Trading and emotion regulation: The heart of financial decision-making?

Mark Fenton-O'Creevy[1], Ale Smidts[2], Jeffrey Todd Lins[3]

[1] Open University, Milton Keynes, UK

[2] Rotterdam School of Management, Erasmus University Rotterdam, The Netherlands

[3] Saxo Bank, Copenhagen, Denmark

Trading and emotion regulation: The heart of financial decision-making?

Abstract

We review research on emotions and financial decision making, with a particular emphasis on the role of emotion regulation and on traders in financial markets. We argue that variability in emotion regulation is a good candidate to explain important intra and inter-individual variability in susceptibility to key decision-making biases and hence in financial performance of market actors. We develop hypotheses concerning these relationships and describe a study which we are embarking on investigation the role of emotion regulation in relation to the decision-making of professional traders in investment banks.

Trading and emotion regulation: The heart of financial decision-making?

Introduction

Until recently the study of financial decision making has been more influenced by the assumptions of financial economics than psychology. Neo-classical financial economics has been a prime influence on research into markets and market behavior. Traders within such markets are understood as profit maximisers who act on price information which summarizes all available knowledge about asset values (Fama, 1991; Fama, 1998). Such markets are designed to be transparent and have low transaction costs such that profit opportunities are only fleetingly available and market imperfections are eradicated (MacKenzie, 2006). Within this paradigm there are strong assumptions about investor rationality and the nature of investor preferences.

In the last two decades, understanding of markets and market behavior has been changed by the advent of behavioral finance (De Bondt, Palm, & Wolff, 2004; Thaler, 1993), which has drawn upon the insights of cognitive psychology to incorporate cognitive biases, into models of financial decision making, modeling investor behavior and explaining some well known deviations of market behavior from the predictions of the efficient markets hypothesis – a mainstay of the neo-classical paradigm (Fama, 1991). However, within this field of study, until recently,the main role accorded to emotions is that they are an interference with rational cognition, or are accorded a utility in anticipated future outcomes rather than being central to choice and action (Shefrin, 2000).

In contrast, the trader practitioner literature is full of references to emotion and 'market sentiment'. For example: -

> *"Trading is emotion. It is mass psychology, greed and fear."* (Marcus in Schwager, 1993: 49)

Advances in neuroscience are demonstrating that, as Phelps (2006: 46) concludes in a recent review,

> *"The mechanisms of emotion and cognition are intertwined from early perception to complex reasoning. … Examining cognitive functions without an appreciation for the social, emotional, and motivational context will result in an understanding that may be limited in its applicability outside of the research laboratory."*

More recent work has begun to show the importance of emotion in understanding financial decision-making and risk behaviour more generally (Bechara & Damasio, 2005;

Damasio, 1994; Finucane, Alhakami, Slovic, & Johnson, 2000). There is evidence both of emotion playing a biasing role on judgement which is detrimental to human performance and of emotions playing a role which enhances performance. First, emotions can bias information retrieval. For example, Meyer, and colleagues (1990) offer evidence that it is most easy to recall experiences which are congruent with current emotional state. Second, emotions can directly bias the cognitive processes engaged in decision-making. For example, Lerner and Keltner (2001) show fear to increase risk perception (and decrease riskiness of choices) and anger to reduce risk perception (and increase riskiness of choices). Lo, Repin and Steenbarger (2005) found some clear associations between day-traders' emotions (as measured by an emotional-state survey), their decision making, and performance (N=80). Investors who experienced more intense positive and negative emotional reactions to gain and loss were poorer performers than those with more attenuated emotional responses.

However, there is also evidence that the use of emotional cues offers an important advantage in everyday decision-making (Bechara & Damasio, 2005; Brickner, 1932). There is some evidence too which supports the idea that emotions may support effective decision-making in a financial context. For example Seo and Barrett (2007) carried out a study of investment club members (N=101), using an internet-based investment simulation accompanied by emotional-state surveys. They found that individuals who experienced more intense emotions achieved higher decision-making performance. There is some degree of support for two contrasting perspectives. The first suggests that emotions primarily interfere with rational assessment of information and risk. The second that emotions by representing experience gained across many relevant prior situations are an aid to navigation in complex information environments. Accounts of emotions as bias focus primarily on the role of non-relevant emotions. By contrast, accounts of emotions as information focus primarily on the role of emotions in encapsulating prior relevant experience. In principle, these two perspectives may not then be in contradiction.

Emotion regulation and financial behavior

The recent literature on emotion regulation makes it clear that humans do not just experience emotions; we actively regulate them (Gross, 2002; Gross & Thompson, 2007). Further there is evidence of both trait and state variability in emotion regulation effectiveness. It thus seems likely that the regulation of emotion (e.g. down-regulating non-relevant

emotions while remaining sensitive to relevant emotions) may play an important role in moderating emotion effects on performance.

Behavioral finance has been primarily concerned with examining the role of well known cognitive biases in perception and management of risk in underpinning departures in aggregate market behavior from the joint predictions of the efficient markets hypothesis and the capital asset pricing model. Thus the focus has been on the existence in the general population of such biases as the disposition effect, path dependence and loss aversion. However, it is also clear that there is considerable individual variability in propensity to such biases. Little attention to date has been paid to the antecedents of such variability. While, there has been a range of studies of antecedents of the disposition effect; these have primarily focused on 'investor sophistication' and 'experience' with little or no attention to the underlying psychological processes which may be implicated in such biases.

Very recently empirical research has begun to address the possible role that emotion regulation processes may play in individual susceptibility to biases such as loss aversion. A large scale qualitative field study of investment bank traders (Fenton-O'Creevy, Nicholson, Soane, & Willman, 2005; Fenton-O'Creevy, Soane, Nicholson, & Willman, 2008) showed important differences between novice and expert traders in emotion regulation strategies and showed many traders and their managers to be much concerned with the regulation of emotion to avoid adverse impacts of strong emotions on trading decisions. A recent laboratory study (Sokol-Hessner, Hsu, Curley, Delgado, Camerer, & Phelps, 2009) showed loss aversion to be reduced by adopting an intentional cognitive approach to emotion regulation[4]. Directing subjects to adopt such a strategy resulted in lower arousal relative to losses (as measured by skin conductance) and in lower behavioral loss aversion compared to a control group. Another recent laboratory study (Heilman, Crisan, Houser, Miclea, & Miu) showed an (instructed) intentional cognitive approach to emotion regulation to reduce the impact of induced emotions on risk aversion and on performance in the pre-hunch/hunch stage of the Iowa Gambling Task such that risk aversion was reduced and performance in the gambling task was greater relative to a control group.

Gross and colleagues (Gross, 2007) have developed a staged model of emotions, which distinguishes between strategies for emotion regulation which intervene at different stages of the emotion process. A self-report measure, the Emotion Regulation Questionnaire,

[4] In terms of Gross and Thompson's (2007) framework this would be a reappraisal strategy

identifies habitual approaches to emotion regulation: reappraisal, in which an intentional cognitive reappraisal of the stimulus affects the emotion response; and response modulation (or expressive suppression) in which expression of an experienced emotion is effortfully modulated.

Such self-report measures are easy to administer and have been successfully linked in research to important outcomes. However, they depend on subjects' awareness of their habitual strategies (which may be pre-conscious) and on subjects' motivation to be honest in their self report.

Thus physiological measures are highly desirable since they do not depend on accuracy of subjects self assessment and may encompass pre-conscious as well as conscious emotional states.

One important physiological measure which has recently been linked to emotion regulation is heart rate variability (HRV). The autonomic nervous system can be subdivided into the (excitatory) sympathetic and (inhibitory) parasympathetic sub-systems (SNS and PNS respectively). These interact, often antagonistically, to produce variation in physiological arousal. During periods of stability and low stress the PNS is dominant and maintains a lower degree of physiological arousal and lower heart rate. During physical or psychological stress the SNS becomes dominant increasing physiological arousal and heart-rate. Effective emotion regulation requires the ability to adjust physiological arousal on a moment by moment basis (Gross & Thompson, 2007). Heart-rate variability provides a measure of the moment by moment interaction of the SNS and PNS yielding information about autonomic flexibility and thus regulated emotion responding. HRV can be considered a proxy for the central autonomic network's regulation of the timing and magnitude of an emotional response via inhibition, in response to context(Appelhans & Luecken, 2006; Geisler & Kubiak, 2009; Hansen, Johnsen, & Thayer, 2009; Moses, Luecken, & Eason, 2007; Utsey & Hook, 2007). Higher levels of HRV have been associated with constructive coping in university students and lower HRV with the use of repressive coping strategies, anxiety, depression and rigid attentional processing of threat (Appelhans & Luecken, 2006).

While early studies have focused on resting HRV as providing a global assessment of regulatory capacity, recent studies have demonstrated the utility of HRV in providing a task-related, moment by moment, assessment of regulation(Moses et al., 2007) and suited to field studies of task performance (Segerstrom & Nes, 2007)

Understanding trader performance

Susceptibility to biases

One of the challenges often encountered within economics in the application of measures concerning utility and performance to investors' behavior is the complex problem of determining an appropriate representation of a so-called "wealth level", where these are considered In the case of traders' behaviors, this determination is far more straightforward, since utility and performance may be framed with respect to stated limitations, expectations and benchmarks within an institution's own framework for individuals' trading activity - a comprehensive representation of wealth is neither necessary nor meaningful.

We briefly clarify that a necessary distinction in the activity of traders may be made, essentially around what may be designated here as "market making" and "speculative trading". Whereas for the sake of brevity we shall consider the latter category to be self-evident, *market making* considers the role in modern capital markets of agents who stand as counterparties to buy and sell transactions of other market participants, providing bid and ask prices at a spread, which constitutes the revenue mechanism for the market maker. In reality, market makers may make use of a complicated mixture of price prediction and inventory management in order to attempt to obtain higher revenues, however, the important distinction is that this activity is greatly focused on price-setting and therefore encompasses some elements that are quite different from direct speculation in the value of assets.

Given explicit targets and metrics for the outcome of both market making and speculative trading for specific transaction flows and market exposures, we can derive measures for inferring important behavioral phenomena, such as risk and loss aversion, path dependence and disposition effect, from trading data, which are describe briefly below:

Risk and loss aversion: Following the prevalent paradigm of expected utility within economic theory concerning decision-making under uncertainty, risk aversion is described by the concavity of a utility function indicating a smaller change in utility for gains than that for equivalent losses. However, this representation of risk aversion has been subject more recently to substantial criticism from within behavioral finance (Rabin, 2000). Alternatively, Rabin argues that "the most firmly established feature of risk preferences" is loss aversion and argues this to be more satisfactory explanation of risk behavior. Given targets and limitations defined for trader activity as described above, we may construct meaningful measures both for risk aversion and loss aversion.

Path dependence: Prospect Theory predicts risk-proclivity in the domain of losses, however, other work has illuminated further the complex dependency of risk aversion and risk willingness on prior outcomes, including the importance of the "break-even" point. The net effects of outcomes prior to key trading episodes may be derived empirically and correlated with risk behaviors and sensor data.

Disposition effect: Much past empirical research has documented that the propensity of investors to liquidate holdings in assets in which the current value represents a capital loss is significantly lower than for those they might realize a gain. This predisposition has already been linked in previous work to the avoidance of regret and to the active seeking of pride about prior decisions (Shefrin & Statman, 1985).

Financial Performance

We have good reason to believe that traders in investment banks have particular opportunities for profit that arise from lower than average transactions costs, timing advantages and some access to short-lived information advantage relative to most market actors. Further, exploiting these advantages requires skill and it is reasonable to assume that skill levels vary between traders. Thus is makes sense to think in terms of expertise in trading and to hypothesize that susceptibility to a range of decision biases will detract from skilled trader performance. While differences in trader skill will influence financial outcomes, the relationship between skill and financial outcomes will not be straightforward and we need to be careful which measures of performance we adopt. While skill will be one element which predicts financial performance, there are important other elements. First, trader profit and loss (P&L) needs to be understood in relation to risks taken. Second, it needs to be understood in relation to market conditions. One trader may make a greater return than another, not because of greater skill, but because they are operating in different market conditions. Third, trader performance needs to be understood in relation to the risk limits they operate within. A trader given higher limits may perform better by making the same trades but for larger sums than a colleague with lower risk limits. Finally there will be a large random element in traders' daily P&L. For these reasons a simple financial measure such as daily P&L may not be good measure of traders' performance. However, in making remuneration decisions, investment banks typically consider (longer–term) financial performance as a major element but make adjustments for the elements highlighted above. Further the operation of the labor market will tend to set a reasonably efficient price (at least in ranking terms) for trader skill. Thus a

reasonable proxy for global trader performance may be total annual remuneration. An approach in previous research (Fenton-O'Creevy, Nicholson, Soane, & Willman, 2003; Fenton-O'Creevy et al., 2005) has been to classify traders in terms of total remuneration and managerial ratings of performance. Thus we can use managerial ratings and total annual remuneration as global measures of trader performance. While we can also construct 'performance episode' measures of performance as described below:

Performance against a benchmark: As described previously, insofar as traders' activity includes some component of market making, the expected outcomes of this activity are not zero, that is, hypotheses concerning efficient markets and random walk behaviors for returns are not governing assumptions. Traders endeavor to enhance profitability on a transaction return process that is constructed to be net positive (as a function of bid/ask spreads and access to interbank liquidity) on average. As such, in many cases it is possible to compute an expected "benchmark earning" on transactions as well as further derive cumulative and per unit measures. Traders' are often aware of their current performance against such measures both with respect to current exposures as well as the past (at varying time horizons: minutes, hours, days, etc).

Hypotheses

There is now empirical evidence, from laboratory studies, for a positive relationship between intentional cognitive approaches to emotion regulation and decision performance for decisions under risk and uncertainty. There is also a substantial body of interview data which suggests many expert traders and trader managers to believe effective emotion regulation to be important to effective trading performance. However findings from laboratory studies with naïve subjects do not necessarily translate into the behavior of expert performers in real world performance domains (Todd & Gigerenzer, 2007). Thus we seek to examine whether such effects of emotion regulation on decision-making performance hold for the case of real world trading by professional financial traders.

Thus we test:-

H1: Traders with a higher propensity to regulate emotions through an intentional cognitive (reappraisal approach) will evidence less loss aversion and less path dependence when trading

H1a: Traders with a higher mean heart rate variability will evidence less loss aversion and less path dependence when trading

H2: Traders with a higher propensity to regulate emotions through an intentional cognitive (reappraisal approach) will, ceteris paribus, exhibit better financial performance

Ha2: Traders with higher mean heart rate variability will, ceteris paribus, exhibit better financial performance

H3: Trading performance episodes marked by less effective emotion regulation, as measured by heart rate variability, will be characterized by lower performance outcomes and greater deviation from normatively rational behavior

The present study

The present study is part of a broader programme of research investigating the role of emotions in the decision-making of traders, investors and consumers. The research programme will bring together experimental laboratory research on naïve subjects with field studies on real investors and traders in investment banks.

We outline below a two part study which is yet to be conducted. We anticipate having results from at least the first stage of the study by the time of the conference so will be able to present preliminary results.

Pilot study

The pilot study will a) establish the viability of our planned measures in the field setting; b) provide a working definition of performance episode for the next stage of research; c) provide a rich description of the interplay of trader behavior, emotion arousal and emotion regulation across a performance episode.

Sample

Access has already been agreed to two cohorts of foreign exchange traders in two investment Banks (one in London and one in Copenhagen). The pilot sample will consist of four FX traders, two highly experienced and (in the judgment of managers) expert, and two modestly experienced traders. The expert and inexperienced traders will be matched on nature of trading activity (i.e. spot trading versus complex risk; low liquidity currency crosses versus high liquidity products).

Data capture

Each trader will be fitted with an electrocardiograph sensor with built in accelerometer. The sensor can capture heart-rate and motion data in real-time and has a built in data store. The motion data allows for us to control for level physical activity in relation to heart rate.

A filtering stage in signal processing allows identification of R-peaks and removal of artifacts.

Average heart rate (as a moving average over 5 minute intervals will) provide a measure of arousal

Heart Rate Variability (HRV) measured a) by standard deviation of inter-beat intervals. b) frequency spectrum analysis to calculate power in the low frequency (LF) and high frequency (HF) ranges. (HF power is mainly related to activation of the SNS and LF to activation of both SNS and PNS). Both will be measured over a rolling 5 minute period at 1 minute intervals

Procedure

Base data will first be established for each trader as they engage in a neutral activity.

For each pair of traders a planned news event will be identified which is salient to the pricing of products they trade. The traders will be monitored over a period from one hour prior to the news event to one hour after the news event. The monitoring will have several components.

1. ECG via an electrocardiograph sensor. This signal will be later processed to provide 1 minute and 5 minute moving averages of heart rate and heart rate variability.

2. Video capture of activity. A researcher will sit by the trader and operate a video camera to capture facial expression, activity and audio. Using a procedure drawn from expertise research (protocol analysis), the trader will be asked to provide a constant spoken narrative of their actions and decisions including commentary on feelings. (The pilot study procedure will run twice for each trader. On the first occasion the procedure will not include a talk aloud protocol. This will help us identify whether findings from physiological data are dominated by the effect of the requirement for traders to narrate their actions.)

3. Time stamped trading data will be captured along with relevant price data. Later analysis will identify key trading episodes.

A debrief will be conducted with each trader to capture their impressions of key events in the monitored period, including their own judgments of performance and outcomes.

Analysis

Analysis will focus first on providing a rich description of the unfolding of trading performance episodes, including the nature of emotional response and regulation. To do this, video data and processed sensor data will be synchronized and displayed simultaneously alongside a trading timeline which notes key trading and market events.

A rich qualitative account of reactions to key market events will be constructed for each trader and comparisons will be made between traders in the 'expert/inexperienced' pairs.

Main Study

While final design of this study will depend on outcomes of the pilot stage, we outline below some main features of the study and how it will address the hypotheses outlined above. The main study will have two components, a between trader comparison in which the individual trader is the unit of analysis and a within trader comparison in which performance episodes clustered within traders are the unit of analysis.

Sample

For the within trader component of the study we have identified a group of 22 FX traders in two investment banks. Trading experience varies from 1 year to 20 years. All but 1 are men. All are engaged in market-making with defined discretion to take proprietary risks when suitable opportunities arise. For the between trader component we are seeking to expand the sample by engaging further cohorts of traders in additional banks. Target sample is 60 traders.

Measures

Emotion Regulation

We draw on two measures of emotion regulation.

Emotion Regulation Questionnaire (ERQ). Gross and John's (2003) stage based model of emotion regulation distinguishes emotion regulation strategies by the stage in the emotion generation process at which regulation occurs.

Heart Rate Variability (see above)

Susceptibility to biases

Trading and market price data will be collected for each trader for each performance episode. The data will be analyzed to calculate a series of measures of departures from normatively rational trading behavior as described above

Financial Performance

Management estimate of global performance: Single item : please rate this traders performance in relation to other traders in the

Total annual remuneration: Traders total annual remuneration in the previous financial year including bonus

Performance against a benchmark (as discussed above)

Procedure

Each trader will be monitored in a neutral setting to establish baseline cardio data. They will then be administered the ERQ .

Each trader will be set up with a cardio sensor which has been synchronized to a time signal. Each trader will be monitored for cardio-data on multiple occasions of at least one hour. As far as possible monitoring will occur around planned market news releases to ensure useful levels of market activity. Cardio sensor recorders will be synchronized with a time signal from the trading platform prior to monitoring to ensure later matching with trading and market data.

Post hoc analysis of market and trading data will be used to identify key market and trading events.

Analysis of relationships between ERQ, HRV, behavioral biases and financial performance will test the hypotheses outlined above.

Summary

We have reviewed recent research on emotion and financial decision-making with a particular focus on emotion regulation. We have argued that emotion regulation is a good candidate as an antecedent of variability between and within individuals in susceptibility to some key departures from normative prescriptions for optimal decision-making in financial markets.

We have paid particular attention to heart rate variability as a physiological measure which may have utility in investigating such relationships.

Finally we have described studies which we are embarking on to test hypotheses about the relationship between emotion regulation and decision-making performance in financial markets. We will present the results from at least the first stage of the study by the time of the conference.

References

Appelhans, B. & Luecken, L. 2006. Heart rate variability as an index of regulated emotional responding. Review of general psychology, 10(3): 229.

Bechara, A. & Damasio, A. 2005. The somatic marker hypothesis: a neural theory of economic decision. Games and Economic Behavior, 52(336-372).

Damasio, A. R. 1994. Descartes' error: Emotion, reason and the human brain. . New York: Putnam.

De Bondt, W., Palm, F., & Wolff, C. 2004. Introduction to the special issue on behavioral finance. Journal of Empirical Finance, 11(4): 423-427.

Fama, E. F. 1991. Efficient Capital Markets: II. The Journal of Finance, 46(5): 1575-1617.

Fama, E. F. 1998. Market efficiency, long-term returns, and behavioral finance, Journal of Financial Economics, Vol. 49: 283-306 224 pages.

Fenton-O'Creevy, M., Nicholson, N., Soane, E., & Willman, P. 2003. Trading on illusions: Unrealistic perceptions of control and trading performance. Journal of Occupational and Organizational Psychology, 76: 53-68.

Fenton-O'Creevy, M., Nicholson, N., Soane, E., & Willman, P. 2005. Traders: Risks, decisions and management in financial markets. Oxford: Oxford University Press.

Fenton-O'Creevy, M., Soane, E., Nicholson, N., & Willman, P. 2008. Thinking, feeling and deciding: The influence of emotions on the decision making and performance of traders, Academy of Management. Anaheim, California.

Finucane, M. L., Alhakami, A., Slovic, P., & Johnson, S. M. 2000. The Affect Heuristic in Judgments of Risks and Benefits. Journal of Behavioral Decision Making, 13(1): 1-17.

Geisler, F. & Kubiak, T. 2009. Heart rate variability predicts self-control in goal pursuit. European Journal of Personality.

Gross, J. 2002. Emotion regulation: affective, cognitive, and social consequences. Psychophysiology, 39: 281.

Gross, J. & John, O. 2003. Individual Differences in Two Emotion Regulation Processes: Implications for Affect, Relationships, and Well-Being. Journal of Personality and Social Psychology, 85(2): 348-362.

Gross, J. J. 2007. Handbook of emotion regulation. New York, NY: Guilford Press.

Gross, J. J. & Thompson, R. A. 2007. Emotion regulation: Conceptual foundations. In J. J. Gross (Ed.), Handbook of emotion regulation. New York, NY: Guilford Press.

Hansen, A., Johnsen, B., & Thayer, J. 2009. Relationship between heart rate variability and cognitive function during threat of shock. Anxiety, Stress and Coping, 22(1): 77-89.

Heilman, R., Crisan, L., Houser, D., Miclea, M., & Miu, A. Emotion regulation and decision-making under uncertainty. Working paper: Emotion and Cognition Neuroscience Laboratory, Program of Cognitive Neuroscience, Department of Psychology, Babeş-Bolyai University, Cluj-Napoca, CJ 400015, România

Lerner, J. & Keltner, D. 2001. Fear, Anger, and Risk. Journal of Personality and Social Psychology, 81(1): 146-159.

MacKenzie, D. 2006. An engine, not a camera: how financial models shape markets: Cambridge, Mass.: MIT Press.

Meyer, J. D., Gayle, M., Meeham, M. E., & Harman, A. K. 1990. Toward a better specification of the mood congruency effect in recall. *Journal of Experimental Psychology*, 26:: 465-480.

Moses, Z., Luecken, L., & Eason, J. 2007. Measuring Task-related Changes in Heart Rate Variability.

Phelps, E. A. 2006. Emotion and cognition: Insights from Studies of the Human Amygdala. Annual Review of Psychology, 57(1): 27-53.

Rabin, M. 2000. Risk aversion and expected-utility theory: A calibration theorem. Econometrica, 68(5): 1281-1292.

Schwager, J. D. 1993. Market Wizards: Interviews with Top Traders: Collins.

Segerstrom, S. & Nes, L. 2007. Heart rate variability reflects self-regulatory strength, effort, and fatigue. Psychological Science-Cambridge-, 18(3): 275.

Shefrin, H. & Statman, M. 1985. The disposition to sell winners too early and ride losers too long: Theory and evidence. The Journal of Finance, 40(3): 777-790.

Shefrin, H. 2000. Beyond Greed and Fear: Understanding Behavioral Finance and the Psychology of Investing (Boston, MA: Harvard Business School Press).

Sokol-Hessner, P., Hsu, M., Curley, N., Delgado, M., Camerer, C., & Phelps, E. 2009. Thinking like a trader selectively reduces individuals' loss aversion. Proceedings of the National Academy of Sciences, 106(13): 5035.

Thaler, R. H. 1993. Advance in Behavioral Finance. New York: Russel Sage Foundation.

Todd, P. M. & Gigerenzer, G. 2007. Environments that make us smart: Ecological rationality. Current Directions in Psychological Science, 16(3): 167-171.

Utsey, S. & Hook, J. 2007. Heart rate variability as a physiological moderator of the relationship between race-related stress and psychological distress in African Americans. Cultural Diversity and Ethnic Minority Psychology, 13(3): 250.