a fun exercise. And just because I like repeating myself, this is not any investment advice whatsoever, just our thoughts put onto virtual paper. We may or may not take any of those ideas as actual trades. Looking at what follows this week, positioning for May and then the summer might be quite interesting. US Q1 GDP, Fed meeting, ISM Manufacturing index and Payrolls in the last 3 days of the month are definitely a promising finish. The dollar seems to have been front-running a dovish Fed and below average data as the dollar basket (DXY) has dropped by almost 4% in the last two weeks. GDP could definitely surprise to the downside regardless of the bleak 1% target the street currently has but the question is how much of that is already priced in. On the contrary, if there is an even slightly better than expected data, the dollar could quickly regain strength. A peek at the seasonality data supports the

negative returns for this month but also potentially suggest a relatively strong reversal in May. So, we start with a strong historical probability (belief) of an upward reversal in the dollar next month and adjust for the four scenarios that could arise by combining strong/weak economic data with hawkish/dovish Fed statement. The end result is our view that the dollar has priced in significant weakness and we still see it as a good investment in our portfolio with the potential of benefiting of seasonally strong May and loose

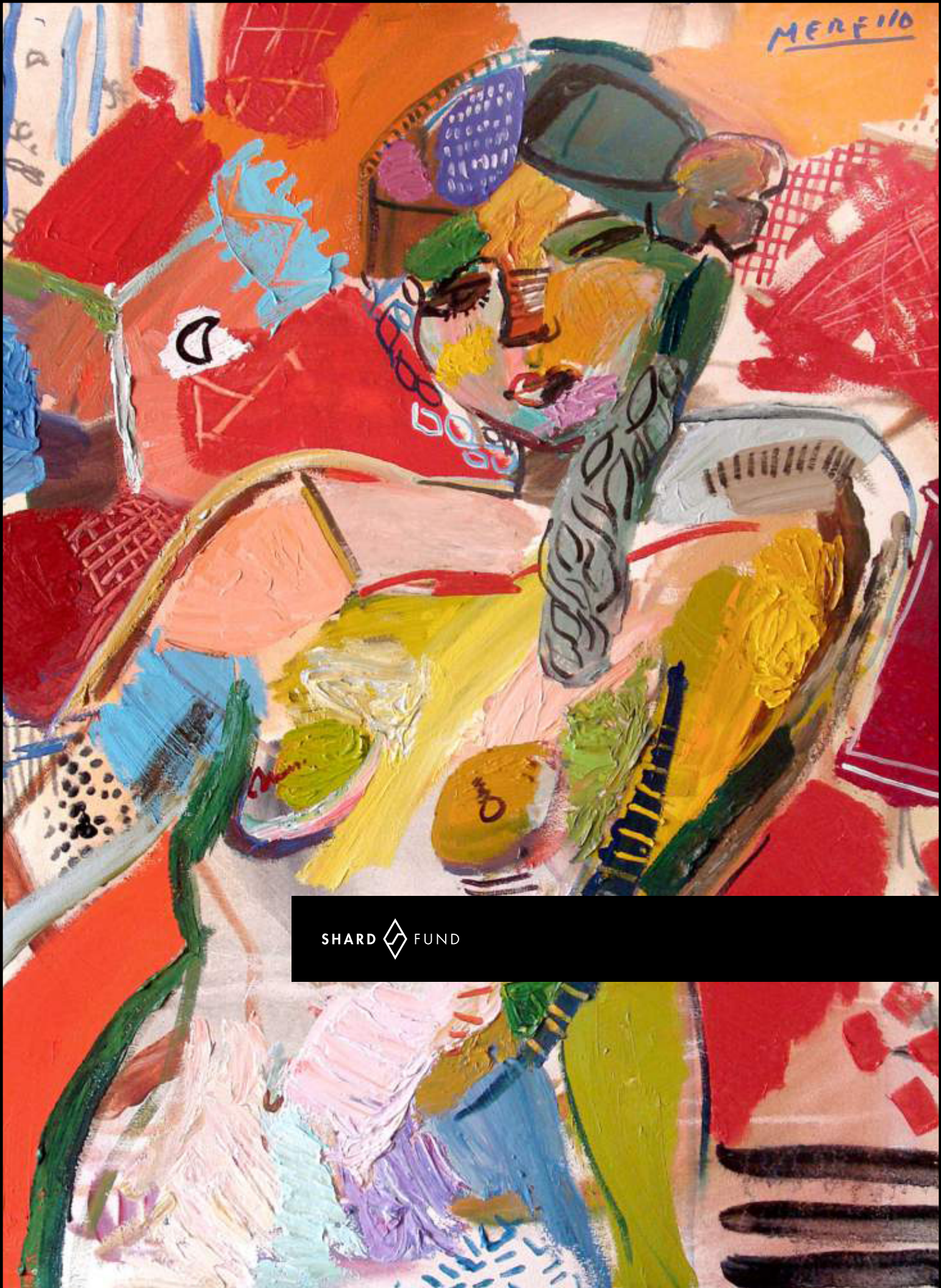
monetary policies by ECB and BoJ. As for the Fed staying dovish and potentially not raising rates this year (increasingly priced in by futures) we see bonds as a better solution, especially now when we enter the favourable summer season. Again, here we talk about favourable probabilities that could turn out to be completely wrong. It's all about the risk/reward. As for general stock markets, being long volatility or keeping your portfolio tightly hedged might not be the worst idea for the summer. Only time will tell.

DXY	Average return (time horizon ends in 2014)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5yr	0.03%	0.15%	0.38%	-1.16%	3.23%	-0.74%	-0.93%	0.58%	0.04%	-0.77%	2.07%	0.08%
10yr	0.57%	0.02%	-0.31%	-1.11%	1.31%	-0.15%	-0.69%	0.60%	0.02%	0.14%	0.78%	-0.07%
15yr	0.74%	0.09%	0.02%	-0.65%	0.39%	-0.45%	-0.10%	0.34%	-0.44%	0.16%	0.06%	-0.97%
20yr	1.09%	0.07%	-0.06%	-0.32%	0.31%	-0.30%	-0.14%	0.45%	-0.68%	-0.13%	0.56%	-0.76%
25yr	0.92%	0.28%	0.20%	-0.45%	0.21%	-0.29%	-0.40%	0.11%	-0.75%	0.08%	0.70%	-0.74%
50yr	1.17%	-0.29%	0.21%	-0.33%	0.47%	-0.19%	-0.20%	0.22%	-0.64%	-0.29%	0.24%	-0.90%

DISCLAIMER

Interview: The views expressed in this interview are purely those of the author; they do not pretend to reflect any views that may prevail at Sussex University nor should they be taken as investment advice.

ShardFund is not a registered entity, it's a project. This report expresses the opinion of ShardFund's team and is not a solicitation to buy or sell any security. The writing represents our best judgment as of the date of preparation, and is subject to change without notice. Before making any investment decision you should always consult your personal financial advisor and conduct your own due diligence. The recipient of this report should also assess his own financial situation, goals, and sophistication prior to making any investment. All views expressed, implied, or otherwise are solely derived by Shard Fund's team members. The information herein was obtained from sources believed to be reliable, but has not been independently verified by ShardFund. Therefore, we do not guarantee its accuracy.



SHARD  FUND