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RECENT MODELS IN BEHAVIORAL FINANCE PUT TO TEST

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1. Introduction

Over the last two decades, academic researchers have documented the empirical success of two types of trading strategies, which have been used by investment professionals since long: Contrarian investing and momentum strategies. Originally, the success of contrarian strategies was attributed to market over-reaction, which stands in contrast to the under-reaction hypothesis associated with momentum effects. It was only recently that theoretical work has begun trying to consistently model behavioral explanations for these challenges to asset pricing. I will review two empirical papers, which test some predictions of the new models.

The remainder of this introduction will lay out the challenge behind explaining the stylized facts. Section 2 will summarize the unifying models of DANIEL/HIRSHLEI-FER/SUBRAHMANYAM (1998), BARBE-RIS/SHLEIFER/VISHNY (1998) and HONG/STEIN (1999) before I discuss the empirical work of HONG/LIM/STEIN (2000) in section 3 and LEE/SWAMINATHAN (2000)

in section 4. Section 5 concludes this review.

1.1 Challenging rational asset pricing

Much of the early work on return reversals and continuations[1] was driven by researchers in behavioral finance, challenging the traditional body of rational asset pricing. The idea is to find systematic deviations from what risk-based theories would predict prices to be and to associate them with the growing list of biases borrowed from research in cognitive psychology. With the work of DELONG/SHLEIFER/SUMMERS/WALDMANN (1990) and SHLEIFER/VISHNY (1997) it has been shown that the "pervasive market forces" of MILLER (1987, p. 284)[2] might be insufficient to do away with human's cognitive limitations: provided that investors do not learn from their errors, the pricing effects from cognitive biases will not peter out. But the challenge of consistency and a parsimonious structure remains, as implied by MILLER more than a decade ago. An excellent survey on the current state of behavioral finance can be found in HIRSHLEIFER (2001).

The work on price reversals based on contrarian indicators like past long-run performance or valuation multiples was led by DE-

BONDT/THALER (1985,1987) and LAKONI-SHOK/SHLEIFER/VISHNY (1994). They interpreted their results to be in line with an *overreaction* of investors. An *underreaction* hypothesis was proposed by JEGADEESH/TITMAN (1993) and CHAN/JEGADEESH/TITMAN (1996) to explain their results on intermediate-run return momentum. Even though this might suggest that the evidence against rational pricing just kept mounting, the proposition of both over- and underreaction led behavioral finance into a quagmire of inconsistency, while proponents of the rational paradigm found comfort in seeing over- and underreactions to average out; just as predicted by market efficiency (FAMA, 1998)[3].

Clearly, digging for pricing anomalies and picking behavioral explanations from a hodgepodge of psychological evidence reported from the micro-level of individual behavior cannot be good economics (MILLER 1987). In order to seriously compete with existing models, any precursor to what one day might become a "B-APM"[4] would need to (1) yield parsimonious and unifying explanations, (2) generate further predictions which can be subjected to out-of-sample tests and (3) be based on plausible assumptions of investor behavior, see FAMA (1998) and HONG/STEIN (1999).

Some models have now been put forward which neither fare too badly in meeting that challenge nor can they be expected to yield an ultimate answer. As will be shown below, the findings of HONG/LIM/STEIN and LEE/SWAMINATHAN lend support to some ideas of how to reconcile reversals with momentum. But neither of them exploits the full range of new predictions made. So they are neither of much help in sorting out between the differences of the new behavioral models nor do they ultimately refute risk-based pricing.

2. Reconciling over- and underreaction

The challenge in explaining both contrarian return reversals and momentum seems to lie in the inconsistency of allowing for both over- and underreaction. However, the ideas behind the recent models of BARBERIS/SHLEIFER/VISHNY (1998) (BSV), DANIEL/HIRSHLEIFER/ SUBRAHMANYAM (1998) (DHS) and HONG/STEIN (1999) are actually not as outrageous as proponents of the rational framework might want to suggest. It is by taking into account differences in sources and intensity of information that things start to look more reasonable. But FAMA (1998) has its point that unifying models need to focus on either over- or underreaction as their driving force, as BSV, DHS and HONG/STEIN do.

It is no wonder that all three models are able to explain the stylized facts of long-run return reversals and intermediate-run momentum. It is striking, however, how they differ in their setups and underlying assumptions: The representative investor of BSV has misperceptions about shifting regimes, while the DHS model is based on overconfident investors[5] receiving private information. HONG/STEIN do not specifically rely on a cognitive bias. They describe a simple market setting with two types of traders where information on fundamental value spreads gradually among newswatchers who are paired up with momentum traders.

Unfortunately, while all three models make different out-of-sample predictions, these are hardly conflicting. It is by design that they seek to link momentum to long-run reversals, so that their essential predictions boil down to that strong (weak) reversals will happen in conjunction with strong (weak) momentum. In the case of BSV, such segmentation should depend on the strength and weight[6] of relevant pricing information. They admit that it is hard to classify events on a priori grounds this way. The DHS story of reversals and momentum results from private information. It leads

to a somewhat richer setting of new predictions, which are mostly related to corporate actions and the belief of firms in their over-/undervaluation. According to the model of HONG/STEIN, momentum and the ensuing overshooting of prices are caused by gradual diffusion of information. If information spreads more slowly or when there is more private information in a market segment[7], the effects of both reversals and momentum should be more pronounced[8]. Again, these predictions point in different directions but they hardly rule each other out.

3. Testing proxies for information diffusion

The paper of HONG/LIM/STEIN is a follow-up of HONG/STEIN and tests whether momentum strategies will be more successful for stocks where information spreads more slowly among market participants. It should be noted that this is only the first part of one prediction (out of three) made by HONG/STEIN, which was originally about momentum *and reversals*. They use data on analyst coverage of NYSE/AMEX/Nasdaq stocks as a proxy for information diffusion and find the expected positive relationship with momentum. Their results are largely driven by "loser" stocks and are explained by HONG/LIM/STEIN with the importance of analyst coverage in propagating bad news.

In constructing a proxy for information diffusion, HONG/LIM/STEIN had to account for possible side effects and reverse-causalities from other variables such as size and trading turnover, as well as transaction costs and short-selling constraints. So they construct several versions of a *residual analyst coverage* by running monthly regressions of analyst coverage against these control variables. Their results appear to be largely robust to either of these variants. The impact of residual analyst coverage on intermediate-run return continua-

tion is analyzed by HONG/LIM/STEIN in two ways: First they form portfolios based on two-way sorts of past performance[9] and residual analyst coverage. Second, they run cross-sectional regressions of a measure for serial correlation on size and analyst coverage.

Either way, they find higher momentum returns and higher six-month return autocorrelation for stocks with lower analyst coverage. As shown by their portfolio strategies, it is mainly the underreaction of loser portfolios that drives the results. HONG/LIM/STEIN report a highly significant return of 0.7 % per month from a size- and momentum-neutral spread trade between loser stocks with high and low analyst coverage. Given that low-coverage stocks exhibit more momentum and that this is mostly driven by loser stocks, it appears that underreaction is stronger for bad news where analyst coverage is also more important.

Unfortunately, HONG/LIM/STEIN do not test whether their proxy for information diffusion also accounts for differences in long-run return reversals as predicted by HONG/STEIN.

4. Trading activity in a momentum life cycle

LEE/SWAMINATHAN report how information on past trading volume helps to improve both intermediate-term momentum and long-run reversal/value strategies for stocks listed on the NYSE and AMEX. None of the models discussed above (section 2) mentions trading volume explicitly. LEE/SWAMINATHAN infer predictions on trading volume from these models, which are not in line with their results. They offer an informal "Momentum Life Cycle" theory: Stocks are subject to periods of investor favoritism and neglect, thus they become winner and loser. In this life cycle, trading volume acts as an indicator of a stock's "popularity" according to which they classify early and late stages of momentum and reversals.

The key variable in the paper of LEE/SWA-MINATHAN is their measure of trading volume. This could just be a proxy for market liquidity, i.e. a rational component in asset pricing. However, they argue that this is not the case. LEE/SWAMINATHAN define trading volume in relative terms as the ratio of shares trade to the total shares outstanding, hence it is barely correlated with traditional liquidity proxies[10]. In addition, their results on volume based trading strategies (see below) show that high volume can also account for high returns, which is inconsistent with a liquidity story.[11]

LEE/SWAMINATHAN form portfolios based on sorts of past intermediate-run performance[12] and trading volume. They report raw returns as well as several risk adjustments[13], but the qualitative results remain identical: Low volume stocks outperform high volume stocks, which is consistent with a liquidity story. However, price momentum is stronger for high volume stocks, both up- and downward. The latter does not bode well with a liquidity-based explanation. It poses also a challenge to the models discussed above.

The models of BSV, DHS and HONG/STEIN predict that *both* momentum and reversals will be more pronounced for market segments where the respective driving forces of each model are more important[14]. The results of LEE/SWAMINATHAN show that high volume is indicative of strong momentum for winners. In contrast, for losers it is low volume, which leads to stronger momentum. In other words, if trading volume is the link between reversals and momentum, the direction of its effects are not as clear-cut as implied by BSV, DHS and HONG/STEIN. According to LEE/ SWAMI-NATHAN, other stock characteristics like past long-run performance determine whether, say, high volume leads to stronger or weaker effects of reversals and momentum.

LEE/SWAMINATHAN posit that volume is an indicator of popularity and neglect in their "Momentum Life Cycle" hypothesis. It might be promising to develop a formal model of such a life cycle build on principles of existing (rational) market-microstructure models. Again, such a model should be evaluated according to its assumptions, parsimonious structure and out-of-sample predictions.

5. Conclusion

Until recently, a consistent behavioral explanation for the returns of contrarian and momentum strategies has been lacking, owing to the conflicting notions of market over- and underreaction. By relating the known behavior of U.S. stock returns to new data on stock characteristics like analyst coverage and trading volume, HONG/LIM/STEIN and LEE/SWA-MINATHAN construct out-of-sample tests on the models of DHS, BSV and HONG/STEIN. Their results lend credibility to some basic intuitions on patterns of market over- and underreaction. However the full extent of predictions made by the models of BSV, DHS and HONG/STEIN has not been exploited, yet. Especially, the DHS model yields rich predictions on corporate actions, which have not been tested. The results of LEE/SWAMINATHAN show that the impulse-response mechanisms of BSV, DHS and HONG/STEIN might be unable to capture the full story.

An inherent conflict between behavioral finance and the rational framework is the importance attached to human shortcomings at the micro-level, while explaining asset prices at the macro-level (MILLER, 1987). The informal "Momentum Life Cycle" hypothesis of LEE/SWAMINATHAN relates both to market microstructure as well as asset pricing at the macro level. Incorporating its content into a formal model might yield new insights into how the micro-effects of the various cognitive biases lead to long-run return reversals and intermediate-run momentum in stock returns.

Footnotes

[1] A.k.a. contrarian and momentum strategies. Contrarian strategies are a.k.a. value or winner/loser depending on whether they are based on valuation multiples like book-to-market and price-earnings or on past *long-term* performance.

[2] "That we abstract from all these stories in building our models is not because the stories are uninteresting but because they might be too interesting and thereby distract us from the pervasive market forces that should be our principal concern."

[3] At another front, defenders of the rational paradigm offered evidence for risk-based explanation: FAMA/FRENCH (1993,1995) argue that value stocks earn a "distress" premium and question the econometric significance of momentum. HARVEY/SIDDIQUE (2000) explain momentum with a skewness factor by extending the mean-variance optimization of traditional portfolio theory to the third distributional moment.

[4] A "Behavioral Asset Pricing Model".

[5] HONG/STEIN (1999, p. 2144) classify BSV and DHS as both being driven by "a single representative investor". This is only correct in the case of BSV. DHS explicitly base their model on two different sets of investors: Risk-neutral informed and risk-averse uninformed investors.

[6] Strength pertains to the content, like a sharp change in earnings, and weight to the statistical importance, e.g. a single observation, as opposed to a string of data.

[7] I.e. when there are higher barriers for information diffusion.

[8] In addition, HONG/STEIN expect a relationship between the pattern of serial return correlations and the investment horizon of their momentum traders.

[9} They follow the methodology of JEGADEESH/TITMAN (1993) but chose to form larger portfolios, i.e. with less extreme past performance.

[10] Like firm size, stock price and relative trading spreads.

[11] At the end of their paper, LEE/SWAMINATHAN (section IV.D), report further evidence indicating that their results might be driven not by the level of but changes in trading volume.

[12] Past performance is measured over various periods from three months up to a year.

[13] Three Factor Model of FAMA/FRENCH (1993) and size.

[14] I.e. misperceptions are larger (BSV), investors are more overconfident (DHS) or information diffuses more slowly (HONG/STEIN).

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