

Multi-asset quant

The fragility of benchmark risk premia estimates

Global Markets Research

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The fragile assumptions about benchmark risk premia

Asset class	Assumed return (10-15 year horizon)	Risk premia over cash**
Equities	Inflation* + 525bp	725bp
Duration	Inflation* + 200bp	400bp
Credit	Inflation* + 275bp	475bp
Commodities	Inflation* + 150bp	350bp
FX	Not considered to be an asset class	?

* Inflation assumed to be 225bp

** Cash assumed to be 25bp

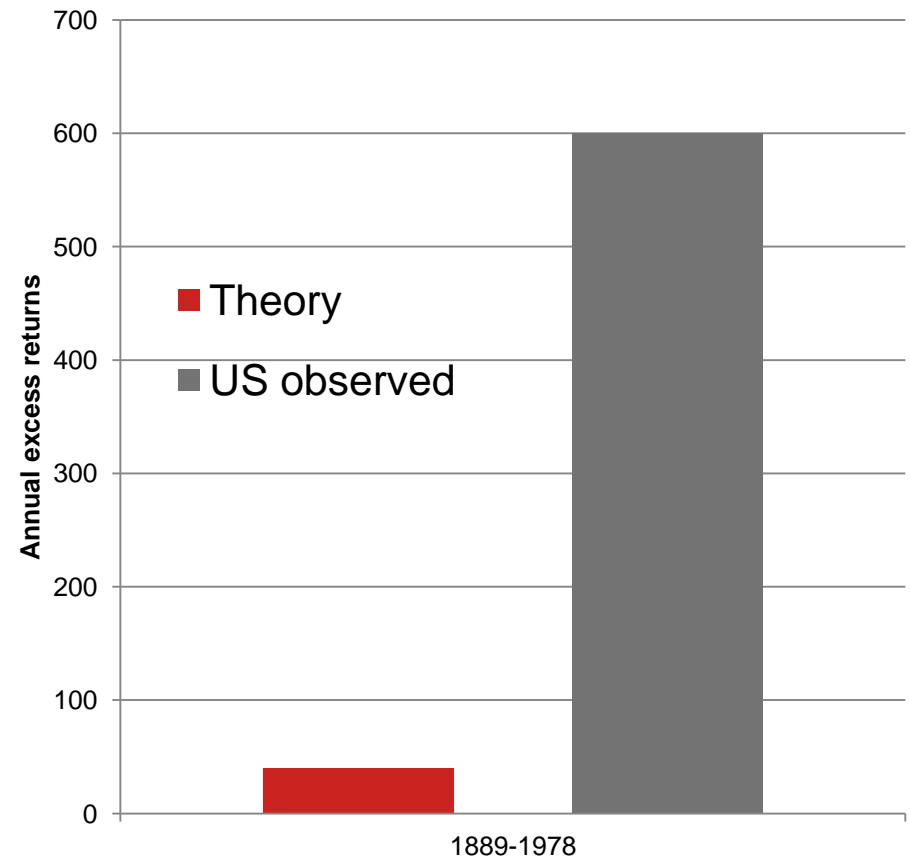
A theoretical problem—the equity risk premium puzzle

Mehra – Prescott showed standard models could justify only 40bps

Theory suggests a lower return for equities

In addition, the economies are constructed to display equilibrium consumption growth rates with the same mean, variance and serial correlation as those observed for the U.S. economy in the 1889–1978 period. We find that for such economies, the average real annual yield on equity is a maximum of four-tenths of a percent higher than that on short-term debt, in sharp contrast to the six percent premium observed. Our results are robust to non-stationarities in the means and variances of the economies' growth processes.

Historical US equity returns exceed the theoretical value



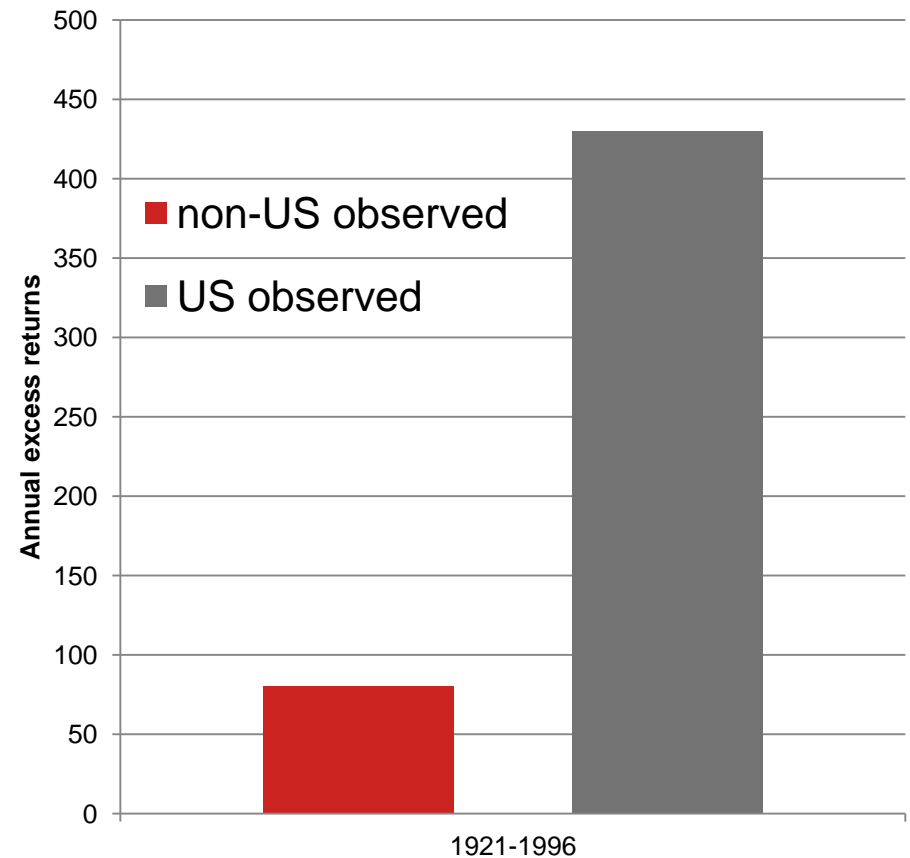
An empirical problem—survivorship bias

Is the American past the world future? Non-US history shows an equity risk premium around 80bps

Global market excess returns are much closer to the theory

Long-term estimates of expected return on equities are typically derived from U.S. data only. There are reasons to suspect, however, that these estimates are subject to survivorship, as the United States is arguably the most successful capitalist system in the world. We collect a database of capital appreciation indexes for 39 markets going back into the 1920s. Over 1921 to 1996, U.S. equities had the highest real return of all countries, at 4.3 percent, versus a median of 0.8 percent for other countries. The high equity premium obtained for U.S. equities therefore appears to be the exception rather than the rule.

The US experience appears to be an anomaly

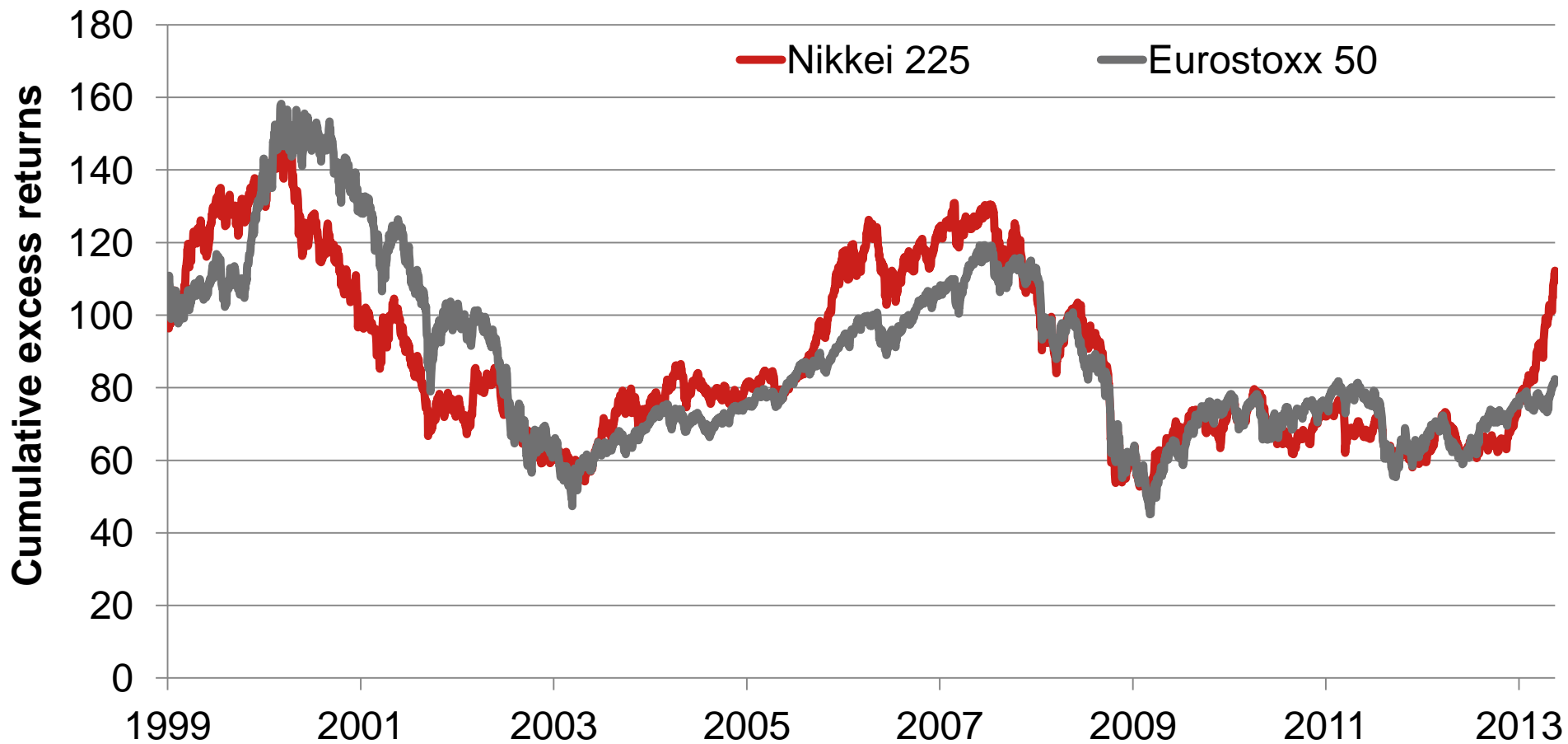


The last 15 years looks like the theory in America...

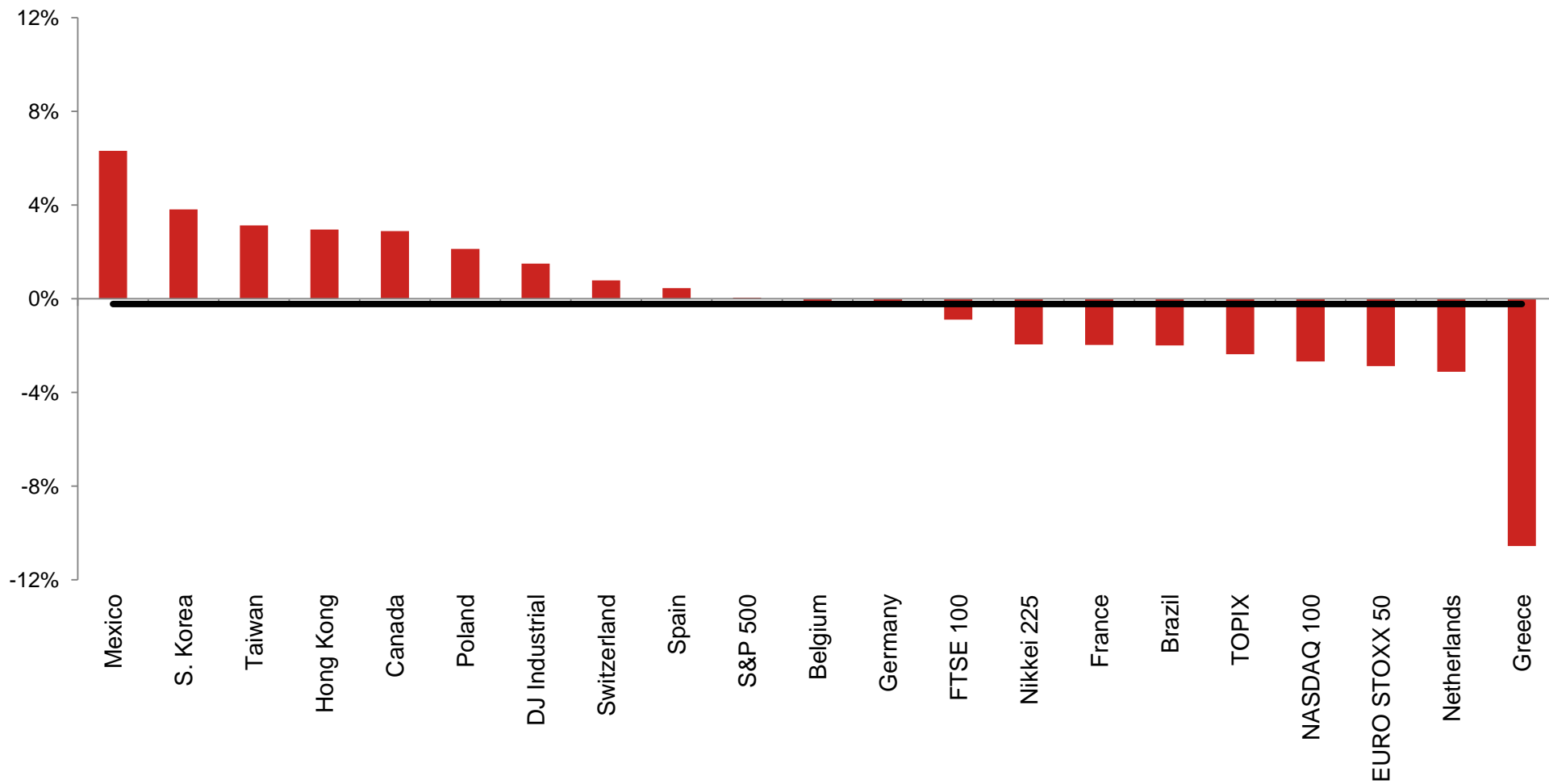
Even recent US experience has not lived up to expectations



... in Europe and Japan ...

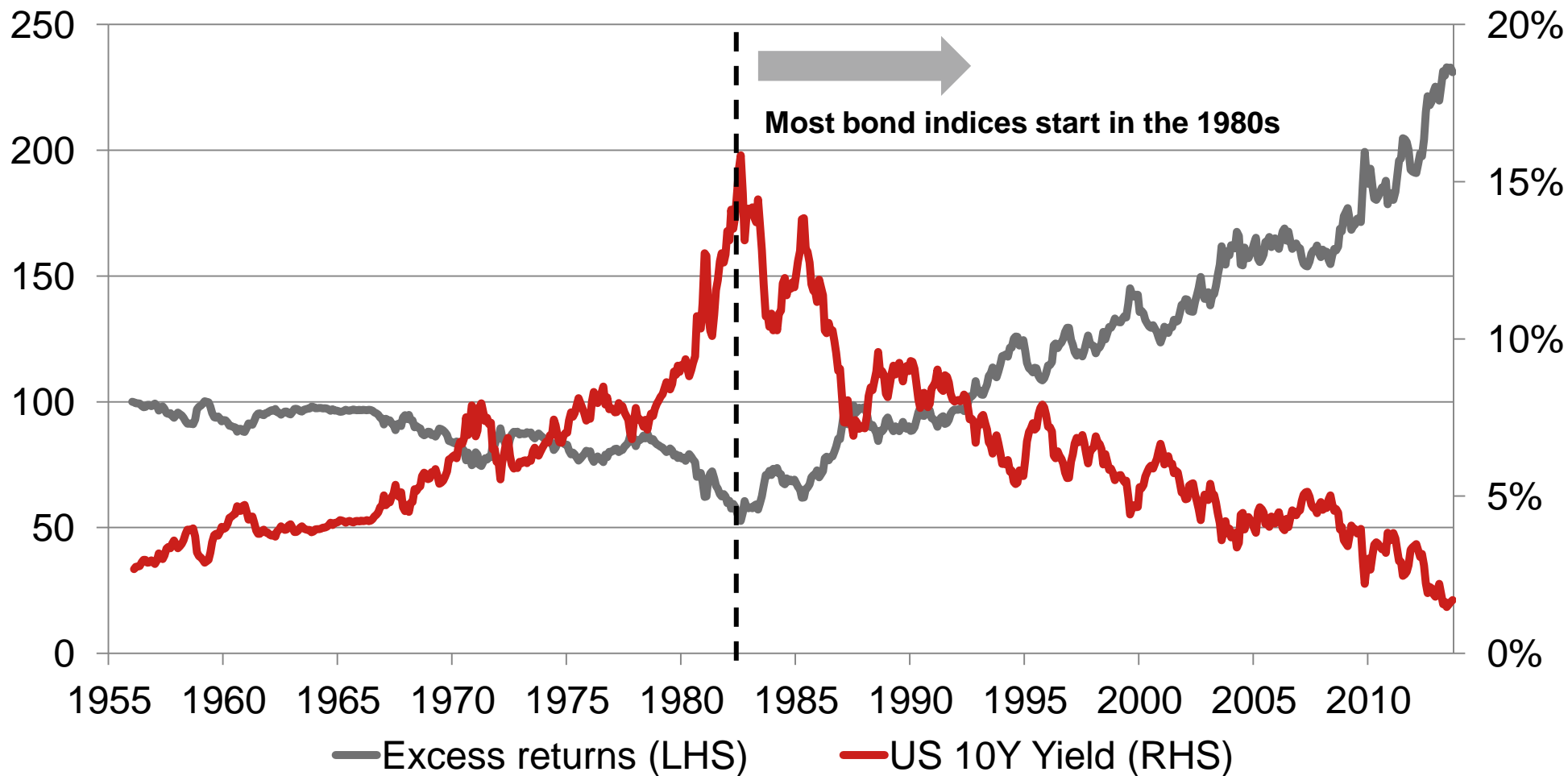


... and in the world at large



Fixed Income risk premia look just as fragile

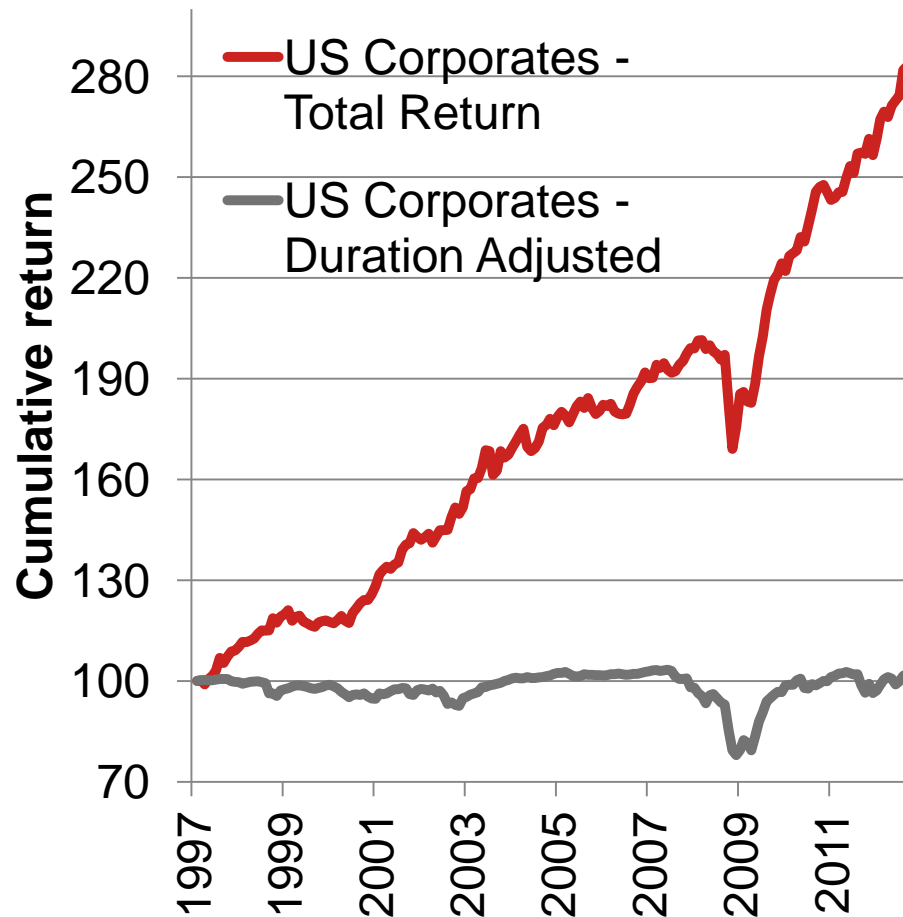
What are expected returns, conditional on low yields at the beginning?



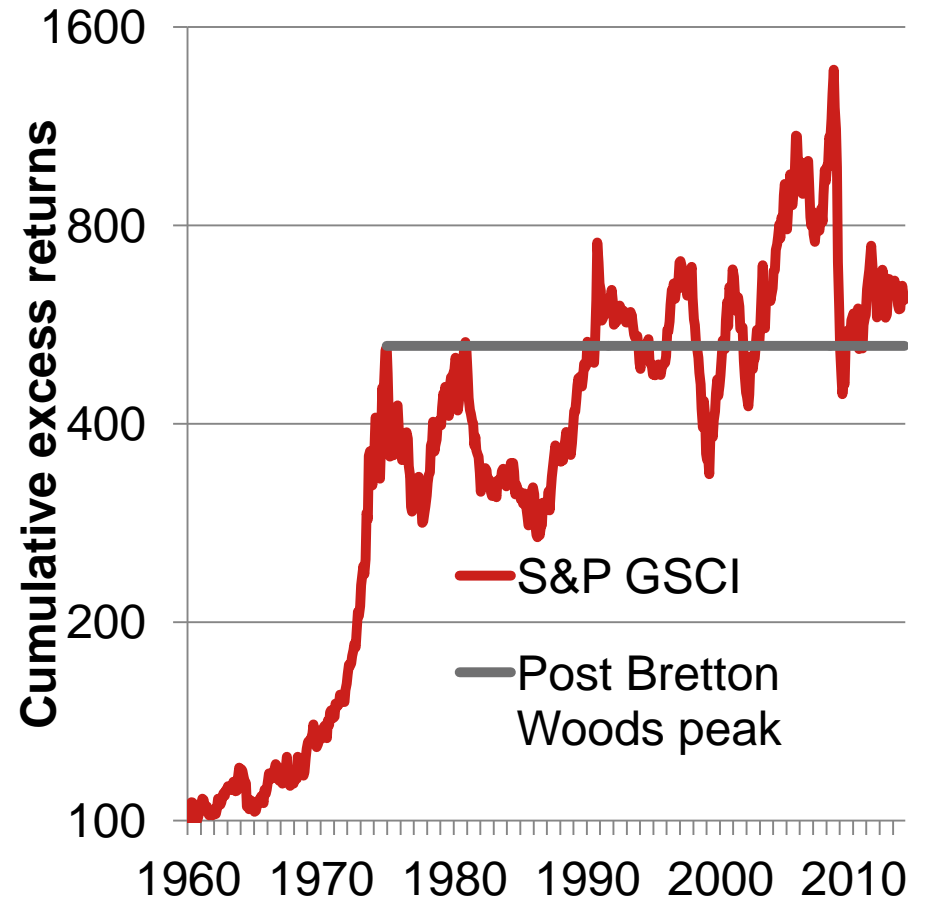
Fragile in both theory and data

Should credit or commodity benchmarks earn a risk premium? Do they show any evidence of having one?

Stripped of duration, credit returns are close to zero



Lots of up and down but commodities also don't add much



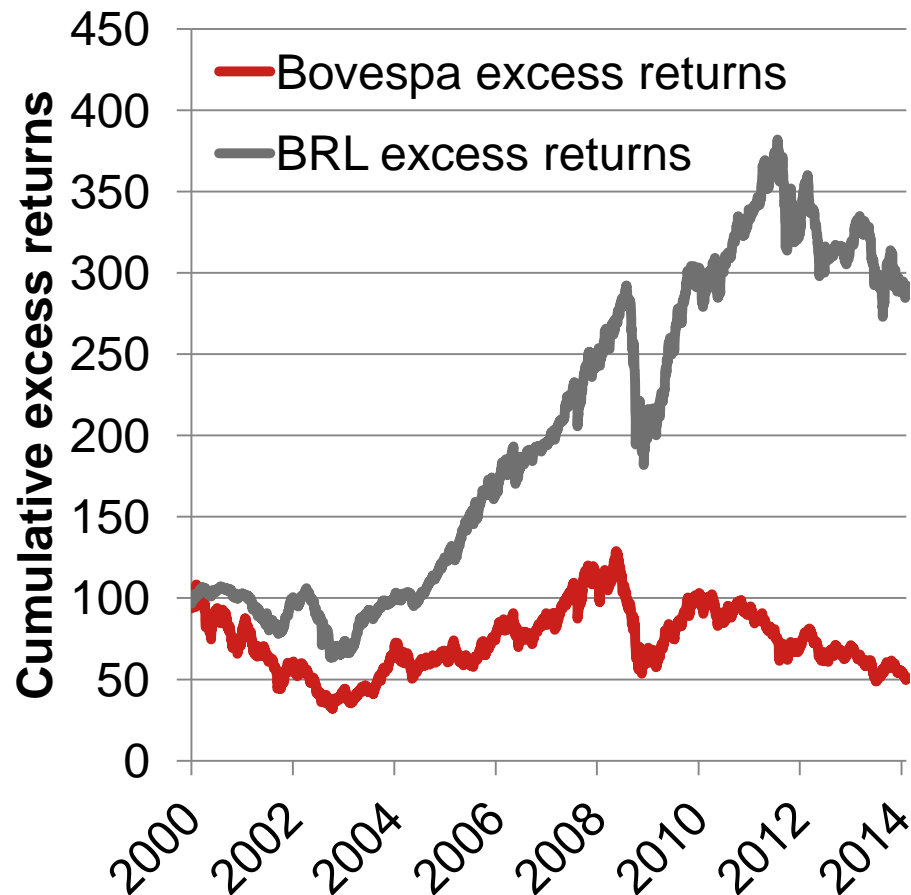
Source: Bloomberg, Nomura Research. Commodity returns backfilled from 1960 to 1970 by Nomura assumptions.

FX risk premia may be the biggest puzzles

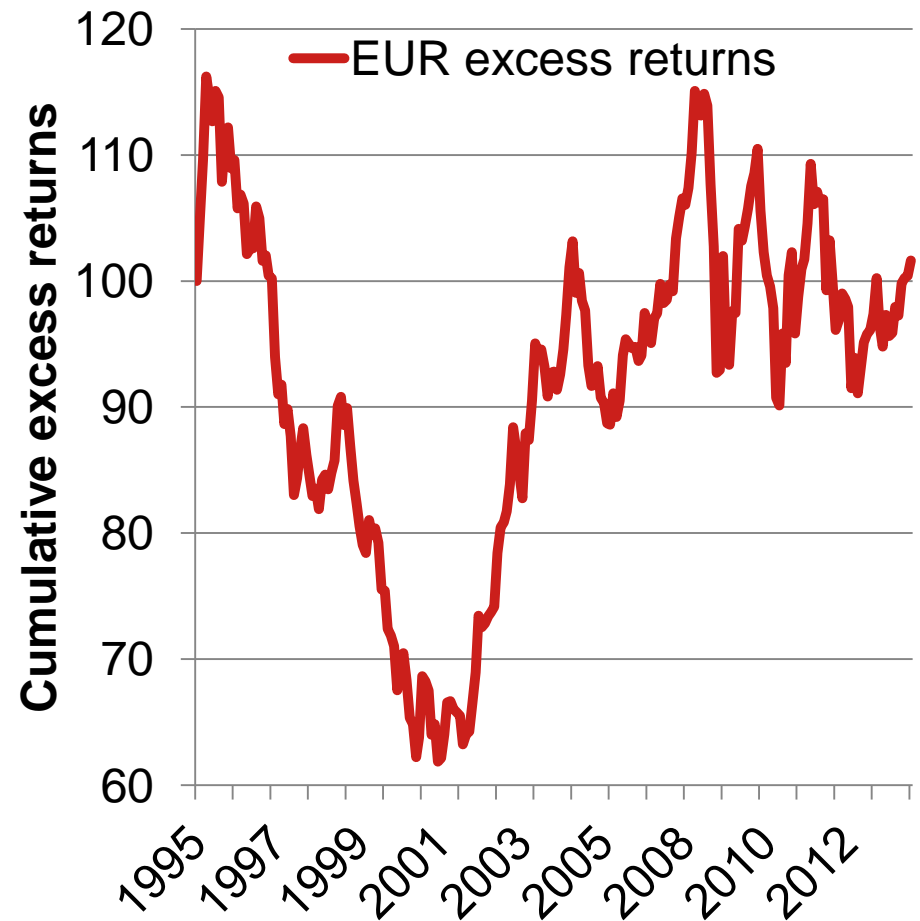
Brazil—why should the currency pay a risk premium but not the equity market?

EURUSD—should the EUR or the USD earn a risk premium? Does either?

NMFXBRL performs despite failing equity markets



EUR excess returns have been both positive and negative



An answer? Risk premia are time varying, not constant

Theory before 1973

- CAPM derived in one-period context
- Static framework
- Volatility and risk premia taken as given, constant
- Even if risk premia change over time, such changes are not predictable
- Random walk assumed

Theory after 1973

- Single period to multi-period
- Static to dynamic
- Endogenous risk premia and volatility
- **Risk premia are time-varying** and predictable
- **Random walk not necessary** for efficient markets, even in theory

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RISK AVERSION AND THE MARTINGALE PROPERTY OF STOCK PRICES*

BY STEPHEN F. LEROY

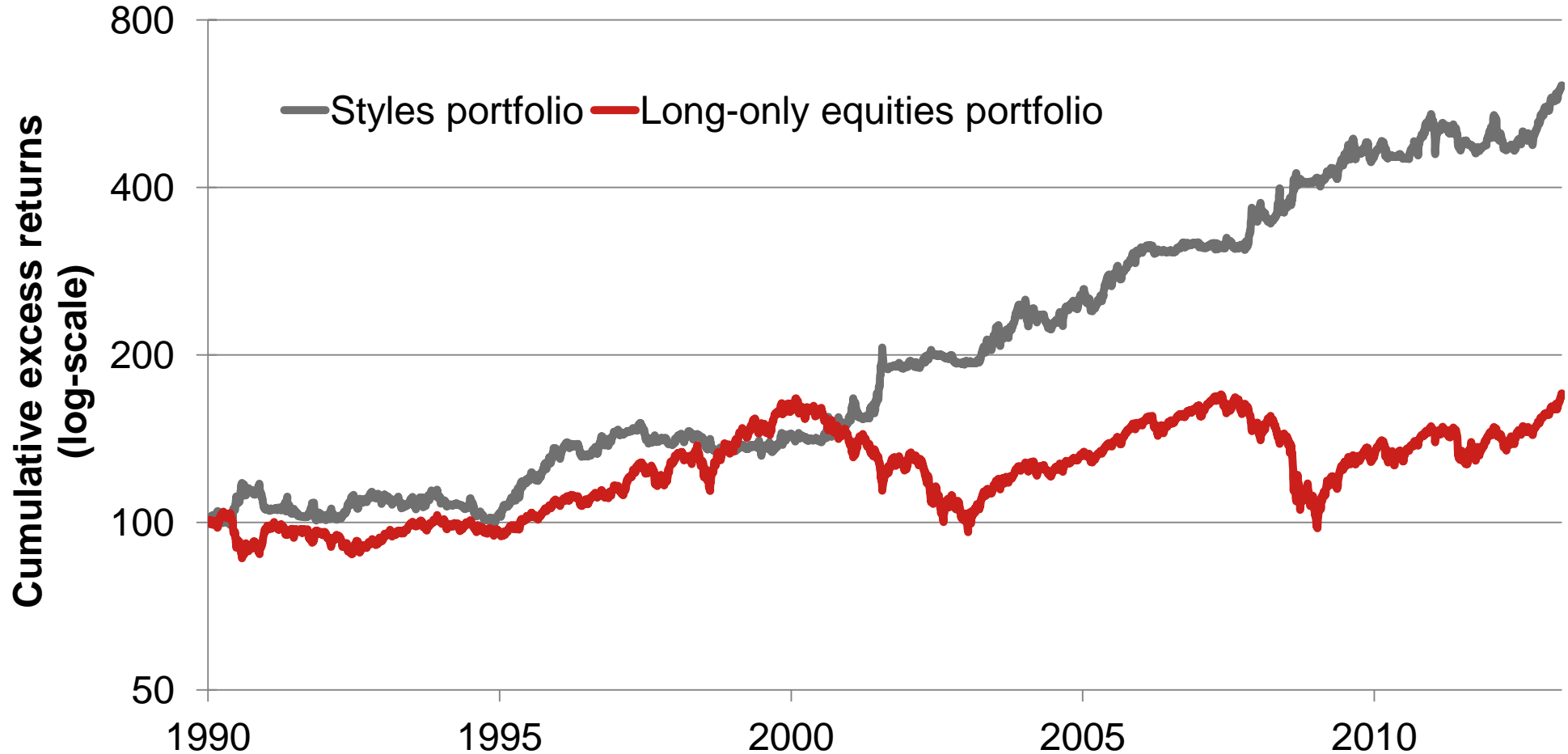
1. INTRODUCTION AND SUMMARY OF CONCLUSIONS

RECENT EMPIRICAL STUDIES of the random properties of stock prices¹ have supported the conclusion that rates of return on stock follow a martingale—i.e., that the expected rate of return on stock conditional on past realized rates of return is always equal to its unconditional expectation. In addition, the martingale property has received theoretical support from recent work by Samuelson [10].² However, Samuelson's result depends on the assumption that investors require an exogenously given expected rate of return. It is natural to inquire whether the martingale property can be derived when the assumption of a given expected rate of return is relaxed. That question will be discussed in this paper.

If it is no longer assumed that the expected rate of return may be taken as given, then it becomes necessary to consider how the expected rate of return is determined, and this involves analyzing the relation between the riskiness of stock and the risk-aversion of investors. We are led to consider models of portfolio selection of the type developed by Tobin [13], [14] and Markowitz [6], and the associated models of capital market equilibrium of Sharpe [12] and Lintner [5], since these deal explicitly with this question. However, it is apparent that models of the Sharpe-Lintner type, though they do relate the expected rate of return to the optimizing behavior of risk-averse investors, can cast no light on the martingale question. This is so because these models assume a one-period

Given predictability, long-only is neither necessary nor sufficient

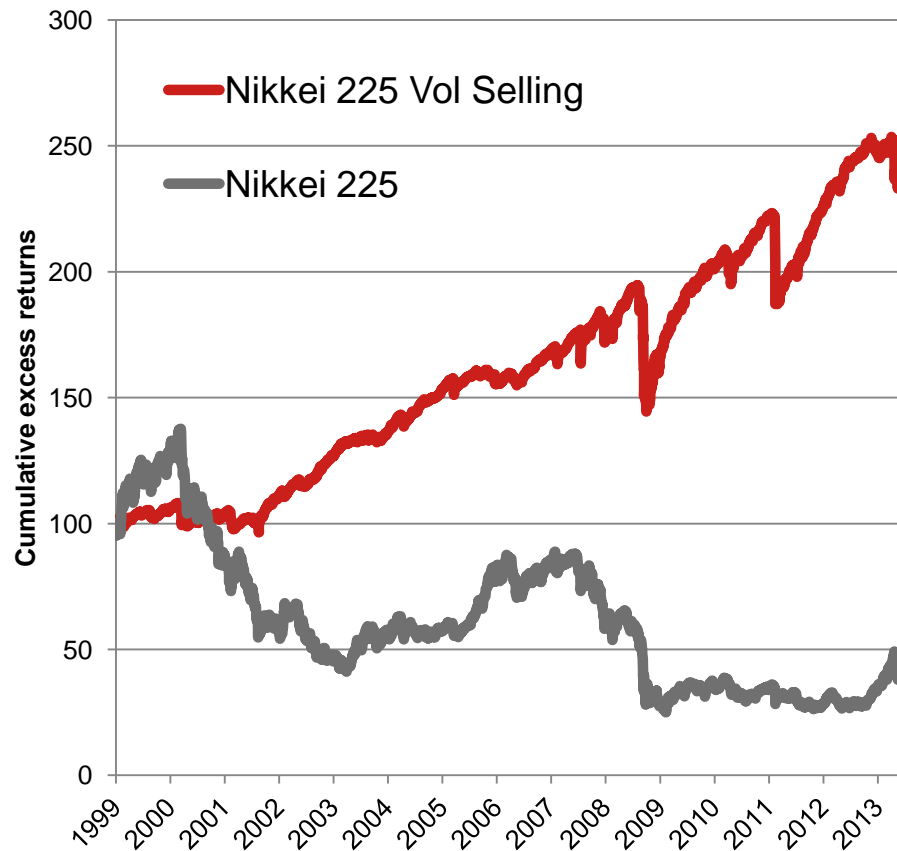
Styles (e.g. carry, value, momentum) are consistent with time-varying risk premia



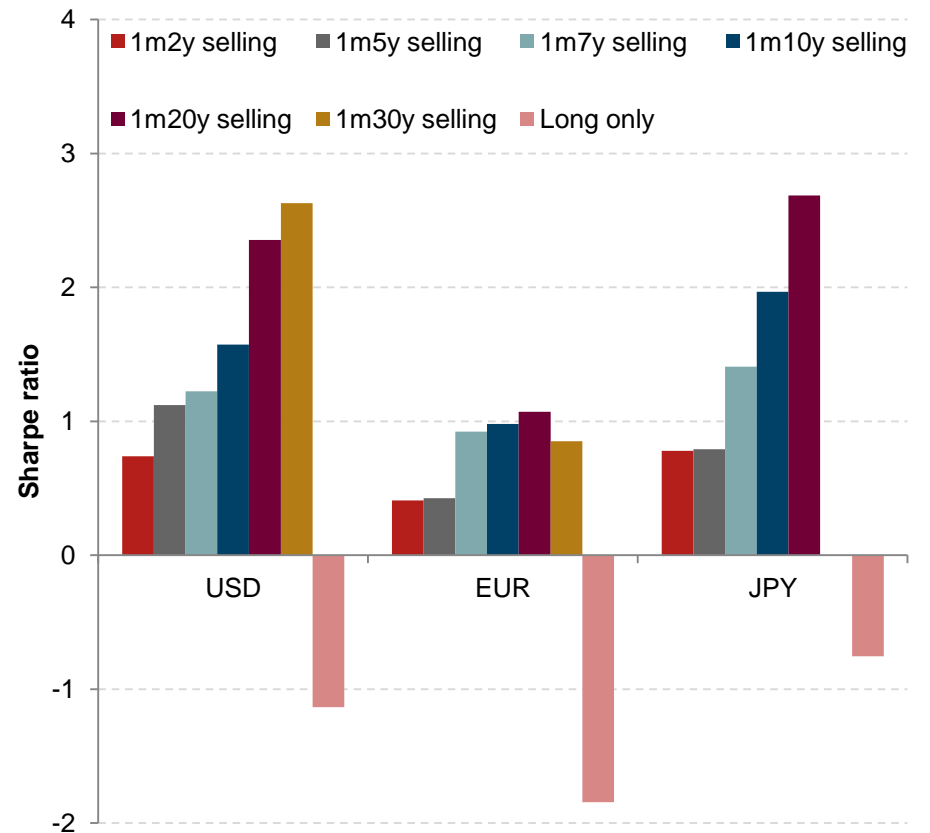
Short gamma is a kind of carry trade

Short volatility has worked well in falling equity and bond markets

Equity volatility selling in Japan has positive excess returns



Rates volatility selling during rising rates beats long-only

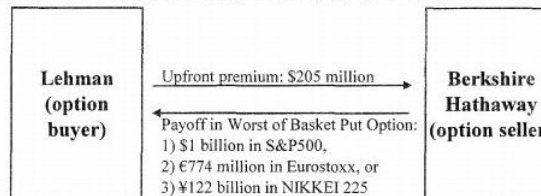


Even the Sage of Omaha trades “WMD”

What you think I say versus what I do?

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CDTR example - Worst of Basket Put Option



- ◆ Lehman buys from Berkshire Hathaway an European-style put option in one of three indices: \$1 billion in S&P500, €774 million in Eurostoxx, or ¥122 billion in NIKKEI 225.
 - Trade Date: 2007
 - Expiration Date: 2027
 - Upfront Premium: \$205 million
 - Strikes: At trade date, the option was at-the-money (1,433.79 for S&P500, 4,158.73 for Eurostoxx and 17,441.16 for NIKKEI 225)
 - Settlement: At expiration date, Lehman will choose the index that will provide the greatest payoff subject to a minimum of zero
- ◆ Trade is not subject to CSA, and thus, Lehman cannot request margin from Berkshire Hathaway. To account for this counterparty exposure, future cash flows are discounted at LIBOR plus 32 bps rather than LIBOR flat.
- ◆ The tenor of the option is 20 years; however, listed options only have expiry up to 3 years. The desk has hedged with 10-year OTC options.

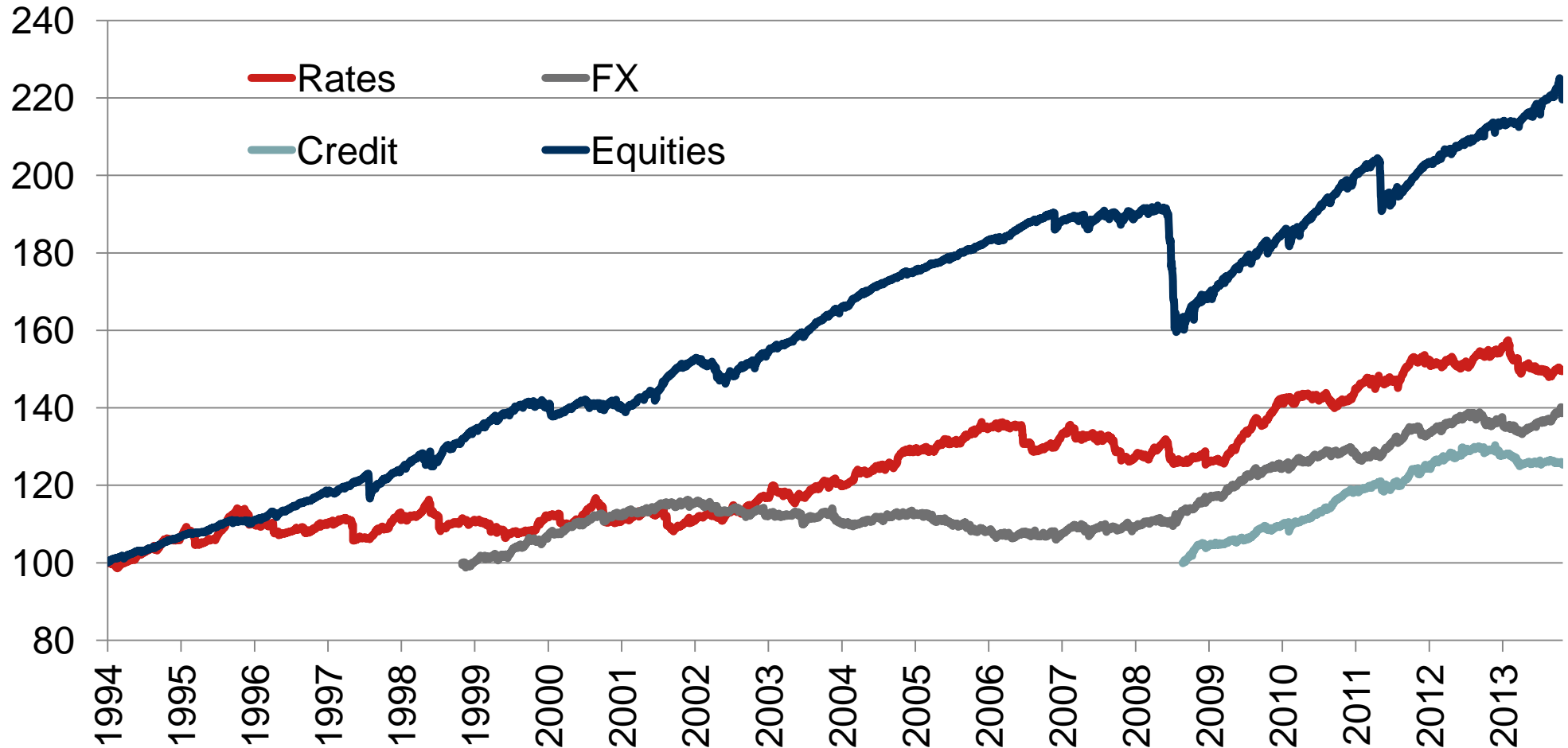
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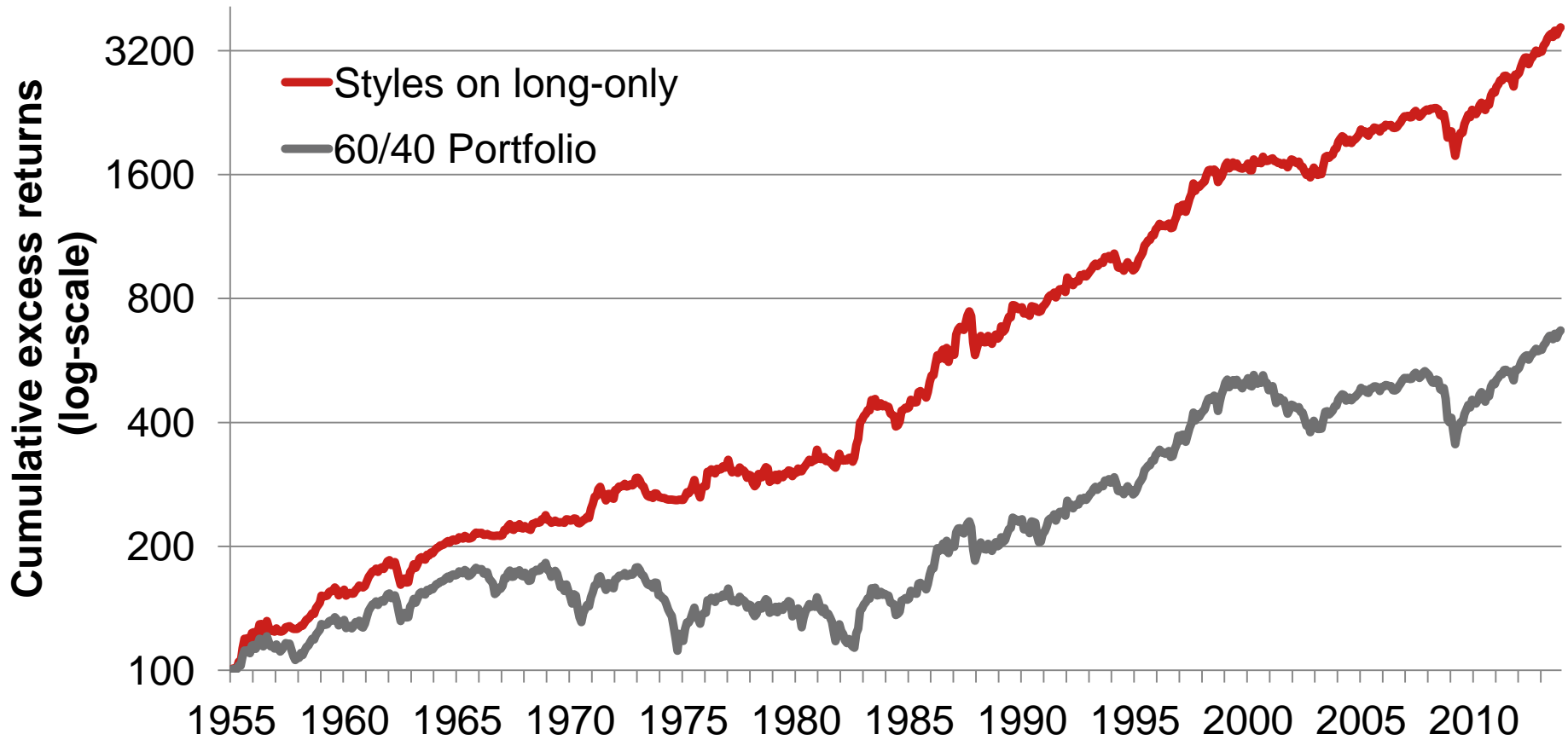
Could volatility today be what equities were in the 1950s?

Volatility risk premia has been profitable



Time-varying risk premia, styles, and benchmarks

Estimating risk premia may not be possible or necessary, but change is hard



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