Turning BP's into Bucks: A Quantitative Method for Transforming Yield Curve Swings into Income Streams

Quantitative Investment Association
The Jonathan Club

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Enhancing a Fixed Income Portfolio

Alternatives are Limited to the Usual Suspects

- **Take directional risk**
  - Analytical tool: Rate forecasting
  - Implementation: Duration management
- **Take quality risk**
  - Analytical tool: Credit analysis
  - Implementation: Corporates and riskier governments
- **Take foreign risk**
  - Analytical tools: Country risk analysis, currency forecasting
  - Implementation: Sovereign debt, currency hedging
- **Take contingent claim risk**
  - Analytical tool: Embedded and explicit option analysis
  - Implementation: Callables, MBS's, futures and options

Enhancing a Fixed Income Portfolio

Exploiting a Randomly Filtered Long/Short Strategy

INVESTMENT PROCESS

- Zero Mean
- Symmetric Distribution

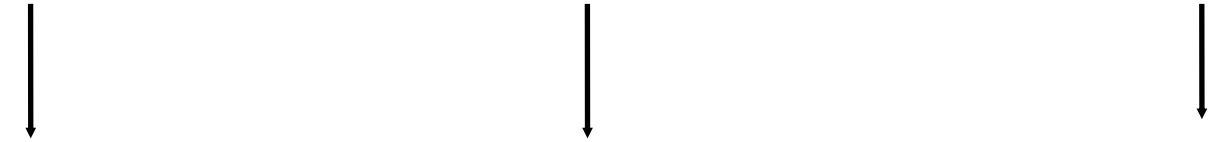
BINARY CHOICE MODEL

- Accuracy in Excess of 50%
- No Directional Bias
- Randomly Correct

FLEXIBLE INSTRUMENT

- Freedom to do Long/Short
- Tracks the Investment Process

INDEX-ENHANCING OVERLAY



BENEFIT #1

Very Low Correlation to Underlying Investment Process

BENEFIT #2

Value-Added in Proportion to the Accuracy of the Binary Choice Model

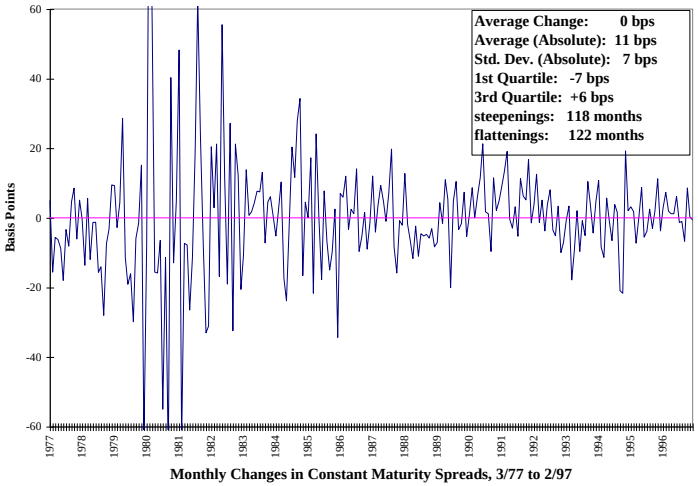
BENEFIT #3

Near Zero Cost Outlay to Implement

Yield Curve Spread Changes

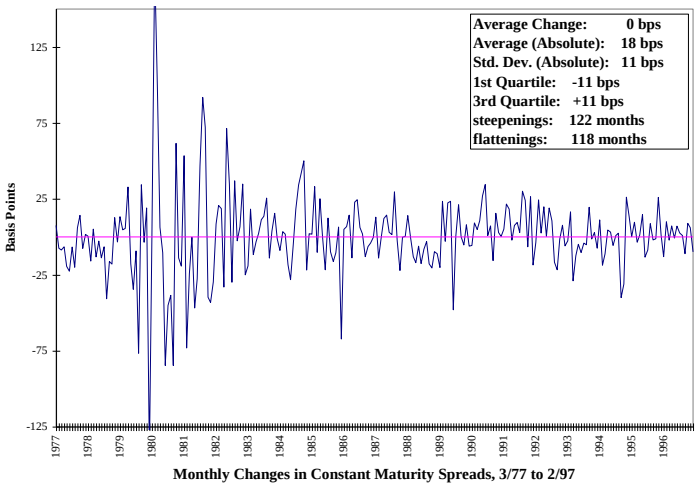
A Zero-Mean Symmetric Investment Process?

2 Year vs. 5 Year Treasuries
Monthly Yield Spread Changes



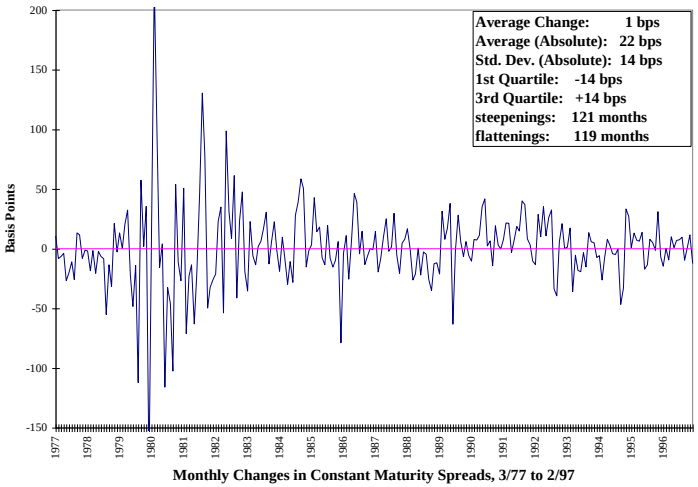
Monthly Changes in Constant Maturity Spreads, 3/77 to 2/97

2 Year vs. 10 Year Treasuries
Monthly Yield Spread Changes



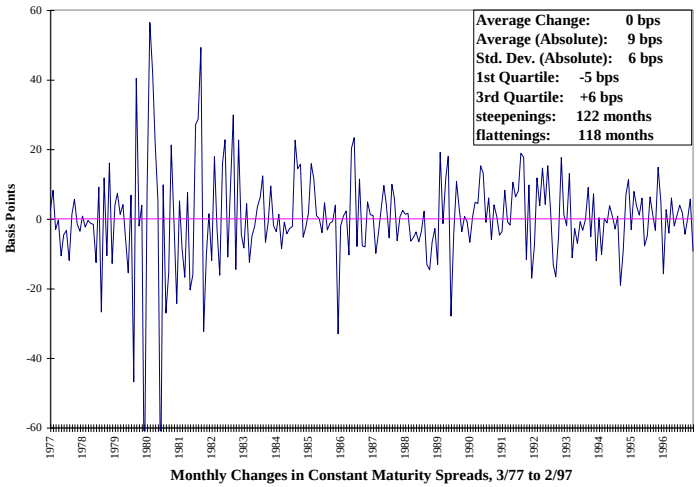
Monthly Changes in Constant Maturity Spreads, 3/77 to 2/97

2 Year vs. 30 Year Treasuries
Monthly Yield Spread Changes



Monthly Changes in Constant Maturity Spreads, 3/77 to 2/97

5 Year vs. 10 Year Treasuries
Monthly Yield Spread Changes

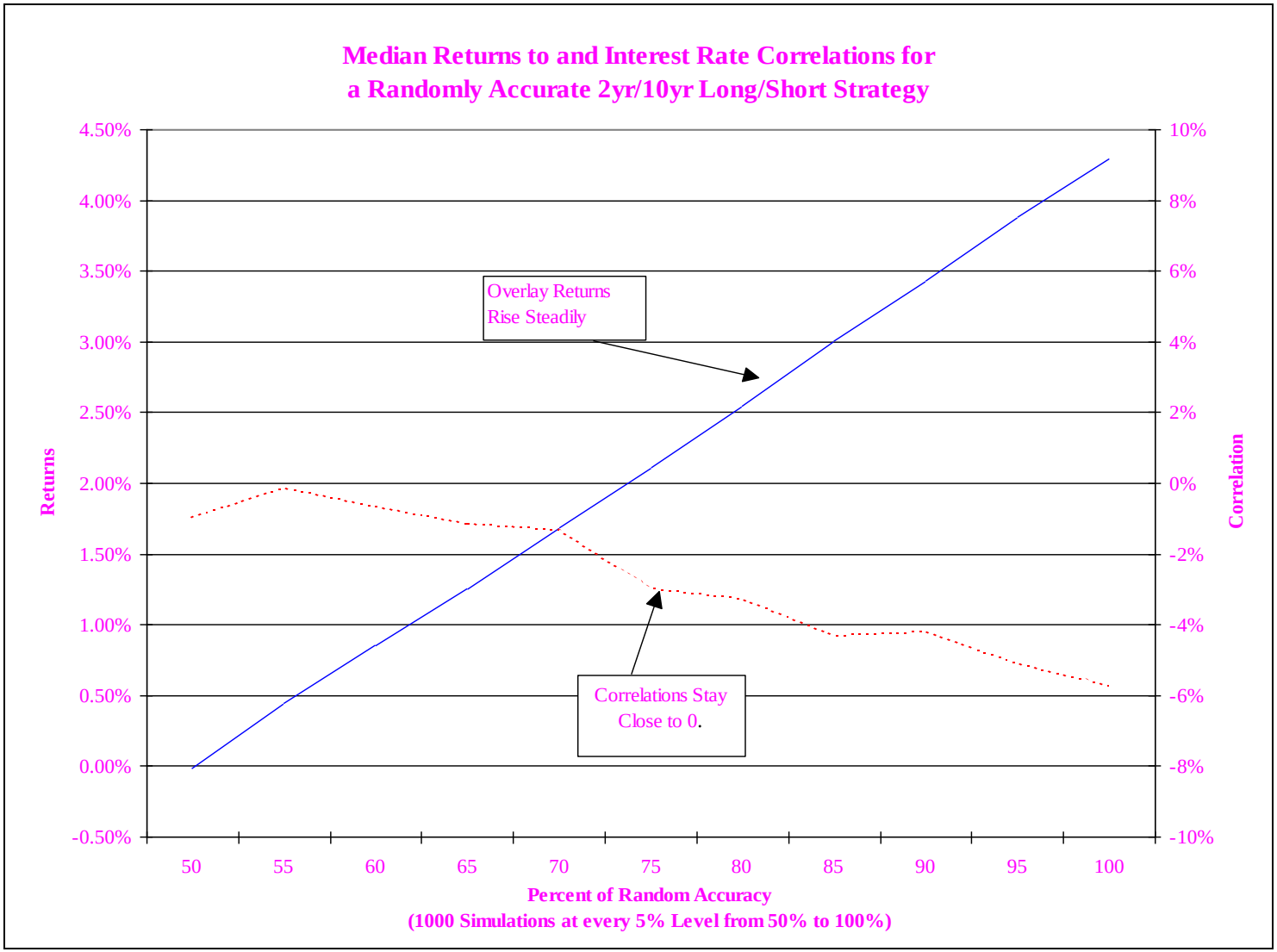


Monthly Changes in Constant Maturity Spreads, 3/77 to 2/97

Note: All spread changes are calculated as the convergence of the one-month forward spread at the end of the previous month to the spot spread at the end of the current month.

Yield Curve Spread Changes

Simulated Results of a Randomly Successful Long/Short Filter



Correlations in Practice

Spread Change vs. Yield Change Correlations are Strong…

	CORRELATION MATRIX Monthly Yield Curve Changes vs. Monthly Yield Changes (Forwards Converging to Spots One Month Later)									
	2yr/3yr (Jun 76)	**2yr/5yr (Jun 76)**	**2yr/10yr (Jun 76)**	**2yr/30yr (Mar 77)**	**3yr/5yr (Jan 62)**	**3yr/10yr (Jan 62)**	**3yr/30yr (Mar 77)**	**5yr/10yr (Jan 62)**	**5yr/30yr (Mar 77)**	**10yr/30yr (Mar 77)**
2 Year (Jun 76)	-54%	-63%	-78%	-83%	-54%	-76%	-81%	-72%	-79%	-63%
3 Year (Jan 62)	-41%	-53%	-71%	-78%	-54%	-74%	-79%	-69%	-78%	-64%
5 Year (Jan 62)	-35%	-41%	-62%	-70%	-38%	-65%	-72%	-67%	-76%	-62%
10 Year (Jan 62)	-29%	-33%	-46%	-56%	-29%	-44%	-58%	-43%	-61%	-58%
30 Year (Feb 77)	-25%	-27%	-38%	-43%	-21%	-38%	-43%	-41%	-45%	-37%

Dates of initial starting point for each time series are in parentheses. Correlations are performed on the period of overlap between each correlated pair.

Correlations in Practice

Once Filtered, Correlations to Bond Market Become Small…

CORRELATION MATRIX

Analytic•TSA Yield Curve Management Program vs.:

	Major Bond Market Return Indices							
	Lehman Govt/Corp	**JP Morgan**		**Salomon Brothers US Govt Bond Indices**				
		US Govt.	Global Govt.	1 Year +	1 Yr - 3 Yr	3 Yr - 7 Yr	7 Yr - 10 Yr	10 Year +
2yr/5yr	4%	2%	-9%	3%	-2%	-2%	3%	9%
2yr/10yr	-14%	-13%	-9%	-14%	-9%	-11%	-15%	-14%
2yr/30yr	12%	15%	5%	14%	20%	19%	12%	7%
Equal Wgt	2%	4%	-4%	3%	7%	6%	2%	1%

Correlations in Practice

In Fact, Correlations to Most Asset Class Returns are Low

CORRELATION MATRIX Analytic•TSA Yield Curve Management Program vs.:								
Other Assorted Measures and Indices								
	Yield Curve Program Performance				**S&P 500 Return**	**US Dollar Trade Wgt.**	**MS Equity Indices**	
	2yr/5yr	2yr/10yr	2yr/30yr	Equal Wgt.			EAFE	World
2yr/5yr	100%	16%	-9%	36%	26%	17%	-4%	5%
2yr/10yr	16%	100%	50%	82%	-19%	-2%	-1%	-7%
2yr/30yr	-9%	50%	100%	81%	-10%	0%	0%	-4%
Equal Wgt	36%	82%	81%	100%	-6%	4%	-2%	-3%

Predicting Yield Spread Changes

An Application of Qualitative Choice Models

1. We define: $\mathbf{Y_i} = \begin{cases} 1 & \text{If Spread Widens in Period } i \\ 0 & \text{If Spread Narrows in Period } i \end{cases}$

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2. We seek to find β for:

$$\mathbf{PROB(Y_i = 1 | X) = F(X_i'\beta)}$$
$$\mathbf{PROB(Y_i = 0 | X) = 1 - F(X_i'\beta)}$$

Where:

$\mathbf{X}$ = fundamental factors

β = factor weights

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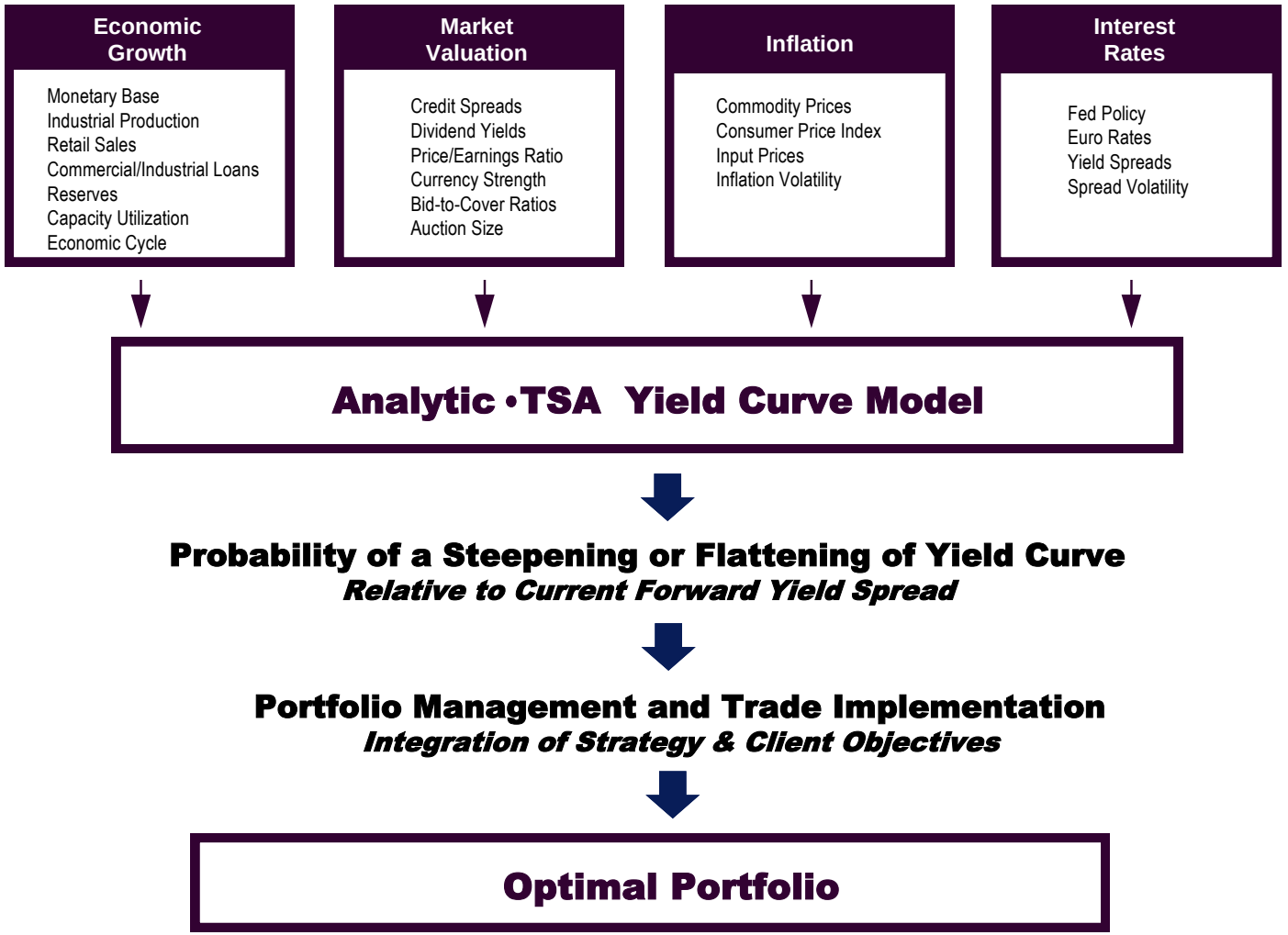
3. We solve for β by maximizing:

$$\ln(\mathcal{L}) = \sum_{i=1}^{n}\left[Y_i \cdot \ln\left(F\left(X_i'\beta\right)\right) + \left(1 - Y_i\right) \cdot \left(1 - \ln\left(F\left(X_i'\beta\right)\right)\right)\right]$$

Predicting Yield Spread Changes

Variable Selection and Implementation

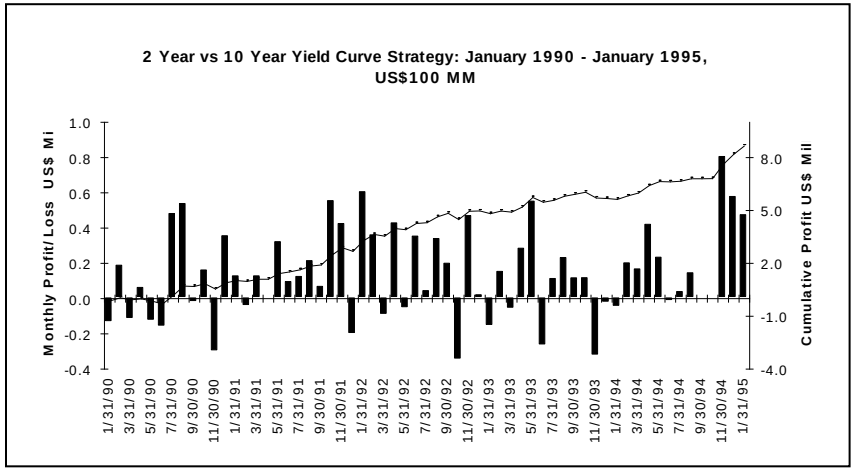


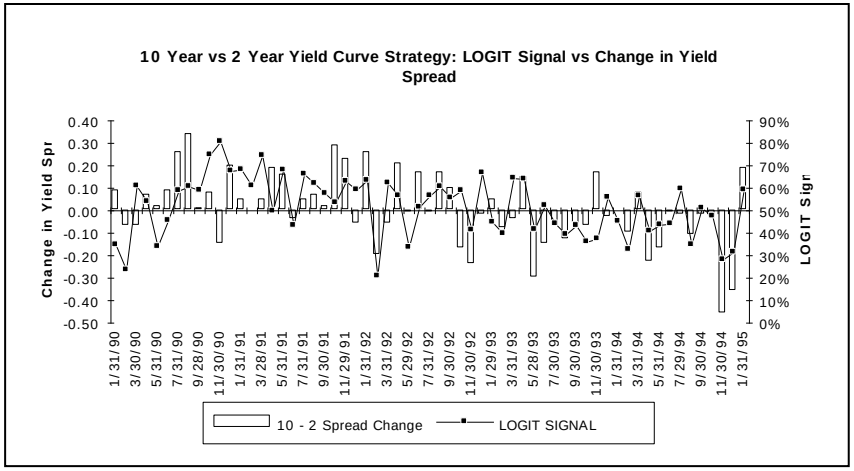
Strategy Implementation

2Yr/10Yr Model Simulation with Equal Positions

	$100 MM	%
Strategy Total Return	$ 8,655,300	9.01
Average Annualized Return		1.74
Average Trade	$ 141,890	0.14
Maximum Drawdown	$ 404,227	0.43
Hit/Miss Ratio (50% Filter)	69%	
Perfect Foresight Total Return	$ 14,138,000	15.16

Filter	Hit ratio	Per Trade	# Trades
70%	83%	$221,625	6
66%	80%	$192,113	15
62%	71%	$160,496	24
58%	70%	$178,899	40
54%	70%	$152,909	54





1. **Estimation period: 7/76 to 12/89**

2. **Out-of-sample backtest period: 1/90 to 1/95**

Strategy Implementation

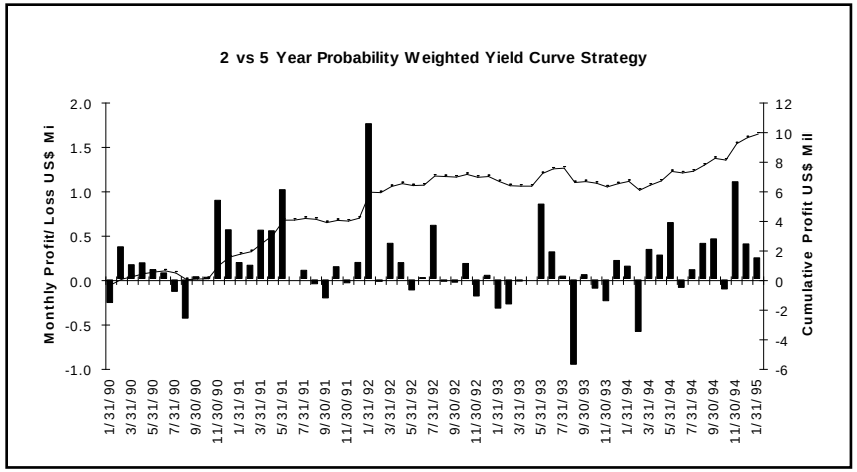
Backtest Results with Varying Positions

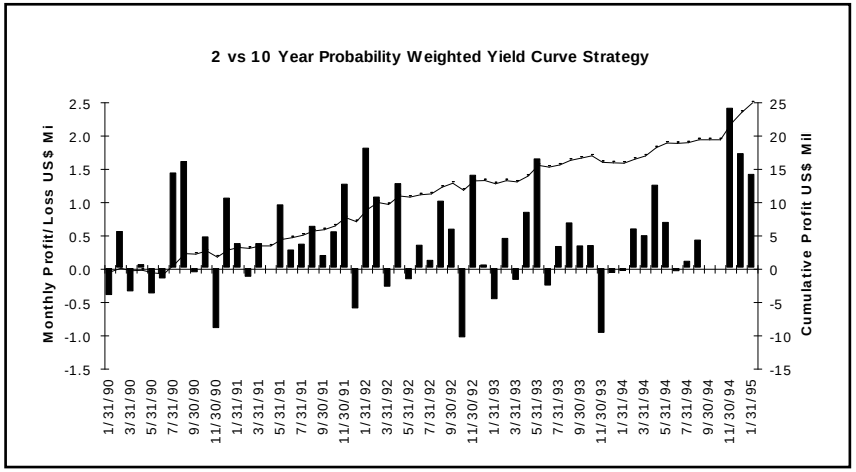
2 Year vs 5 Year Strategy

Strategy Total Return US$ 100MM	**$ 9,910,000**
Average Trade	**$ 160,000**
Maximum Drawdown	**$ 970,000**
Scaling Filter	**60%**
Scaling Factor	**3x**

2 Year vs 10 Year Strategy

Strategy Total Return	$ **24,990,000**
Average Trade	**$ 410,000**
Maximum Drawdown	**$1,050,000**
Scaling Filter	**55%**
Scaling Factor	**3x**





1. **Estimation period: 7/76 to 12/89**

2. **Out-of-sample backtest period: 1/90 to 1/95**

Simulated Performance Summary 1990 - 1996

		3-Way Equal Weighted	2 Yr/5 Yr	2 Yr/10 Yr	2 Yr/30 Yr
1990	Q1	-0.10	-0.09%	-0.07%	-0.14%
	Q2	0.06	0.34	-0.23	0.07
	Q3	0.58	-0.58	0.99	1.33
	Q4	0.53	0.52	0.21	0.87
Annualized		**1.07**	**0.18**	**0.89**	**2.14**
1991	Q1	0.28	0.31%	0.20%	0.32%
	Q2	0.54	0.53	0.41	0.68
	Q3	0.31	-0.17	0.40	0.70
	Q4	0.85	0.33	0.77	1.45
Annualized		**1.99**	**1.00**	**1.80**	**3.18**
1992	Q1	0.58	0.69%	0.87%	0.19%
	Q2	0.70	0.09	0.72	1.29
	Q3	0.68	0.13	0.58	1.35
	Q4	0.12	0.01	0.13	0.20
Annualized		**2.10**	**0.93**	**2.31**	**3.05**
1993	Q1	-0.10	-0.65%	-0.07%	0.41%
	Q2	0.34	0.60	0.56	-0.15
	Q3	0.11	-0.22	0.45	0.09
	Q4	-0.13	-0.29	-0.24	0.12
Annualized		**0.21**	**-0.56**	**0.70**	**0.47**
1994	Q1	0.26	0.30%	0.31%	0.17%
	Q2	0.13	0.21	0.63	-0.46
	Q3	0.21	0.41	0.18	0.05
	Q4	1.24	0.74	1.39	1.61
Annualized		**1.86**	**1.66**	**2.53**	**1.38**
1995	Q1	-0.09	0.44%	0.27%	-0.99%
	Q2	0.18	0.76	0.04	-0.24
	Q3	0.32	-0.20	0.34	0.96
	Q4	0.03	-0.05	0.11	-0.21
Annualized		**0.44**	**0.95**	**0.76**	**-0.49**
1996	Q1	0.17	0.06%	0.09%	0.34%
	Q2	0.03	0.00	0.22	-0.13
	Q3	0.13	-0.04	0.18	0.24
	Q4	0.22	0.16	0.37	0.12
Annualized		**0.55**	**0.17**	**0.87**	**0.57**

Summary Statistics				
Cumulative	8.50%	4.49%	10.28%	10.70%
Annualized	1.17	0.63	1.41	1.46
Standard Deviation	0.59	0.62	0.81	1.09
Maximum Drawdown	0.30	0.71	0.40	1.27
Hit Ratio	77.38	65.48	69.05	69.05