ALL IN ONE BASKET

Why Job, Home, and Social Security Are as Important to Retirement Planning as an Investment Portfolio

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"No man is an island," the poet John Donne wrote in 1624. Just as one person's life is part of a bigger picture, so is one person's financial-asset portfolio. An individual's economic worth is made up of more than just an investment portfolio.

Other assets such as human capital, real estate, and pensions (for example, Social Security retirement benefits) often represent a significant portion of an individual's total wealth. These assets, however, often are ignored by practitioners when building portfolios, despite the fact that they share common risks with financial assets. In this article, we explore how incorporating human capital, housing wealth, and pensions into a portfolio optimization routine can help us build more efficient portfolios for investors.

We first describe the different dimensions of wealth, starting with human capital, that make up an investor's total wealth and the risk embedded in them. Based on that analysis, we then infer how to build optimal portfolios that account for the presence of these other assets.

Human Capital

Human capital has a variety of definitions but generally can be thought of as the total economic value of an individual's set of skills and talents. Human capital is a unique asset because it varies by age, health, education, occupation, industry, and experience, among other variables, and it is nontradeable. These traits, in effect, create endowed exposures to certain risk factors that can be difficult to effectively hedge.

The approach we use to estimate the total value of human capital and its return (i.e., riskiness) is motivated by the work of Ibbotson et al. (2007), which defines human capital as the mortality-weighted net present value of wages. The individual is assumed to retire at age 65; mortality is based on the U.S. Society of Actuaries 2000 annuity mortality table for a unisex individual; expected inflation is based on historical inflation expectations from the Cleveland Federal Reserve; the nominal discount rate is based on the historical yield for different Barclays Investment Grade Industry Bond indexes (yields plus a term premium); and expected wage growth rates are based on changes in employment expectations obtained from the U.S. Bureau of Labor Statistics.

We obtained historical quarterly wage data from the Bureau of Economic Analysis for 10 U.S. industries we selected for the analyses: construction, finance, government, health care, lodging, manufacturing, mining, real estate, transportation, and utilities. The correlations over the past 20 years between the changes in the value of these 10 industry-specific forms of human capital and the returns of 13 asset classes are shown in table 1 to provide the reader with some perspective about the extent and statistical significance of the relations. The assumed age for the human capital estimates in table 1 is 45.

Correlations are statistically significant for many of the relationships, generally more so for fixed-income assets than cash, equities, and alternative asset classes. The average absolute correlation across all asset classes is 0.27 with a median of 0.25. Some correlations are notably high; for example, the correlation between the human capital of the real estate industry and the return on real estate investment trusts (REITs) is 0.6.

This is an intuitive relationship. It suggests that changes in the value of REITs have a significant and positive relationship with wages in the real estate industry. The obvious implication is that individuals who work in real estate likely should have a lower (or no) allocation to REITs among their financial assets compared to individuals who work in other industries.

Understanding how portfolio weights should vary based on different asset and risk exposures is the primary goal of this article. There is potentially only a single efficient frontier for financial assets when ignoring other assets, but this efficient frontier becomes far more dynamic (and varying) as different types of individual assets are considered across investors.

Pension Wealth

Pensions represent a significant asset to U.S. households, especially older households. Among elderly Social Security beneficiaries, 53 percent of married couples and 74 percent of unmarried people receive 50 percent or more of their income from Social Security.[1] The value of pension wealth for the purpose of this analysis is defined as the mortality-weighted present

Table 1: Correlations between Industries (Human Capital) and Asset Classes (Financial Assets)

Listed are correlations between the changes in value of the 10 industry-specific forms of human capital and the returns of 13 asset classes, color-coded according to *p*-values, or the probability with which a correlation coefficient is different from zero. The colors highlight the *p*-values that are statistically significant at 0.1-percent, 1-percent, and 5-percent levels. The darker the color, the stronger the significance. For example, a person who works in the real estate industry would want to avoid investing in REITs given the high correlation between the real estate industry and the REIT asset class and the fact the result is highly statistically significant.

Asset Class	Consumer	Financial	Government	Health Care	Lodging	Manufacturing	Mining	Real Estate	Transportion	Utility
Cash	–.023	.009	–.069	–.087	–.156	–.013	–.111	–.094	–.033	–.095
Interm-Term Bond	.313	.572	.691	.502	.142	.645	.288	.200	.517	.610
Long-Term Bond	.306	.588	.696	.522	.168	.742	.331	.209	.549	.650
TIPS	.317	.155	.348	.327	.241	.354	.352	.282	.282	.369
High Yield	.569	.340	.359	.260	.666	.079	.369	.648	.316	.298
Non-U.S. Bond	.207	.381	.447	.232	.123	.419	.250	.161	.331	.267
Large Growth	.244	.078	–.048	.084	.362	–.137	.066	.251	.099	–.101
Large Value	.368	.253	.078	.155	.388	.008	.255	.373	.228	.067
Small Growth	.224	.079	–.083	.099	.397	–.139	.066	.263	.099	–.091
Small Value	.335	.208	.034	.167	.385	–.016	.200	.367	.206	.046
Non-U.S. Equity	.347	.266	.081	.145	.444	–.023	.221	.394	.215	–.014
Commodity	.253	.127	.042	.039	.261	–.036	.323	.353	.011	–.021
REITs	.576	.398	.315	.314	.501	.257	.493	.602	.421	.248

Highly Significant · Significant · Less Significant · Not Significant

value of a person's future Social Security benefits, discounted at the risk-free rate. By considering Social Security retirement benefits separately from human capital, we assume they are independent. This is obviously a simplifying assumption, because pension benefits and human capital are related, especially because Social Security retirement benefits are wage-based. However, the risk factors associated with pension benefits are different than those associated with human capital, and the relation between human capital and pension benefits will vary by individual, which supports considering human capital and pension wealth separately.

Housing Wealth

According to the U.S. Census Bureau, home ownership in the United States was 65.3 percent as of the third quarter of 2013 and has ranged between 63 percent and 69 percent since 1965. A unique risk with housing wealth is leverage. Homes in the United States are generally purchased with some kind of loan, such as a mortgage, with down payments that can be as little as 5 percent, although a 20-percent down payment is more common. A 20-percent down payment implies a five-times multiple with respect to how a change in the value of the home will affect the net equity. For example, if an individual owns a home worth $100,000 with a mortgage of $80,000, and the house increases in value by 10 percent (to $110,000) the return realized by the owner, based on the net equity, is 50 percent ($10,000/$20,000 = 50%). The amount of leverage is obviously very important for homeowners, because even slight changes in housing values can have a material impact on the net equity of a home, especially for younger investors who may have less equity.

The risk we associated with housing wealth is based on the change in different S&P/Case-Shiller Home Price Indexes for 10 different cities, with data obtained from the Federal Reserve Bank of St. Louis.[2] The 10 cities we selected for the analysis are Atlanta, Charlotte, Cleveland, Washington DC, Las Vegas, Miami, Minneapolis, Phoenix, Seattle, and San Francisco. Individual cities were selected to represent different regions, but states or other characteristics could just as easily have been used. The cities selected were intended to be broadly representative of the United States.

Financial Capital

Financial assets are the most easily observable and most liquid portion of household wealth, and they therefore tend to receive the majority of attention from financial planners building a portfolio.

The weight of financial assets as part of an investor's total wealth varies by investor type and age. Younger individuals tend to have little financial wealth, but they accumulate financial wealth over their working careers through savings, which is then spent down during retirement. Financial assets are usually largest in a person's life when retirement commences.

For the purpose of this analysis, financial assets serve as a completion portfolio, which is optimized considering the other components (i.e., human capital, housing wealth, and pensions) that make up an investor's total economic wealth. The objective of the portfolio optimization considered here is to find the combination of financial assets that minimizes the variance in inflation-adjusted change in total wealth for a given level of return. Traditional optimization techniques define risk as the

variance of financial assets, ignoring additional wealth components.

In our optimization, financial assets are represented by the following 13 asset classes: cash; five bond asset classes (U.S. intermediate-term, U.S. long-term, U.S. TIPS, U.S. high-yield bond, and non-U.S.); five equity asset classes (U.S. large growth, U.S. large value, U.S. small growth, U.S. small value, and non-U.S.); and two alternative-asset classes (REITs and commodities). We consider the historical returns of the 13 asset classes from the second quarter of 1993 to the first quarter of 2013, for a total of 80 quarters.

We selected this opportunity set to reflect asset classes that are commonly used by investment professionals when building portfolios for clients.

Total-Wealth Analysis

To demonstrate how the relative weights of these different assets may change over an individual's lifetime, it is illustrative to consider a hypothetical individual who is representative of an average U.S. household. We assume that at age 25 the individual earns $40,000 a year in after-tax income. Over the individual's lifetime, we assume the real wage growth rate will grow at a constant 1 percent per year, the annual savings rate is 10 percent, the discount rate is 8 percent, and the rate of expected inflation is 3 percent.

We also assume that the individual purchases a $100,000 home at age 30. The home is purchased with a 10-percent down payment (that comes from financial capital) with the remainder financed by a 30-year mortgage at an interest rate of 5 percent.

We assume that the real growth rate of the home is 1 percent. Social Security retirement benefits are assumed to be $20,000 per year, in today's dollars, commencing at age 65. The real discount rate for Social Security retirement benefits is 5 percent.

The relative wealth proportions associated with this scenario are depicted in figure 1.

Figure 1 highlights a number of general trends over a person's lifecycle. It shows that human capital tends to be the dominant asset for younger households and is transformed into other forms of wealth over a person's lifecycle, reaching 0 percent when the individual retires at age 65.

Furthermore, the value of pensions increases as the individual ages (as the realization of the benefits comes nearer). Additionally, financial capital is likely to be at its largest at retirement (it follows a hump shape over an individual's lifetime). Finally, the relative value of real estate may increase during an individual's lifetime, and if housing wealth is not used to fund retirement, it potentially becomes the dominant asset later in life.

The scenario considered here demonstrates that even at its peak, financial capital never accounts for more than 50 percent of the individual's total wealth. This insight in turn raises the question: How can an asset

Figure 1: How the Components of a Person's Wealth Change Over a Lifetime

In this hypothetical example. a person's human capital is the dominant asset early in his or her career. Human capital diminishes over a lifespan, reaching 0 percent when the person retires and other forms of wealth play larger roles.

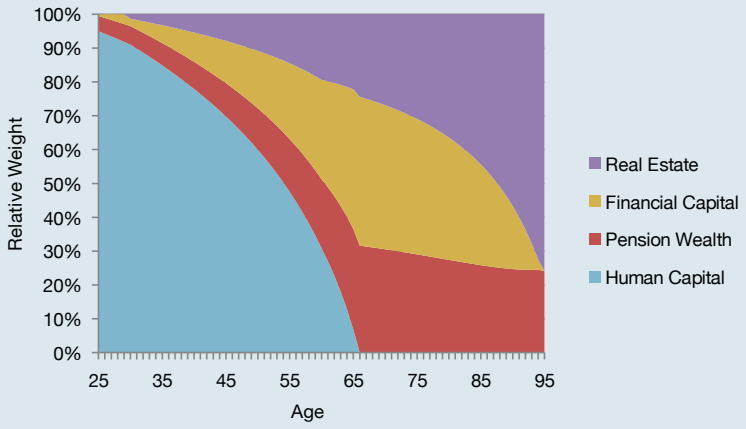


Table 2: Building Total Wealth

We created 1,000 simulations representing different combinations of wealth. Here are 10 total-wealth scenarios representing different compositions of total wealth by age.

	Scenario Number									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Human Capital	80%	80%	60%	60%	40%	40%	20%	20%	5%	5%
Housing Wealth	5%	0%	15%	0%	30%	10%	20%	5%	15%	30%
Pension Wealth	5%	5%	10%	10%	20%	10%	30%	50%	30%	55%
Financial Capital	10%	15%	15%	30%	10%	40%	30%	25%	50%	10%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Assumed Age	30	30	40	40	50	50	60	60	70	70
Housing Equity	20%	20%	40%	40%	60%	60%	80%	80%	100%	100%
Implied Leverage	5.00	5.00	2.50	2.50	1.67	1.67	1.25	1.25	1.00	1.00

allocation based entirely on less than half of a client's assets truly be optimal?

Total-Wealth Optimizations

To study the impact of including these dimensions of wealth in a portfolio-optimization setting, we created 1,000 simulations, representing different combinations of wealth based on job type, location of housing wealth, and age. We call these "total-wealth portfolios." For human capital, we consider the human capital associated with the 10 industries mentioned earlier. For housing wealth, we incorporate the housing wealth of the 10 U.S. cities. Finally, we incorporate 10 scenarios, representing different relative proportions of each of the four wealth components based on ages between 30 and 70.

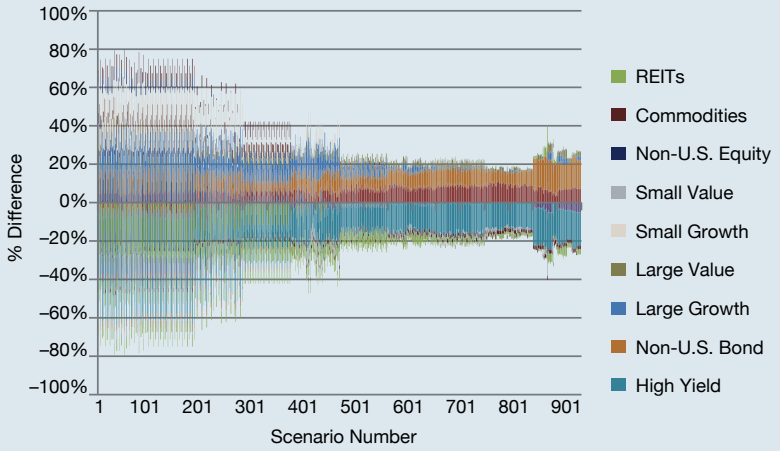
Every possible combination of these simulations leaves us with a 1,000 total-wealth combinations. The lower number simulations (1–500) reflect potential asset weights for an individual younger than 50, who has higher relative levels of human capital. The higher numbers (501–1,000) reflect potential weights for an individual older than 50, who has higher relative levels of the other three assets, most notably pensions. The age-based scenarios are shown in table 2.

We placed three constraints on the optimization to reflect common investor considerations as well as to more easily isolate the differences that result from holding different amounts and types of wealth. First, there is no shorting (i.e., all asset-class weights must be positive). Second, the maximum allocation to a single asset class is 20 percent of the portfolio. This ensures the portfolio must have weights to at least five asset classes. Third, the return of the financial assets (i.e., the portfolio) must be equal to the average quarterly return of all available asset classes over the test period, which was 2.05 percent.

The third constraint is included to ensure the resulting allocations are at least somewhat balanced across both equities and fixed income. Given these three assumptions, the return of each of the financial assets for the optimized portfolios will be identical (within four decimal places); however, the asset-class weights will vary by scenario depending on the riskiness of the other assets (human capital, housing wealth, and pension wealth) and their weights included in the optimization.

Figure 2: Importance of Total Wealth

Here are the percentage differences between the optimal portfolio allocations for the 1.000 scenarios, which consider a person's total wealth, and optimal allocations that ignore total wealth.



The results of the optimizations are shown in figure 2, which shows the percentage differences between the optimal portfolio allocations for the 1,000 total-wealth simulations and the optimal allocations that ignore human capital, real estate, and pension wealth—what we term the "non-total-wealth portfolio."

Figure 2 allows us to identify some important patterns in terms of how incorporating a person's total wealth into the portfolio optimization has an impact on the portfolio weights.

First, the relative dispersion in the optimal asset allocations is clearly more significant for younger individuals with higher levels of industry-specific human capital, with some absolute differences exceeding 75 percent when compared with the non-total-wealth-optimized portfolios.

For simulations 1 to 200, based on scenarios 1 and 2 in table 2, where the human capital weight is 80 percent, the average absolute difference versus the non-total-wealth portfolio is 49.9 percent, and the average difference versus the average overall portfolio is 35.6 percent. Both of these represent significant differences in the allocations to different asset classes.

Across each of the optimized simulations, when comparing the total-wealth portfolios to the non-total-wealth portfolios, there are lower allocations to long-term bonds, especially high-yield bonds. These reductions are offset with higher allocations primarily to large-growth stocks and commodities. When comparing the total-wealth-optimized portfolios with each other, it is difficult to pinpoint common differences, although allocations to long-term bonds increase in scenarios where pensions are a significant asset (and where the individual is assumed to be older).

Overall, the differences between the optimization routines that incorporate a person's total wealth and the routine that ignores it are material. In other words, ignoring an investor's total-wealth assets leads to portfolio allocations that are inefficient.

Take a Holistic View

In this article, we explored the implications of taking a total-wealth perspective to portfolio optimization. For the analysis, the

assets included in the optimization were extended beyond financial assets to include human capital, housing wealth, and pension wealth. The financial assets were treated as a completion portfolio that is optimized to minimize the variance in inflation-adjusted change of the total wealth of an investor.

The optimal allocation for an investor's financial assets varies materially based on different total-wealth risk exposures. The differences were largest for those scenarios where human capital was the dominant asset (i.e., for younger individuals). These results suggest that there is not a single set of portfolio weights for all individuals (or investors), and that allocations should vary based on each individual's unique assets and risks.

This research has important and practical implications for investors, clients, and practitioners. Perhaps most notably, the perspective of an efficient portfolio must be gauged with respect to its risk contribution to an investor's total wealth. For example, financial planners developing portfolios for clients should consider an investor's total wealth when creating portfolios and not focus entirely on the investor's financial assets.

Additionally, plan sponsors interested in building custom target-date portfolios should consider the unique industry-specific human capital, region-specific housing, and other types of risks that make their participant populations unique.

Finally, this methodology can be extended to other types of investors, such as charitable endowments, because each investor has risks that extend beyond the portfolio and should be considered in the optimization routine.

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Endnotes

1. See http://www.ssa.gov/pressoffice/basicfact.htm.
2. See http://research.stlouisfed.org/fred2/release?rid=199.

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