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Hedge fund performance attribution under various market conditions

Dimitrios Stafylas[a], Keith Anderson[b,*], Moshfique Uddin[c]

[a] Aston Business School, Aston University, Birmingham B4 7ET, England, United Kingdom
[b] The York Management School, University of York, Freboys Lane, Heslington, York YO10 5GD, England, United Kingdom
[c] Leeds University Business School, Maurice Keyworth Building, University of Leeds, Moorland Road, Leeds LS6 1AN, England, United Kingdom

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ABSTRACT

We investigate US hedge funds' performance. Our proposed model contains exogenous and endogenous break points, based on business cycles and on a regime switching process conditional on different states of the market. During difficult market conditions most hedge fund strategies do not provide significant alphas. At such times hedge funds reduce both the number of their exposures to different asset classes and their portfolio allocations, while some strategies even reverse their exposures. Directional strategies share more common exposures under all market conditions compared to non-directional strategies. Factors related to commodity asset classes are more common during these difficult conditions whereas factors related to equity asset classes are most common during good market conditions. Falling stock markets are harsher than recessions for hedge funds.

1. Introduction

The last financial crisis raised doubts about the hedge fund (HF) industry which has long been considered as being able to produce positive returns irrespective of the market conditions (Hentati-Kaffel & de Peretti, 2015). However this cannot be completely answered with stronger, more comprehensive evidence as the existing knowledge cannot sufficiently explain HF performance under various market conditions including any financial crisis. In this paper we investigate the impact of multiple business cycles and different market conditions on the performance of different HF strategies (alpha and risk exposure), focusing on the North America region. We use the terms *multiple business cycles* based on the National Bureau of Economic Research (NBER) definition and *market conditions* based on the Wilshire 5000 market index. We make the distinction between *business cycles* and different *market conditions* because we want to shed light on the difference between them in HF strategies, assisting investors in their decision-making process. We examine HF performance in a more comprehensive way and not just isolating one or two economic periods or financial crisis events. By using a parsimonious empirical specification described later, we focus on HFs that invest primarily in the North America region due to our use of three full U.S. business cycles. This region represents more than $1.9 trillion of HF assets under management corresponding to almost 72% of worldwide total (Preqin Global Hedge Fund Report, 2016).

Although there are studies that examine funds' variability over time (see Section 2), there is a need to examine HF strategy performance in a more comprehensive way. More specifically, the direct impact of different business cycles and market conditions on HFs needs to be examined further. The current knowledge is fragmented (e.g. focusing on only one crisis or economic event). Also within current models there is no direct link between fund performance and market conditions, as some studies (e.g. Bollen & Whaley, 2009; Jawadi & Khanniche, 2012) focus on the internal change of funds' exposures, and the macro variables used by other authors (e.g. Avramov, Barras, & Kosowski, 2013; Bali, Brown, & Caglayan, 2014 and Racicot & Theoret, 2016) do not necessarily represent the different states of the economy. According to NBER, the recession has as an attribute a significant decline in the economic activity lasting more than few months usually visible in the real GDP, industrial production, employment, real income, and wholesale-retail sales. Down market regimes have as an attribute substantial return downturns and market volatility (see Section 4.2).[1] Moreover, the single models used to describe all HF strategies or conditions are over-simplistic and do not efficiently capture the exposures and excess returns delivered to investors.

Our model uses a stepwise regression and then applies it to business

* Corresponding author.
E-mail address: keith.anderson@york.ac.uk (K. Anderson).

[1] In other words, a recession refers to a decline in economic activity and is related mostly to *real assets*. On the other hand, a down market refers to periods where there is a significant downturn in returns with high market volatility, and is related mostly to *financial assets*. We implicitly assume that down regimes which are related mostly to financial assets have a more direct and severe impact on HFs' performance (in alphas and exposures) than recessions. Our results in Section 4.3 confirm this. The binary classification of business cycles or regimes focuses on these two most important elements. In this study, we examine the different implications of these two phenomena on HFs' performance (see also Section 4.3). This paper does not study the business cycle itself, nor does it examine different states of business cycles as this is beyond its scope. We use similar terminology as NBER.

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cycles (NBER expansions/recessions) and to the market via a regime switching model with up/down regimes. This is implemented for each of the 11 HF strategies that we model (see Section 3.2). Our proposed modeling approach differs from the studies cited here, as it uses a parsimonious model that is flexible enough to accurately identify for each strategy changes in asset and portfolio allocations, within each of the underlying market conditions. Our study covers an important gap and since there is a need to focus on one region as different regions of the world have different business cycles, we choose the most important economically: North America and HFs that invest primarily in this region. HFs that invest only in the emerging markets do not have a direct exposure to these economic conditions. Another important gap is the lack of an investigation into HF performance within different business cycles and market conditions together as these two different states do not necessarily coincide and they have different implications for HFs, causing confusion to investors. Thus, we are the first to compare HFs under these two states that present different attributes (as shown later). Furthermore, instead of using one general commodity factor, we use specific ones (agriculture/food, energy, industrial and precious metals) for more accurate results. We use for the first time a commodity factor related to the agricultural/food industry that caters specifically for HFs that invest in this "traditional" sector.

Our findings contribute to the literature, in terms of the dynamic nature of HFs (e.g. Bali, Brown, & Caglayan, 2011; Giannikis & Vrontos, 2011), common risk factors among strategies (e.g. Billio, Getmansky, & Pelizzon, 2012), changes in asset classes and portfolio allocations (e.g. Patton & Ramadorai, 2013) and high significance of specific factors (e.g. Meligkotsidou & Vrontos, 2014). The contribution of our paper further lies in the fact that we provide the first examination of the performance of different HF strategies within multiple U.S. business cycles and up/down market conditions. We use a transparent, easy to follow approach, to get a more comprehensive explanation of HF performance. In addition, unlike previous studies, we do not use only one general commodity factor but many specific ones. This is important because, as suggested by Bhardwaj and Dunsby (2012), commodities cannot all be considered to behave in the same way in the market. In addition, we use a commodity factor related to the agriculture/food industry, as we do not expect that it fluctuates a lot during business cycles; also it is a factor that has not been given attention in the HF academic literature. Moreover, we use a customized parsimonious model that tackles the "dimensionality" reduction issue in HFs and can accurately capture changes in asset and portfolio allocations for each strategy within different conditions. This helps investors to know what to expect from different strategies, especially during multiple stressful financial conditions. Furthermore, we perform a systematic database merging and cleaning approach that can be used as a benchmark for future studies since this is not a trivial process that can be followed easily. Also, our study helps fund administrators to apply more flexible fee policies considering changing market conditions.

In this study we have several interesting results. First, during bad times most HF strategies do not provide significant alphas and fund managers are concerned with minimizing their risk. At such times HF strategies have fewer exposures in terms of different asset classes and portfolio allocations and some strategies even reverse their exposures. During 'good' times fund managers focus more on delivering high returns, increase their systematic risk and exploit the upward market movement. Second, more directional strategies have, on average, more common exposures within different market conditions compared to less directional strategies that by nature have more systematic risk. Third, factors related to commodity asset classes (e.g. agriculture, energy and industrial metals factors) are more common (in addition to the market factor) during 'bad' times, whereas factors related to equity asset classes (e.g. market, momentum, small minus big and high minus low factors) are most common during 'good' times. Fourth, market volatility appears to affect HF performance more than business cycle volatility does. We use a battery of robustness tests and our findings are still valid.

The outline of the paper is as follows. The next section briefly reviews the relevant literature. Section 3 presents our empirical specification and describes the data used in our analysis. Section 4 empirically estimates our model and discusses the implications of the results along with a battery of robustness checks. Section 4.3.10 concludes the paper.

2. Literature review

This section presents the relevant literature associated with HF performance. We consider mostly studies that follow the down-up and up-down approaches, also including studies that consider methodological issues and structural breaks, as explained later in this section.

Early studies (such as Sharpe, 1992) explained HFs in a linear framework. However there was soon a development toward non-linear models that explained the non-linear payoffs of HF returns following the down-up approach. This approach begins with the underlying assets to find the sources of HF returns and involves HF replication portfolios by trading in the corresponding securities. These trading constructed factors are specified as asset-based style (ABS) factors (Fung & Hsieh, 2002). We distinguish studies that explained HFs through option portfolios and trend followers (Fung & Hsieh, 2001, 2002, 2004) and option-based buy and hold strategies (Agarwal & Naik, 2000, 2004) or studies that showed that the so-called market neutral strategies are not so neutral for investors (Duarte, Longstaff, & Yu, 2007). Although important, these studies do not significantly help investors to choose and evaluate HFs for three reasons. First, these exposures are not static and change over time (as we show later). Second, the factors are not easy for investors to replicate (e.g. lookback straddles[2]). Third, some strategies (e.g. global macro or multi-strategy) are not well defined, and thus are difficult to replicate.

The up-down approach begins with identifying the sources of HF returns and relates pre-specified risk factors for HF performance attribution, and consists of two streams. The first uses additional refined factors that better explain HF returns. The second stream, which can be regarded as an extension of the first, deals with methodological issues and funds' structural breaks. Although both streams use more advanced econometric techniques (e.g. regime-switching models) and confirmed previous studies that HFs have nonlinear returns and exposures, there remain significant gaps in many of the non-linear models mentioned above which we address in this paper. In particular, these non-linear models are not enough sufficient or cannot completely describe the changing exposures across different business cycles and market conditions (many of them just use specific macro variables or isolate a specific crisis/event). Moreover a single model is not sufficient to describe all HF strategies or conditions because it is over-simplistic. The single general commodity factor used to date is very broad, and (as we show later) HF managers following many strategies switch from equities into commodities during hard times.

In the first stream of the up-down approach, we distinguish studies from Bali et al. (2011, 2014) and Avramov et al. (2013). Bali et al. (2011) found that there is a positive correlation between HF exposure to default risk premium and HF returns, meaning that risk premia on risky assets are negatively correlated with present economic activity. Moreover, HFs with lower exposure to inflation derive higher returns in the future. Extending their previous work in 2011 Bali et al. (2014) found that macroeconomic risk factors such as default spread, term spread, short-term interest rates changes, aggregate dividend yield, equity market index, inflation rate, unemployment rate, and the growth rate of real gross domestic product per capital, are more powerful determinant on HF returns compared to other factors such as market,

[2] A lookback straddle is a combination of a lookback call plus a lookback put. Both options are traded in Over-The-Counter markets. These respectively grant the holder the right but not the obligation to buy (sell) an asset at the lowest (highest) price identified during the lifetime of the option.