

## Multiple Alpha Sources and Active Management

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## Risk Parity Portfolios

- Allocation objectives
- The methodology – parity risk budgeting
- Historical performance\*
- Total portfolio approach: beta + alpha
- Summary

\*The results of the back-test do not reflect actual client trading or the impact of material economic and market factors on PanAgora's decision-making process for an actual PanAgora client account. The results are hypothetical and were achieved through the retroactive application of a model constructed on the basis of historical data and designed with the benefit of hindsight. The models may not perform as well when applied prospectively.

## Allocation objectives



### Achieving High Sharpe Ratio by Equal Risk Contribution

- Provides efficient beta portfolios for long-term investors
- Offers a spectrum of risk/return choices
- Combined with alpha sources: Forms the optimally efficient investment portfolio from a total risk perspective
- *Balanced risk allocation leads to efficient beta portfolios*

## Allocation Objectives



### Balanced Fund: A Misnomer

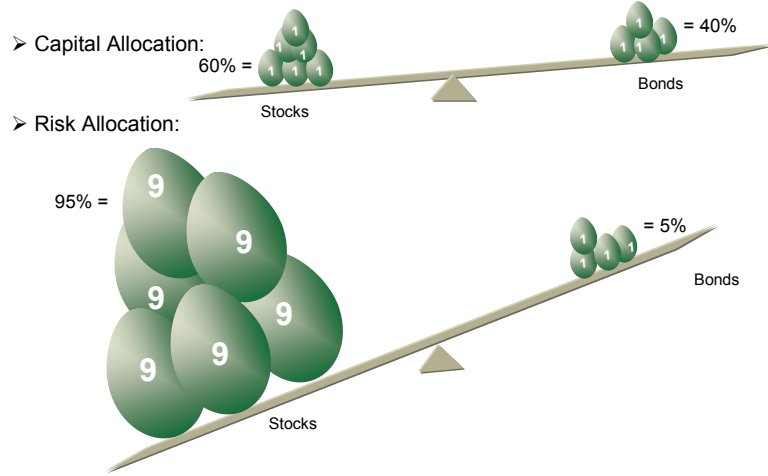
- The traditional 60/40 stock/bond allocation does not provide sufficient *risk* diversification
  - From 1983 to 2005, stocks contributed to 93% of overall risk while bonds contributed 7%
  - The disparity in risk contribution reflects the fact that stocks are much riskier than bonds
- 60/40 portfolio returns are 98% correlated with stock returns
- Because of this, the 60/40 portfolio has a Sharpe ratio that is less than that of bonds

	Russell 1000	Lehman Agg	60/40
Average Return	8.29%	3.65%	6.44%
Standard Deviation	15.13%	4.58%	9.60%
Sharpe Ratio	0.55	0.80	0.67

Source: Index Providers

# Allocation Objectives

## Risk Contribution for a 60/40 Portfolio



For illustrative purposes only.  
Source: PanAgora

# Allocation Objectives

## Loss Contribution = Risk Contribution

Loss contribution for a 60/40 representative portfolio

Loss >	Stocks	Bonds
2%	95.6%	4.4%
3%	100.1%	-0.1%
4%	101.9%	-1.9%

Source: PanAgora, based on 60% Russell 1000 Index and 40% Lehman Aggregate Index

Loss contribution should roughly equal risk contribution at 95%

- But stocks' contribution is higher due to greater tail risk (Qian, 2005)

Table is shown for illustrative purposes only.

## Methodology



### Risk budgeting Approach

- Risk budgeting
  - Determine the total amount of risk and contributions to the total risk
- Advantages of risk budgeting approach
  - Uses only covariance matrix, not the expected returns to derive the asset allocation weights
  - Portfolio weights are more diversified and stable
  - Incorporates asset performance through targeted risk contribution
- Wide range applications
  - Active risks in fixed income, equity, and TAA portfolios
  - Manager and strategy selections
  - *Strategy beta exposures*

## Methodology



### Three Ingredients

- For any given level of beta risk, we target equal contribution from each asset
  - Equal contribution from stocks, bonds, and commodities
- Adjust contribution to risk based on monetary policy
- Apply leverage if necessary to achieve targeted level of risk and return
  - Leverage can be implemented with futures and/or swaps

# Methodology



## Why Parity?

- Parity risk contribution implies balanced loss contribution
  - Limit the impact of severe losses from individual assets
- In the long run, the Sharpe ratios of various financial assets should be positive and similar
  - Empirical results and theoretical argument
- Under the assumption of equal Sharpe ratio, the parity portfolios are in fact mean-variance optimal (proof in appendix)

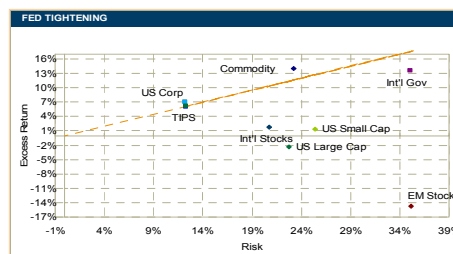
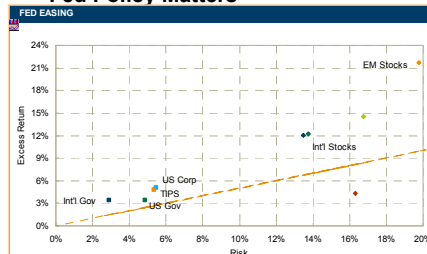
	Average	Stdev	Sharpe
US 5 Year (1919 - 2005)	1.2%	4.6%	0.25
US Corp (1900 - 2005)	1.8%	5.2%	0.34
S&P 500 (1900 - 2005)	5.4%	18.0%	0.30

Source: Global Financial Data, PanAgora

# Methodology



## Fed Policy Matters



- Regimes are based change in Fed discount rate
- Impact on stocks
  - Higher (lower) return and lower (higher) risk in expansive (restrictive) regime
- The effect on commodities is opposite
  - Higher return in the restrictive regime and lower return in the expansive regime
  - It has lower correlation with other assets in the expansive regime
- The effect on bonds is more muted

Sources 1983 - 2004 : Lehman Brothers; MSCI; CFTI Group; Russell; GSCI.  
Prior to 03/1997, Lehman Gov's used for TIPS. EM returns simulated prior to 1988.

## Methodology



### Use Leverage to Balance Risk Contribution

- Leverage is not necessarily dangerous
  - Government bonds leveraged 2:1 have a standard deviation of less than 10%
  - Leverage is appropriate if the underlying portfolio has a high Sharpe ratio
- Stocks already have Embedded Leverage
- Leverage easily implemented with exchange-traded futures and swaps
  - Equity futures, commodity futures, bond futures

## Historical Performance



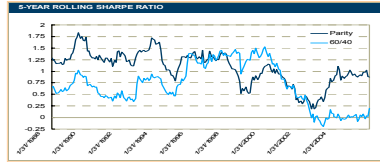
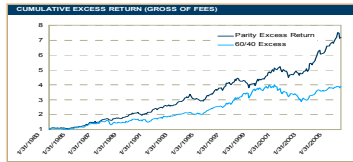
### Simulation Framework

- Eight asset classes
  - US large cap, US small cap, Int'l large cap, EM equity
  - US Treasury, TIPS, Non-US sovereign bonds, commodities
- Allocation procedure
  - Target a constant level of risk (4% , 8% etc.) each month
  - Target parity risk contribution from eight asset class
  - Change risk contribution when Fed changes monetary policy
  - Inputs are regime-based covariance matrices
  - Portfolio weights are derived through a system of equations
- Performance (1983 – 9/2006)
  - Focus on excess returns
  - Simulated returns for portfolio with 8% risk

# Historical Performance



## Simulated Performance\* - Risk Parity Portfolio (at 8% risk)



	Parity	60/40
<b>Avg. Excess Return</b>	<b>8.91%</b>	<b>6.41%</b>
<b>Standard Deviation</b>	<b>8.06%</b>	<b>9.49%</b>
<b>Sharpe Ratio</b>	<b>1.11</b>	<b>0.68</b>

- Risk parity portfolio significantly outperformed 60/40 portfolio with much low risk
- 5 – year Sharpe ratio is always positive

*Tables are shown for illustrative purposes only.*

*Performance is shown gross of fees and does not include the deduction of management fees and other expenses that may be incurred in managing an investment account. A portfolio's return will be reduced by advisory and other fees.*

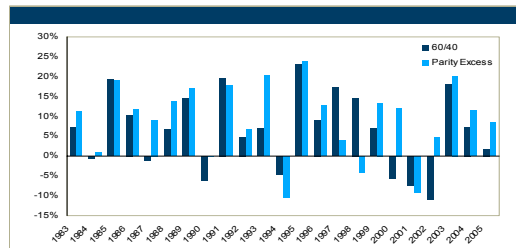
*\* The above results do not reflect actual client trading or the impact of material economic and market factors on an actual PanAgora client account. The results are hypothetical and were achieved through the retroactive application of a model constructed on the basis of historical data and designed with the benefit of hindsight. The model may not perform as well when applied prospectively.*

*Source: PanAgora*

# Historical Performance



## Simulated Performance\* - Risk Parity Portfolio (at 8% risk)



- 20 positive excess returns out of possible 23
- Negative excess returns in 1994, 1998, and 2001
  - 1994: All risky assets performed poorly
  - 1998: Poor performers; Commodities and EM
  - 2001: Poor performers: Commodities, US large cap, Int'l large cap, EM

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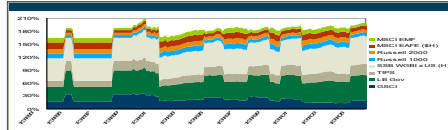
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*Source: PanAgora*

# Historical Performance



## Simulated Performance\* - Risk Parity Portfolio (at 8% risk)



	Average	For 12/2005
Cash	-82%	-96%
Commodities	22%	19%
US Gov	46%	58%
TIPS	19%	25%
Int'l Gov	56%	65%
US Large Cap	10%	8%
US Small Cap	9%	7%
Int'l Stocks	11%	9%
EM Stocks	8%	6%

- Asset allocation
  - Average weights: cash borrowing – 80%, commodity - 22%, bonds – 120%, stocks – 38%
- Fed policy changes are the major cause of portfolio turnover

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 Source: PanAgora

# Historical performance



## Realized Loss Contribution and Correlation

	Loss > 3%	Correlation
Cash	8.2%	0.01
Commodities	16.3%	0.48
US Gov	12.4%	0.45
TIPS	6.4%	0.48
Int'l Gov	5.8%	0.42
US Large Cap	11.7%	0.62
US Small Cap	13.7%	0.59
Int'l Stocks	10.7%	0.55
EM Stocks	14.8%	0.55

- When the portfolio losses are significant, the contribution from individual assets are roughly equal, as intended by the target
  - This ensures individual assets don't dominant total portfolio
- The correlation between portfolio returns and individual asset returns are also balanced

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 Source: PanAgora

## Total Portfolio

### Beta + Alpha

- Risk Parity Portfolios offer efficient beta allocation
- They can be combined with market-neutral alpha sources to form efficient total portfolio
  - Use futures and/swaps to implement risk parity beta exposure
  - Remaining capital is deployed in alpha strategies
    - Portable alpha: global equity/bond/currency
    - Market-neutral equity long/short: US, international
- Flexible allocation between alpha and beta

## Appendix

### Risk Parity Portfolios as MV Optimal

- Assume zero correlations, parity portfolio is MV optimal when the Sharpe ratio is the same for all assets

Parity risk allocation implies  
 $w_i \sigma_i = c = \text{constant}$  (1)  
 $w_i$  – allocation weight,  $\sigma_i$  – standard deviation

Mean-variance optimal weight is

$$w_i = \frac{1}{\lambda} \frac{f_i}{\sigma_i^2} \quad (2)$$

$f_i$  - expected excess return,  $\lambda$ - risk-aversion parameter

Substituting (2) into (1) and solving for Sharpe ratio:

$$\text{Sharpe ratio} = \frac{f_i}{\sigma_i} = (\lambda c) = \text{constant} \quad (3)$$

Equation (3) implies a constant Sharpe ratio for all assets.

## Appendix



### References

- **Risk budgeting:**
  - Qian, Edward, "On the Financial Interpretation of Risk Contribution: Risk Budgets Do Add Up." Forthcoming, *Journal of Investment Management*
  - Qian, Edward, "Risk Parity Portfolios." 2005, PanAgora
- **Fed policy:**
  - See, for example, Conover et al. "Is Fed Policy Still Relevant for Investors?" 2005, *FAJ*, Vol. 61, No. 1
  - Peters, Edgar, "US TAA with Fed Policy Regimes." 1997, working paper, PanAgora

## Biography



Edward Qian, Ph.D., CFA  
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At PanAgora:

**Dr. Qian is Director of Macro-Strategies and Head of Macro Research for the firm. His primary responsibilities include investment research and portfolio management in PanAgora's Macro-Strategies group.**

**Prior to joining PanAgora, Dr. Qian was a Senior Analyst in Putnam Investment's Global Asset Allocation Group. Before joining Putnam, he was a fixed-income Quantitative Analyst at Back Bay Advisors. He also worked at 2100 Capital Group on hedge fund investments in 2004.**

**Dr. Qian has extensive research experience in the areas of asset allocation and quantitative equity investing. His research has been published in several leading financial industry journals. Previously, he was a National Science Foundation Research Fellow at MIT from 1994 to 1996.**

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Publications:

"On the Financial Interpretation of Risk: Risk Budgets do add up" *Journal of Investment Management*, 2006

"Aspects of Constrained Long/Short Equity Portfolios," with E. Sorenson, R.Hua, and L. Ma. *Journal of Portfolio Management*, January 2007.

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