DOES A COMMODITY CARRY STRATEGY WORK? -AN ANALYSIS FROM THE PAST.

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1. INTRODUCTION

1.1 BACKGROUND

The carry trade strategy is an investment strategy that exists amongst the broad spectrum of different investing strategies. This particular strategy is highly prevalent in recent literature; with specific interest to currencies (Koijen, Moskowitz, Pedersen & Vrugtd, 2018). A currency carry trade strategy entails taking a position in which one would short or borrow the low interest rate currency and simultaneously long or lend in the higher interest rate currency (Lee & Wang, 2019). However, the carry trade is a strategy that can be implemented using any asset class (Koijen et al., 2018). Carry is defined as the total return of an asset beyond any price appreciation or depreciation. Furthermore, Koijen et al. (2018) state that the total return to any asset is the combination of any expected price change, carry and an unexpected price shock. In other words, carry can be understood as the returns associated with holding an asset, assuming the price or market conditions remained unchanged (Roberts, 2016). Roberts (2016) explains that an investment return from any asset can be linked to price appreciation or depreciation. In addition to this, the returns can also be influenced by the benefits and costs linked with investment holdings. Thus, the carry of any asset is also seen as the net benefits or costs associated with holding that particular asset.

Most of the literature surrounding the carry trade tends to place emphasis on currency carry for example, a popular paper by Burnside, Eichenbaum and Rebelo (2008) shows how the use of a carry trade in a diversification strategy amongst different currencies provided greater gains. with very few papers focusing on the carry trade in other asset classes(other papers amongst many include: Bakshi & Panayotov, 2013; Bekaert & Panayotov, 2020; Liu, Margaritis & Tourani-Rad, 2012). It begs one to question how a commodity carry trade investment strategy will perform with focus on energy securities, and how will it be structured with respect to different asset classes?

1.2 CORE RESEARCH QUESTION

What factors affect the commodity carry trade strategy and how will this strategy perform?
How does an energy carry strategy perform during multiple economic and market conditions?

1.3 RESEARCH OBJECTIVES

This paper aims to identify how a carry trade strategy would have performed with a focus on a basket of energy commodities. Furthermore, the paper strives to identify and investigate how different variables and economic conditions impact this strategy and further try review the extent to which the energy securities influence the returns to the overall commodity returns.

1.4 IMPORTANCE AND BENEFITS OF THE PROPOSED STUDY

The body of literature in this area of research is inconclusive at best and is relatively scarce. Therefore, the focus of this study may shed additional light on the topic of commodity carry, more specifically how energy commodity carry performs, thus providing a basis for future academic research on the subject. This research paper seeks to provide sound empirical evidence to enable a better understanding of the dynamics of the commodity carry trade. In doing so, this paper may provide newfound knowledge to industry professional and academics alike.

The potential benefits of this study include that of:

I. The enhancement of investment decisions;
II. Improved diversification of investment strategies; and
III. May offer a better understanding of the commodity carry trade.

This study may provide useful information to the following individuals:

I. Academics (particularly those in the field of finance and economics);
II. Institutional investors;
III. Retail investors;
IV. Asset managers;
V. Traders; and
VI. Hedge fund managers.

1.5 DELIMITATIONS

Crucial delimitations of the proposed study include but are not limited to, examining the effects of the proposed carry strategy on the asset class of commodities with a particular focus on that of energy commodities. The conscious decision to focus on energy is a result of the access to information, the fact that the prices of commodities within the energy sector are the same across borders and finally energy and more specifically oil is an extremely topical subject in current times. Other commodities such as those of precious metals and agriculture were considered but deemed to be unfeasible due to the access of data; complications in the way they are priced and time restrictions relating to the development of the model.

1.6 ORGANIZATION

The rest of the research proposal is structured as follows: Section (2) will review the available body of literature and discusses the factors that are deemed to influence commodity carry. Section (3) will provide an overview of the research methodology that encompasses the theoretical framework, research design and data collection. Section (4) will present the data analysis and discussions on the findings. Finally, Section (5) will provide a comprehensive list of all references utilised in the development of this study.

2. LITERATURE REVIEW

2.1 HOW IS COMMODITY CARRY CALCULATED?

Before arriving at a final calculation to estimate the level of carry of a commodity, it must be identified that carry can be generalised across multiple asset classes. Koijen et al (2018) decomposes the return to any asset as:

Return = carry + expected price appreciation + unexpected price shock.

Where carry and expected price appreciation forms the expected return component. This emphasises that carry is an observable characteristic of any asset that is model-free (Koijen et al., 2018). A key component of commodity carry is that unlike other assets where carry is either more easily observed or can be estimated as the net benefit of holding (which is characterised as a cash flow item) the specific asset, commodity carry involves additional components which are not easily observable and alternative measures are needed in order to infer the level of carry in commodities (Bianchi, 2018; Heaney, 2002; Koijen et al., 2018; Roberts, 2016; Shang, Yuan & Huang, 2016).

Although thin, the commodity carry literature agrees that the convenience yield of holding a commodity net of financing, transport and specifically storage costs gives the level of carry for the commodity (Bianchi, 2018; Koijen et al, 2018; Roberts, 2016). The no arbitrage futures price of a commodity (F_t) is given by the equation:

$$F_t = S_t(1 + rf_t - \delta_t) \tag{1}$$

Where S_t is the spot price, rf_t is the risk free rate and δ_t is the convenience yield in excess of storage costs.

By using commodity futures where the expected convenience yield is embedded in the futures price, it avoids the difficulty involved with observing. Through the application of Koijen et al. (2018) who show that carry can be observed through the current spot and futures prices of the asset:

$$C_t = \frac{S_t - F_t}{F_t} \tag{2}$$

However, a problem still exists as commodity spot markets are illiquid and accurate spot prices are hard to come by. If one substitutes the commodity futures into Koijen et al. (2018) generalised carry formula; commodity carry is observed as:

$$C_t = (\delta_t - rf)\frac{1}{1 + rf - \delta_t} \quad [3]$$

A problem still exists due to the difficulty in observing the convenience yield. Therefore, in order to overcome such issues with spot prices and convenience yields, two futures contracts can be used, which are closest to expiry. In this way extrapolation can be used to compute the synthetic spot price based on the futures curve and interpolation allows for the estimation of the synthetic one-month futures price (Koijen et al., 2018). The computation of returns to the commodity carry have been similar to what is known in the literature as basis. Yang (2013) defines that commodity futures contracts with a high basis implies that such commodities have a high ratio of spot to futures price. Such high basis contracts are expected to have higher returns than low basis future contracts. Similarly, high commodity carry tends to achieve higher expected returns than low commodity carry.

Literature also highlights conditions where commodity carry is expected to perform better. More specifically, commodity carry strategies are expected to outperform where markets are in backwardation[1] and underperform when markets are in contango[2] (Bianci, 2018). The explanation of the performance in backwardated or contangoed markets emanates from the theory of storage, first explored and explained by Kaldor (1939), Working (1949), and Brennan (1958) (Miffre, 2016). The theory of storage provides the thread that links the difference in spot and future prices of commodities to the convenience yield, costs of storage and value forgone from owning the physical asset (Miffre, 2016). The reason for outperformance in a backwardated market emanates from the convenience yield exceeding the storage costs and interest rate. Such condition implies a signal where inventory levels are low at the point in time. Thus, the market would be willing to pay a higher premium for a timely delivery in tight market conditions (Frankel, 2014). Similarly, if the commodity is in excess supply, the convenience yield would be smaller than the costs of holding and such situation signals contangoed markets (Shang et al., 2016). Therefore, although difficult to observe, the convenience yield, which plays a vital role in understanding in the market conditions optimal for the commodity carry trade, is arguably based on the supply and demand of commodities and the associated holding costs (Working, 1949).

[1] Backwardation simply refers to the situation where the current futures price is less than the expected (future) spot price (O'Brien & Schwarz, 1982).

[2] Contango is the situation opposite to backwardated. In other words, when the expected spot price is less than the current futures price.

2.2 THE FINDINGS ON COMMODITY CARRY

Although commodity carry has not received much attention within the academic literature, one of the motivating factors for this paper, the few papers that have explored commodity carry have highlighted the relevance of exploring this factor in more detail. One strand of the commodity carry literature focuses on generalising carry across multiple asset classes where a global diversified portfolio is formed using a carry trade strategy. Koijen et al. (2018) reveal that carry strategy returns across and within all asset classes cannot be explained by value, momentum and time series momentum. This finding is reinforced by Bakshi et al. (2019) where a carry factor is used in conjunction with a momentum factor to summarise the cross-sectional variation of commodity returns. Thus, commodity carry is distinct in its ability in explaining and driving the returns in commodity prices that is not explained by other well-known global factors. The uniqueness of carry in the commodity literature forms the basis for this paper.

The performance of commodity carry during different phases of the business cycle has received mixed conclusions. Koijen et al. (2018) find that all asset classes including commodities tend to have lower carry returns during global recessions but Bakshi et al. (2019) find that the commodity carry strategy was more profitable in recessions than expansions. Levine, Ooi, Richardson and Sassville (2018) paper documents long run outperformance of commodity futures which is associated mainly with interest-rate adjusted carry. Further they document the higher returns coincide with backwardated markets where inflation is high and the economy is expanding. However, Levine et al. (2018) also finds positive and significant returns when the market is in contango with high inflation or an expanding economy. Therefore, this paper aims to reconcile the difference in performance over the business cycle by reporting how the energy commodity carry strategy performs during different macroeconomic events and phases of the business cycle.

Finally, some research suggests that part of the return to commodity carry is explained by downside risk. Koijen et al. (2018) find that commodities have downside betas that are significant. Such findings can be compared to earlier works of Bailey and Chan (1993). As previously mentioned, the returns to a commodity carry strategy are akin to the basis (Koijen et al., 2018). Bailey and Chan (1993) state that there is a risk premium embedded in the basis in the various commodity markets which reflects a compensation for the undiversifiable market risk. Thus, similar to the variations in the risk premia which cause distinct variations in the basis across commodity markets, commodity carry strategies exhibit different downside betas.

3. METHODOLOGY

3.1 SAMPLING AND DATA COLLECTION

The study makes use of secondary data, acquired from the Bloomberg Terminal. The study will utilise the historical futures prices of various energy commodities over the period of November 1998 to June 2020 . The energy commodities observed include that of gasoil, Brent crude oil, WTI crude oil, heating oil, gasoline and natural gas. The reason these particular commodities were chosen is due to the fact that they offer a good representation of the composition of the commodities in the energy sector, they are the most popular (traded) energy commodities and historic futures pricing data is readily available. The rationale behind using this particular sample period is to account for the fact that pre-1998 there is a lack data on a significant portion of the energy commodities under observation and the fact that a sample period spanning over 20 years as is the case in this instance may enable further analysis (and therefore greater understanding) of how a commodity carry strategy performs during significant market-wide events that occur infrequently. Historical price data is also gathered on the S&P 500 index, the Bloomberg commodity index and the Bloomberg Energy Sub index.

3.2 DESCRIPTION OF OVERALL RESEARCH DESIGN

The study will be conducted using quantitative research. The research approach will be explanatory as well as deductive in nature and will test the selected hypothesis through empirical analysis. A threefold tactic is used to tackle the data, first the authors seek to calculate the carry of a commodity futures contract using a method similar to that that of Koijen et al (2018). Second, securities are ranked according to the carry that was calculated and use this ranking to weight securities in a theoretical carry trade portfolio similar to that of Koijen et al (2018) once again. Last but not least, after computing the carry of said theoretical carry portfolio by using a back testing approach, returns are compared to a benchmark.

3.2.1 Calculating Carry

Commodity spot markets are often highly illiquid and clean spot price data on commodities is very difficult to source and is often unavailable. Thus, to overcome this issue, a synthetic spot and 1-month futures price is derived by linearly interpolating the two available futures prices F_1 and F_2, and use this information to compute the 1-month carry. By following this technique, one need not search for the actual spot prices, therefore, one can consider the slope between two futures prices of different maturities as opposed to that of the slope between the spot price and the futures price. Thus, the carry of holding the second futures contract F_T^2 can be computed by assuming that its price will converge to F_t^1 after $T_2 - T_1$ months:

$$C_t = \frac{F_t^1 - F_t^2}{F_t^2(T_2 - T_1)} = (\delta - r_t^f)\frac{S_t}{F_t^2} \qquad [4]$$

Where:

$C_t =$ The carry for the commodity futures contract.

$F_t^1 =$ The price of the nearest to maturity futures contract with T_1 months to maturity.

$F_t^2 =$ The price of the next nearest to maturity futures contract with T_2 months to maturity.

$T_2 =$ Time to maturity for F_t^2.

$T_1 =$ Time to maturity for F_t^1.

$\delta =$ Convenience yield in excess of storage costs.

$r_t^f =$ Risk free rate at time t.

$S_t =$ Spot price at time t.

3.2.2 Formation of The Theoretical Carry Trade Portfolio

In an effort to represent all available commodities in the construction of the carry trade portfolio, this paper will utilise a method in which all the commodities under observation are weighted by their carry ranking relative to the sum of carry of all commodities available. This method is thought to deliver more stable returns due to the fact that it is inherently more diversified than the common top *x*% minus bottom *x*% method as this method places little to no emphasis on the securities between these extremes. It is important to distinguish whether a long or short position will be entered into with regard to the respective commodities. If carry as calculated in equation 1 is positive, that is $C_t^i > 0$, a long position will be taken in that commodity at time t. However, if carry is negative, that is $C_t^i < 0$, a short position will be taken in that commodity at time t.

Thus,

$$W_t^i long = \frac{C_t^i > 0}{\sum C_t > 0} \qquad \text{OR} \qquad W_t^i short = \frac{C_t^i < 0}{\sum C_t < 0} \qquad [5]$$

Where:

$W_t^i long$ = The weighting on each commodity i at time t in which a long position will be taken, that is those that are shown to have a positive carry value $(C_t^i > 0)$.

$W_t^i short$ = The weighting on each commodity i at time t in which a long position will be taken, that is those that are shown to have a positive carry value $(C_t^i < 0)$.

$C_t^i > 0 =$ the carry of security i as calculated using equation 1 that is to be "longed".

$C_t^i < 0 =$ the carry of security i as calculated using equation 1 that is to be "shorted".

$\sum C_t > 0$= The sum of all the positive carry values $(C_t^i > 0)$ for the respective commodities at time t.

$\sum C_t < 0$= The sum of all the negative carry values $(C_t^i < 0)$ for the respective commodities at time t.

Once the weighting has been assigned to each available security, the carry of the carry trade portfolio can be computed in a similar way to that of the return of the portfolio. Thus, the carry of the carry trade portfolio is equal to the sum of the weighted average carry of the high carry commodities at time t minus the weighted average carry of the low carry commodities:

$$C_t^{carry\ trade} = \sum_i W_t^i\, C_t^i = \sum_{W_t^i>0} W_t^i long C_t^i - \sum_{W_t^i<0} |W_t^i short| C_t^i > 0. \qquad [6]$$

The carry of the carry trade portfolio is therefore always positive and depends on the cross-sectional dispersion of carry among the included commodities.

It is also important to note that the carry will be computed on a 1-month, 3-month, 6-month and 12-month basis thus the portfolio is rebalanced every 1, 3, 6 and 12 months respectively, which entails that the seasonal components that can arise in calculating the carry of certain securities are not smoothed. Therefore, such computations allow for further analysis of the trends that may be present within the sample period.

3.2.3. Comparison of Returns to The Selected Benchmarks

Once the returns of the theoretical carry trade portfolio have been calculated (using equation [6]), they will be compared to the returns of three indices that will utilise a more passive buy and hold strategy. After examining the returns of various commodity indexes, Greer (2000) came to the conclusion that an unleveraged commodity index produced returns that are similar in magnitude and volatility to that of equity returns. Thus, the paper acknowledges a predisposition to expect returns comparable to this when using a commodity carry trade strategy. The benchmarks (indices) chosen for this particular task are that of the S&P 500, the Bloomberg Commodity Index and the Bloomberg Energy Sub Index. These particular indices were chosen as they are thought to provide insight into market wide performance in the case of the S&P 500, they track the energy sector through futures contracts and thus utilise the same data as our aforementioned methodology as is the case when referring to the Bloomberg Commodity Index and the Bloomberg Commodity Sub-Index. The indices also are comprised of the commodities which we have chosen to focus on, making them an ideal choice in providing a benchmark to compare returns against. By looking at three different indices, it is possible to study the returns of the theoretical carry trade portfolio at three different levels, thus providing a comprehensive analysis of the performance of such a portfolio.

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