

## Best of Both Worlds

### *Balancing Asset Growth and Liability Hedging*



Ed Peters  
Co-Director of  
Global Macro

Asset/Liability management has almost exclusively focused upon asset growth. While current liabilities can be immunized through techniques such as Liability Directed Investment (LDI), there is still risk that assets will not be enough to cover new liabilities as the work force of a firm increases, wages rise, and longevity increases. Equities rise with economic growth and so hedge against future liabilities that come from growth in the underlying business of the fund's participants. Equities supply an engine of growth so that a fund's assets can grow at a rate that matches the actuarial assumptions of growth necessary to meet future liabilities.

So, a portfolio of equities is an important part of managing future liabilities. But what of current liabilities? Liabilities change as the discount rate fluctuates with long term interest rates. In order to hedge against such changes in the liability stream, a fixed income component is necessary.

Unfortunately, combining stocks with bonds lowers expected return so that plans are forced to choose between asset growth and liability matching. The widespread approach is to focus on asset maximization. Diversification into other non-equity asset classes is used to lower the volatility and increase returns of the portfolio, not to hedge liabilities. This growth oriented strategy assumes that growing assets sufficiently will also solve the liability problem by achieving overfunded status. But 2008 has shown the danger of putting all of our strategic eggs in the asset growth basket as asset values plummeted while liabilities soared.

So the question is can we balance asset growth with current liability management? That is, can we have hedge future and current liabilities at the same time? Thankfully, the answer is, yes. A portfolio of essential betas, which balance risk while also diversifying capital, can achieve such a goal. By contrast, a static policy portfolio or partial LDI hedged approach can fall short even over

an extended period of time. In this paper we will study these three approaches.

#### Problems with "Policy" Portfolios

Defined benefit plans typically develop a long-term strategic asset allocation, or "policy portfolio" that is designed to meet the growth needs determined by their liabilities. This portfolio is, by design, more complex than the simple 60/40 stock and bond portfolio we have been describing in previous articles. The strategic portfolio typically has many asset classes under the assumption that this increases "breadth." In addition, the policy portfolio has fixed weights since its composition is determined by long run average statistical measures of risk, return and diversification. This "static" approach to asset allocation is typically used to differentiate "strategic" asset allocation from "tactical" asset allocation. Indeed, "strategic asset allocation" and "static asset allocation" have become synonymous. However, the bear market that began in 2007 has shown the short comings of this approach in high relief. The market is rarely at its average level of risk. Likewise, correlations are hardly ever at their long term average. Instead, these measures are dynamic and change with the business cycle. There are periods of high volatility like 2008 and low volatility like 2006. Correlations across asset classes tend to be lower in periods of low volatility and higher in high volatility regimes. Unfortunately bear markets in equities tend to be periods of high volatility, so diversification is either less effective or can even fail when we really need it. This is not a recent phenomenon, and is characteristic of all equity bear markets going back to the 1930s.

In addition, as we experience the different volatility regimes, the realized risk of the static portfolio is always different than its expected risk. In 2004 – 2006 a static allocation would have realized risk significantly below its target as the market experienced exceptionally low

volatility. Conversely the same static portfolio would have experience significantly higher volatility in 2007 – 2008. A static asset allocation assumes constant risk, which is never achieved in real life.

To further complicate things, long term interest rates usually fall during these periods of high volatility which means that liabilities soar. Just when asset values are declining, liabilities climb and defined benefit plans find that their funded status is likewise falling. The market is not a static environment. It is dynamic, and even statistical relationships change over the market cycle.

So the problems with typical policy portfolios are:

- 1) Low correlation with liabilities
- 2) Realized risk that is higher or lower than targets for long periods
- 3) Decreased diversification during down markets

It is clear that the current practice of creating a static policy portfolio does not meet the goals of most defined benefit plans. The recent trend of increasing “breadth” failed in the bear market that began in 2007. An alternative approach is clearly needed.

In this study we will compare a typical policy plan with a portfolio of essential betas and an LDI oriented plan that directly hedges a portion of the liabilities. We will examine the funded status over time and see which, if any of the plans achieves our goal of hedging liabilities while also growing assets to hedge future liabilities.

### Three Strategic Plans

While each defined benefit plan has different liability streams and different policy portfolios, most plans have similar characteristics. For the purposes of this study we will use the Citi Liability Index as described in Bader and Ma (1995) when it was developed at Salomon Brothers. For the rest of this paper when we refer to “liabilities” we will be referring to the Citi Liability Index. The data for the Citi Liability Index only goes back to January 1995 so there are several economic scenarios missing from the data, in addition to the fact that stocks have underperformed bonds during this period. But, if nothing else, it does give a worse case scenario for us to look at.

We will simulate and compare 3 strategic plans. All are 100% funded on January 1, 1995 when the Citi Liability Index starts. The “Policy Plan” will be allocated according to Leibowitz and Bova (2008). The second portfolio, the “Essential Beta Plan,” will be allocated according to risk balancing techniques described in our earlier article “Balancing Betas: Essential Risk Diversification.” The third portfolio would be a balanced mix of stocks and the Citi Liability Index which we will call the “50% LDI Plan.”

### The Policy Plan

For the “policy plan” portfolio we will use an asset allocation described in Leibowitz and Bova (2008). This portfolio was given through a survey of consultants as a “typical” policy portfolio for institutional investors and consists of:

- 1) 25% US Equities
- 2) 20% International Equities
- 3) 10% Real Estate
- 4) 5% Emerging Market Equities
- 5) 5% Private Equity
- 6) 25% US Bonds
- 7) 10% Alternatives

For the purposes of this paper we will assume the following equivalent investments all in local currency returns:

- 1) US Equities = Russell 3000 Index
- 2) International Equities = MSCI EAFE Index
- 3) Real Estate = NAREIT Index
- 4) Emerging Market Equities = MSCI Emerging Market Index
- 5) Private Equity = HFRI Private Issue/Reg D Index
- 6) US Bonds = Barclays Aggregate Bond Index
- 7) Alternatives = HFRI Fund of Funds Index

While many plans can have significantly different asset allocations than the one specified here, it appears to be fairly representative. The only component which appears to be missing is an exposure to high yield bonds, but it is unlikely that would significantly change the results.

### The Essential Beta Plan

The essential beta plan portfolio balances risk across three dimensions:

- 1) Across asset classes,
- 2) Within asset classes, and
- 3) Across time.

To balance risk across asset classes, it is necessary to leverage sovereign bonds in the futures market to extend their duration and also include a portfolio of real assets (commodities and treasury inflation protected securities, or TIPS) in order to offset the significant inflation risk added by the bonds. By extending the duration of the sovereign bonds, the essential beta plan is able to balance the risk between stocks and bonds rather than having over 90% of the risk budget in equities as is the case in most growth

oriented balanced portfolios. In addition the 14 – 15 year duration of the leveraged sovereign bond component is similar to the liability duration of most defined benefit plans. As a result, the fixed income component of the essential beta plan not only diversifies equities, but also is an effective liability hedge. So balancing risk across asset classes also creates a portfolio that effectively hedges a significant portion of liabilities.

Balancing risk within asset classes amounts to equal capital weighting developed market stocks and bonds and also increasing the capital weight of emerging markets and small cap stocks. The former occurred because risk is similar within the developed markets. Increasing the weight of emerging market and small cap stocks may seem counter intuitive since both sectors have higher volatility than developed markets, but in reality their cap weighting is smaller than their risk weighting.

Through time, the essential beta portfolio rebalances by increasing equity weights in low volatility periods and decreasing equity weights in high volatility periods in order to achieve the 9% risk target in both periods. This dynamic weighting process is for risk control purposes and is not based upon an implicit forecast for market returns. Is this “tactical asset allocation (TAA)?” TAA shifts assets around a static benchmark based upon a return forecast. A dynamic strategic portfolio like the essential beta plan is not “TAA” since allocation changes are not due to return forecasts. Allocations change based upon risk budgeting and changes in the underlying volatility environment in order to stabilize the realized risk of the portfolio and are entirely based upon rules, not forecasts.

This dynamic rebalancing through time also affects liability hedging since liabilities are also affected by the volatility regimes as we shall see below.

While we divide returns in this study into high and low volatility periods using the VIX only, the essential beta process incorporates multiple dimensions of risk including the VIX, credit spreads, monetary policy, and economic growth in determining the appropriate asset allocation. A forthcoming paper will go into this in more detail.

### The 50% LDI Plan

The third portfolio is strictly hypothetical. Suppose we could have a portfolio which is 45% stocks, 45% a liability hedged portfolio of bonds and 10% cash. Such a portfolio would fully hedge half our liabilities and still have 50% of our risk budget for growth (In this case an equal capital weight is also the same as an equal risk weight since liabilities and stocks have similar volatilities and low correlation). The weighting of 45/45/10 gives the portfolio

the same 9% annualized risk target of the policy and essential beta portfolios. In a simplistic view this 50% LDI portfolio offers the best of both worlds. But does it really? Below we will see that this simplistic method does not, in fact, do the job.

The 50% LDI plan is strictly hypothetical since a portfolio cannot be constructed to exactly match the Citi Liability Index. It is, however, an ideal upon which to compare the concepts behind LDI as well as a comparison with the policy and essential beta portfolios which are investable. It also tests a quasi-LDI approach adapted by many plans. In this approach a portion of the strategic asset allocation is given to long bonds in order to partially immunize liabilities while keeping assets in equities for growth. This is exactly the goal, but as we will see, the static weights of this approach are a draw back despite its simplicity.

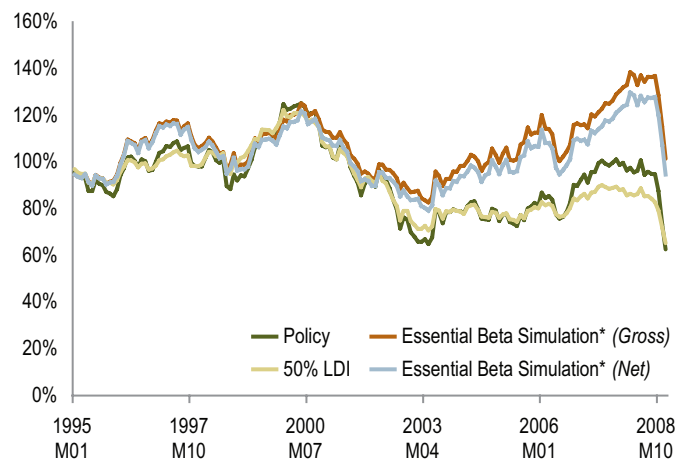
### The Study

First we look at the funded status of the three plans over time relative to the Citi Liability Index. We calculated this using the “Funded Ratio Return” as described in Bader and Ma (1995):

$$FRR = ((1 - \text{portfolio return}) / (1 - \text{liability index return})) - 1$$

Where return is the monthly percent change. Illustration 1 below shows how the funded status changed from 1/95 – 12/08:

**FIGURE 1: FUNDED STATUS**  
January 1995 – December 2008



Source: First Quadrant, L.P.

The Y-axis measures the funded status. What we see is that all three portfolios become overfunded during the tech bubble of 1997 – 1999, but then become underfunded by 2001 when the bubble bursts. However, by 2004 the essential beta plan is back to being fully funded. The Policy

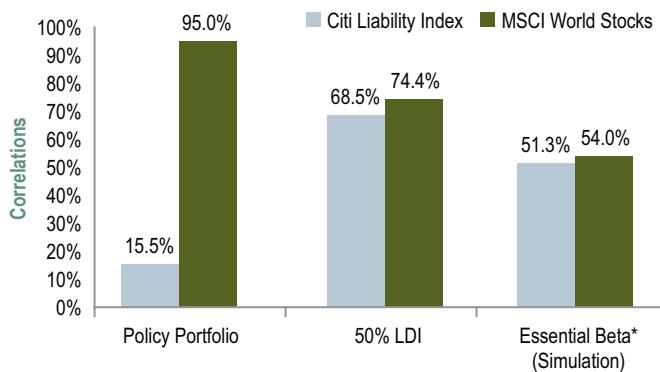
\*Supplemental Information. Please see **Essential Beta – Simulated Performance** disclosure as well as the **Essential Beta Composite** and related disclosures at the end of this article for important information on the simulation and composite.

Portfolio becomes fully funded by 2007, some six years after being underfunded. The 50% liability hedged portfolio never recovers. All three portfolios suffer in funded status during November and December 2008 when liabilities soar 13.6% and 21.3% respectively. But the essential beta portfolio remained slightly overfunded, while both the policy portfolio and the 50% LDI portfolio become severely underfunded. Interestingly, the policy portfolio and the 50% LDI portfolio have similar patterns showing that the policy portfolio does mimic a liability hedged portfolio, but unfortunately neither portfolio actually hedges funded status effectively during this period.

One reason for the funding shortfall of the policy portfolio can be seen in the following chart which shows correlations with the MSCI World Stock Index and the Citi Liability Index for the 3 portfolios:

**FIGURE 2: ESSENTIAL DIVERSIFICATION**

*Correlations with Global Stocks and Liabilities: January 1995 – December 2008*



Source: First Quadrant, L.P.

The policy portfolio has the same diversification problem as a traditional 60/40 portfolio despite the extra “pie slices” in its composition. It still has a 95.02% correlation with stocks and only a 15.49% correlation with liabilities. This is another illustration of how “breadth” does not actually result in diversification as we discussed in our earlier paper, “Does Your Portfolio Have ‘Bad Breadth?’”. The policy portfolio is oriented entirely towards growth with the hope that asset growth will be higher than liability growth. Sadly that has not been true during this period as we will see below.

The essential beta and 50% LDI portfolios, on the other hand, have a significant correlation with both stocks and liabilities showing that they do have both elements of growth and liability hedging in them. Of course they were designed this way. Yet, in the last 14 years, the 50% LDI portfolio still failed to maintain funded status. The question is why?

The following table shows returns for the 3 plans as well as the MSCI World and the Citi Liability Index:

\*Supplemental Information. Please see **Essential Beta – Simulated Performance** disclosure as well as the **Essential Beta Composite** and related disclosures at the end of this article for important information on the simulation and composite.

**FIGURE 3: PERFORMANCE SIMULATIONS (%)**

*January 1995 – December 2008*

	Liabilities	MSCI World	Policy Portfolio	50% LDI	Essential Beta* (Gross)	Essential Beta* (Net)
1995	39.07	17.43	18.83	25.70	28.00	27.38
1996	-2.93	14.81	13.77	5.80	19.73	19.15
1997	18.92	20.76	16.48	18.59	10.99	10.45
1998	10.32	19.15	6.24	14.39	2.97	2.46
1999	-11.97	26.27	16.37	5.75	5.25	4.73
2000	18.75	-10.77	1.24	3.60	13.58	13.02
2001	12.91	-15.25	-1.72	-0.98	-5.03	-5.51
2002	21.54	-25.20	-8.33	-3.02	11.35	10.80
2003	6.83	22.75	21.97	13.90	17.78	17.20
2004	11.65	9.49	10.98	9.85	19.70	19.11
2005	7.86	13.74	10.71	10.29	17.98	17.40
2006	0.25	13.52	13.84	6.86	3.05	2.54
2007	-2.89	2.83	4.74	0.53	10.70	10.15
2008	17.58	-39.93	-26.13	-13.18	-9.67	-10.13

Ann Ret	9.88%	2.97%	6.27%	6.59%	10.00%	9.45%
Ann Rsk	13.30%	14.48%	9.28%	8.95%	8.90%	8.90%
Sharpe	0.42	-0.10	0.21	0.25	0.63	0.57
Liab Corr	100.00%	2.26%	15.49%	68.45%	51.34%	51.34%
Stk Corr	2.26%	100.00%	95.02%	74.42%	54.00%	54.00%

Policy Portfolio = 25% R3000, 25% Leh Agg, 20% EAFE, 5% Em Mkts Stks, 10% REITS, 10% HFRI FOF, 5% HFRI Private Issue Index  
 50% LDI = 45% MSCI World Stocks, 45% Citi Liability Index, 10% Cash

During this particular time period the growth element (the stock market) grossly underperformed liabilities causing the underperformance of the 50% LDI portfolio. But it could easily have been the other way around. Nonetheless, this simulation shows that with a static allocation to liability hedging, which is a cornerstone of LDI, a plan can still become underfunded even over a long time period.

In addition, though all three portfolios outperformed the MSCI World Stock Index the Policy Portfolio and the 50% LDI portfolio still ended the period underfunded because they underperformed liabilities. In the end, liabilities are the real benchmark of a defined benefit plan, not stocks.

The essential beta plan, on the other hand outperformed both of the other plans and matched liabilities over the period despite its simple composition compared to the policy portfolio, and lack of direct liability hedging as in the 50% LDI portfolio.

The reason is the dynamic risk allocation in the essential beta portfolio, as opposed to the static weights in the policy and 50% LDI portfolios. The following table shows performance when time is divided into high and low volatility regimes. The regimes are defined by the VIX index which has a median of 20. So when the VIX is greater than or equal to 20 we are in the high volatility regime, and the reverse occurs when the VIX is less than 20:

**FIGURE 4: PERFORMANCE SIMULATIONS IN VOLATILITY REGIMES (%)**  
January 1995 – December 2008

Regime		Policy Portfolio	50% LDI	Essential Beta* (Gross)	Essential Beta* (Net)	Liabilities	Wrld Stks
High Volatility:	Ann Rtn	2.40	4.31	5.75	5.25	11.96	-2.79
	Ann Rsk	11.05	10.73	9.46	9.46	14.56	17.91
	Sharpe	-0.15	0.03	0.18	0.13	0.55	-0.38
	Liab Correl	18.30	66.10	57.60	57.60		
	Stk Correl	96.00	79.40	57.90	57.90		
Low Volatility:	Ann Rtn	13.25%	10.75%	16.88%	16.38%	9.21%	13.85%
	Ann Rsk	5.50%	5.84%	8.19%	8.19%	11.32%	7.69%
	Sharpe	1.66	1.13	1.55	1.51	0.45	1.26
	Liab Correl	9.10	80.80	35.20	57.60		
	Stk Correl	91.60	49.90	60.20	57.90		
		High Volatility: VIX>20		Low Volatility: VIX<20			

The essential beta plan has less variation in its realized risk in the two regimes than the other two portfolios because its asset allocation shifts to compensate for changes in risk over time. So while all three portfolios have total risk of approximately 9%, we can see that the policy and 50% LDI portfolios vary at different times because of their static asset allocations.

Plus in the low volatility regime, where all 3 portfolios achieve their best returns, essential beta still outperforms. While its Sharpe ratio is slightly lower than the policy portfolio, its realized risk is higher. So it achieves a higher total return. This shows that the essential beta portfolio is a more efficient portfolio in a traditional mean/variance sense. That is the essential beta methodology achieves a

higher, more consistent Sharpe ratio (excess return over cash divided by standard deviation) than the other two portfolios over a full market cycle.

Finally, the dynamic weighting based upon volatility regimes used in the essential beta plan increases the liability hedging component when you really need it and focuses on growth when liability hedging is less of an issue. In the above table we can see that liabilities and stocks have very different characteristics in the high and low volatility regimes. Specifically:

- 1) In the High Volatility regime stocks have higher volatility than liabilities but significantly lower returns, and
- 2) In the Low Volatility regime stocks have much lower volatility than liabilities and significantly higher returns.

So from an asset/liability standpoint we would rather have more liability hedging in the high volatility regime (when liabilities dominate returns) and less in the low volatility regime (when equities dominate returns).

The policy plan portfolio always has a high correlation with equities and minimal exposure to liabilities so it has virtually no liability hedging.

The 50% LDI plan, because of its static weights actually has a lower correlation with liabilities in the high volatility regime and a higher correlation in the low volatility regime. This is exactly the opposite of what we want. Why does this happen? From a volatility standpoint, equities dominate in the high volatility regime and liabilities in the low volatility regime. The static weights of the 50% LDI portfolio give it higher risk budgeted exposure to whatever asset has the highest volatility. So when you need more liability hedging it gives you less. When you want more asset growth, you also get less.

The essential beta plan, due to its dynamic risk budgeted weighting methodology decreases equity weights in the high volatility regime and increases equities in the low volatility regime. For bonds, the liability hedging component of the portfolio, it does the reverse. So it has more bond exposure, and so more liability hedging, in the high volatility regime when it is needed. The essential beta plan also decreases the liability hedging component in the low volatility environment, when it is not needed. Instead essential beta increases equities, the growth component of the portfolio, based upon risk budgeting not return forecasting.

It is this pattern which explains why the policy portfolio and the 50% LDI portfolio remain underfunded after 14 years. Their static nature does not hedge liabilities when it is most needed. The dynamic process in essential beta

\*Supplemental Information. Please see **Essential Beta – Simulated Performance** disclosure as well as the **Essential Beta Composite** and related disclosures at the end of this article for important information on the simulation and composite.

increases liability hedging when liabilities are likely to grow and decreases it when it is not. It does so without forecasting returns or liabilities, but through a rules based, risk budgeting approach.

It is a “dynamic strategic” portfolio, through the essential beta process, rather than the traditional “static strategic” portfolio that allows us to reach our goal of having both asset growth and liability hedging in the same plan.

## The Best of Both Worlds

We can see from this simulation that a portfolio of essential betas, balancing risk across asset classes, within asset classes, and across time can indeed give us the best of both worlds. A portfolio of essential betas balances asset growth and liability hedging through:

- 1) A diversified portfolio of equity betas to participate in long run economic growth,
- 2) Very long duration sovereign bonds which both diversify the equities against economic declines and hedge against liability growth that occurs because of drops in long-term interest rates,
- 3) A portfolio of real assets to hedge against inflation risk caused by the exposure to long duration bonds, and
- 4) A dynamic risk budgeted asset allocation that changes with the market cycle that increases liability hedging when liabilities are more likely to grow and increases allocations to growth when assets are more likely to grow.

The resulting portfolio of essential betas can balance both liability hedging, to lock in a portion of current liabilities, with asset growth to hedge against the growth of future liabilities. These two goals have long been considered incompatible. With a portfolio of essential betas, we can achieve both.



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**Essential Beta – Simulated Performance** *Simulated performance is no guarantee of the future results in a live portfolio using the strategy. Potential for profit is accompanied by possibility of loss.*

**General Disclosures:** The simulated performance used in this presentation may differ from live performance experienced using the strategy for the following reasons: • The simulation assumes that we adjust the risk and capital allocated to each sub-strategy on a monthly basis after the close on the last day of each month, whereas the live product may not adjust the allocations exactly at that time. • The simulation assumes that the strategy and sub-strategy guidelines are constant through the life of the portfolio, whereas, the guidelines for live portfolios may have changed over the life of each portfolio. • The simulation assumes fixed transaction costs whereas live portfolio transaction costs will be variable. • The simulation uses a synthetic long duration zero coupon bond for each bond country allocation. The cash return for the synthetic bond can vary by broker. • The simulation assumes all trading takes place once a month (on the last day of the month) whereas live portfolios may trade often during the month. • Hypothetical or simulated performance results have certain inherent limitations. Unlike an actual performance record, simulated results do not represent actual trading. Also, since the trades have not actually been executed, the results may have under or over compensated for the impact, if any, of certain market factors, such as lack of liquidity or positions need to be rounded based upon contract size when futures trades are being executed. Simulated trading programs in general are also subject to the fact that they are designed with the benefit of hindsight. No representation is being made that any account will or is likely to achieve profits or losses similar to those shown. Unless otherwise noted, performance returns for one year or longer are annualized. Performance returns for periods of less than one year are for the period reported. **Disclosures Specific to Simulation:** The Essential Beta simulation is constructed with the goal to diversify risk in a portfolio by strategically allocating risk to several sub-strategies/asset classes including, without limitation: Developed Market Equities; US Small Cap Equities; Emerging Market Equities; Real Estate Investment Trusts (“REITs”); Diversified Commodities; US Treasury Inflation-Protected Securities (“US TIPS”), and Long Duration Zero Coupon Synthetic Bonds (“Synthetic Treasuries”). The simulation assumes Synthetic Treasuries are created by using futures on various developed country sovereign bonds. The simulation additionally attempts to balance risk relative to country and sector weightings. The simulation targets overall portfolio risk allocations based on pre-determined indicators of market risk which may change over time. **Investment Management Fees:** All performance results presented include trading commissions. The FQ investment management asset-based fee schedule (assets managed in millions) for this strategy, which is negotiable, is as follows: \$0–\$100, 0.50%; \$100–\$350, 0.30%; and more than \$350, 0.15%. Asset-based fees are charged incrementally. For example, a \$200 million dollar portfolio will be charged .50% for the first \$100 million, 0.30% for the next \$100 million.

**COMPOSITE INFORMATION**

Essential Beta	Total Return Gross	Total Return Net	Number of Portfolios <sup>1</sup>	Composite Dispersion (%)	Total Composite Assets <sup>1</sup> (Millions USD)	% of Firm Assets <sup>1</sup>	Total Firm Assets <sup>1</sup> (Millions USD)	*Actively Managed AUM <sup>1,2</sup> (Millions USD)	*Total Firm Assets (Including Notional Values) <sup>1,3</sup> (Millions USD)
2009 (Mar-Apr)**	+8.8%	+8.7%	<5	–	5	0.1	8,382	17,671	17,802

See Additional Disclosures for important information concerning this composite and the effect of fees. \*Supplemental Information. \*\*All performance and AUM data is preliminary. <sup>1</sup>At End of Period Reported. <sup>2</sup>Includes market values for fully funded portfolios and the notional values for margin funded portfolios, all actively managed by First Quadrant and non-discretionary portfolios managed by joint venture partners using First Quadrant, L.P. investment signals. First Quadrant is defined in this context as the combination of all discretionary portfolios of First Quadrant, L.P. and its joint venture partners, but only wherein FQ has full investment discretion over the portfolios. <sup>3</sup>Includes market values for fully funded portfolios and the notional values for margin funded portfolios managed by First Quadrant and non-discretionary portfolios managed by joint venture partners using First Quadrant, L.P. investment signals. First Quadrant is defined in this context as the combination of all discretionary portfolios of First Quadrant, L.P. and its joint venture partners, but only wherein FQ has full investment discretion over the portfolios.

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**First Quadrant, L.P.**

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