



Default Investment Options in Defined Contribution Plans: A Quantitative Comparison

**The International Actuarial Association (IAA)
Conference, IACA/PBSS Section, Boston**

Gaobo Pang

Senior Economist
Research & Innovation Center, Watson Wyatt Worldwide

May 7, 2008

New developments in retirement finance and regulations

- Defined contribution (DC) plans and retirement prospects
 - More workers relying on DC plans as the primary source of retirement income outside of Social Security
 - Automatic enrollment to save regularly
 - Effective default investment to invest wisely
- Pension Protection Act of 2006 (PPA)
 - Creates a safe harbor for certain automatic enrollment arrangements in 401(k)s
 - Introduces qualified default investment alternatives (QDIAs) for participants who do not make an investment election
- DOL's QDIA regulation (effective Dec. 2007, proposed Sept. 2006)
 - Three QDIAs (only) are balanced funds, lifecycle funds (target-date) & managed account
 - Sponsors are generally relieved of fiduciary liability if a participant is defaulted into a QDIA

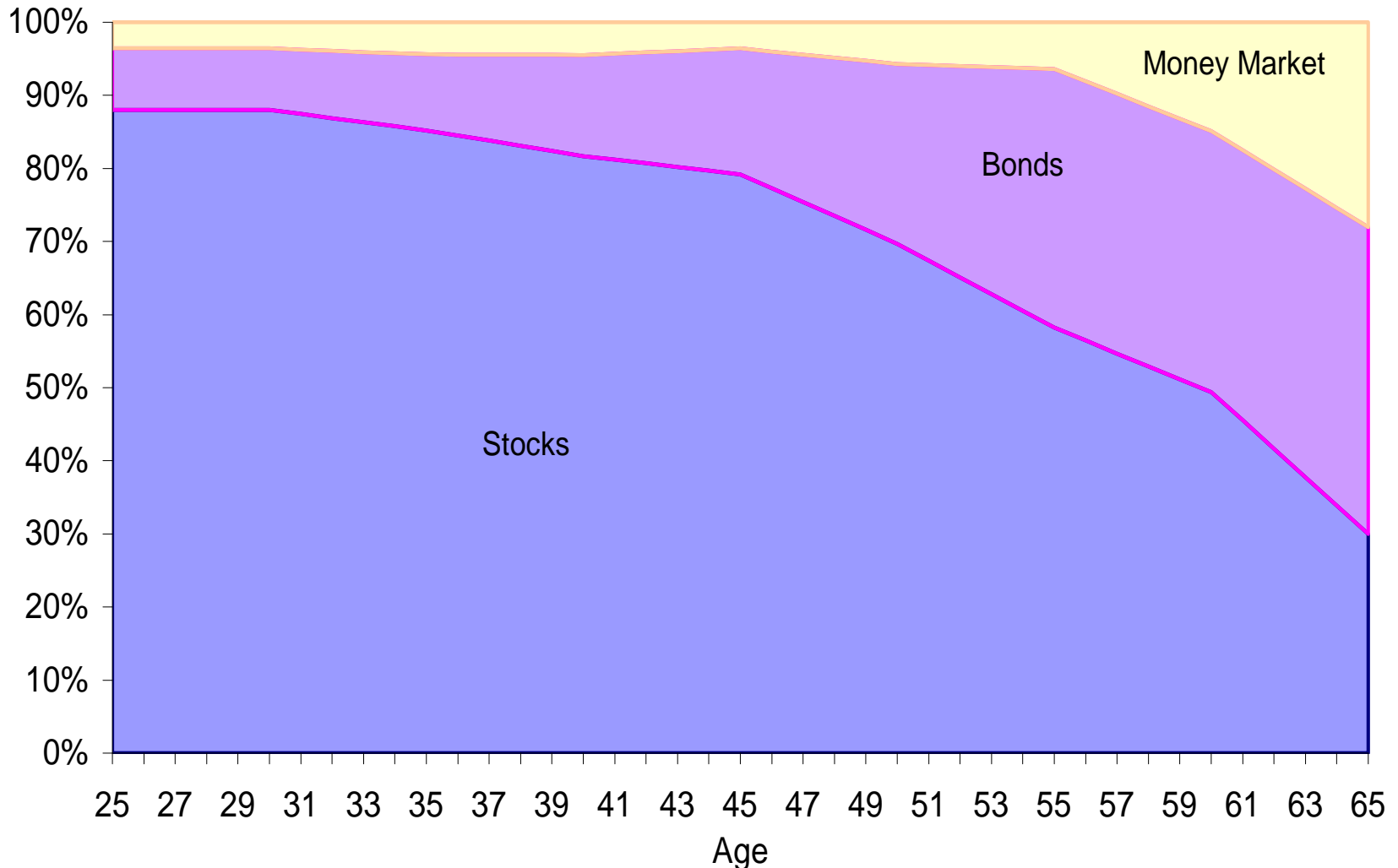
Default investment strategies: Will plan participants be better off or worse off?

- Lifecycle funds (QDIA 1)
 - Shift asset mix from riskier stocks to safer assets as participants get closer to retirement
 - Are collective and do not accommodate individual risk tolerance, specific preferences or worker characteristics
 - Have mushroomed in recent years: assets \$5.5 billion in 2000, over \$150 billion in 2007 (Porteba *et al* 2006, TIAA-CREF 2007)
 - Are preferred by most of large DC plan sponsors as the default investment option (Watson Wyatt survey, Nov. 2006)
- Balanced funds (QDIA 2)
 - Maintain a constant mix of equity and fixed-income instruments, independent of age or target retirement date
 - Hold asset allocations consistent with average preferences for risk and capital appreciation for participants as a whole
 - Traditionally a part of defined benefit plan management
- A highly risk-averse investment strategy (*not* a QDIA)
 - Treasury Inflation-Protected Securities (TIPS)

Comparing QDIAs: Average market asset allocations

- Three classes of assets: U.S. equities, government bonds and money market
- A market portfolio for the lifecycle fund
 - Age 25: 88% in equity, 8.4% in government bonds, and 3.6% in cash
 - Age 65: 30% in equity, 42% in bonds, and 28% in cash
 - See next slide for the glide path
 - Source: Poterba *et al* (2006) with interpolations and extrapolations between the fund target years
- A market portfolio for the balanced fund
 - 66% in equities, 26.4% in government bonds and 7.6% in money market
 - Source: weighted average of the 15 largest balanced funds, Morningstar, Dec. 2006

Lifecycle Fund Asset Allocations



Comparing QDIAs: Underlying asset returns

- A vector autoregressive (VAR) model captures co-movements of asset returns on stocks, bonds, and money market based on historical data 1960-2004
- The VAR coefficients are built in the simulations
- Historical annual mean and std. dev. of the real returns (i.e., subtracting actual inflation)
 - S&P500 equity return: (5.8%, 15.6%)
 - Long-term government bonds: (2.6%, 10.1%)
 - Money market return: (2.2%, 2.6%)
 - TIPS: 2.2% (average, based on data 2003-05)

VAR Estimation and Stochastic Simulations

$$V_t = \beta_0 + \sum_{k=1}^K \beta_k V_{t-k} + \mu_t \quad \mu \sim (0, \Sigma) \quad E\mu_t \mu_s = 0 \quad \text{for } t \neq s$$

- V: vector of returns on equity, bonds and money market
- VAR coefficients and covariance matrix capture serial and contemporaneous correlations among historical returns
- Returns are simulated by applying VAR Coefficients to previous returns plus current shocks according to $\hat{\Sigma}$

Estimated Variance-Covariance Matrix ($\hat{\Sigma}$)

	Stock	L-T Bond	Money Market
Stock	0.023398	0.00476	0.00079
L-T Bond	0.00476	0.006172	0.000401
Money Market	0.00079	0.000401	0.000332

Vector Autoregression (VAR) Estimation on Real Asset Returns, 1960-2004

	Coef.	Std. Err.
<i>Stock_t</i>		
Stock _{t-1}	-0.064	0.161
Bond _{t-1}	0.078	0.292
Money _{t-1}	1.361	1.115
Constant	0.041	0.032
<i>L-T Bond_t</i>		
Stock _{t-1}	-0.105	0.083
Bond _{t-1}	-0.415*	0.150
Money _{t-1}	3.103*	0.572
Constant	-0.023	0.017
<i>Money Market_t</i>		
Stock _{t-1}	0.004	0.019
Bond _{t-1}	-0.118*	0.035
Money _{t-1}	0.913*	0.133
Constant	0.004	0.004

Note: * indicates significance at 1%; insignificant otherwise.
Source: Authors' estimations.

A hypothetical long-career worker in a DC plan

- Working career: ages 25-65
- Earnings at age 25: \$40,000 in real terms
- Real annual salary raise: 4% before earnings peak at age 50, then 0% until retirement age 65
- Contribution to the DC account: 6% of annual pay (employer and employee combined)
- No plan leakages or service breaks (somewhat unrealistic but convenient assumptions)

Capital Appreciation and Preservation: Findings From Simulations

- Total contributions: \$202,000
- Age-65 terminal retirement wealth
 - TIPS investment: \$301,000
 - Lifecycle fund: 95% of the outcomes fall in \$174k - \$1.3m
 - Balanced fund: 95% of the outcomes fall in \$166k - \$1.4m

Terminal Wealth (\$1000) at Age 65: Comparing Balanced and Lifecycle Funds

Decile	<u>Median</u>		<u>Mean</u>		<u>Standard Deviation</u>	
	Balanced	Lifecycle	Balanced	Lifecycle	Balanced	Lifecycle
1	\$194.5	\$200.7	\$187.8	\$194.9	\$32.7	\$30.0
2	260.5	263.3	260.1	262.9	17.3	15.3
3	313.9	312.6	313.4	312.7	16.1	13.9
4	363.9	360.4	364.3	360.5	16.1	13.9
5	417.9	410.9	418.2	411.0	17.7	15.4
6	479.0	468.3	479.5	467.7	20.9	17.8
7	553.3	537.0	553.8	536.7	26.2	22.4
8	650.8	627.8	652.5	627.9	36.7	31.0
9	796.0	764.7	802.7	769.2	64.6	53.7
10	1136.2	1082.4	1254.6	1194.1	439.2	362.3
Overall	\$447.5	\$438.6	\$528.7	\$513.8	\$359.8	\$303.4

Capital Appreciation and Preservation: Findings From Simulations (cont.)

■ Capital appreciation

- The balanced fund outperforms the lifecycle fund for 53% of the time
- The balanced fund has a greater upward potential of wealth creation owing to its equity larger holdings at the end of working years when the portfolio is large
- Given the portfolio size in near-retirement years, a small percentage swing of investment return could mean a large amount of wealth lost

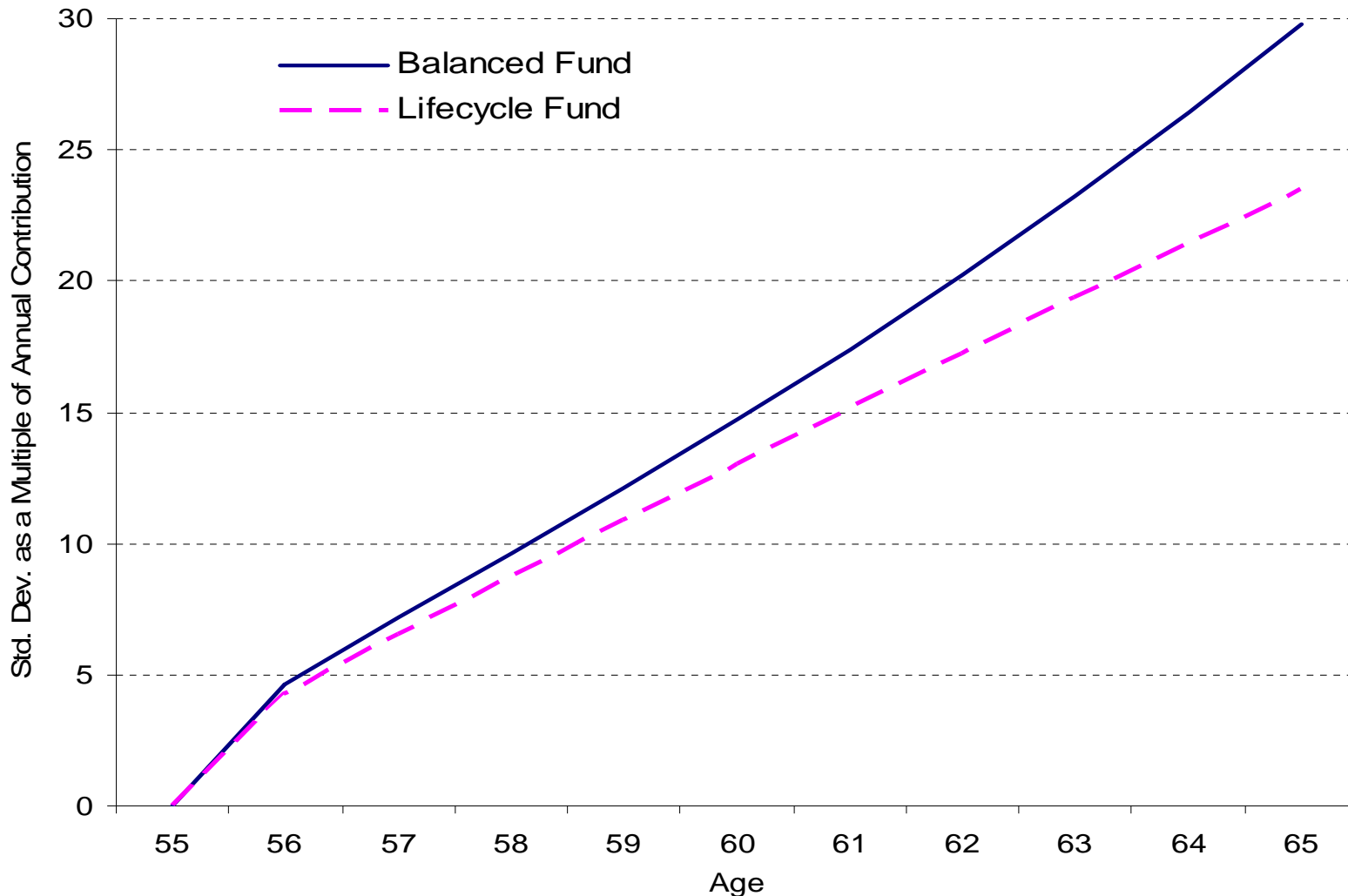
■ Capital preservation

- The lifecycle fund outperforms the balanced fund when the market is down

Investment risk in near-retirement years

- Look at investment strategies for the last 10 years (ages 55-65)
- Accumulated savings of \$250,000 at age 55 (approximately median value of the lifecycle and balanced funds at age 55)
- Annual contributions (\$6,400 yearly for 50-65)

How many annual contributions to make up the loss? Loss = one Std. Dev. of balance, 15% chance



Some notes about lifecycle funds

- “Human capital” theory supports lifecycle funds
 - Human capital (e.g., present value of future labor earnings) is usually more comparable to a bond
 - Human capital is larger (smaller) at younger (older) ages
 - Equity fraction of an individual’s financial wealth should start high and decline with age
 - Asset allocations should vary for riskier human capital, particularly if correlated with equities
- Often-neglected weakness of the average lifecycle fund
 - Assets shift rapidly to money market near retirement
 - Less hedging opportunities and considerable exposure to volatility in annuity prices arising from movement in interest rates

Concluding remarks

- The balanced fund
 - Is slightly more likely to outperform the lifecycle fund, but
 - Its more aggressive portfolio leaves plan participants more vulnerable to losses while retirement approaches
- The lifecycle fund
 - Is better at safeguarding wealth in a downward market
 - Is still doing a reasonable job of building wealth
 - However, may forgo hedging opportunities for the purchase of immediate life annuities.
- Neither fund is a sure win over TIPS, though expected to outperform
- When designing or selecting default investment options, should consider the above investment implications as well as
 - Participants' wage patterns, risk tolerance, fund fees, and availability of DB and Social Security benefits