

Memorial for Harry Markowitz  
Bruce Jacobs Remarks  
“Collaborating with Nobel laureate Harry M. Markowitz: A Remembrance”  
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I had the privilege to honor Harry Markowitz at Q in the Fall of 2009 and at UC San Diego in 2015 on the occasion of the 25<sup>th</sup> anniversary of Harry winning the Nobel Prize. It is indeed a privilege to be here now at Q to honor Harry’s legacy.

I first met Harry in person in 1995 here at Q. Five years earlier, I had sent him my manuscript about the rise of portfolio insurance and the crash of 1987. Harry’s response was brief, but very encouraging, so I sent him a copy of an updated draft to which he replied with a lengthy letter.

Well, I was emboldened, and I called Harry. Toward the end of our conversation, he said: “Bruce, is there something that you wanted to ask me?” I replied: “Yes, Harry, in fact there is. Would you provide a foreword for the book?” His response was: “I would be delighted to. Of course, it will depend upon whether I find something interesting to say.”

Indeed, he did. Harry’s foreword lucidly distinguishes between portfolio insurance and portfolio theory and highlights their differing effect on financial market stability. My book, *Capital Ideas and Market Realities: Option Replication, Investor Behavior, and Stock Market Crashes*, was published in 1999.

I would talk to Harry at Q and learned that he liked my 1988 article with Ken Levy on disentangling equity return regularities and our 1999 article on the integrated optimization of long-short portfolios. We were in the process of collecting our equity works into a book, and I asked Harry if he would again write a foreword. At a wonderful dinner with Harry and his delightful wife Barbara, Harry said he would, once again, if he had something interesting to say.

And again, he did. That foreword appeared in our book, *Equity Management: Quantitative Analysis for Stock Selection*, published in 2000. It discusses why mean-variance investors add constraints on security position sizes and sectors when optimizing a portfolio, despite the theoretical costs of these constraints. As Harry indicated, “constraints are added because the investor seeks protection against contingencies whose probability of ‘disutility’ is underrated by mean-variance approximation.”

Harry also says in his foreword: “It may be fairly asserted that Jacobs and Levy’s work is based on mine and my work is based on theirs. The[ir] portfolio selection models...are special cases of the Markowitz “general” model...This is the sense in which their work is based on mine...When colleagues and I built the Daiwa Portfolio Optimization System in 1990...our expected return estimation procedures were based on Jacobs and Levy (1988), [our disentangling article]. Thus [he said], our work was based on theirs.”

At about this time, my colleagues and I at Jacobs Levy published the article “On the Optimality of Long-Short Strategies.” This article examined the optimality of market-neutral long-short portfolios and in deriving formulas for equitizing such portfolios provided the theoretical underpinnings for 130-30 type strategies.

We shared the article with Harry, and this initiated a collaborative research relationship. Together, we addressed the optimization of long-short portfolios subject to realistic constraints on shorting. Harry, Ken, and I published two works on this topic.

In the early 2000s, Harry, Ken, and I discussed the idea of designing a financial market simulator. Harry is well known for creating a simulation programming language called SIMSCRIPT. At the time, most financial market models assumed that prices change smoothly and continuously which allowed for analytical solutions. The Jacobs Levy Markowitz market simulator allows more realistically for discontinuous price changes.

JLMSim was presented in two articles, which showed how changes in the proportions of various types of investors affect security prices, and how the simulator can be used to find equilibrium expected returns.

After the Global Financial Crisis of 2008, Ken and I tackled a problem that had long concerned us—the impact of financial leverage. Leverage, whether stemming from outright borrowing, from the use of derivatives, or from shorting, can magnify a portfolio’s volatility. Harry’s mean-variance optimization model considers portfolio volatility, but it does not consider what we call the “unique risks of leverage,” that is, margin calls.

Investors often adopt the classic solution of incorporating a leverage constraint when optimizing a portfolio. Harry outlined methods for doing so in 1959. But constraints cannot solve the whole problem. An investor can determine the portfolio that is optimal for a given level of constraint, but which level of constraint is optimal? Mean-variance optimization considers the tradeoff between expected return and volatility risk, but our mean-variance leverage optimization considers the tradeoffs between expected return, volatility risk, and leverage risk. Ken and I published several articles on this starting in 2012.

In response, Harry suggested an alternative solution, the development of a stochastic margin call model. I needn’t delve into the details of the comparison of these two models, because they are discussed elsewhere, but the important point is that increased awareness and consideration of leverage risks in portfolio formation can only have salutary effects for investors, the market, and the economy.

Harry graciously wrote the foreword to the second edition of our *Equity* book now having the subtitle “The Art and Science of Modern Quantitative Investing.” He wrote: “Some of the new sections include works on which Jacobs, Levy, and I collaborated—or, in the case of leverage aversion, debated—so, we have continued to build on each other’s research.”

Why did Harry work into his 90’s? Barbara would ask Harry about retirement, and he would say: “Well, when I do retire, I’d want to do something I really enjoy. And that’s what I’m doing now, every day—playing in my sandbox.”

Harry, you will be missed—your love of learning, your lifelong dedication to the field, and your knowledge creation. Your legacy will live on for generations.

Thank you.