Differential Portfolio Advice: Investment Solutions for Individual Investors

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Why This Matters?

This paper provides a comprehensive framework for offering portfolio advice. This framework takes into account the impact of income risk and investment horizon. Finally, it places factor investing in the context of lifecycle investing.

Who Should Read This Paper?

This paper is relevant for investors who are developing multi-asset class solutions. Additionally, it is relevant for investment strategists and asset allocators.

01. Introduction

The accumulation of financial assets over time depends on choices that investors make about how much of their income to save, and how to invest those savings. These decisions, in turn, depend on the growth rate of real income, and possible changes in attitudes towards risk over the lifecycle.

This paper explores the impact on portfolio choice of accounting for both income risk and changes in risk aversion across time. We show that including these effects produces optimal splits between risky and risk free assets (glide paths) that depend upon investor -specific characteristics. Our work suggests that the efficiency gains from incorporating investor-specific characteristics can be up to 20% relative to a baseline case of no differences across investors. The achievement of these efficiency gains depends in part on effective portfolio construction; risk management; identification of growth-sensitive and defensive strategies, and cost management.

More concretely, our results suggest that:

- Income risk is most important for investors who are in the later stages of their working lives.
- Investors in the early stages of their careers should overweight growth sensitive factors and sectors.
- Investors in the later stages of their careers, and retired workers should overweight defensive factors and sectors.

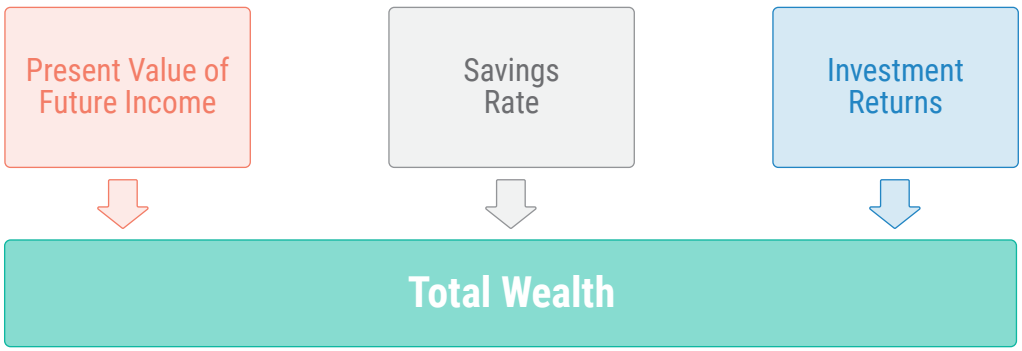
The next section of this paper illustrates the role of income growth in the accumulation of financial assets. Section 3 discusses the impact of income risk on basic glidepaths, while Section 4 addresses the impact of attitudes towards risk on factor allocations over time. Section 5 shows the impact on portfolio choice of including both income risk and changing attitudes towards risk.

02. The Role of Income Risk

Income and income growth play important roles in thinking about wealth and portfolio construction. Decisions about consumption and saving rely on the path of income. Since current consumption depends on not just current income but also the path of future income, financial economists view an investor's wealth at any point in time as reflecting the present value of future income and the value of their investment portfolio. Exhibit 1 illustrates the relationship between income growth, investment returns and wealth.

If savings rates (deferred consumption) are positive, and long run expected asset returns are also positive, then over time the percentage of wealth attributable to future income versus an investment portfolio should shift. For example, contrast a new entrant to the workforce with a retired worker. The new entrant to the workforce has no financial assets, but has a long period of labor force participation in front of them. All of this worker's wealth comes from the present value of future income. By contrast, a retired worker has no future income, but has (in principle) financial assets. Consequently, all of the retired worker's wealth comes from the value of their financial assets. For the purposes of investment strategy, the issue is determining the point at which income risk should be reflected in portfolio construction.

Exhibit 1 - Wealth Accumulation Has Multiple Sources

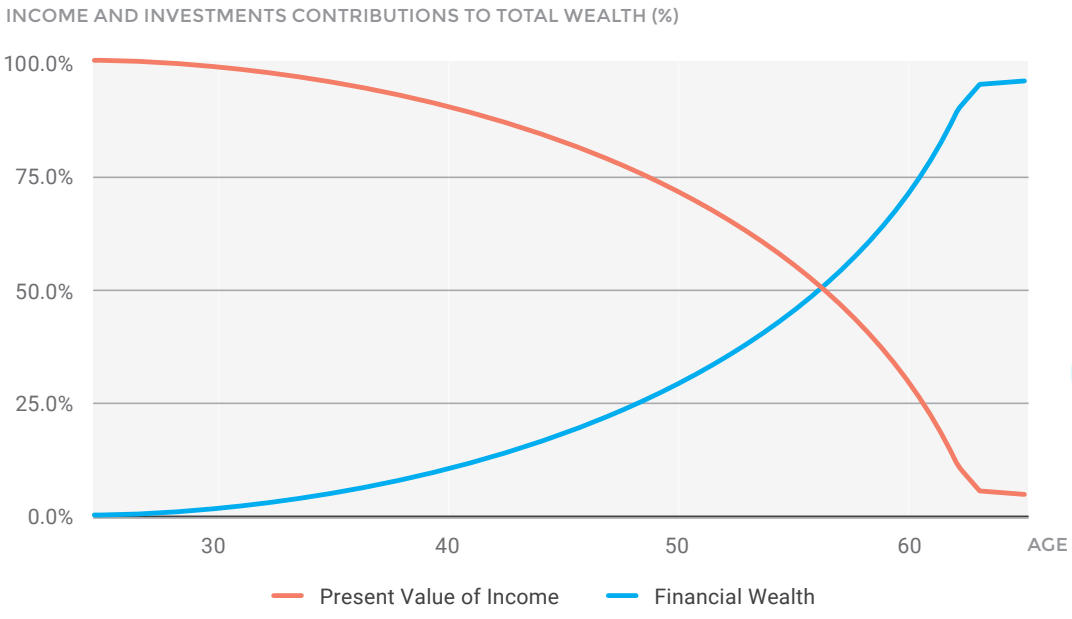


To illustrate the issue, let's focus on a simple example. This example traces out the change over time of the allocation of wealth to labor income versus financial assets. In our example, real labor income is assumed to grow at 2.5% annually; annual real investment returns are assumed to be 3.5%; future income is assumed to be discounted at a 2.0% real rate. The investor is assumed to spend 40 years in the workforce and to have a retirement period of 20 years. Furthermore, the investor is assumed to save 15% of annual income. The savings rate was chosen to produce a retirement income equal to 60% of the final year's income.

Exhibit 2 shows how the composition of wealth changes as the investor ages. In this example, the present value of future income is the dominant source of wealth until the investor is around 50 years old. Moreover, financial wealth represents roughly 40% of total wealth when the investor reaches age 53, and exceeds 50% of total wealth when the investor reaches age 58.

Exhibit 2 raises two interesting questions, both prompted by the observation that income growth and investment returns depend on real economic growth. The first question is the point in the career cycle at which investment strategy should explicitly consider the correlation between income growth and economic growth. The second issue is whether (and when) the investor should rebalance between investment strategies that are more (or less) highly correlated with economic growth. Each of these issues is discussed below.

Exhibit 2 - The Impact of Labor Income Declines Over Time



03. Incorporating Income Risk Into Glide Paths

The issue that we analyze in this section is the impact on the split between bonds and equities of income risk. We start our analysis with a base case glidepath that shows the split between bonds and equities when there is no income risk. We then add in income risk. Finally, we assess the impact of including sector-specific income risk. Our main conclusion is that relative to the base case glidepath, investors should hold more bonds throughout the working period, and should reduce their exposure to sector-specific equity risk.

To focus on the impact of adding income risk, we assume that asset returns are drawn from a stable distribution. Appendix A shows the expected return, risk and correlation assumptions that we used for our analysis. Furthermore, in all three of our examples we assume that the investor begins working at age 25 and retires at age 65. Thus, in all of our examples, income is zero after age 65. The implication of this assumption is that portfolio choice will depend on income risk only during the working period.

In our analysis, allocations to bonds and equities are driven by changes in attitudes towards risk across the life cycle.[1] We assume that investors who are early in their careers are less risk averse than those who are in retirement. And, we center our assumptions about attitudes towards risk so that mid-career investors (those in the 45-55 age group) hold the market portfolio.[2] The second assumption is an equilibrium assumption, in the sense that overweight positions (relative to capitalization weights) by one set of investors are offset by underweight positions by other groups of investors.

[1] There are other ways to generate glide paths. For example, we can assume that investors are finitely-lived and that income has a jump-discontinuity at retirement. This kind of set up solves for a path for asset holdings as of the first day of work. In this structure, the driver of the declining proportion of risky assets is the present value of future income. Our set up finds portfolio holdings at each date across time.

[2] In our set up, investors are assumed to have recursive preferences, and more specifically, Epstein-Zin preferences. These preferences separate the impact of risk aversion from the impact of the timing of cash flows. The latter effect is controlled with the Elasticity of Intertemporal Substitution (EIS). In our work, we assumed that the EIS is approximately 1.0.

Exhibit 3 shows a glide path for the split between bonds and equities, under the assumption of no income. This glide path is our baseline glide path. As expected, the investor has a very small allocation to bonds in the early years of working. During the early period of retirement (65-75), equity holdings decrease to roughly 50% of the total portfolio. And, at age 85, equity holdings decrease again, to approximately 35% of the total portfolio. To reiterate an earlier point- the portfolio allocations in the baseline glide path are generated by changing attitudes towards risk.

As discussed in the previous section, total wealth depends not only on the returns to financial assets, but also the growth and volatility of income. And, if income growth is correlated with the returns to financial assets, then the risk of total wealth will be affected by income risk.

Exhibit 3 - Equity Allocations Decrease Over Time in the Basic Glidepath

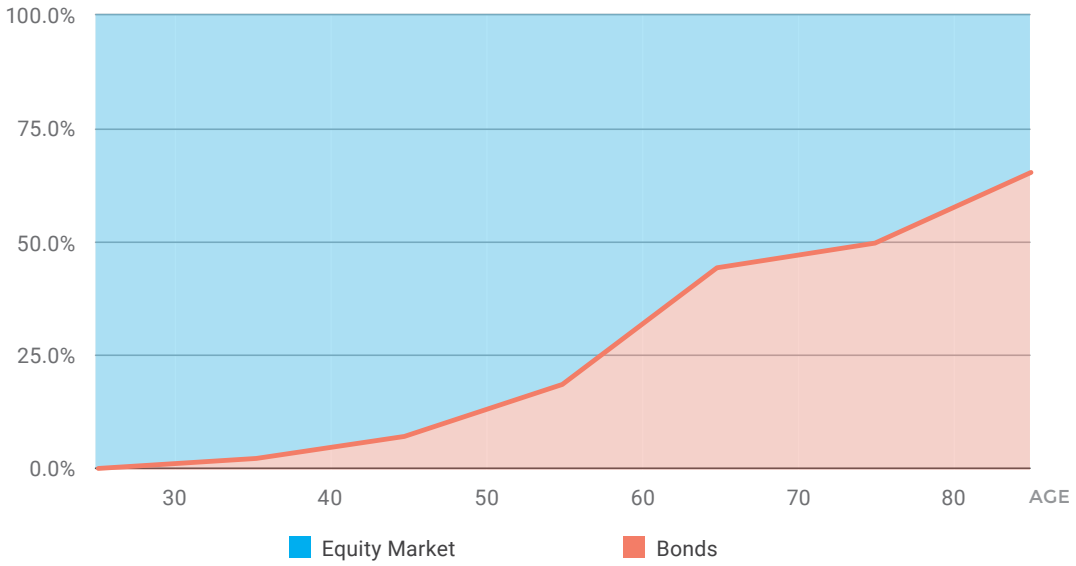


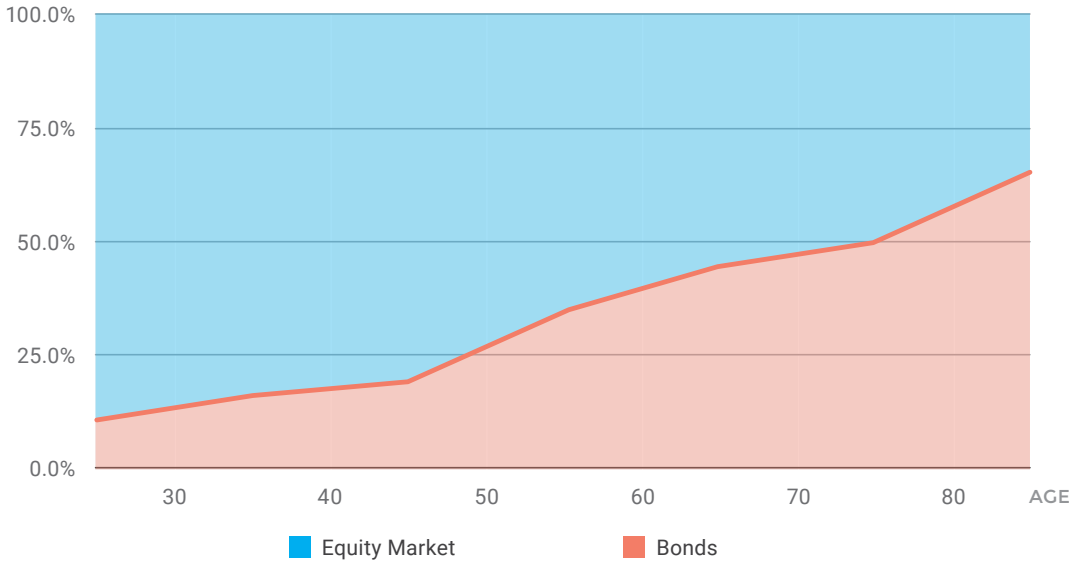
Exhibit 4 shows the income betas, sorted by age and income level. The data in the exhibit are taken from recent work by Guvenen et al (2017). In addition to income betas for the representative worker, the exhibit includes income betas for the finance and technology sector. The following points are evident from the exhibit:

- Positive income betas suggest that income risk plays a role in the risk of total wealth
- The effect of income risk varies across age and income levels.
- Employment sector can have an impact on income risk.

Exhibit 4 - Income Risk Varies by Age, Sector and Income Level

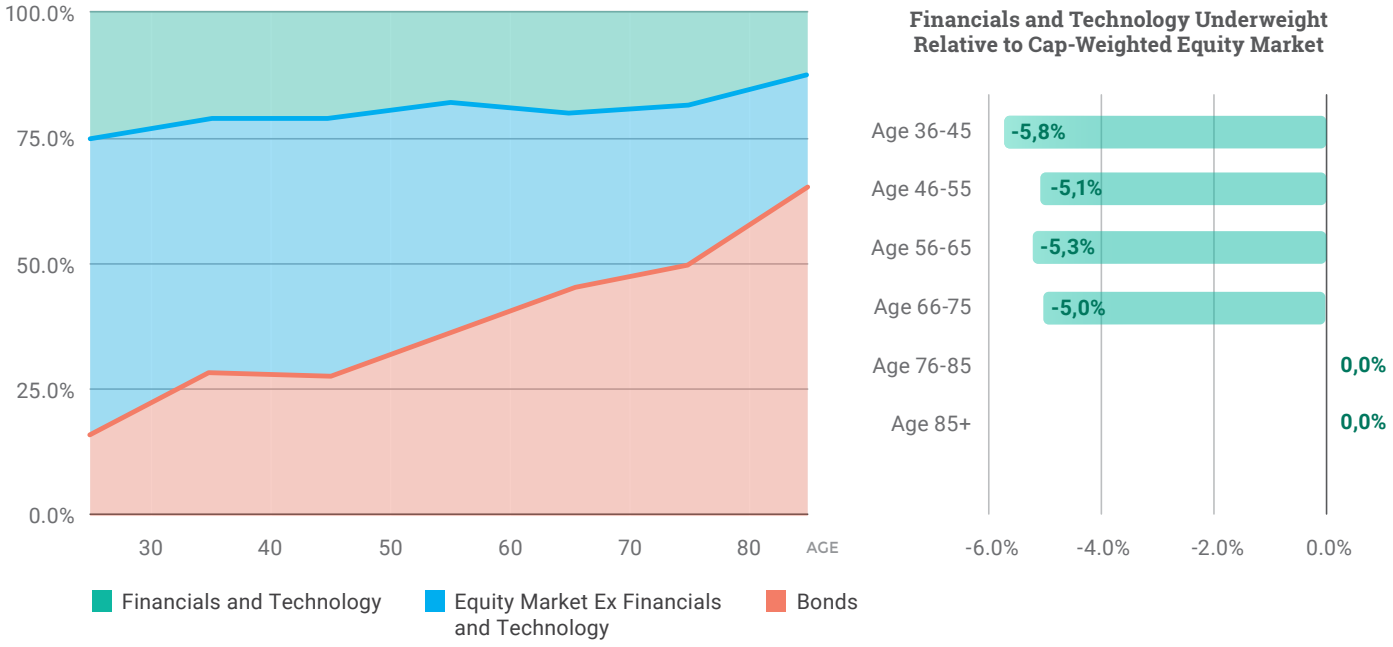
The effect of including income risk on the glide path is shown in Exhibit 5. The positive correlation between income risk and the return to risky assets shifts the portfolio allocation away from equities and into bonds throughout the working period. And, since the investor has no income in retirement, the portfolio allocation is the same as in the baseline case.

Exhibit 5 - Incorporating Income Risk Increases the Bond Allocation



In Exhibit 4, investors in the finance and technology sectors had higher income betas than the all-sector betas. Exhibit 6 shows the impact on the glide path of using the finance/technology income betas rather than the all-sector income betas. The higher income betas for finance/technology workers translate into yet higher allocations to bonds early in the working period. However, in this case the investors equity allocation is underweight exposure to finance and technology stocks. As in the previous case, the post-retirement portfolio allocations are the same as the base case.

Exhibit 6 - Sector-Specific Risk Is Hedged with Equity Sector Allocations



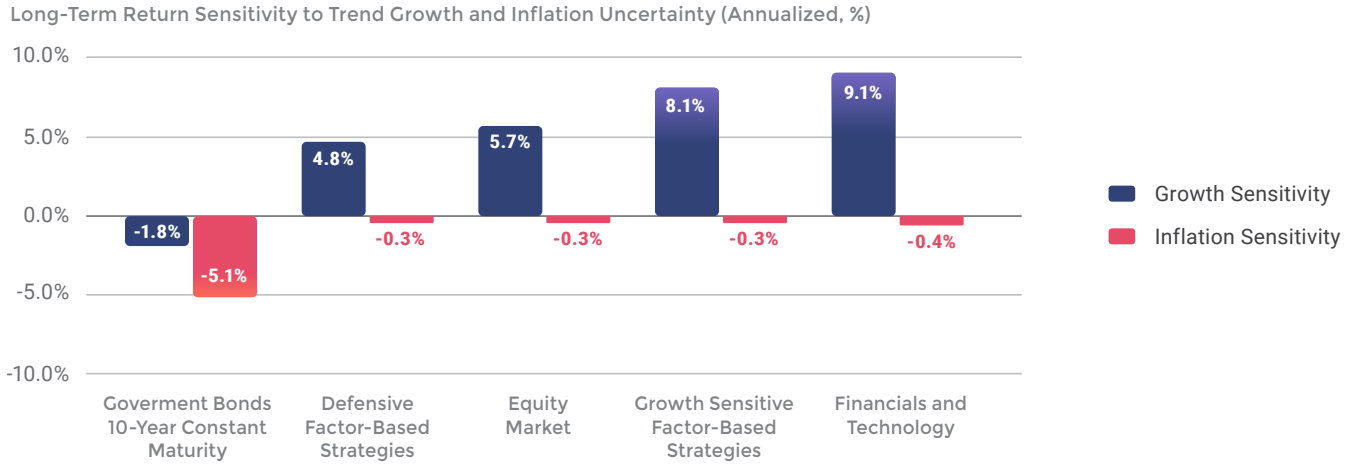
04. Differentiating Macro Risk Across Time

The literature on factor premiums has shown that historically, value and small cap stocks have generated premiums (relative to pure CAPM pricing). One explanation for these premiums is that cash flow growth for small cap and value stocks is more sensitive to shocks to real economic growth than large cap and growth stocks. Thus, time periods where shocks to growth are positive and above trend have tended to be associated with higher excess returns to small cap and value stocks (relative to large cap and growth stocks).

By contrast, the principal driver of historical returns to nominal government bonds has been shocks to inflation. Unexpected and persistent positive shocks to inflation have historically been associated with negative bond returns (and vice versa). Positive shocks to real growth have historically been associated with increased real (and nominal) bond yields, and consequently negative nominal (and real) bond returns.

Exhibit 7 shows five portfolio strategies that are categorized according to their exposure to shocks to real growth. In addition to long-duration government bonds and capitalization-weighted equities, the exhibit includes a portfolio concentrated in finance and technology stocks, a portfolio that is skewed towards positive real economic growth, and a portfolio that is tilted towards below-trend real economic growth. How should investors vary their allocations to these strategies across the lifecycle?

Exhibit 7 - Portfolio Strategies Vary in Their Exposure to Economic Growth



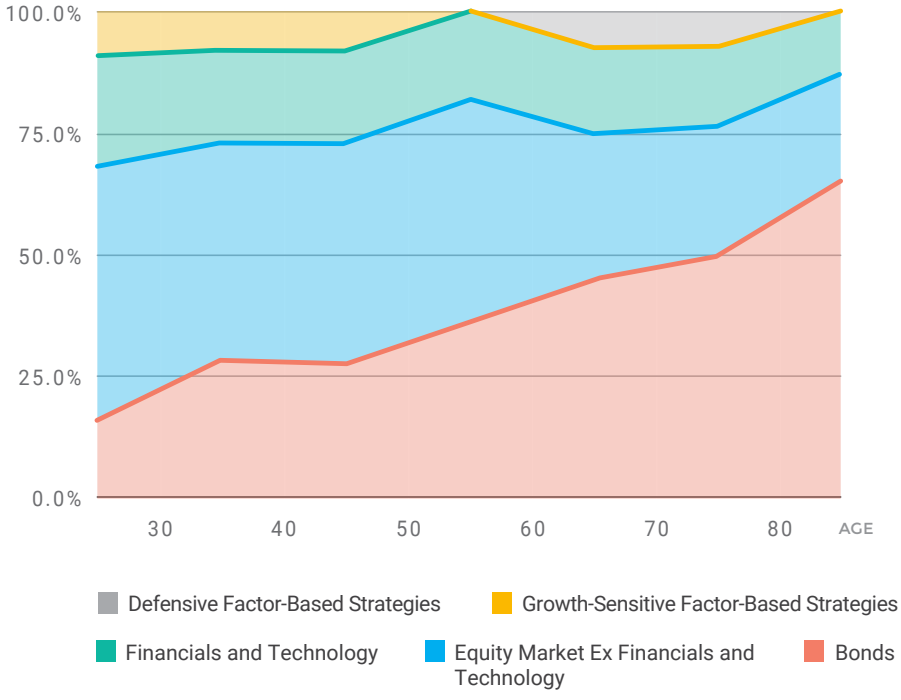
The previous section motivated changes in the split between bonds and equities as a function of changes in attitudes towards risk across the lifecycle. Let's take this one step further and suppose that attitudes towards risk reflect a willingness to withstand significant negative shocks to real economic growth. When such shocks occur, two natural questions for investors are: first, how long will the shock last and second, will real growth revert to its long-term trend.

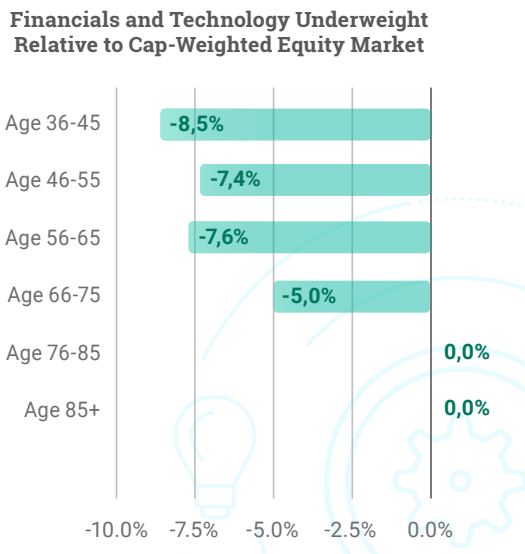
Unfortunately, the answers to these questions are only revealed over long time periods. A reasonable hypothesis is that long-horizon investors (e.g. those early in their careers) have more capacity to withstand such shocks than retirees. Thus, we can link attitudes towards risk to willingness to withstand economic shocks. And, because asset classes and strategies can be linked to their exposure to macroeconomic shocks, we can link them to portfolio choices across the life cycle.

Exhibit 8 summarizes the impact on portfolio allocations of including macro-sensitive strategies and income risk into decisions about portfolio allocations. Relative to the baseline glidepath, including macro-sensitive strategies and income risk leads to:

- Higher bond allocations across the working period
- Reduced allocations to equity sectors with high correlations to income risk
- Higher allocations to growth-sensitive strategies early in the working period
- Higher allocations to defensive strategies later in the working period and in retirement

Exhibit 8 - Factor Exposures Vary Across the Lifecycle





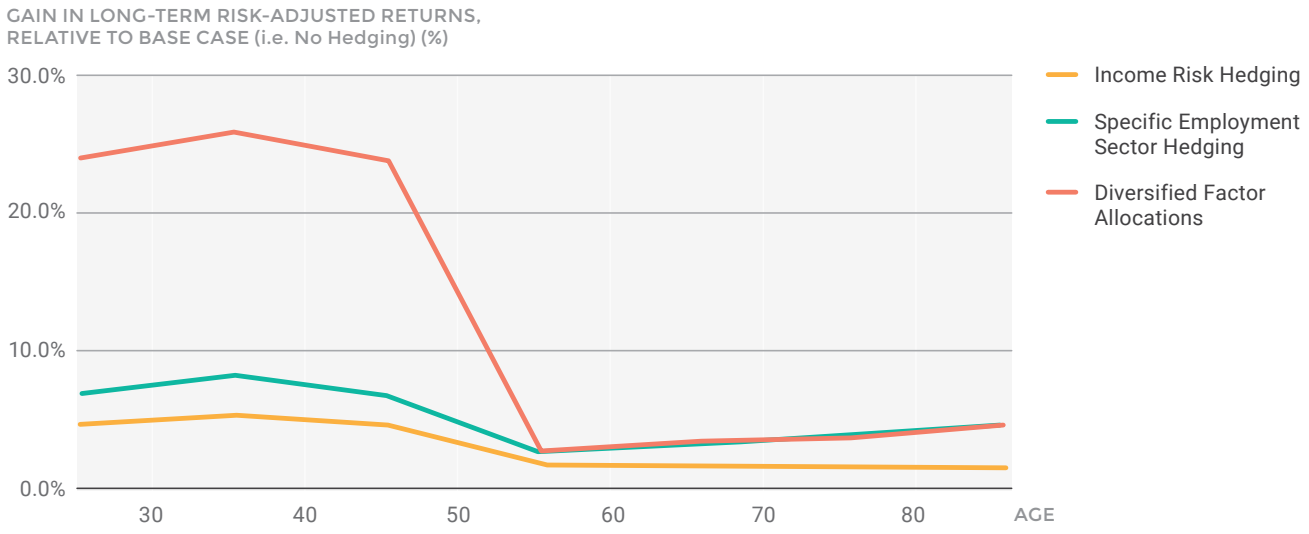
05. Impact of Combining Income Risk and Macro Risk

The effect of including income risk and macro risk can be analyzed through the impact on long-run expected return and long-run risk. Exhibit 9 summarizes the impact on expected return, while Exhibit 10 summarizes the effects on portfolio risk. The figures in the exhibits are changes relative to the baseline glide path.

The effects of including factor risk (i.e. increasing exposure to strategies that are sensitive to macroeconomic shocks) are to increase expected returns early in the life cycle, and to slightly reduce risk across the lifecycle. The reason for this is because a tilt towards macro-sensitive strategies is, by definition, a tilt towards strategies that perform well when the economy experiences above trend growth. Investors who choose these strategies should be compensated for the risk. Early career investors have an investment horizon that is potentially long enough to realize such returns.

As Exhibit 9 illustrates, the expected return benefit decreases with age. The reason the benefit decreases is because the shorter horizon of late career

Exhibit 09 - Factor Exposure Is Important In the Asset Accumulation Phase



investors and retirees favors strategies that are defensive with respect to macroeconomic shocks. These types of strategies have lower expected returns than strategies with high exposure to economic growth.

Incorporating income risk has a small effect on total portfolio return (as illustrated in Exhibit 9). However, as shown in Exhibit 10, the impact on portfolio risk is quite significant during the working period. Depending on the employment sector, portfolio risk can be reduced by 10-20% relative to the baseline glidepath. Moreover, the effect of including income risk dramatically increases in the later stages of the working years.

Exhibit 10 - Hedging Income Risk Is Important Mid-to-Late Career

06. Implications and Conclusions

This paper has discussed portfolio choice problems across the lifecycle. The paper posited that investor attitudes towards risk change across the lifecycle. Furthermore, the paper showed that decisions about investment portfolios cannot be separated from the sources of income. In our analysis, the risk to total wealth depends on financial returns and labor income.

Our conclusion is that investors would be served by dynamically changing their portfolio allocations through the lifecycle. In particular, our analysis suggests that:

- Wealth volatility can be reduced by incorporating income risk in portfolio choice.
- Early career investors can gain by tilting to strategies that are sensitive to macroeconomic growth
- Late career investors and retirees can gain by tilting towards strategies with lower correlation to macroeconomic growth.

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APPENDIX - LONG-TERM RISK AND RETURN ASSUMPTIONS

The table below shows the long-term risk and return assumptions used in our analysis. To find our long-term risk and return assumptions, we used an equilibrium asset pricing model. That model finds both risk and return in two steps: first, we find the value of any asset as the discounted value of current and future cash flows. Second, we assess the impact of macroeconomic shocks on both discount rates and cash flow growth. This set up means that asset (or strategy) premiums can vary with their exposure to economic growth. For example, strategies that have high exposure to real economic growth will have returns that are more significantly dependent on above trend economic growth.

Table 1 shows the model-based, long-term return and risk for 10-year zero-coupon government bonds, market-cap equity, financial/technology equity, a growth-sensitive equity portfolio and a defensive equity portfolio. Table 2 shows the model-based long-term correlations for the same portfolios. The growth-sensitive and defensive portfolios were determined through equity allocations that were more (or less) exposed to real economic growth.

Table 1 - Model-Based, Long-Term Return and Risk

	Long-Term Return (Annualized, %)	Long-Term Risk (Annualized, %)
10-Year Goverment Bonds	2.3%	10.6%
Equity Market	7.4%	12.1%
Financials and Technology	9.7%	18.2%
Growth-Sensitive Portfolio	11.3%	16.7%
Defensive Portfolio	6.8%	10.0%

As such, these portfolios represent tilts away from market-cap equities. In the case of the growth-sensitive portfolio, the tilts equally weight stocks with a strong bias towards value and small cap. Historically, real cash flow growth for these assets exhibits a larger beta to real economic growth, relative to market. Similarly, the defensive portfolio was constructed by equally weighting stocks characterized by higher dividend yield and profitability. Historically, real cash flow growth on these assets exhibits a lower beta to real economic growth, relative to market.

Table 2 - Model-Based, Long-Term Correlations

	10-Year Goverment Bonds	Equity Market	Financials and Technology	Growth-Sensitive Portfolio	Defensive Portfolio
10-Year Goverment Bonds	100.0%	-28.2%	-30.0%	-29.9%	-27.2%
Equity Market	-28.2%	100.0%	96.8%	94.9%	93.7%
Financials and Technology	-30.0%	96.8%	100.0%	98.0%	96.8%
Growth-Sensitive Portfolio	29.9%	94.9%	98.8%	100.0%	94.9%
Defensive Portfolio	-27.2%	93.7%	96.8%	94.9%	100.0%