Investing in the Stock Market for Sex? Evidence and Regulatory Approaches

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Abstract
According to finance theory and supporting evidence, individual investors maximize expected returns on their stock market investments by holding a diversified stock portfolio and by limiting trading. However, a substantial subset of individual investors deviate from this strategy, causing them to earn, on average, a much lower return than if they had followed that strategy. Less wealthy investors and investors who are single men deviate from portfolio theory more than other investors and, consequently, they earn low stock returns. The prevailing view in finance is that individual investors deviate from portfolio theory because of irrational overconfidence and reliance on heuristics. In contrast, the hypothesis of this paper is that individual investors deviate from portfolio theory and accept lower rates of expected return on investment in an attempt to satisfy other, more pressing, needs. I use evolutionary psychology to show that investors may be deviating from portfolio theory in an attempt to attain evolutionarily important goals, such as to acquire status or to acquire a mate. I then briefly consider what regulatory implications flow from individual investors investing in the stock market partly for reasons other than to maximize their expected returns on investment.
There is no clear evidence from experience that the investment policy which is socially advantageous coincides with that which is most profitable . . . . The game of professional investment is intolerably boring and over-exacting to anyone who is entirely exempt from the gambling instinct; whilst he who has it must pay to this propensity the appropriate toll.

John Maynard Keynes, The General Theory of Employment, Interest and Money (1935), Chapter 12

I. Introduction

A large body of evidence from the field of finance shows that individuals are atrocious stock market investors. They buy and sell the wrong stocks at the wrong time, under-diversify their holdings, and incur excess transaction costs by actively managing their stock portfolios (either on their own or through advisors).

This bad stock market investing behavior costs individual investors a great deal of money. For example, using data from a large discount stock brokerage firm, Terrance Odean finds that if an individual sells shares of a company to buy shares of another company, on average, the return over the following year on the shares that she purchased will be 3.3 percentage points lower than the return on the shares that she sold. And this is before taking into account either management fees or commissions on the purchase and sale of the shares. One law and finance scholar put the total commissions and management fees paid in the U.S. in 1992 at over $100 billion, or about 1.8% of the market value of all U.S. equities. Under-diversification can also be very expensive for some investors – a 2007 study based on the investment holdings of the entire Swedish population showed that, for the most under-diversified of investors, the cost of under-diversification was more than 5% of their financial wealth. Under-diversified investors also lose because they tend to hold the wrong type of stocks – they prefer stocks that

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2 See for example Barber and Odean, *Id.*
4 Odean, *supra* note, Table 1.
5 Stout, *supra* note at 674.
have a chance of a very large gain (so-called lottery-type stocks), and these types of stocks tend to greatly underperform the market.7

Some groups of investors are more prone to making these investment mistakes than others. For example, single men earn worse stock market returns than married men, who in turn earn worse returns than women.8 As well, less wealthy and less well-educated investors are more prone to making investment mistakes, and thus more prone to earning lower stock market returns, than their wealthier and more educated counterparts.9

That this bad stock market behavior persists in the face of evidence of its cost is perplexing to finance scholars. Given the wealth of information available to investors through the media and professional advisors, it ought to be easy for individual investors to avoid making the investment mistakes described above. The rules that individual investors should follow if they wish to maximize their risk-adjusted returns are well-known and uncontroversial. The bedrock investment rule is the portfolio theory of stock market investing, which was first formalized by Harry Markowitz in 1952.10 Since that time, variants of portfolio theory have been universally accepted by finance scholars and professionals as the preferred model for stock market investment.11 The gist of portfolio theory is that investors maximize their risk-adjusted returns by investing in a portfolio of stocks that is diversified by industry and geographically. The percentage of their assets that an investor ought to invest in stocks will depend on the degree of his or her risk aversion – the higher an investor’s risk aversion, the lower the percentage of his or her wealth that the investor ought to invest in stocks.12 However, the basic diversification strategy will apply regardless of investor risk aversion level. A concept that follows from portfolio theory is that, as individual investors generally do not have access to non-public information about particular stocks, they should not try to outperform the stock market through trading – such activity will increase transaction costs without increasing expected returns. Individual investors ought to buy and sell stocks only for liquidity reasons, for tax reasons or to rebalance their portfolio to match their risk aversion level.13

Economists assume that individuals invest in the stock market for the same reason that they engage in other forms of savings. They invest to temporally maximize their utility. They reduce their current consumption and invest the amount of the reduction in the stock market in order to increase their consumption in the future.14 But if this were the sole reason for individuals investing in the stock market, individuals would invest according to the tenets of portfolio theory, as that strategy has been shown to be the one that maximizes returns (and thus maximizes

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8 Barber and Odean, supra note.
10 Harry Markowitz, Portfolio Selection, 7 J. FINANCE 77–91 (1952).
11 See for example ZVI BODIE, ALEX KANE & ALAN J MARCUS, INVESTMENTS (9th ed. 2011).
12 Id.
13 Id.
14 See Paul A Samuelson, An Exact Consumption-Loan Model of Interest with or without the Social Contrivance of Money, 66 J. POLIT. ECON. 467–482 (1958) for an economic model for savings.
future consumption). The question that this paper focuses on is: In the face of overwhelming evidence that diverging from portfolio theory is so costly, why don’t individual investors invest according to the tenets of portfolio theory?

The prevailing view amongst economists and finance scholars is that individuals depart from portfolio theory because they lack relevant information or because they suffer from cognitive distortions. The hypothesis of this paper is that many people invest in the stock market not only to maximize their expected return on investment, but also in an attempt to (consciously or unconsciously) satisfy other (often more pressing) human needs, and that those other needs may be better satisfied by deviating from portfolio theory. Deviating from portfolio theory may even be a sensible strategy for some investors, rather than being solely due to cognitive distortions or to a lack of information.

This hypothesis is based on two recent lines of research relating to gambling. Firstly, a number of finance scholars have presented empirical evidence that investors who participate in gambling activities, such as buying lottery tickets, are more likely than non-gamblers to deviate from portfolio theory.\(^{15}\) Secondly, recent research in psychology and evolutionary psychology suggests that people gamble to satisfy needs, rather than, as was previously thought, solely because they suffer from cognitive distortions.\(^{16}\) The fact that gamblers are more likely than non-gamblers to deviate from portfolio theory suggests that people deviate from portfolio theory at least partly for the same reasons that they gamble. If they gamble in an attempt to satisfy certain needs, then they may also deviate from portfolio theory in an attempt to satisfy those same needs.\(^{17}\)

What needs might investors be attempting to satisfy by deviating from portfolio theory? There is survey data and other evidence that individual investors deviate from portfolio theory because that manner of investing gives them the same form of enjoyment or entertainment as they get from gambling.\(^{18}\) More interestingly, though, is that there is also evidence that individual investors both gamble and deviate from portfolio theory in an attempt to satisfy needs much more profound than entertainment.\(^{19}\)

Using experiments and other sources of data, evolutionary psychologists show that young single men of low status take far more risk than others, and that they take these risks to obtain social status or to increase their chances of acquiring a mate, both of which are evolutionarily very important.\(^{20}\) Evolutionary psychologists have also shown that the same pattern applies to financial risk-taking. In a number of experiments, men (but not women) who are primed for competing for status or for mate acquisition take riskier financial decisions than when they are...
not so primed. The evidence from finance that single men and people of lower social status deviate from portfolio theory more than other investors is consistent with an evolutionary psychology explanation for why investors deviate from portfolio theory. That is, some investors may deviate from portfolio theory in an attempt to satisfy evolutionarily important needs, such as the need for social status or the need to acquire a mate. There is also some evidence from evolutionary psychology that risk taking does indeed help men to achieve their goals of increasing status and acquiring a mate. It follows from this evidence that, even though deviating from portfolio theory reduces expected returns on investment, deviating may actually be a sensible strategy for status-seeking or mate-seeking investors.

Individuals investing partly for reasons other than to maximize investment returns may have regulatory implications, particularly in the areas of securities law and pension law. One recent example of where taking into account investors’ actual investment behavior might have improved regulation is the pension legislation recently introduced by the U.K. government. Before the changes introduced by that legislation, U.K. pensioners were required to use their accumulated pension assets to purchase a life annuity at the time that they retired. However, the recent legislation abolished that rule. As a result, British retirees may now invest their pension assets as they see fit. The extent to which this rule change is beneficial to pensioners will depend, in part, on how well those pensioners invest their pension assets. If, as the finance evidence suggests, the pensioners will do a poor job of investing their pension assets, then this rule change may be very costly to pensioners. If the U.K. government had considered that individuals may not always invest solely to maximize expected returns on investment, it might have come up with different legislation. Instead, it assumed that individuals invest solely to maximize expected returns and, accordingly, that more investor choice is always a good thing. The government also assumed that those hoary concepts of disclosure and investor education would solve bad stock market investing behavior.

Securities law is premised on the assumption that, with more information, individuals will make better decisions. For example, it is argued that if issuers must fully disclose the risks associated with the shares that they issue, investors will be in a better position to assess the risk and to demand a return commensurate with the risks. However, if people deviate from portfolio theory to satisfy evolutionarily important needs rather than because of a lack of information or financial know-how, rules requiring more disclosure may not be a sufficient policy response to

22 Kumar, supra note.
26 The legislation requires that retirees be given advice about their alternatives regarding their pensions. See Id. for criticism of this provision of the legislation.
bad investor decision-making. Actual restrictions on investment activity might be necessary to curb this behaviour.

On the other hand, stock market regulation itself may be contributing to the poor financial returns of individual stock market investors. As an example, securities laws generally require companies wishing to issue shares to the public to file detailed disclosure documents on which they have legal liability for misstatements. I argue that these rules restrict the supply of the type of lottery-type stocks that are preferred by individual investors, and that this restricted supply makes that type of stock more expensive than it would otherwise be. As the purchasers of these types of shares also tend to be unsophisticated, less wealthy investors, those disclosure rules may be harming the very investors that the rules were meant to protect. If some individuals prefer to make risky financial decisions (for whatever reason), then limiting the supply of risky stocks means that those individuals will either have to pay more for those stocks or will have to shift their resources to other, even more costly, risky financial activities such as buying lottery tickets?

That investors deviate from portfolio theory for reasons other than those associated with maximizing expected returns on investment is not a novel idea. The concept has been considered (and even modelled) in the economics literature and in recent finance literature. However, the contribution of this paper is twofold: (i) it uses an interdisciplinary approach (i.e. finance, psychology and evolutionary psychology) to attempt to explain the needs that individual investors might be trying to satisfy by deviating from portfolio theory and (ii) it considers how securities and pension regulation might be changed to account for people investing in the stock market partly to satisfy these needs.

In Part II, I show how individuals deviate from portfolio theory and how costly these deviations are to individual investors. In Part III, primarily using evolutionary psychology, I describe the needs individual investors may be a attempting to satisfy by deviating from portfolio theory. In Part IV, I consider some of the securities law and pension law implications of individuals investing for reasons other than those associated with maximizing their expected returns on investment.

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29 Under the Efficient Markets Hypothesis, the demand curve for shares is flat; that is, an investor could buy an unlimited number of shares of a company without affecting the price. In practice, though, the demand curve may be downward sloping. This would be the case if, for example, people had heterogeneous views on the value of company. See Edward M Miller, Risk, Uncertainty and Divergence of Opinion, 32 J. FINANCE 1151–1168 (1977). For a list of empirical studies that find that demand for stocks is downward sloping, see the papers listed on page 13 of LYNN A STOUT, THE MECHANISMS OF MARKET EFFICIENCY: AN INTRODUCTION TO THE NEW FINANCE (2003).
31 See, for example, Nicholas Barberis & Ming Huang, Mental Accounting, Loss Aversion, and Individual Stock Returns, 56 J. FINANCE 1247–1292 (2001); Nicholas Barberis & Wei Xiong, What Drives the Disposition Effect? An Analysis of a Long-Standing Preference-Based Explanation, 64 J. FINANCE (2009); Nicholas Barberis & Wei Xiong, Realization Utility, 104 J. FINANC. ECON. 251–271 (2012); Eugene F. Fama & Kenneth R. French, Disagreement, Tastes, and Asset Prices, 83 J. FINANC. ECON. 667–689 (2007).
II. Suboptimal Investing – Nature of the Problem and its Cost

A. Stock Market Investing: Theory versus Practice

Modern portfolio theory is based on the assumption that investors are driven by only two factors – they like to earn expected returns on their portfolio but dislike variance of those returns. In 1952, Harry Markowitz constructed a model showing that an investor can reduce but not completely eliminate variance of returns by holding a portfolio of securities that have a low covariance of returns with one another. Relying on the assumptions that investors care only about expected return and return variance, William Sharpe and John Lintner each separately developed a model of capital asset pricing known as the Capital Asset Pricing Model (“CAPM”), and which has become the workhorse of modern finance. Under the CAPM, variance of expected return on a stock is driven by two types of risk: company-specific risk (also called idiosyncratic risk) and systematic risk. Company-specific risk is, by definition, uncorrelated to market prices in general, and can be completely eliminated by holding a large number of stocks. Accordingly, that risk is not priced. Systematic risk of an asset can be thought of as the extent to which the price of that asset moves with movements in market prices in general – the more that the price of an asset moves with market price movements, the larger is the systematic risk. The main inference of the CAPM is that the expected return on an asset is positively and linearly related to its systematic risk and that no other factor affects the expected return. Based on the CAPM, an investor maximizes her risk-adjusted return by investing in some combination of a risk-free asset (such as government bonds) and as widely diversified a portfolio of risky assets as possible.

32 Markowitz, supra note., p. 77.
33 Id. at 79 & 89.
34 William F Sharpe, Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk, 19 J. FINANCE 425–442 (1964); John Lintner, The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets, 47 REV. ECON. STAT. 13–37 (1965). In their models, Sharpe and Lintner both assume that investors have homogeneous expectations and that investors can borrow and lend funds at the risk-free rate of interest, Sharpe, supra note at 433; Lintner, supra note at 15. Sharpe recognizes the unrealistic nature of the assumptions, Sharpe, supra note at 434.
35 By holding a very large number of stocks, an investor’s variance of returns is minimized because negative company-specific shocks are likely to be balanced by positive company-specific shocks.
36 For example, all stocks tend to do well in periods of strong economic growth and tend to do poorly in times of weak growth. See Id. at 441.
37 Id. at 436.; Lintner, supra note at 14.
38 In theory, each investor would hold a value-weighted portfolio of all available securities in the market, Id. at 25.
While the CAPM continues to be the workhorse of finance, the relationship between risk and return implied by the CAPM has been very difficult to prove empirically. Most studies show that the correlation between risk and return is positive but that the relationship is less monotonic and much flatter than the theory predicts. Two explanations have been given for the failure of the CAPM to predict expected stock returns. Richard Roll suggests that the market portfolio is unknowable and, as a result, “there is practically no possibility that . . . [a test of the CAPM] . . . can be accomplished in the future.” The second explanation is that the CAPM fails because the assumptions on which it is based, such as the assumption that investors have homogeneous expectations of future returns and that arbitrage is cost-free, do not hold.

Even if the CAPM is flawed, there is little doubt that holding a diversified portfolio of stocks and minimizing trading is the strategy that individual investors ought to follow if their goal is to maximize their risk-adjusted expected returns. In order to minimize company specific risk (and thus to maximize risk-adjusted returns), investors ought to hold a portfolio of stocks that is diversified across companies, industries and countries. As well, an investor ought not to trade stock except for liquidity reasons, for tax reasons or to rebalance her portfolio so that the risk profile of the portfolio matches her risk aversion level at any particular time. For ease of reference, in the remainder of this paper, I will use the term portfolio theory to mean any investment strategy that conforms to the concepts of wide diversification and limited trading.

A vast finance literature shows that individual investors regularly deviate from portfolio theory in a variety of ways. These deviations may be usefully slotted into two categories – active portfolio management and under-diversification. Active portfolio management means that individual investors trade too much relative to the dictates of portfolio theory. Behavior that falls into the category of under-diversification include holding too few stocks, holding stocks.

40 Subrahmanyam, Id. at 32.; Richard Roll, A Critique of the Asset Pricing Theory’s Tests, 4 J. Financ. Econ. 129–176, 129 (1977); Fama and French, supra note at 3.
41 Roll, supra note at 129, in theory, the market portfolio would include all possible assets (including such things as human capital) and not just stocks; Fama and French, supra note; Miller, supra note.
42 Stout, supra note; Fama and French, supra note.
44 Bodie, Kane, and Marcus, supra note.
45 Deviations from portfolio theory are enumerated and extensively discussed in Barber and Odean, supra note. For a discussion on how individual investors differ in their investment behavior from institutional investors, see Asad Kausar, Alok Kumar & Richard J Taaffler, Why the Going-Concern Anomaly: Gambling in the Market? 6 (2013).
46 Using a large data set from a U.S. discount broker, Barber & Odean find that the average portfolio turnover rate is 75% per year (far more than seems necessary for liquidity, tax or rebalancing purposes). See Brad M Barber & Terrance Odean, Trading is Hazardous to Your Wealth: The Common Stock Investment Performance of Individual Investors, 55 J. Financ. 773–806 (2000). Even where investors choose to delegate their stock trading activity by investing through actively managed mutual funds, they trade the mutual funds more than seems optimal. Lynn Stout calculated that the rate of turnover of mutual fund holdings was 26% in 1991. Stout, supra note at 666.
47 See Barber and Odean, supra note, who find that the average number of stocks held by individual investors in their discount brokerage accounts was 4; W. N. Goetzmann & Alok Kumar, Equity Portfolio Diversification, 12
whose returns are highly correlated with one another,\(^48\) and having a strong home bias.\(^49\) As well, under-diversified individual investors prefer to hold stocks that exhibit the risk profile associated with lottery tickets; that is, they want stocks that have a low cost, a large chance of a small loss and a small chance of a large gain.\(^50\) Alok Kumar finds that individual investors are more likely to hold lottery-type stocks than institutional investors and that less wealthy individual investors are more likely to hold lottery-type stocks than wealthier individuals.\(^51\)

The essence of the under-diversification problem is that under-diversified investors take on risk for which they are not compensated. An under-diversified investor could reduce the riskiness of his portfolio without reducing his expected return simply by spreading his investment over a greater number of stock holdings.\(^52\) Note that an investor could hold a very risky portfolio and still comply with portfolio theory. For example, an investor who had $10,000 to invest could, in theory, borrow $30,000 and invest the full $40,000 in a very broad-based basket of stocks. This would certainly be a risky strategy since a 25% decline in stock prices would wipe out the investor. However, this strategy would be fully in keeping with portfolio theory since the investor would be employing a diversified buy and hold strategy. Accordingly, a risk-seeking investor need not deviate from portfolio theory to satisfy her desire for risk. However the preference for lottery-type stocks suggests that individual investors do not want just any risk; they want stocks that have a risk profile which includes the possibility of a very big win.

B. Bad Investment Behaviour is Costly

Active management and excess trading is very costly to investors. Kenneth French puts the overall cost of active investing in the United States in 2006 at $106 billion, or $330 per American.\(^53\) In a U.S. study of 1992 active investing costs, Lynn Stout calculated costs of over $100 billion dollars.\(^54\) A Taiwanese study found that individual investors lose a staggering 3.8

\(^48\) Id. at 435.

\(^49\) An investor who has a home bias invests primarily in stocks of companies headquartered in the country of residence of the investor. See Norman Strong & Xinzhong Xu, Understanding The Equity Home Bias: Evidence From Survey Data, 85 REV. ECON. STAT. 307–312 (2003) for the proposition that individual investors tend to invest overwhelmingly in stocks of companies in their home country; See KENNETH R FRENCH & JAMES M POTERBA, INVESTOR DIVERSIFICATION AND INTERNATIONAL EQUITY MARKETS NBER WORKING PAPERS SERIES (1991) for the proposition that the percentage of investors’ portfolios dedicated to foreign stocks has increased over time; See Kenneth R French, Presidential Address: The Cost of Active Investing, 64 J. FINANCE 1537–1573 (2008) for the proposition that investors who trade excessively also tend to buy local stocks; also see Goetzmann and Kumar, supra note.

\(^50\) See Id. and Kumar, supra note.

\(^51\) Id.

\(^52\) See, for example, BODIE, KANE, AND MARCUS, supra note.

\(^53\) See French, supra note at 1560.

\(^54\) Stout, supra note.
percentage points of investment return each year because of excess trading.\(^{55}\) Two-thirds of the loss is attributable to unnecessary trading commissions and transaction taxes and the remaining one-third is attributable to the fact that shares that individual investors sell perform better than the shares that they buy.\(^{56}\) A recent Swedish study found that investors who are frequent traders perform more poorly than passive investors.\(^{57}\) Mirroring the Taiwanese study, they find that two-thirds of the underperformance is attributable to unnecessary transaction costs and one-third is attributable to “stock selection or timing”.\(^{58}\) The study also shows that less educated and less wealthy investors bear a much higher proportion of trading losses than other investors, relative to the value of their stock portfolios.\(^{59}\)

The cost of under-diversification is more difficult to quantify. Under-diversification reduces the risk-adjusted returns to investors, but, for most investors, this is not nearly as costly as active management.\(^{60}\) However, for a small subset of investors, under-diversification has been shown to be very costly.\(^{61}\) For example, in a study of Swedish households, Laurent Campbell et al. show that 5% of the population lose more than 5% of their financial wealth because they are under-diversified.\(^{62}\)

Another cost associated with under-diversification relates to the fact that under-diversified individual investors prefer to hold lottery-type stocks. A preference on the part of some investors for lottery-type stocks may increase the price (and thus reduce the expected returns) of those stocks to below what the CAPM predicts. Accordingly, undiversified individual investors not only take on risk for which they are not fully compensated, they further reduce their expected return by buying overpriced lottery-type stocks. Kumar finds that the return on lottery-type stocks is almost 8% lower than on non-lottery-type stocks.\(^{63}\) As lottery-type stocks are held disproportionately by less sophisticated and less wealthy individuals, those investors bear a high proportion of this cost relative to the size of their stock portfolios. In the remainder of this Part, I review the finance literature which empirically show that lottery-type stocks are overpriced, and then I explain how lottery-type stock overpricing could persist. The discussion is somewhat technical, although I expect that even those without a finance background can follow it. However, readers can skip ahead to Part III without losing the thread of the paper.

1. Overpricing of Lottery-type Stocks


\(^{56}\) See Id.

\(^{57}\) Anderson, *supra* note.

\(^{58}\) See Id. at 4.

\(^{59}\) Id. at 5. Investors who did not have a university degree and who were among the 40% least wealthy in the country owned 3% of total financial wealth but bore 27% of the trading losses.

\(^{60}\) See Calvet, Campbell, and Sodini, *supra* note. Goetzman and Kumar find that, adjusted for risk, the least diversified group of investors underperforms the most diversified group by 2.4 percentage points. See Goetzmann and Kumar, *supra* note at 435.


\(^{62}\) Calvet, Campbell, and Sodini, *supra* note.

\(^{63}\) Kumar, *supra* note at 1925.
Andrew Ang et al. find that stocks with high idiosyncratic volatility at a given point in time have low future returns. Stocks in the top quintile of idiosyncratic volatility underperform stocks in the bottom quintile of idiosyncratic volatility by about 1% per month. This is contrary to what theory suggests, which is that there ought to be no correlation between the idiosyncratic volatility and expected returns. Recent studies have also purported to show that the returns on stocks predominantly held by individual investors (which tend to be stocks exhibiting high volatility) do not increase with the riskiness of the stock. In fact, in some studies, the returns on such stocks has been shown to decrease with the level of idiosyncratic risk. This seemingly perverse risk-return relationship has been observed in recent U.S., Dutch and German studies. However, Turin Bali et al. show that if the preference for holding stocks that exhibit an extreme positive return (i.e. lottery-type stocks) is taken into account, this result reverses and returns on such stocks increase slightly with the level of idiosyncratic risk. This finding is consistent with Kumar, who finds that the average annual risk-adjusted return for portfolios held by individual investors is 1.1 percentage points less than the return on a market portfolio and that this underperformance increases as the percentage of lottery-type stocks in the portfolio increases. It is the preference for positive skewness that is priced, not a more abstract preference for risk.

Shares of companies that have gone into financial distress are an example of lottery-type stocks. Campbell et al. find that shares of financially distressed companies have higher than average systematic volatility. The CAPM predicts, therefore, that such shares ought to have higher than average returns. However, Campbell et al. find that shares of distressed companies have lower than market returns. Asad Kauser et al. posit that the reason why shares of distressed companies underperform is that their price is driven up by investors because of their “lottery-type” attributes. They attribute the underperformance to “gambling-motivated” trading behavior of individual investors. Shares of companies that are in financial distress fit the profile of lottery-type stocks because they have a very low price, there is a large chance of the shares becoming worthless and a small chance of a very large return if the company is able to become viable. A recent example is the shares of American Airlines. American Airlines went bankrupt in November 2011 and its shares traded as low as $0.20 in that month. However, by April, 2014, the price had increased to $27 – 135 times the price in November 2011. In almost

64 Andrew Ang et al., The Cross-Section of Volatility, 61 J. Finance 259–299 (2006).
65 Id. at 261.
66 For the U.S. study, see Goetzmann and Kumar, supra note at 457; For the Dutch study, see Arvid O I Hoffmann & Stephan Mefferin, Technical Analysis and Individual Investors 17 (2014); For the German study, see Stefan Meyer & Sebastian Schroff, Lottery Losses of Retail Investors 17 (2013).
68 Kumar, supra note at 1927.
70 Id. at 2902.
71 Kauser, Kumar, and Taffler, supra note at 3.
72 Kauser, Kumar, and Taffler, supra note.
73 http://online.wsj.com/news/articles/SB10001424052702303456104579489282879045884
all bankruptcy cases, shareholders lose virtually all of their investment, but in this particular case the shareholders got a very big win.

At the heart of the CAPM is the assumption that investors need to be compensated for taking on risk – the higher the systematic risk of a stock, the more expected return that an investor will demand in order to hold that stock. It has been assumed in the literature that the compensation for taking on risk is always in the form of higher expected return. However, the compensation could be partly in a form other than expected returns on investment – for example, it might just be in the form of the enjoyment that some investors receive from investing in the stock market. The compensation that is in a form other than expected returns on investment would be difficult to measure and may be greater for certain types of stock, such as lottery-type stocks. If investors obtain greater enjoyment from holding lottery-type stocks than from holding other stocks, they may be prepared to pay more for those stock (in other words, they might be willing to accept a lower expected return) than the price predicted by the CAPM. This preference on the part of individual investors might be what causes the expected return on those stocks to be less (and the price to be higher) than the CAPM predicts.

In theory, if the preferences of individual investors cause certain stocks to exhibit a lower level of expected return than the CAPM predicts, arbitrageurs would short sell that stock until the expected return on that stock equals the expected return predicted by the CAPM. In practice, though, arbitrage may be difficult to accomplish and, in any event, it will not be costless. Arbitrageurs need to borrow stock (which may be difficult, particularly for stock of smaller companies) in order to short sell it. If the individual investor sentiment for a stock is strong, arbitrageurs may need to hold a large undiversified short position in that stock for an extended period of time. This is a risky proposition and arbitrageurs would have to balance that risk against their expected profit on the short position. Accordingly, arbitrageurs may be unwilling to short certain stocks, with the result that the low expected return may persist. It is even possible

74 Markowitz, supra note; Sharpe, supra note; Lintner, supra note.
75 See discussion in Part III.A.
76 This analysis is similar to that employed by Markus Brunnermeier, Christian Gollier & Jonathan A. Parker, Optimal Beliefs, Asset Prices, and the Preference for Skewed Returns (2007). They suggest that individual investors obtain utility from choosing to hold optimistic beliefs about future outcomes, and that they design their investment portfolios in such a way as to maximize the sum of the optimistic beliefs utility and the utility that they obtain from earning high returns on their investments.
80 Id. and the papers referred to therein.
81 See Andrei Shleifer & Robert W Vishny, The Limits of Arbitrage, 52 J. Finance 35–55 (1997); Han and Kumar, supra note; Barberis and Thaler, supra note. For additional literature on the difficulty of arbitraging, see Bali, Cakici, and Whitelaw, supra note at 444. Fama and French, supra note show mathematically that if some investors obtain utility from holding stock that is unrelated to the expected return of that stock, the price of that stock will remain higher than what the CAPM predicts, even if arbitrageurs are active.
that a superior strategy for professional traders is to buy stocks that they believe are overpriced, with the expectation that individual investors will bid up the prices of those stocks even further.  

III. Using Evolution to Explain Deviations from Portfolio Theory

Under-diversification and active portfolio management are difficult to explain using traditional finance or economics models. Under economics theory, investing in the stock market is a form of savings; that is, as with other forms of savings, by investing in the stock markets, individuals reduce their current consumption in order to fund future consumption. If, as the traditional finance and economics models assume, the sole reason for investing in the stock market is to shift consumption into the future, rational individual investors would invest according to portfolio theory because that investing style has been shown to maximize risk-adjusted expected returns (and hence to maximize the expected amount available for future consumption). Accordingly, in the face of the overwhelming evidence that individual investors deviate substantially from portfolio theory and that such deviations are costly, individual investors who deviate from portfolio theory must either (i) be acting irrationally (that is, in a way that does not maximize their utility) or (ii) be attempting to satisfy needs that can be better satisfied by investing in a manner that deviates from portfolio theory.

Over the last 30 years or so, many finance scholars have adopted concepts developed by behavioral economists to explain why investors deviate from portfolio theory. A common behavioral explanation is that individual investors trade excessively and under-diversify because they are overconfident in their own stock picking abilities. Another common explanation is that investors base their decisions to buy and sell stocks on recent price movement using the so-called availability heuristic. Excess trading and under-diversification may also be aggravated by the disposition effect; investors sell their winning stocks and keep their losers, rather than simply keeping both winners and losers. The behavioral analysis assumes that under-diversification
and excessive trading are irrational and that, with the right incentives and information, investors will change their behavior.\textsuperscript{90}

There is a great deal of empirical literature supporting both the behavioral effects discussed in the previous paragraph and the proposition that those behavioral effects reduce investors’ expected returns.\textsuperscript{91} However, there is also evidence that factors such as overconfidence may not be the main reason for why people deviate from portfolio theory.\textsuperscript{92} In a study using trading data and an investor survey, Daniel Dorn and Gur Huberman show that self-reported overconfidence does not explain the degree of diversification or of trading.\textsuperscript{93} Experiments have been conducted that only weakly support the proposition that people who are overconfident trade more\textsuperscript{94} and have poorer performance.\textsuperscript{95} Mark Grinblatt and Matti Keloharju show that sensation seeking and overconfidence both contribute to excess trading, but that sensation seeking is the more explanatory of the two variables.\textsuperscript{96} There appears to be even less of a link between overconfidence and under-diversification. Alok Kumar finds that the propensity to under-diversify is negatively correlated with measures of overconfidence.\textsuperscript{97} Accordingly, in the face of this often conflicting empirical evidence of the role that overconfidence plays, it is worth considering other potential explanations for why individual investors deviate from portfolio theory.

The hypothesis of this paper is that individual investors deviate from portfolio theory in an attempt to (consciously or unconsciously) satisfy needs that they could not satisfy if they invested according to portfolio theory. I defer until later a discussion of what needs investors may be attempting to satisfy by deviating from portfolio theory. However, I do assume that the needs that investing in the stock market satisfy, other than those associated with maximizing expected returns, are all forms of current consumption.

Earlier in this Part, I introduced the economics concept of savings as a mechanism for temporally maximizing utility. I also suggested that that mechanism applied equally to stock market investing; that is, by investing in the stock market, people decrease their current consumption in order to increase their future consumption. However, the analysis changes somewhat if individuals invest in the stock market partly for current consumption.

Investor decisions regarding the extent to which they follow or deviate from portfolio theory can be thought of as attempts to further temporally maximize utility by balancing current

\textsuperscript{90}See Subrahmanyam, \textit{supra} note. The irrationality of this type of behavior was first discussed by Daniel Kahneman & Amos Tversky, \textit{Prospect Theory: An Analysis of Decision Under Risk}, 47 \textit{ECONOMETRICA} 263–292 (1979).
\textsuperscript{91} For a recent summary and analysis of this literature, see Barber and Odean, \textit{supra} note.
\textsuperscript{92} See Dorn and Huberman, \textit{supra} note at 439.
\textsuperscript{93} Id. at 472.
\textsuperscript{97} Kumar, \textit{supra} note at 1917; also see KAUSAR, KUMAR, AND TAFFLER, \textit{supra} note at 32.
consumption against future consumption. By deviating from portfolio theory, investors give up some future consumption (because they earn lower stock market returns) in order to derive current consumption. In theory, an investor who derives current consumption by investing contrary to portfolio theory could achieve a similar mix of current versus future consumption by (i) reducing the amount that he invests in the stock market but investing according to the tenets of portfolio theory and (ii) spending the amount of the investment reduction on goods or services that give the investor the same type of current consumption that he would have derived if he had deviated from portfolio theory. To determine whether to follow or to deviate from portfolio theory, the investor would need to compare the utility that he derives under each of those strategies. It is conceivable that an investor who makes this calculation (explicitly or implicitly) would decide that deviating from portfolio theory is a utility maximizing strategy, even though it is not a strategy that maximizes expected returns on investment.

It follows from this hypothesis that, even if individual investors could be convinced that their stock market investing behavior was costing them in terms of reduced future consumption, they would continue to trade excessively and under-diversify so long as the utility that they derive from investing in that manner was greater than the utility that they would derive by investing according to portfolio theory.

There is evidence that individual investors do enjoy investing in the stock market in a manner that deviates from portfolio theory, and that they do not derive that same enjoyment by following portfolio theory. In a comprehensive U.S. survey of investors who held accounts at a full service broker, respondents reacted more positively to the following statements regarding their attitudes towards investing than any other of the proffered statements: “I enjoy investing and look forward to more such activity in the future” and “relying exclusively on mutual funds reduces the personal satisfaction I obtain from making my own investments.”

In a study of German investors which matched survey responses to trading records from a discount broker, those who responded positively to the question of whether they enjoyed investing traded much more than those who responded negatively to that question. Similar results were found in a Dutch study matching survey results to trading records. Nicholas Barberis and Ming Xiong suggest that the disposition effect (i.e. investors sell their winners and keep losers) is caused by what they call “realization utility”; that is, investors enjoy the feelings associated with selling winners and are averse to the feelings associated with selling losers. In a subsequent study, they tested the realization utility theory by taking images of participants’ brains using functional magnetic resonance imaging while those participants were engaged in a simulated trading game. The results were that when issuing sell orders on winning stocks,

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98 They rated those statements at 4.09 and 3.94, respectively, with 5 being the most positive response. See Ronald C Lease, Wilbur G Lewellen & Gary G Schlarbaum, The Individual Investor: Attributes and Attitudes, 29 J. FINANCE 413–433 (1974).
99 Dorn and Sengmueller, supra note.
100 ARVID O I HOFFMANN & HERSHEY SHEFRIN, ONLINE INVESTORS: WHAT THEY WANT, WHAT THEY DO, AND HOW THEIR PORTFOLIOS PERFORM (2008).
101 Barberis and Xiong, supra note.
102 CARY FRYDMAN ET AL., TESTING THEORIES OF INVESTOR BEHAVIOR USING NEURAL DATA (2013).
participants experience a sharp rise in activity in the part of the brain associated with feelings of pleasure.\textsuperscript{103}

While these studies are evidence that some people deviate from portfolio theory because it gives them a form of current consumption (i.e. enjoyment or entertainment), the studies do not consider whether investors take into account the very substantial cost of deviating from portfolio theory. Accordingly, these studies do not answer the question of whether investor deviations from portfolio theory are rational – investors might not be aware that their investment behavior is significantly reducing their return on investment.

Nor do the studies deal with the question of what it is about deviating from portfolio theory that investors enjoy. Do they enjoy deviating from portfolio theory simply because that manner of investing is entertaining, in the same way that watching a movie is entertaining? Or does the enjoyment come about because deviating from portfolio theory satisfies more profound needs? I make the case below that individuals may be deviating from portfolio theory to invest to satisfy evolutionarily important needs, such as the need for status and the need to find a mate. The building blocks of my case are (i) recent finance literature which finds that investors who deviate from portfolio theory are also prone to engaging in gambling and other risky behavior and (ii) recent psychology and evolutionary psychology literature which finds that people may gamble and engage in other risky behavior to satisfy evolutionarily important needs. I will expand on those building blocks below, after which I will develop an evolution framework for why individuals deviate from portfolio theory.

A. Stock Market Investment as Gambling

From the earliest days of portfolio theory it has been mooted that some people deviate from portfolio theory because they like to gamble.\textsuperscript{104} It may seem intuitive that people who participate in the stock market by under-diversifying or through excess trading may also be the same people who like to gamble. However, it is only recently that the link between stock market investment behavior and gambling propensity has been empirically tested.\textsuperscript{105} While this literature is still in a nascent stage, the link between investment behavior and gambling is compelling.

Using account data (including stockholdings, trading and demographic information) from a discount brokerage firm, Kumar finds that individual investors who under-diversify prefer to invest in lottery-type stocks, which Kumar defines as stocks that have attributes associated with lottery tickets.\textsuperscript{106} As mentioned earlier, these attributes include a low price, a large chance of a small loss and a small chance of a large gain. Stocks that have a high positive skewness of

\textsuperscript{103} Id.
\textsuperscript{104} In fact Markowitz himself suggests that stock market speculation is “gambling”. He posited that some people may like to buy stocks that have a small chance of a large gain. See Markowitz, \textit{supra} note; also see Harry Markowitz, \textit{The Utility of Wealth}, 60 J. POLIT. ECON. 151–158 (1952).
\textsuperscript{105} Kumar was the first to empirically test the link between gambling and stock market investing, see Kumar, \textit{supra} note.
\textsuperscript{106} Id.
returns\textsuperscript{107} or “that exhibit an extreme positive return”\textsuperscript{108} have these attributes. A desire to hold lottery-type stocks would tend to result in under-diversification since diversification would reduce the chance of a truly big win. Suppose that a particular individual investor has a preference for a small chance of an extreme positive return and that the only two stocks that are available to him each have a 1\% chance of a tenfold increase in price. Also assume that the return on one stock is independent of the return on the other. If the investor holds one stock, he has a 1\% chance of a tenfold return. If he holds both stocks he has only a 0.01\% chance of a tenfold return.\textsuperscript{109} If the investor’s objective is to maximize his chances of earning the extreme tenfold return, he will buy just one of the two stocks. This concept may be generalized to the real world of investing. The more stocks an investor owns, the more likely it is that he will earn a market return rather than a return that is much higher (or lower) than the market return.

Kumar finds empirically that those investors who fit the profile of lottery ticket buyers (such as young single men) are more likely to both under-diversify and to buy lottery-type stocks.\textsuperscript{110} He also finds that those of low relative status – those relatively poorer than their neighbours – buy both more lottery tickets and more lottery-type stocks.\textsuperscript{111} Based on an analysis of the U.S. Consumer Expenditure Survey, Geng Li also finds that people who gamble are more active in stock markets.\textsuperscript{112} The implication of this research is that an investor’s propensity to gamble somehow affects his or her stock market investing behavior.

Recent empirical studies find that stock trading substitutes for lottery ticket purchases in the U.S., in Germany and in Taiwan – individual investors trade less during periods where the national lottery jackpot is high.\textsuperscript{113} This effect is greater for male and less educated investors and in the trading of lottery-type stocks.\textsuperscript{114} Kumar also finds that, like the demand for lottery tickets, the demand for lottery-type stocks increases in bad economic times.\textsuperscript{115} A Swedish study used trading records and tax records to find that those who hold under-diversified portfolios also trade excessively, and that those who engage in that behavior tend to have lower income, wealth, age and education (attributes that are associated with lottery ticket buyers).\textsuperscript{116} Lucasz Weber and Elke Markiewicz recruited participants into a simulated investment game and, at the end of the game, had participants complete a DOSPERT (a measure of gambling propensity) survey.\textsuperscript{117}

\textsuperscript{107} See Id.; Kumar, Page, and Spalt, supra note.
\textsuperscript{109} Since the returns on each stock are assumed to be independent of each other, the chance of getting a tenfold return by holding both stocks is 1\% multiplied by 1\%.
\textsuperscript{110} Kumar, supra note.
\textsuperscript{111} Id.
\textsuperscript{112} GENG LI, GAMBLERS AS PERSONAL FINANCE ACTIVISTS (2012).
\textsuperscript{113} See ANNE JONES DORN, DANIEL DORN & PAUL SENGMEUeller, TRADING AS GAMBLING (2012); XIAOHUI GAO & TSE-CHUN LIN, DO INDIVIDUAL INVESTORS TRADE STOCKS AS GAMBLING? EVIDENCE FROM REPEATED NATURAL EXPERIMENTS (2011).
\textsuperscript{114} DORN, DORN, AND SENGMEUeller, supra note.
\textsuperscript{115} Kumar, supra note at 1921.
\textsuperscript{116} Anderson, supra note.
They found that “gambling risk-taking propensity predicts trading volume”. Mark Grinblatt and Matti Keloharju used Finnish investor tax filings, driving records and psychological tests given to military recruits to find that excess trading is driven by both sensation seeking (measured in the number of speeding tickets) and by overconfidence (measured by psychological tests administered by the military). These studies are all consistent with the proposition that stock trading substitutes for forms of gambling, such as lotteries.

As discussed in Part II.B.1., the empirical evidence is that the expected returns on lottery-type stocks is lower than on non-lottery-type stocks. Accordingly, investors who are only interested in maximizing their expected returns ought not to buy lottery-type stocks. The fact that individual investors do buy lottery-type stocks might just mean that they fail to understand that the expected return on those shares is lower than the expected return on non-lottery-type stocks. Experiments have shown that people do misunderstand probabilities in many gambling situations, but there is also evidence that people gamble even when they understand the probabilities. In a 2006 Canadian study, students were given specialized instruction on the statistics of gambling. Six months after the end of the instruction, those same students were tested on their ability to calculate gambling odds, and were found to be better able to calculate those odds than before the instruction. However, the study also found that those students were no more likely to decrease their gambling behavior than students in the control group. In addition, a number of studies involving pathological gamblers also find that there is little or no correlation between numerical reasoning skills and gambling behavior. These studies suggest that gambling is not due to a simple misconception of the relationship between risks and return. The studies support the proposition that people engage in gambling behaviour because they derive utility from it. To the extent that individual investors deviate from portfolio theory to satisfy the same needs that gambling satisfies, these studies also support the proposition that individual investors derive utility from deviating from portfolio theory.

Additional support for the proposition that individual investors know what they are doing when they deviate from portfolio theory is the paper by Dorn and Huberman. They use German brokerage account data and survey data to find that individual investors who self-report being less risk averse hold less diversified portfolios and trade much more often. As well, in a U.S. study matching survey data with brokerage account data, those who said they were willing

118 Id.
120 Bali, Cakici, and Whitelaw, supra note; Barberis and Huang, supra note.
122 Id.
123 These studies are summarized in Chrisi Lambos & Paul Delfabbro, Numerical Reasoning Ability and Irrational Beliefs in Problem Gambling, 7 INT. GAMBL. STUD. 157–171, 159 (2007).
124 Dorn and Huberman, supra note.
125 Id.
to take more risk held fewer stocks. These studies suggest that investors are not unaware of the level of risk that they are taking on by deviating from portfolio theory.

In summary, there is mounting evidence that people who have more of a propensity to gamble deviate from portfolio theory more than those who have less of a propensity to gamble. There is also evidence that stock market investing is a substitute for gambling activity and that people are aware that they are taking on additional risk when they deviate from portfolio theory. The finding of a link between propensity to gamble and propensity to deviate from portfolio theory suggests that people deviate from portfolio theory for the same reasons that they gamble. Accordingly, if people gamble to satisfy certain needs, we may be able to infer that people also deviate from portfolio theory to satisfy those same needs.

B. Gambling (and Deviating from Portfolio Theory) to Satisfy Needs

The analysis in this Part draws on research from the fields of economics and psychology into why people gamble. I first review the prevailing views in economics and psychology that people gamble because they suffer from cognitive distortions. I then review (i) more recent theories in economics that people obtain utility from gambling and (ii) theories in psychology that people engage in leisure gambling to fulfill certain needs. I follow with a summary of the tenets of evolutionary psychology, which I believe offers some promising reasons for why and under what circumstances people engage in risky behavior, such as deviating from portfolio theory.

Research in the field of psychology into why people gamble has only been rigorously conducted during the last 30 years and has generally been limited to studying the motivations of problem gamblers. Much of this research has focused on whether problem gambling is associated with various cognitive distortions. Even less is known about what motivates leisure gamblers – that research is in a nascent stage. However, the results of the limited research into

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127 The use of biological behavioral science, such as evolutionary psychology, in the study of law is recent but growing. For an overview of the field of Law and Behavioral Biology, see Owen D Jones & Timothy H Goldsmith, Law and Behavioral Biology, 105 COLUMBIA LAW REV. 405–502 (2005). For a discussion on how principles of evolution may be incorporated into the field of economics, see ARTHUR E GANDOLFI, ANNA SACHKO GANDOLFI & DAVID P BARASH, ECONOMICS AS AN EVOLUTIONARY SCIENCE (2002).
129 Fortune and Goodie, supra note at 298.
130 See Binde, supra note for a discussion of what motivates leisure gamblers. I use the terms non-problem gambler and leisure gambler interchangeably. There appears to have been a belief among some academics that the study of leisure gambling was a “taboo” subject in the academic world – see William N Thompson & Bob Potts, Happiness Is: The Las Vegas Gambler, 15 GAMING LAW REV. ECON. 365–373 (2011). The finding of that paper, based on empirical evidence, is that gamblers are happier than non-gamblers. The likely relationship is that happy people tend to gamble more than unhappy people, rather than gambling causing happiness.
leisure gambling suggests that leisure gamblers may not suffer from the same cognitive disorders as do problem gamblers. As well, leisure gamblers may have different personality traits than problem gamblers. As the motivations and personalities of leisure gamblers may differ substantially from those of problem gamblers, it is not clear how relevant the research into problem gambling is to leisure gambling.

The prevailing view in economics is that people gamble because of cognitive distortions. However, as discussed below, recent scholarship attempts to fit the desire to gamble into the theory of expected utility maximization.

1. Cognitive Distortions

The prevailing wisdom in both psychology and economics is that cognitive distortions play a leading role in gambling. Amos Tversky and Daniel Kahneman have greatly influenced the study of the psychology of gambling. Kahneman and Tversky are also the founders of the field of behavioral economics, which is the branch of economics most closely associated with the study of decision making under conditions of uncertainty. Unsurprisingly, then, in both psychology and contemporary economics, much of the research into gambling has to do with identifying the cognitive disorders which lead people to gamble and (particularly in psychology) considering ways in which such cognitive disorders may be corrected.

Kahneman and Tversky suggest that in making decisions under uncertainty, people do not seem to actually calculate the odds or to rely on statistical analysis. Rather, they appear to rely on heuristics, and it is the reliance on these heuristics which sometimes leads people to make systematic errors or biased judgements. The cognitive distortions that gamblers (or, at least, gamblers who are pathological gamblers) suffer from are thought to be caused by the biases from using the heuristics identified by Kahneman and Tversky.

Erica Fortune and Adam Goodie catalogue the common gambling-related cognitive distortions and associate them with the heuristics identified by Kahneman and Tversky. For example, they observe that pathological gamblers believe that they can influence the outcome of random events and they suggest that this cognitive distortion is based on the availability

131 Fortune and Goodie, supra note at 303.
132 See Adam S Goodie, The role of perceived control and overconfidence in pathological gambling., 21 J. GAMBL. STUD. 481–502, 497 (2005). For example, leisure gamblers are less confident and more risk averse than problem gamblers.
133 Fortune and Goodie, supra note at 298; Binde, supra note.
134 Kahneman and Tversky, supra note; JOHN VON NEUMANN & OSKAR MORGENSTERN, THEORY OF GAMES AND ECONOMIC BEHAVIOR (1953).
135 Fortune and Goodie, supra note.
136 Id. at 299.
138 Fortune and Goodie, supra note at 300.
139 Fortune and Goodie, supra note.
heuristic.\textsuperscript{140} Pathological gamblers also believe that there are correlations between independent events such as the outcome of a toss of a coin – if heads comes up, say, 4 times in a row, they believe that the odds of tails coming up in the next toss is more than 50%.\textsuperscript{141} This latter distortion, often referred to as “gamblers fallacy” is very prominent in pathological gamblers and is thought to be a distortion derived from the representative heuristic.\textsuperscript{142} Pathological gamblers also tend to be overconfident due to using the representative heuristics.\textsuperscript{143} The availability heuristic is thought to be the reason for the observed phenomenon of big wins early in a person’s gambling experience making it more likely that the person will become a pathological gambler – the early wins contribute to an expectation of winning in the mind of the person.\textsuperscript{144} Pathological gamblers also believe that their chances of success are “higher than the objective probability should warrant”.\textsuperscript{145} Note the similarity between the cognitive distortions that appear to motivate pathological gamblers and the cognitive distortions which have been identified in the field of behavioral finance which cause investors to deviate from portfolio theory (see introduction to Part III).

More than 80% of people in many western countries have gambled at some point in their lives.\textsuperscript{146} However, only a small percentage of the population have ever become pathological or problem gamblers.\textsuperscript{147} Some of the cognitive distortions identified in the previous paragraph have been shown not to apply, or to apply to a much lesser extent to leisure gamblers. For example, leisure gamblers appear to be less overconfident and less prone to the illusion of control than are problem gamblers.\textsuperscript{148} Leisure gamblers are also less subject to gambler’s fallacy and to seeing illusory patterns.\textsuperscript{149} As well, pathological gamblers have been found to be more certain than leisure gamblers of their erroneous perceptions.\textsuperscript{150} Chrisi Lambos and Paul Delfabbro find that pathological gamblers make more cognitive mistakes than leisure gamblers.\textsuperscript{151} Leisure gamblers

\textsuperscript{140} Known in the literature as the illusion of control. See \textit{Id.} at 303.
\textsuperscript{141} Jacobsen et al., \textit{supra} note at 351; Fortune and Goodie, \textit{supra} note at 301.
\textsuperscript{142} Jacobsen et al., \textit{supra} note at 355; Fortune and Goodie, \textit{supra} note at 301.
\textsuperscript{143} \textit{Id.} at 302.
\textsuperscript{144} Jacobsen et al., \textit{supra} note at 353. Compare that finding to the to the finding of Markku Kaustia & Samuli Knupfer, \textit{Do Investors Overweight Personal Experience? Evidence from IPO Subscriptions}, 63 J. FINANCE 2679–2702 (2008) in the investment context that people who do well in the first IPO that they buy are much more likely to buy into another IPO.
\textsuperscript{145} Fortune and Goodie, \textit{supra} note at 301. This cognitive distortion is thought not to be derived from reliance on heuristics. See also See Goodie, \textit{supra} note for a fuller discussion of the role in gambling of the illusion of control.
\textsuperscript{147} H J Shaffer, M N Hall & J Vander Bilt, \textit{Estimating the Prevalence of Disordered Gambling Behavior in the United States and Canada: A Research Synthesis.}, 89 AM. J. PUBLIC HEALTH 1369–1376 (1999) is a meta-study of North American gambling studies. They find that the lifetime adult prevalence for pathological gambling is around 1.5% and the lifetime adult prevalence for problem gambling is around 3.85%.
\textsuperscript{148} Goodie, \textit{supra} note at 497.
\textsuperscript{149} Andreas Wilke et al., \textit{Illusionary Pattern Detection in Habitual Gamblers}, \textit{EVL. HUM. BEHAV.} (2014).
\textsuperscript{150} Jacobsen et al., \textit{supra} note at 355; Denis Cote et al., \textit{Near Wins Prolong Gambling on a Video Lottery Terminal}, 19 J. GAMBL. STUD. 433–438 (2003).
\textsuperscript{151} Lambos and Delfabbro, \textit{supra} note.
have also been found to be less impulsive than pathological gamblers. Accordingly, it does not follow from the research into problem gambling that cognitive distortions are a primary motivation for the vast bulk of gamblers. Needs fulfilment, discussed below, may be what motivates leisure gamblers.

2. Gambling as Needs Fulfilment

a. Views of Economists

Economists have struggled to explain the prevalence of gambling. The accepted view is that, in a world with decreasing marginal utility of income, rational actors would never accept a fair bet because the gain in utility of a win would be less than the loss of utility in the case of a loss. In their treatise of 1953, John von Neumann and Oskar Morgenstern formalized the concept of decreasing marginal utility of income into a number of axioms. Von Neumann and Morgenstern were certainly aware that gambling was problematic for their model. They ask in their treatise: “May there not exist in an individual a (positive or negative) utility of the mere act of “taking a chance,” of gambling, which the use of the mathematical expectation obliterates?” They quickly answered this question in the negative on the grounds that such a utility would contradict the axioms they formulate in their treatise. More recently, Paul Samuelson stated that gambling involves only transfers of money, “creating no new money or goods.

Jacob Marschak gave the following example of a situation in which one might reasonably be said to gain utility from a risky activity: A mountain climber might prefer to climb a mountain that has a 95% survival rate than climbing either (i) a mountain that has an 80% survival rate or (ii) a mountain that has a 100% survival rate. However, this preference set is not recognized by an expected utility model since it violates the axiom of monotonicity. Marschak suggests that revising the concept of rational choice to reflect “the love of danger” would make it impossible to attain “manageable utility indices”. John Harsanyi and others have suggested that utility theory excludes gambling utility because any utility associated with gambling has to

153 ALFRED MARSHALL, PRINCIPLES OF ECONOMICS: AN INTRODUCTORY VOLUME 112 (1890); PAUL A SAMUELSON, FOUNDATIONS OF ECONOMIC ANALYSIS (1947).
154 The axioms include transitivity, completeness, stochastic dominance and monotonicity; VON NEUMANN AND MORGENSTERN, supra note at 26.
155 Id. at 28.
156 Id. at 28. and at 629: “Thus a suitable definition of utility (which in such a situation is essentially uniquely determined by our axioms) eliminates in this case the specific utility or disutility of gambling, which prima facie appeared to exist.”
157 SAMUELSON, supra note.
159 Marschak, supra note, the issue of whether it is also a departure from rationality is discussed at 138 and following.
160 Id., p. 139.
do with the process of gambling and not with the consequences of gambling.\textsuperscript{161} In summary, while some of the leading early thinkers on utility theory acknowledged that it is possible that individuals may obtain utility from gambling, they could not fit gambling utility into a rational expectations model and, accordingly, they chose to ignore any concept of gambling utility in their models.

An early attempt to explain gambling within expected utility theory was provided by Milton Friedman and L.J. Savage.\textsuperscript{162} They developed a utility function to explain why individuals might be risk seeking in regard to certain decisions and risk averse with respect to other decisions.\textsuperscript{163} The neo-classical utility function that describes the marginal utility of money is concave throughout. In contrast, the utility function Friedman and Savage develop is concave in some parts and convex in others.\textsuperscript{164} The implication of such a function is that for some decisions, the expected utility associated with the good outcome of a gamble outweighs the expected loss in utility associated with the bad outcome of that gamble, even though the expected money gain is less than the expected money loss. For example, a person in a low socio-economic class may buy a lottery ticket because the benefit of a win is very large (he moves to a higher socio-economic class) and the cost of losing is very low (the cost of a lottery ticket may have almost no impact on his standard of living). Accordingly, the individual may buy a lottery ticket even if the expected return on the ticket is decidedly negative. This utility function also explains why an individual who gambles also buys insurance. Paying an insurance premium may have little effect on an individual’s standard of living, but an uninsured loss may cause the individual to lose socio-economic status.\textsuperscript{165}

More recently, researchers have developed models to explain gambling that maintain the traditional concavity of utility functions. John Conlisk developed a model in which there is a separate utility to the process of gambling that is not captured by the income utility function and once this separate utility is taken into account, gambling fits within the diminishing marginal returns to income model.\textsuperscript{166} This separate utility has to do with the suspense and excitement of the process of gambling.\textsuperscript{167} Marc Le Menestrel maintains the axioms of the neo-classical expected utility function but suggests that individuals may also be motivated by the process of gambling and, accordingly, \textit{that “a rational individual”... [will take into account]... “a preferred process and a preferred consequence”}.\textsuperscript{168} John Nyman et al. suggest that gambling fits within the traditional concave utility function once you take into account the fact that individuals who gain gambling winnings get an additional benefit that they do not get from labor income,

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\textsuperscript{161} See Marc Le Menestrel, \textit{A Process Approach to the Utility of Gambling}, 50 THEORY DECIS. 249–261, 250 (2001) for a discussion on this issue and the related issue of the difficulty of distinguishing between process and outcomes.


\textsuperscript{163} Id.

\textsuperscript{164} For a diagram of the function, see \textit{Id.} at 295.; It bears a resemblance to the kinked value function developed in Kahneman and Tversky, \textit{supra} note.

\textsuperscript{165} Friedman and Savage, \textit{supra} note.


\textsuperscript{167} \textit{Id.} at 261.

\textsuperscript{168} Le Menestrel, \textit{supra} note at 251.
namely that they do not have to work for the gambling winnings – gambling income thus commands a premium over labour income.\textsuperscript{169}

While none of these theories have gained wide acceptance among economists, they show an increased understanding that neo-classical expected utility theory ought to be able to account for the observed facts that people derive some form of utility from gambling.\textsuperscript{170} While economists have generally understood that people may derive utility from gambling, that utility is not the type of utility that can be modelled and, accordingly, it has been ignored.

\textit{b. Views of Psychologists}

Because research into the psychology of gambling started relatively recently, it is almost exclusively studied through the lens of cognitive distortions and personality variables, which are the psychological disciplines that prevailed throughout the entire period that the subject has been studied.\textsuperscript{171} However, recent scholarship has started to consider biological, social and evolutionary reasons for why people gamble.\textsuperscript{172} Some of this research suggests that people engage in leisure gambling not only due to cognitive distortions but also to satisfy certain human needs, such as the need to garner social rewards or to experience the pleasurable anticipation of a potential reward.\textsuperscript{173}

Per Binde recently developed a theory that while “\textit{a chance of winning}” is common to all forms of gambling, it is not the real motive for leisure gambling – “\ldots pure money is the \textit{medium} of gambling, not what gambling actually is about”.\textsuperscript{174} The possibility of gain through gambling induces feelings of pleasure and satisfaction.\textsuperscript{175} Studies show that winning can trigger certain neurochemical processes in the brains of humans and animals – the positive feelings associated with being rewarded for taking risk may thus be the result of natural selection.\textsuperscript{176} As well, since human societies are built on the concept of reciprocity, receiving more than one pays in a gambling game is “\textit{exceptional and pleasant}”.\textsuperscript{177} In Binde’s theory, the psychological and symbolic value of winning are the ingredients that help fulfil other motivations for leisure gambling.\textsuperscript{178}

It is fair to say that this theory is in its early stages. However, it raises an interesting counterpoint to the prevailing view that gamblers gamble because of cognitive distortions.

\begin{footnotesize}
\begin{itemize}
\item \textsuperscript{171} Jacobsen et al., \textit{supra} note at 358.
\item \textsuperscript{172} For example, Binde, \textit{supra} note.
\item \textsuperscript{173} \textit{Id.}
\item \textsuperscript{174} \textit{Id.} at 83., emphasis added.
\item \textsuperscript{175} \textit{Id.} at 87.
\item \textsuperscript{176} \textit{Id.} at 87.
\item \textsuperscript{177} \textit{Id.} at 87.
\item \textsuperscript{178} \textit{Id.} at 88.
\end{itemize}
\end{footnotesize}
c. **Evolutionary Psychology**

Evolutionary psychology is the scientific field that stands at the intersection of evolutionary biology and cognitive science.\(^{179}\) It is a field that may help to explain the circumstances under which people prefer to gamble (and to deviate from portfolio theory) rather than to take the safer decision. In this Part, I very briefly describe the field of evolutionary psychology and summarize what it has to say about decision making under uncertainty.

Evolutionary biology posits that a trait of an organism will be selected for if that trait increases the fitness of the organism.\(^{180}\) Fitness in this context means the rate at which genes are passed on to the next generation.\(^{181}\) The human brain will have evolved at least from the time that humanoids first appeared, with the traits that were most conducive to fitness being passed on from generation to generation. However, evolution is a slow process. During almost all of the time that our brains were evolving, humans were hunter-gatherers living in small social groups, and so the architecture of the brain that humans now possess would have evolved to help people adapt to the environment in which hunter-gatherers found themselves, rather to our current environment. As the environment in which we now live is much different from the one in which our brains developed, our brains may not be as well suited to our current environment as they could be. In other words, our brains remain “functionally specialized to solve problems that were characteristic of hunter-gatherer societies, rather than those of the modern world (e.g. habitat selection; foraging; social exchange; competition from small armed groups; parental care; language acquisition; contagion avoidance; sexual rivalry).”\(^{182}\)

Rational expectations models of economics are based on the assumption that our brains are general purpose instruments in the sense that they solve any type of problem using the same computational rules and the same logic.\(^{183}\) Evolutionary psychology, on the other hand, posits that we use different systems for managing different evolutionary challenges, such as mate acquisition and self-protection.\(^{184}\) Evolutionary psychology also differentiates between proximate and ultimate reasons for doing a thing.\(^{185}\) For example, the proximate reason for a man buying a Prius automobile may be to help the environment but the ultimate reason for doing so may be to increase his status, thereby becoming more attractive to women.\(^{186}\)


\(^{181}\) Id.

\(^{182}\) Cosmides and Tooby, supra note at 329.


\(^{184}\) These evolutionary challenges include status, mate acquisition, mate retention, friendship, self-protection, and kin-care, see Kenrick et al., supra note at 765; also see Cosmides and Tooby, supra note.


Hunter-gatherers would have had to evolve mechanisms for assessing risk in many different circumstances (e.g. whether to risk injury by hunting or by challenging someone in the group for status). Those who were good at assessing those risks would have survived (and passed along their genes) to a greater degree than those who were not as good at assessing those risks. There is ethnographic evidence that “in a variety of socio-economic systems and for a variety of behaviors, we are able to act as if capable of assessing outcome distributions, value functions and needs or aspiration levels, and of implementing effective, risk-sensitive actions.”

In many situations, we do not actually calculate the odds, but assess risk, variance and return using heuristics. It may be that we apply those same risk assessment mechanisms to assessing financial risk.

The evolutionary biology concept of life history theory, which evolutionary psychology has adopted, posits that organisms must make decisions about how much time and resources to allocate to present reproduction as opposed to allocating resources to things like growth and survival, which will assist it in future reproduction. The organism makes these decisions at any particular time based on such things as its sex, age and its subjective life expectancy. Life history theory has been applied to human decision making. Evolutionary psychology stipulates that, in addition to risky decision-making being domain specific, it is also not stable over a person’s lifetime. Whether a person takes a risky or a safe decision in any particular circumstance may also depend on where that individual is in his or her life cycle and on the particular environmental cues which that individual has been subjected to in the past or in the present. For example, single men (who are likely to be in mate acquisition mode) may make riskier decisions in order to acquire resources (which they will need to attract a mate) than married men, who might be more concerned with not losing resources because they are in mate retention mode.

Evolutionary psychology has been criticized as being a “just so” theory. One problem is that since we evolved in an environment that is much different than the one which we now inhabit, the link between our evolutionary history and the current utility of that evolution is quite weak. As well, environment can change the organism, so that putting an organism in an environment that is different from the one in which it evolved weakens the link between

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187 See See GIGERENZER, supra note; see also Leda Cosmides & John Tooby, Are Humans Good Intuitive Statisticians After All? Rethinking Some Conclusions From the Literature on Judgment Under Uncertainty, 58 COGNITION 1–73 (1996).
189 Kahneman and Tversky, supra note; GIGERENZER, supra note.
191 Id.
193 Id.
195 STERELNEY AND GRIFFITHS, supra note at 318.
196 STERELNEY AND GRIFFITHS, supra note.
evolution and fitness. As well, homo sapiens are the only surviving humanoids, so it is impossible to compare our traits to those of closely related species as biologists do with, for example, birds.

While it is difficult to directly test evolutionary psychology theories with regards to humans, it is possible to test the theories experimentally. The general design of evolutionary psychology experiments is to prime the subjects in a treatment group to be in a certain mode (e.g., mating, disease avoidance) before conducting a task, then comparing the results of that task with the results from a control group who have performed the same task but who have not been primed. A number of experiments (many of which I refer to later in the Part) have been conducted to test whether subjects’ propensity to make risky decisions change if they are in a certain evolutionary mode. Under these experiments, subjects are generally primed to be in a specific evolutionarily important mode, such as mate acquisition mode or status seeking mode. They are then asked to engage in a task to determine whether they make risker decisions than subjects in the control group. As deviating from portfolio theory is riskier than abiding by portfolio theory, these experiments may also help to explain the ultimate reasons why people deviate from portfolio theory.

The balance of this Part uses evolutionary psychology theory and empirical evidence (including the experiments referred to above) to analyze why people may under-diversify their stock portfolios and buy lottery-type stocks.

i. Risk Sensitive Foraging Theory

Evolutionary biologists studying animal foraging behavior find that if there are two potential foraging areas open to an animal, it will choose the one that has less variability in yield even if the other has a greater expected yield, provided that the one with less variability in yield provides enough to sustain the animal. This is known as “risk sensitive foraging theory.” From a survival point of view, this makes sense. More variability in yield might lead to some good feasts but it also leaves open the possibility of not eating for a few days and thus perishing. It is only when the less variable foraging area cannot sustain the animal that it will forage in the more variable area. The human brain evolved during a time that we were foragers, so it is reasonable to conjecture that we are also “functionally specialized for making [foraging] decisions.” In other words, humans may have an evolved system for making risk-sensitive judgements that combines data about means, variance and need to come up with the optimal decision, without actually making the detailed calculations.

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197 For example, improved diets mean people are much taller now than 100 years ago, so it is not possible to say that human height optimizes fitness, Id. at 315.
198 STERELNEY AND GRIFFITHS, supra note.
199 Ermer, Cosmides, and Tooby, supra note.
201 Rode et al., supra note; Haselton et al., supra note.
202 Rode et al., supra note at 300.
still hunter-gatherers show that they typically make decisions that minimize the risk of not getting sufficient food, rather than maximizing the abundance of food.\textsuperscript{203}

If the human brain is specialized for making risk-sensitive resource acquisition judgements, then that same function could be used to make resource acquisition decisions for things other than food.\textsuperscript{204} Indeed, risk sensitive foraging theory could be applied to stock market investing. Investors have the choice of adopting a low variance diversified approach or a higher risk undiversified approach. If taking a low variance portfolio approach to investing will not yield the investor enough to meet his or her aspirations, the investor will have to adopt a high variance undiversified portfolio approach to investing in order to have any chance of meeting those aspirations. This theory is consistent with the empirical evidence in finance that those who have less wealth tend to under-diversify their stock portfolios more than their relatively wealthy counterparts. Less wealthy investors may buy lottery-type stocks because getting a large payoff may be the only way for them to achieve their aspirations.

Risk-sensitive foraging theory may also be applied to the acquisition of status.\textsuperscript{205} As discussed in Part III.2.c.ii., status is important to men because women prefer to mate with men who have it. If a man has insufficient status to attract a mate, he may have to adopt a risky status-seeking strategy, as adopting the safe strategy means that he will fail in an evolutionary sense. Applying risk sensitive foraging theory to stock market investing, low status men would prefer a highly variable investment strategy while high status men would opt for a less variable strategy to make it less likely that they lose status.\textsuperscript{206} Accordingly, consistent with the empirical finance data, risk sensitive foraging theory predicts that low status men (proxied by those with relatively less wealth) would under-diversify and hold lottery-type stocks and that high status men would tend to hold a diversified portfolio.

\textit{ii. Risk-taking to Acquire Status}

It has been hypothesized that, like many mammals, humans evolved in small social groups in which status relative to others in the group was important, particularly for males.\textsuperscript{207} Status determines mating opportunities and access to resources.\textsuperscript{208} Dominance theory is a well-developed evolutionary tool which is used to predict the circumstances under which animals will compete for status.\textsuperscript{209} As status is always a relative concept, competing for status is risky because an increase in one person’s status necessarily means a relative reduction in another person’s status. As a result, competing for status with other males may lead to injury (in humans, this might include social injury) if competitors decide to fight back.\textsuperscript{210} Accordingly, deciding when and when not to compete for status is evolutionary very important for men and they should have

\begin{itemize}
\item \textsuperscript{203} Kenrick and Griskevicius, \textit{supra} note; Kenrick et al., \textit{supra} note.
\item \textsuperscript{204} Ermer, Cosmides, and Tooby, \textit{supra} note.
\item \textsuperscript{205} \textit{Id.}
\item \textsuperscript{206} See Daly and Wilson, \textit{supra} note at 5.
\item \textsuperscript{207} Ermer, Cosmides, and Tooby, \textit{supra} note.
\item \textsuperscript{208} \textit{Id.}
\item \textsuperscript{209} \textit{Id.}
\item \textsuperscript{210} \textit{Id.}
\end{itemize}
developed mechanisms for assessing the risks and rewards of competing for status in any given circumstance. Competing for status includes competing for “culturally valued resources”, such as money in our society. Cross-cultural studies show that women prefer men who have high status, but that men tend not to be concerned with women’s status in determining a mate.

One evolutionary reason for humans (and men in particular) having evolved risk assessment capabilities is to be able to weigh the risks and rewards of acquiring resources in order to increase status and consequent mating opportunities. A well-developed mechanism for weighing these risks and rewards should lead to increased mating opportunities and increased fitness. In addition, taking risks to acquire resources may be a way to directly acquire a mate. Experiments have shown that when men are primed to be in mate acquisition mode they are more likely to take risks to acquire resources than men in control groups that have not been so primed. There is also evidence that when the ratio between men and women is high, men make riskier financial decisions because men must compete more strongly for mating opportunities. When the ratio of men to women is high, a man who takes a slow and steady approach to financial decision making may find that there are few potential mates available by the time he acquires sufficient resources to attract a mate. As well, men gamble more than women across cultures.

The empirical evidence from finance is that single men under-diversify and hold lottery-type stocks to a much greater extent than women or married men. Single men may be adopting this investment strategy because they want a chance of a quick big win. A big win will increase their status and, accordingly, increase their chances of acquiring a mate. If the investment strategy does not pay off (i.e. the big win does not come through), they may be no worse off in terms of their chances of acquiring a mate than if they had followed a portfolio theory strategy.

### iii. Risk-taking as Signalling

Risk-taking behavior itself might be a way for men to signal to women their value as a mate. Risk-taking may signal attributes that are desired by women, such as confidence, ambition and mental acuity. Accordingly, male risk-taking may increase the number of mating opportunities. Risk-taking may also be a way for men to signal their gene quality – the theory being that only men with good genes can bear the cost of engaging in unnecessarily risky

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211 Id.
215 Id.
217 Hugill et al., supra note.
behavior. The theory is analogous to the theory of why peahens prefer peacocks with large showy tails. The tails are a signal of good genes as only peacocks with good genes could afford to carry around such unwieldy appendages and survive predators.

Men who were primed with sexual/romantic arousal took more risks in a recent experimental task, but only when they were told that “a romantically available female would view their performance”. In an experiment to test whether women were more attracted to risk takers, men completed a questionnaire regarding their risk-taking propensity, following which they performed a dance. Female participants were then shown a video (blurred to mask facial and physical attributes) of those men dancing and were asked to rate their attractiveness. Female participants reported being more attracted to dancers who had self-reported a high propensity to take risk. In another study, women who were interested in short term relationships reported that they preferred men who were financial risk-takers. So, there is some evidence that financial risk-taking is in itself an attribute to which women respond positively. Accordingly, it may be that men under-diversify their stock market investments to signal to women their desirable qualities.

Risk-taking may also be a signal to other men. Daniel Fessler recently tested his hypothesis, which he calls the Crazy Bastard theory, that men engage in risky activity because men who become known as risk-takers are less likely to be challenged by other men. Fessler showed that men who engage in risky activity in an experiment were perceived by other men as having greater physically stature, even though they had the same physical stature as the non-risk-takers. This is consistent with the results for an experiment conducted by Ermer et al. that men (but not women) make riskier financial decisions in the presence of men who they expect to compete with for status.

iv. Life History Theory

As discussed in Part III.2.c., under life history theory, organisms allocate resources between current reproduction efforts and somatic effort, such as strengthening the body and survival. More somatic effort now may mean more future reproduction, but only if the organism survives. One variable that is relevant to the organism’s allocation between current reproduction effort and somatic effort is the subjective life expectancy of the organism. Organisms which expect a long life tend to defer reproduction efforts and focus on somatic effort early in life.

220 Id.
221 Id.
222 Id.
223 Id.
225 Id.
226 Id.
227 Id.
while those with a short life expectancy will start reproducing early in life.\textsuperscript{228} This has also been shown to be true within species (i.e. those individuals who have a short life expectancy will start reproducing sooner than those with a longer life expectancy).\textsuperscript{229} This ability to use environmental cues to trade off the risks of current versus deferred reproduction is evolutionary designed – those organisms who are better at making these decisions will have better fitness than those organisms that are not good at making those assessments.\textsuperscript{230}

Life history theory has been applied to human behavior. Studies have shown that people who have a lower life expectancy at birth, who grew up with low socioeconomic status, or who grew up in violent or unstable environments are more likely to have children earlier in life.\textsuperscript{231} Vladis Griskevicius conducted a series of experiments to test the hypothesis that the same relationship would hold with respect to financial decision making; that is, that those who grew up with low socioeconomic status would be more likely to make risky financial decisions.\textsuperscript{232} He hypothesized that people who grew up being uncertain about the future will use their environmental cues to take risks to increase their current wealth since future wealth will be of less subjective value to them. The results of the experiments were consistent with Griskevicius’s hypothesis.\textsuperscript{233}

The empirical evidence in finance is that relatively poor investors under-diversify more than richer investors.\textsuperscript{234} To the extent that there is a correlation between wealth during childhood and wealth in adulthood, the fact that less wealthy investors under-diversify is consistent with the life history theory. Relatively poor investors would be more likely to prefer a quick big win than richer investors and would be less interested in following a slow and steady diversified investment strategy because they subjectively believe that they may not live long enough to enjoy the fruits of the slow and steady strategy.\textsuperscript{235}

Life history theory may explain why single men disproportionately under-diversify their investment portfolios and hold lottery-type stocks. Single men are more likely to be in the mate acquisition stage of their life history. Accordingly, they may be disposed to take risks to acquire resources and status, which may increase their chances of acquiring a mate.\textsuperscript{236} Married men, who are more likely to be in mate retention mode, may be more concerned with not losing resources\textsuperscript{237} and, accordingly, they may be more likely to take a slow and steady diversified portfolio approach than single men. The finance empirical evidence in consistent with the life

\textsuperscript{228} Griskevicius et al., supra note.

\textsuperscript{229} Id.

\textsuperscript{230} Wang, Kruger, and Wilke, supra note; Ellis et al., supra note.

\textsuperscript{231} Griskevicius et al., supra note.

\textsuperscript{232} Id.

\textsuperscript{233} Id.

\textsuperscript{234} See for example Kumar, supra note.

\textsuperscript{235} In a recent experiment, participants who came from a lower childhood socio-economic background and who were primed for mortality threats chose more diversified portfolios. However, that experiment was not directly testing risk-reward trade-offs since participants in that experiment were not given any information about the risk or return on the portfolios from which they could choose. See Andrew Edward White et al., \textit{Putting All Your Eggs in One Basket: Life-History Strategies, Bet Hedging, and Diversification}, 24 PSYCHOL. SCI. 715–22 (2013).

\textsuperscript{236} Wilson and Daly, supra note.

\textsuperscript{237} Daly and Wilson, supra note.
history theory, as it shows that single men under-diversify and hold lottery-type stocks to a much greater degree than women or married men.

3. **Summary of Evolutionary Reasons for Under-diversifying**

A number of finance studies summarized earlier in this paper have determined that individual investors who have certain demographic attributes, such as low socioeconomic status, being single, being male and being young, are more likely to under-diversify their stock portfolios. Evolutionary theories of human risk-taking predict that people with those same demographic attributes will take risky decisions to meet certain evolutionary challenges, such as mate acquisition. Accordingly, it may be that people under-diversify and buy lottery-type stocks to (consciously or unconsciously) meet these evolutionary challenges. Whether that investing behavior is actually beneficial to investors is an open question; that is, does deviating from portfolio theory really help investors meet those evolutionary challenges, or is the perceived benefit illusory?

It ought to be possible to experimentally test whether there are evolutionary explanations for individual investors’ under-diversifying. The framework of the experiment would be to prime participants to be in, say, mate acquisition mode before having them participate in an investment game. Their investment behavior would then be compared to the behavior of a control group that participated in the same investment game. Another approach is to test whether low status males make different investment decisions than high status males in a simulated investment game.

**IV. Regulatory Implications**

I have presented in this paper a substantial amount of recent empirical evidence which suggests that people invest in the stock market not only to maximize their risk-adjusted returns. At least some subset of individual investors appear to deviate from the tenets of portfolio theory in their stock market investing in an attempt to satisfy a need for entertainment or even to satisfy more profound needs, such as to obtain status or to acquire a mate. As these latter needs are evolutionarily driven, it may be exceedingly difficult to change investor behavior through, for example, increased education or increased disclosure. In this Part, I briefly outline some financial regulatory implications of individual investors investing partly to satisfy these other needs.

In broad terms, there are two potential securities law regulatory responses to a finding that people invest in the stock market, in part, in an attempt to satisfy current needs. The first would be to enact rules that make it more difficult for people to under-diversify or to trade excessively. This could be accomplished by, for example, having investors go through a licensing process before they are permitted to trade in individual stocks to ensure that they

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238 Colarelli, Spranger, and Hechanova, *supra* note at 164.
understand basic financial concepts such as the risk-reward trade off.\textsuperscript{239} The rationale for such a scheme would be that investors’ brains are maladapted to modern financial decision-making and, as a result, they make costly mistake by deviating from portfolio theory, and the benefits that they perceive that they get from deviating from portfolio theory are illusory. However, a consequence of restricting investor risk-taking in this way is that investors may substitute for risky investing other risky activity, such as buying additional lottery tickets, which may be even more costly to them. An alternative approach would be to amend securities legislation in such a way as to encourage an increase in the supply of “lottery-type” stocks, thus potentially reducing the cost to individual investors of such stocks. Such a change may be Pareto efficient since it may both increase the capital available to entrepreneurs and satisfy needs of investors that are not currently being fully satisfied. Both of these alternative approaches are discussed in Part IV.A.

Pension law may be another area to which a finding that individuals invest in the stock market partly in an attempt to satisfy current needs is relevant. In many countries, there has been a shift away from company sponsored defined benefit plans to employee directed defined contribution plans. If individual investors manage their pension assets partly in an attempt to satisfy current needs, then this may reduce the efficacy of employee directed defined contribution plans as retirement vehicles. This issue is discussed in Part IV.B.

A. Securities Law Implications

1. Regulate Investors

One potential regulatory response to a finding that investors invest in the stock market partly in an attempt to satisfy current needs is to enact rules that make it more difficult for individual investors to under-diversify and trade excessively. Strengthening disclosure requirements would be unlikely to be enough to affect investor behavior.\textsuperscript{240} Accordingly, restricting investor choice may be necessary. The rationale for restricting individual investor choice would be an evolutionary one; that is, investors’ brains are maladapted to modern financial decision-making and, as a result, many individual investors make mistakes that are very costly to themselves. The benefits that individual investors perceive that they get from deviating from portfolio theory may be illusory, being a product of a brain that evolved at a time when humans lived in small hunter gatherer societies. Accordingly, rules which make it more difficult for individual investors to deviate from portfolio theory would be beneficial to individual investors (although individual investors may not perceive it that way).


\textsuperscript{240} KAUSAR, KUMAR, AND TAFFLER, \textit{supra} note at 35.
Stephen Choi notes that the purpose of securities laws is to protect unsophisticated investors and suggests that, rather than regulating issuers of securities and market intermediaries, securities laws ought to regulate investors directly. Under Choi’s proposal, it is the demand for securities that would be regulated, not the supply. Issuers would be permitted to issue any security, but could only sell those securities to investors who have gone through a licensing process, which would ensure that individual investors at least understand basic financial concepts such as the risk-reward trade off.

Given that the current needs that individual investors may be attempting to satisfy by deviating from portfolio theory may be evolutionary driven, simply educating and licensing individual investors may not be enough to prevent them from investing contrary to portfolio theory. Young men in particular take great risks in the process of intrasexual competition for mates, including committing homicide for perceived slights committed by other men. As Daly and Wilson state “... young men constitute a demographic class specialized by history of selection for maximal competitive effort and risk-taking.” Accordingly, young men are not likely to substantially change their risk-taking behavior because of more financial education or disclosure. This is supported by the results of the experiment discussed in Part III.B. in which six months after participants were given instructions on the mathematics of gambling, they were better able to calculate gambling odds but were as likely to gamble as a control group who were not given instructions. The instruction seemed to have had no effect on risk-taking behavior.

As well, a consequence of restricting investor risk-taking in this way is that investors may substitute for risky investing other risky activity, such as buying additional lottery tickets, which may be even more costly to them. Whether individual investors who, say, bought lottery tickets instead of holding an under-diversified portfolio would be better off is an empirical question. Is society better served by encouraging lotteries or by permitting (or even encouraging) investors to, in effect, gamble in the stock market? This may be a difficult empirical question to answer, but it is not self-evident that society or individual investors would be better off.

2. Encourage the Issuance of More “Lottery-type” Stocks.

Securities laws are primarily designed to protect small investors, the assumption in many countries being that sophisticated investors can fend for themselves. Accordingly, stock offerings made to sophisticated investors are subject to much less regulatory oversight than offering made to the general public. One consequence of stock market regulation is that it may have had the effect of reducing the variance of returns on stocks from what it would be in the absence of securities law. For example, Stigler showed that the introduction of the Securities Act, 1933 had

241 Choi, supra note.
242 Id.
243 Daly and Wilson, supra note.
244 Id.
245 Williams and Connelly, supra note.
the effect of eliminating from the market offerings of shares having high variance of returns.\textsuperscript{247} It may well be that these high variance stock offering were lottery-type stocks, which are the type of stocks preferred by a subset of the very same small investors that securities laws were intended to protect. If reducing the supply of lottery-type stocks in this way led to an increase in price of those shares, then the introduction of the Securities Act, 1933 may have adversely affected those individual investors who prefer to hold lottery-type stocks. In addition, companies that would have issued lottery-type stocks in the absence of the costly securities law compliance costs would also be adversely affected.

In most countries, securities law requires that a company which wants to issue its shares to the public go through a costly and time-consuming process of preparing a detailed disclosure document on which they will have legal liability for misstatements or omissions.\textsuperscript{248} These rules likely have the result of reducing the number of smaller, younger companies which issue stock to the public. In fact, lottery-type stocks represent only 1.25\% of the total market capitalization of the U.S. stocks.\textsuperscript{249} As discussed below, the restriction on the supply of such stock might cause the price of that type of stock (i.e. lottery-type stocks) to be higher than it would otherwise be and the return on them to be correspondingly lower than in the absence of securities laws. Arguably, it is the undersupply of high skewness stocks that causes them to be over-priced and thus to have a low expected return.\textsuperscript{250}

The CAPM posits that the demand curve for shares of a particular company is flat. The expected return on those shares is solely a function of their systematic risk. Thus, if the price (i.e. the inverse of the expected return) of those shares falls below (or goes above) the price predicted by the CAPM, investors will buy (sell) shares until the price returns to the CAPM-predicted price. One of the assumptions of the CAPM which are required for this relationship to hold is that arbitrage is costless, which of course is not true in practice. Miller\textsuperscript{251} and Stout\textsuperscript{252} both developed models showing that if investors have heterogeneous expectations about the expected return on a stock and arbitrage is not costless, the CAPM will not hold and the price of that stock will be driven by optimistic investors (or, under my hypothesis, by those investors who hold that stock partly in an attempt to satisfy current needs).

Further evidence that the demand curve for shares is not flat is that the price of shares of companies that get added to stock indexes like the Standard & Poor’s 500 get a one-time but permanent increase of approximately 5\%.\textsuperscript{253} This increase in price is not related to any change in prospects of the company, but may simply be due to increased investor demand for shares of the

\textsuperscript{249} Kumar, \textit{supra} note.
\textsuperscript{250} Barberis and Huang, \textit{supra} note. This is the flip-side to the discussion in Part 3.2 that excess” investor demand causes the price of lottery-type stocks to be higher than what the CAPM predicts.
\textsuperscript{251} Miller, \textit{supra} note.
\textsuperscript{252} STOUT, \textit{supra} note.
company due to increased investor awareness of the company. If the demand curve for stocks is not flat, then increasing the supply of lottery-type stocks might increase the return on such stocks, meaning that the cost to individual investors of investing in them would decrease.

Part of the recently enacted JOBS Act in the U.S. requires that the Securities and Exchange Commission promulgate rules to allow what is known as crowd-funding. As many stocks issued through crowd-funding are likely to be lottery-type stocks, allowing crowd-funding could increase the supply of lottery-type stocks, thus decreasing the price of such stocks.

B. Implications for Pensions

Another area where the issue of stock market investing as current consumption seems relevant is pension law. There has been a well-documented shift away from company sponsored defined benefit plans to employee directed defined contribution plans. However, if individual investors manage their pension assets partly in an attempt to satisfy current needs, then, all else being equal, self-managed pension funds would underperform professionally managed pensions. This may be particularly problematic for less wealthy individuals, as the finance literature suggests that they earn lower returns than more wealthy individuals. Perhaps it would be necessary to limit the right of self-directed pension holders to own individual stocks or to trade excessively. In most western countries, the government gives substantial tax benefits to pension plans in order to encourage individuals to save for their retirement. The case for providing these tax benefits is weakened if individuals manage their pension plans partly in an attempt to satisfy current needs since the governments would then be subsidizing, in part, current consumption.

V. Conclusion

Individual investors deviate from portfolio theory by trading too much and under-diversifying their stock portfolios. The empirical evidence in finance is that these deviations are very costly to investors. Individual investors incur unnecessary commissions and other transaction costs associated with trading and they are not adequately rewarded for the risk they take on by holding undiversified portfolios. In addition, their preference for lottery-type stocks result in the expected returns on those stocks being lower than the CAPM predicts.

A rational individual investor who was only interested in maximizing his or her expected investment returns would adopt a buy and hold strategy and would avoid lottery-type stocks. The observed fact that individual investors do not follow this investment strategy might mean that they deviate from portfolio theory in an attempt to satisfy current needs.

\footnote{254}{Id.}
\footnote{255}{The JOBS Act is an acronym for the awkwardly worded “Jumpstart Our Business Startups” Act. Pub. L. 112-106, 126 Stat. 313 (2012). Crowd-funding is a term used to describe a form of raising capital by which small companies raise funds over the internet from many small investors. The rules allowing crowd-funding have not yet been issued. However, the SEC very recently released a set of proposed rules and has asked the investment community and others to comment on them.}
The needs that individual investors may be attempting to satisfy by deviating from portfolio theory may be evolutionarily driven. Numerous studies in finance show that investors who are young, single, male or who have relatively low wealth tend to deviate from portfolio theory more than investors in other demographics. These results are consistent with the evolutionary psychology literature on risk-taking. That literature finds that young, single men of low status make riskier decisions than others, particularly when they are primed for status seeking or mate acquisition. It ought to be possible to test the evolutionary psychology theories for portfolio theory deviation through experiments in which investors are primed for status seeking or mate acquisition and then observing their investment behavior as compared to a control group that was not so primed.

Regulatory consequences may flow from individual investors obtaining current consumption by investing in the stock market. This paper has touched very briefly on two potential regulatory areas to which this may be relevant – securities law and pension law. I defer a fuller consideration of the regulatory consequences of individual investors investing in the stock market in an attempt to satisfy current needs until the nature of the needs that they are attempting to satisfy is empirically tested.