

***The Myth of Time
Diversification:
Analysis,
Application, and
Incorrect New
Account Forms***

By Jack Duval¹

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Investors are frequently encouraged to increase their risk exposure based upon a long time horizon. When working with clients to determine risk tolerance, registered representatives typically show charts and graphs depicting the decreasing volatility of equities over time and the decreasing likelihood of losing principal over time.

Underlying these sales presentations is the belief in time diversification: the idea that the longer an investment is held, the less likely it is to produce a loss. It is an idea that enjoys wide circulation on Wall Street. It is wrong.

This article will show that time does not reduce risk but actually *increases* risk. How time increases risk will be shown through three examples: the increasing magnitude of potential losses as time increases, the increasing cost of insuring investments as time increases, and the increasing likelihood of experiencing within-horizon losses as time increases.

After proving the myth of time diversification, harmful applications of the myth will be explored. These include: the fact that investors typically think of risk in dollar terms and not percentage terms (as does time diversification), the omission of within-horizon risk discussions, and the reality that most investors do not end up being long-term holders of investments.

Finally, this article will address how the myth of time diversification manifests itself on new account forms. In my experience as an expert in securities arbitrations, the registered representatives' mistaken belief that time reduces risk frequently appears in the selection of "Long-Term Growth" as the investment objective on new account forms. The "Long-Term" part of the investment objective is often communicated to the client as a risk-reducing factor that justifies risky "Growth" oriented investments². Unfortunately, just as flipping a coin 20 times does not change the odds of getting a tails on any one flip, designating an investment as "Long-Term" does not reduce the probability of experiencing a loss on that investment in any one year. Thus investors

¹ The author would like to thank Chuck Austin, Jason Doss, John Duval, Meghan Duval, Jay Salamon, and Rosemary Shockman for thoughtful comments and suggestions on this paper. Of course, any errors are the sole responsibility of the author.

² Many brokerage firms do not require the client to sign the new account form and in these cases the registered representative fills it out by him or herself without ever showing it to the client.

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are put into risky portfolios thinking they have reduced their risk through the intention of long-term holding periods but when the inevitable decline comes, it proves too extreme.

This article advocates that client investment objectives should be based on “time-independent” risk tolerance (i.e. the risk the client would accept in any one year). For most investors, the time-independent risk tolerance is much lower than what they are encouraged to select under the conventional time diversification belief. Indeed, the only case in which time should be a determining factor of risk tolerance is when the anticipated need for the money is known to be short term. For instance, if an investor knows they will need their money in 3 years for a down payment on a house, they should not take any risk with their investments. Investors with a five-year or longer expected time horizon should base their risk tolerance on how much risk is acceptable to them if they were invested for only one year, picked at random from their expected time horizon.

Time Diversification

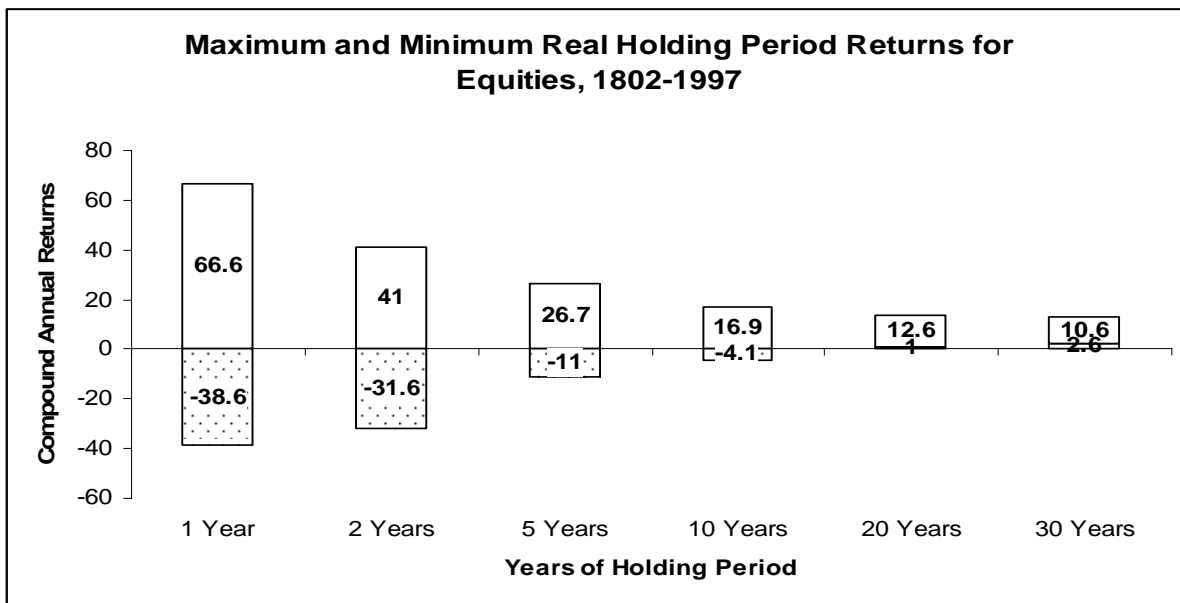
Time diversification is part of the conventional wisdom of Wall Street. Consider this quote

from a Vanguard web page for investor education:

“Time horizon. The more time you have until you’ll need your money, the greater your ability to weather short-term declines in the prices of your holdings. So if your time horizon is at least ten years, emphasizing stocks in your investment program may help you achieve your financial goals more readily.”³

Like the Vanguard passage above, almost all investment literature from brokerage firms, mutual fund companies and separate account managers extols the ability of time to reduce risk. A typical chart will show the percentage chance of loss decreasing with longer investment periods.

A good example of the marketing material shown to investors is the chart below, which is adapted from Jeremy J. Siegel’s *Stocks for the Long Run*. In this chart, the risk of loss is shown decreasing as the years of the holding period increase. For any one year period from 1802 to 1997 the worst one year return was –38.6 percent; for any five year period the worst five-year compounded average



Adapted from: Jeremy J. Siegel (1998)⁴.

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annual return was –11 percent; and for any 30 year period, the worst 30 year compounded average annual return was +2.6 percent.

These analyses of time diversification are based, in part, on the “Law of Large Numbers.” For investors, this concept implies that as the time horizon increases, so does the likelihood that an investor’s actual average return will achieve its long-run historical average. The investment implication is that an investor with a lengthy time horizon can pick a more aggressive asset allocation and *keep it the same* throughout their investment horizon - thus achieving the “holy grail” of investing: increasing returns and decreasing risk at the same time. Consequently, investors often wind up with portfolios that are riskier than their time-independent risk tolerance would allow. The excessive risk becomes apparent only after the inevitable market decline proves to be too extreme.

The truth of the time diversification claim relies on risk being defined solely as the likelihood of loss at the end of the investment horizon. This definition of risk is very narrow and ignores human nature, basic economics, and contrary statistical evidence. The investment pitch of registered representatives is based on a belief in the unequivocal risk-reducing effects of time. This belief will be proven false below.

Three Critiques of Traditional Time Diversification

Economists and finance experts, beginning

with economics Nobel laureate Paul Samuelson in 1963, continuing with his protégé Professor Zvi Bodie, and most recently including author and CFA Mark Kritzman, have developed three distinct critiques of time diversification.

1. Paul Samuelson

In his 1963 paper “Risk and Uncertainty: A Fallacy of Large Numbers,”⁵ Paul Samuelson recalls an encounter he had with a colleague who refused to take a bet with favorable odds on a single flip of a coin but agreed to a series of 100 flips at the same odds. At first glance, Samuelson’s colleague seems to have been making sense; isn’t it logical that many repetitions of the bet would reduce the risk of a loss? However, upon deeper reflection, the proposition is irrational. If an individual finds the risk of a bet unacceptable, why would they find a series of the exact same bet acceptable? The truth is that the series of bets is not acceptable and Samuelson’s paper proves it by accounting for the magnitude of risk taken with each bet.

A parallel to Samuelson’s colleague is a hypothetical investor who finds a 100 percent equity portfolio too aggressive for one year, but agrees to hold the 100 percent equity portfolio for 30 years. According to conventional wisdom, the investor is doing exactly what he or she should.

Yet this strategy completely ignores the crucial fact that over those 30 years, the investor’s investment base will increase dramatically. Recall that the time diversification strategy requires that an

³ Vanguard, “Personal Investors, Planning & Education, Stock, bond and cash investments: Time horizon”; <http://flagship2.vanguard.com/VGApp/hnw/content/PlanEdu/InvestorEdu/PEdIESBCInvestmentsContent.jsp>; Internet; accessed 8 March 2006.

⁴ Siegel, Jeremy J., “Stocks for the Long Run: The Definitive Guide to Financial Market Returns and Long-Term Investment Strategies,” Second Edition, (New York: McGraw-Hill 1998), 27.

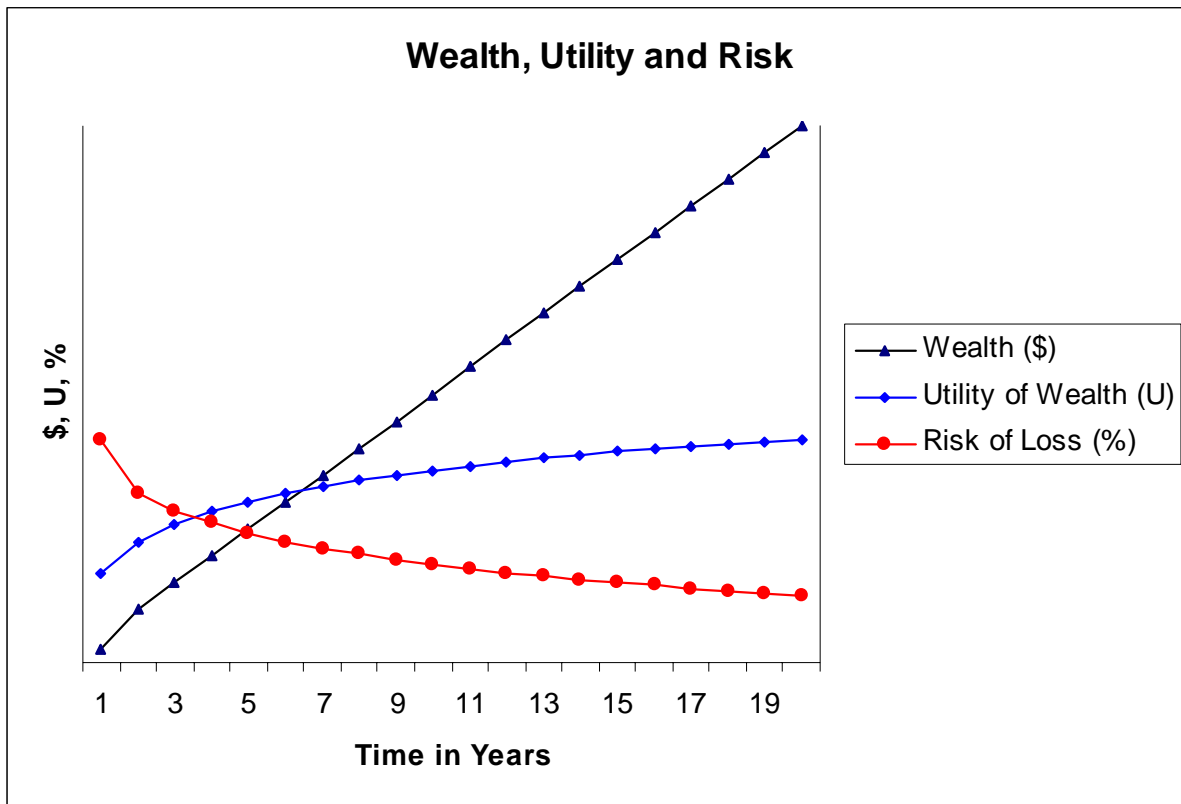
⁵ Paul A. Samuelson, “Risk and Uncertainty: A Fallacy of Large Numbers,” *The Collected Scientific Papers of Paul A. Samuelson*, ed. Joseph E. Stiglitz (Cambridge: MIT Press, 1966), 153-8.

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investor with a 30-year time horizon keep the *same* asset allocation for all 30 years. Thus, time diversification is telling us that a potential 20 percent loss on a \$1 million retirement nest egg in year 30 is just as acceptable as a potential 20 percent loss on a \$2,000 IRA account in year one. My experience working with investors and the fundamental economic concept of the diminishing marginal utility of wealth tells us that this is absolutely not true. Investors are *not* indifferent between a \$200,000 loss on the eve of retirement and a \$200 loss when they are just out of college. Thus the investor should not accept the risk of a portfolio unless the risk in each individual period is acceptable. In the example above, unless the investor finds the potential

\$200,000 loss acceptable, he or she should not invest in the 100 percent equity portfolio.

Samuelson proves this point by showing that the *decrease* in the probability of a loss is exactly offset by the *increase* in the potential magnitude of loss. Therefore instead of increasing an investor's portfolio risk based upon their time horizon, investors should choose an asset allocation based upon the amount of risk they are willing to take in any one year. The risk profile of the "invest for any one year" portfolio will typically be much more conservative than a risk profile based on a lengthy time horizon.

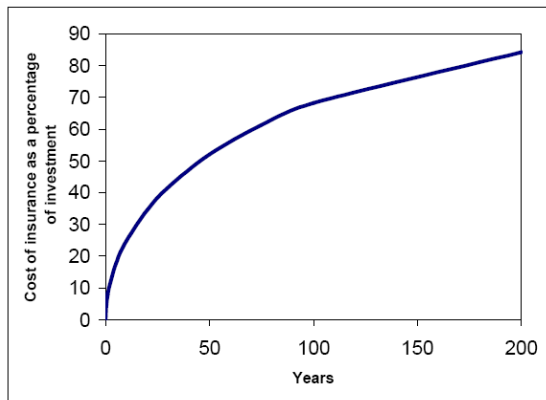


Source: John Duval Associates LLC (2006)

The above-chart illustrates how three things happen over time: wealth increases, the utility (or usefulness) of wealth increases at a slower rate over time, and the risk of loss (defined as end-of-horizon loss) decreases over time. What Samuelson shows us is that the benefit from the decreasing risk of loss is

exactly offset by the declining benefit of having more wealth. (In mathematical terms, the slopes of the utility and risk graphs sum to zero in each time period.)

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Source: Zvi Bodie (1995)

Compare year one, when the risk of loss is high and wealth is low to year twenty, when the risk of loss is low but wealth is high. The conventional time diversification model focuses solely on the diminishing risk of end-of-horizon loss and completely ignores the exponential increase in wealth at risk.

2. Zvi Bodie

Professor Zvi Bodie of Boston University, a former student of Paul Samuelson's at MIT, has also argued against time diversification using the cost of put options over time. Bodie's argument rests on the assumption that the market is able to determine whether risk increases or decreases over time. He writes: "If it were true that stocks are less risky in the long-run, then the cost of insuring against earning less than the risk-free rate of interest should decline as the length of the investment horizon increases. *But the opposite is true.*"⁶

Bodie uses the cost of put options as a proxy for the cost of insuring an investment. (Put options go up in value if the underlying investment they are derived from goes down, thus they can be rightfully viewed as insurance on that investment.) Expressed as

a percentage of the investment, the cost of a one year put option in his example is 7.98 percent, the cost of a five year put option is 17.72 percent, and the cost of a 30 year put option is 41.63 percent, increasing infinitely as the time horizon increases⁷.

This data is summarized in the chart below and can be verified independently by anyone willing to look at the options tables in their daily newspaper. Put options premiums for the same underlying security, with the same strike price, differing only in expiration date will increase in price as the expiration date extends further into the future.

Clearly, the options market has determined that risk increases as the time horizon increases. Otherwise, put options would become *less* expensive as the expiration date was extended.

3. Mark Kritzman

Mark Kritzman, the CEO of Windham Capital Management and a frequent contributor to finance journals, has made another critique of time diversification.

Like Samuelson and Bodie, Kritzman proves that risk *increases* with time. Kritzman's analysis directly disproves the notion that the probability of loss decreases with time.

Through a statistical analysis known as "first-passage time probability," Kritzman has quantified what should be self-evident - the more periods an investor is in the market, the more likely he or she is to experience periods with negative returns. These negative returns occurring during the investment period are called within-horizon losses. The increasing likelihood of within-horizon losses as the time horizon increases should be intuitive to everyone. Just as the more times a fair coin

⁶ Zvi Bodie, "On the Risk of Stocks in the Long Run," *Financial Analysts Journal*, May-June 1995, 18-22.

⁷ See *Id.* at 20.

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is flipped, the more likely it is that tails will appear; the more years an investor is in the market, the more down years that investor is likely to experience. Thus, the probability of incurring a loss *increases* with time, not decreases as the conventional wisdom tells us.

Kritzman concludes from his analysis that since “probability of loss rises rather than falls with time... even those who construe risk narrowly as probability of loss no longer have a leg on which to stand.”⁸

The chart below, which is summarized from a paper by William J. Trainor, Jr. building on Kritzman’s work, shows that as the investment time horizon increases, the risk of within-horizon losses on equities increase as well. For example the risk of a 10 percent or more loss stands at 41.8 percent for any one-year period and increases to 59.7 percent for a 20 year investment period. Remarkably, the risk of a 25 percent or more loss for a five-year period stands at 19.5 percent, even though the risk of an end-of-horizon loss of 25 percent or more is only 4.5 percent. This means that investors leaving their money in the market for five years have an almost 20 percent chance of being down by 25 percent *or more* at some point during those five years – a fact they might find disconcerting if all they have been shown is the 4.5 percent risk of the same loss at the end of the five years!

Thus, even though the end-of-horizon probability of loss declines with time, the within-horizon risk of loss increases with time.

Time Diversification and the Typical Investor

The conventional time diversification story presents an appealing proposition to the investor – invest for long enough and you can eliminate the risk of investing. This rosy scenario is at best a partial truth and has the potential to lead the investor into bad decisions that will haunt them later in the form of destroyed retirement funds, unmet goals and the prospect of having to work for their entire lives.

Where does the conventional story go wrong? It fails the investor in three primary ways that are supported by the three critiques presented above.

1. Percentage versus nominal losses

The first failure is that the conventional model measures risk in percentage terms when investors measure risk in dollar terms. Recall that the conventional model requires the investor to hold the same asset allocation for their entire investment horizon – over which their wealth will grow dramatically. We know that the risk of loss is the same in any year, so the potential magnitude of loss increases every year as wealth grows.

The conventional time diversification story assumes that the investor is indifferent between a small dollar loss and a large dollar loss. However, anecdotal evidence, basic economic theory, and common sense indicate this is false.

Theoretical probabilities for losses of 10 to 25 percent or more

	One-year Horizon		Five-year Horizon		Ten-year Horizon		20-year Horizon	
	End-of-horizon	Within-horizon	End-of-horizon	Within-horizon	End-of-horizon	Within-horizon	End-of-horizon	Within-horizon
10% or more loss	15.3%	41.8%	10.7%	56.6%	5.8%	58.9%	1.8%	59.7%
15% or more loss	9.0%	23.6%	8.3%	40.9%	4.7%	44.0%	1.5%	45.1%
20% or more loss	4.7%	11.9%	6.3%	28.7%	3.8%	32.2%	1.3%	33.5%
25% or more loss	2.1%	5.2%	4.5%	19.5%	2.9%	23.0%	1.0%	24.4%

Note: Assumes: 100% lump sum equity investment; 10 % expected return, 20% standard deviation. Adapted from: William J. Trainor, Jr. (2005).

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Unfortunately, the increasing magnitude of potential losses is not explained to investors. The focus is on the reduced probability of end-of-horizon losses. This focus ignores the crucial fact that the probability of loss in any one year is the same in each year of the investment horizon, and thus a big loss could come at the end of the investment period, when the dollar amounts of the loss would be severe and (most likely) irreplaceable.

2. Increasing risk with time

The second failure of conventional time diversification is that it ignores the fact that risks increase on equity investments the longer they are held. This is especially pernicious for investors who are trying to decide how much risk to take. If the investor is told only that time reduces risk, then they will take an investment stance that increases their risk (typically through their asset allocation) while they believe they are doing the opposite!

We know from the evidence above that within-horizon risks increase with the time horizon. Because of this, investments should be made based on a time-independent basis. A key question that should be asked of clients is: "How much (in dollars) are you willing to lose in any year?" Importantly, the maximum acceptable loss question assumes the risk of within-horizon loss and not the conventional end-of-horizon "guarantee" of positive returns.

Unfortunately, this question is rarely asked, and if it is, it is usually part of a long series of questions and carries relatively little weight. In reality, investors will change their asset allocation once their portfolios have reached a certain loss level. All end-of-horizon predictions will be lost in the pain of the

moment and the client will demand that the registered representative "get them out at any price." These decisions are almost always of the "selling low" variety and hurt the investor greatly. Thus avoiding the "get me out at any price" moment is of paramount importance – and the only way to avoid it is to address it before any money is invested.

The "how much money are you willing to lose" question addresses within-horizon loss directly and should be the centerpiece of the risk tolerance discussion.

3. Where are the "long-term" investors?

The third failure of the conventional time diversification model is that the vast majority of investors *do not* hold their investments for long time frames. Many unexpected events can upend investor intentions of long-term investing, some of which include:

- Market volatility
- Health emergencies
- Disability
- Need to support additional family members
- Lawsuits
- Layoffs
- Early retirement

Mutual fund data supports the reality of investors' short time horizons. According to Dalbar's Quantitative Analysis of Investor Behavior (QAIB) study, from 1984 to 2004, the average equity mutual fund investor held their fund only 2.5 years⁹. The QAIB study also shows that although the stock market has averaged almost 12 percent over the past 20 years, individual equity investors only averaged four percent over the same time period¹⁰. The reason for the discrepancy in market versus realized returns is evident in

⁸ Mark Kritzman, "A New Twist on Time Diversification," *InvestmentNews*, 31 October 2005.

⁹ Cited in Trainor, Jr., William J. "Within-horizon Exposure to Loss For Dollar Cost Averaging and Lump Sum Investing," *Financial Services Review* (2005), 322.

¹⁰ *Id.*

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the QAIB reported fund flows – investors are buying high and selling low¹¹. In short, year-to-year (within-horizon) losses are overwhelming the promises of end-of-horizon success.

Time Diversification and New Account Forms

The myth of time diversification also extends to the new account forms that registered representatives are required to complete upon opening a new brokerage account. Brokerage firm new account documents commonly contain the client investment objective entitled “Long-Term Growth.” While this selection may or may not be reviewed with the client, it can be an inappropriate objective and frequently used against the investor in an arbitration.

For the typical client, “Long-Term Growth” means that they plan on being invested for the rest of their lives and they’d like their investments to grow. For the typical registered representative, “Long-Term Growth” means the conventional time diversification model is in force and they can put the client in more aggressive investments because of their long time horizon.

Furthermore, if the registered representative explains risk only in the terms of conventional time diversification, the client wrongly believes the “long term” part of the investment objective means they are *reducing* their risk. The “growth” part of the investment objective is generic to all clients – after all, everyone wants their investments to grow. However, the universal applicability of the term “growth” renders it virtually meaningless. (For example, an investor can achieve “growth” in a 100 percent treasury bill portfolio.) The only distinction that really matters is how much risk the client is willing to take to achieve that growth.

As mentioned above, new account forms should ask: “how much money are you willing to lose in any one year?” The question should be answered in nominal terms and it should have a signature line next to it. This would force both client and registered representative to address within-horizon risk before any investments were made and (hopefully) avoid the “get me out at any price” decision.

Lastly, if aggressive investments made for a client under the conventional time diversification model prove too risky and the matter ends up in a hearing, the “growth” part of the “Long-Term Growth” investment objective will be cited as the clients’ *willingness* to take risk. This argument may come to the dismay of the clients who were told that the “long-term” part would *reduce* their risk.

Counter-Arguments

The evidence I have presented above does not preclude all defense of the conventional time diversification model. An obvious critique is that while my argument may hold for someone aged 65 who is retiring, it does not hold for a 21 year old college graduate who is just entering the labor force.

This critique is based on the economic concept of human capital, which is simply the present value of an individual’s expected lifetime labor income. For the 65-year-old retiree, their typical human capital is zero (they have no more expected labor income) and their total wealth is equal to their investment assets. For the 21-year old college graduate, their human capital is large (they have all of their working years in front of them) and their total wealth is equal to their human capital (they have no investment assets).

The counter-argument states that if an individual has all (or most) of their working

¹¹ *Id.*

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years in front of them, then they can afford to take risks with their investments. If those investments sustain losses then the individual can offset the losses by increasing their human capital through working more hours, taking an additional job or delaying retirement.

The problem with this critique is that it assumes human capital is *riskless*. This is far from the case. In today's dynamic economic environment, even professionals with significant investments in human capital can find their jobs obsolete. For example, managers with MBAs can be laid off due to corporate restructuring and more recently, radiologists have seen their work emailed to India where x-rays are read by equally qualified doctors at a fraction of the costs. The risk to human capital argues for the 21-year old college graduate to take very little risk with their investments because they don't know the value of their human capital.

In my experience, risks abound for investments and human capital. As human capital is turned into investment capital, it should be invested to protect the investor from losses in the market and employment.

Conclusion

For claimants' attorneys, the broader understanding of time risk outlined above should provide a powerful counter to the common suitability defense of time horizon. Some implications are that:

1. risk tolerance should be established independently from time horizon;
2. clients should be asked explicitly on new account forms: "how much money (in dollars) are you willing to lose in any year?";
3. asset allocations should be determined by how much risk an investor is willing to take in any one year;

4. investments made on the basis of conventional time horizon are likely to be unsuitable;
5. registered representatives who are only telling their clients that time reduces the risk of loss are not following the rules of fair practice and are, in fact, negligent.

Investors care about losses at every step along their investment path, not only at some far away terminal date. Just as stocks do not magically turn into bonds if held for long time periods, portfolio risks do not disappear with longer time horizons. The risk of a loss is the same in each time period.

Risk must be explained to investors in terms of the potential magnitude of declines and the increased likelihood of experiencing within-horizon losses as their time horizon increases.