Models of Asset Pricing
The implications for asset allocation

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Agenda

New orthodoxy in asset pricing

Benchmarking and the single-factor CAPM

Problems with the theory

The evidence for multi-factor models

Multi-factor models – theory and objections

The implications for asset allocation

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The previous orthodoxy

- Up until 10 years ago there were many who believed that the major questions in finance had been answered and that "best advice" was clear

    - An investor should hold the market portfolio and a bond portfolio in a combination that reflects his/her own risk preference

    - i.e. they should never balance risk through stock selection

- This clearly led to the idea of benchmarking against the market (and to tracker funds)

- The problem was, there were "anomalies"

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The new orthodoxy

- However, the term "anomalies" has begun to fall out of use

  - Two of them, "value" and "size", are now considered additional risk factors

  - "Momentum" and "market timing" are not dismissed out of hand (but are not going to be discussed today)

- The basic idea that risk and return can be optimised by altering the combination of bonds and the market has not been overturned but needs to be extended

  - Investors should hold a market portfolio, a value portfolio, a size portfolio (or other combinations of portfolios on the multi-dimensional efficient frontier) and a riskless asset in a combination that reflects their own risk preferences

  - Investors should be aware of their illiquid "background" risks

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Why have benchmarking and trackers been a success?

- The capital asset pricing model (CAPM) suggested that the most efficient risky portfolio is one that reflects the market as a whole

- Benchmarking exploits both theory and low costs (through trackers) to deliver investment advice that in many cases fits with "best advice"

- More risk-averse investors would then alleviate risk by holding a combination of the market and a risk-free investment

- More risk-seeking investors would amplify risk by borrowing and building a levered portfolio

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Irrespective of their risk preferences, if only risky assets are available, all rational investors will choose a point somewhere on the efficient frontier

Return versus risk (risky assets alone)
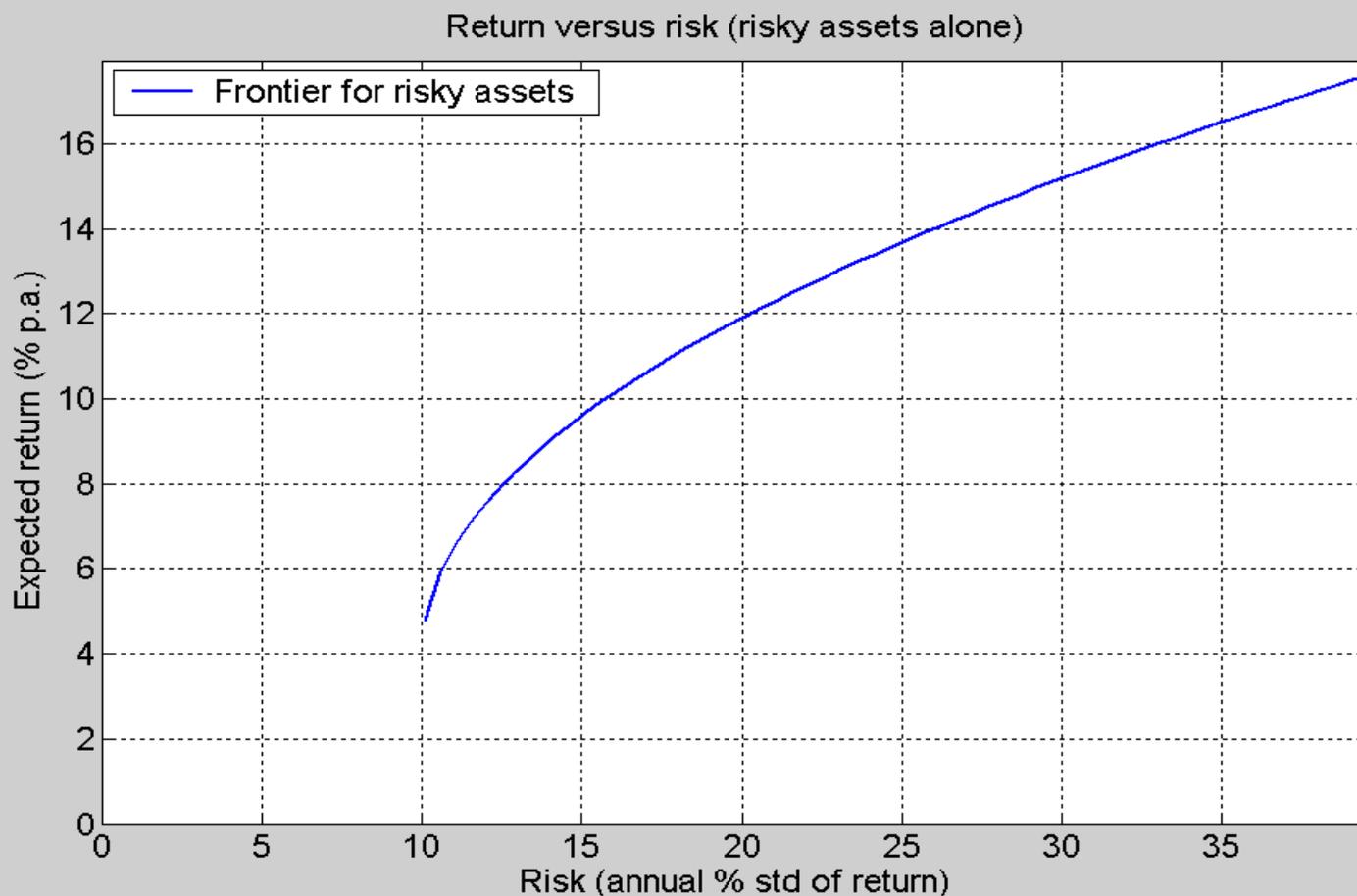
Given the existence of a riskless asset: all rational investors will choose the same point on the efficient risky frontier – the one that is tangential with a line drawn from the risk free return on the y-axis
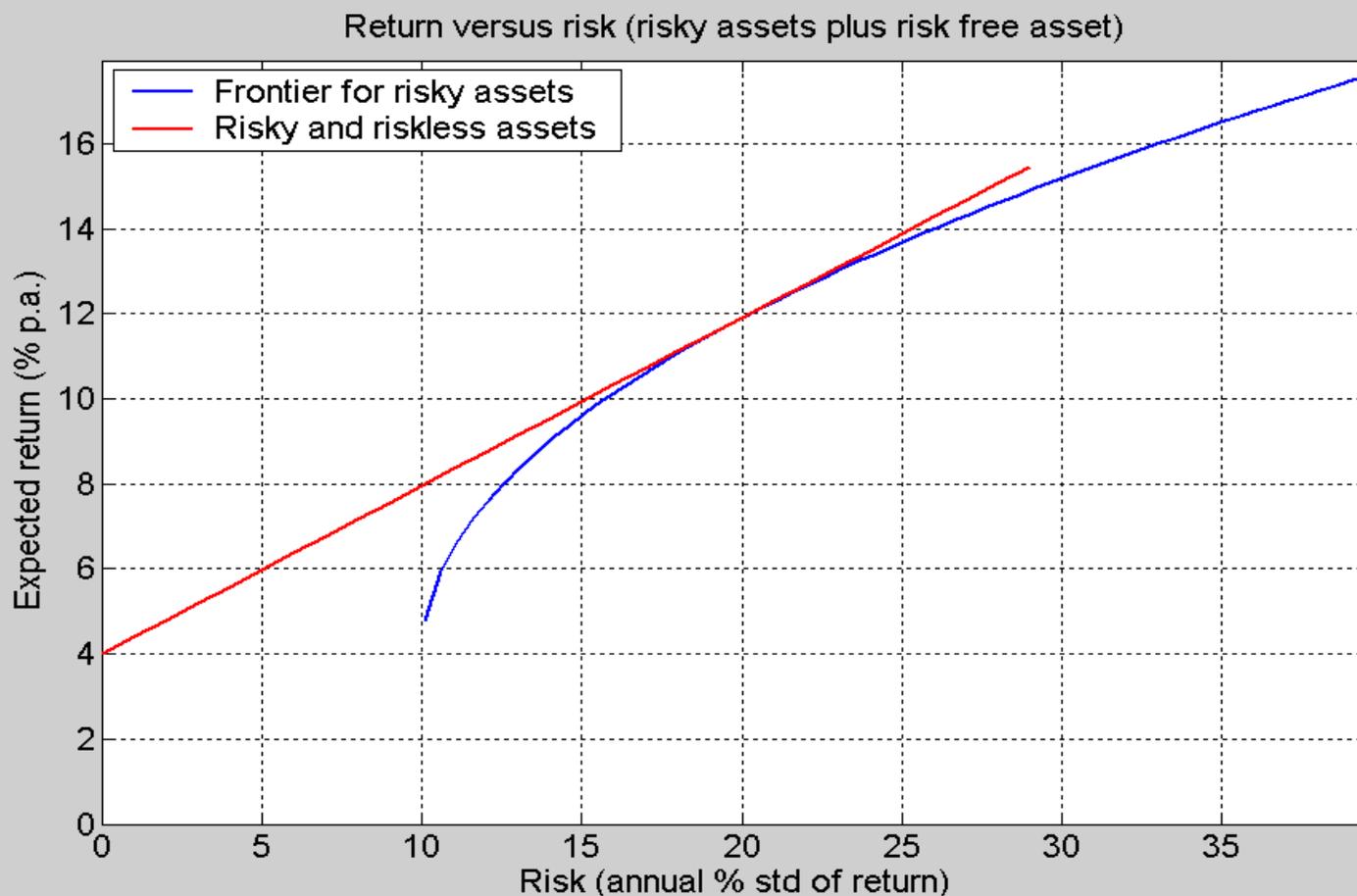
Return versus risk (risky assets plus risk free asset)

Legend:
- Frontier for risky assets
- Risky and riskless assets

x-axis: Risk (annual % std of return)
y-axis: Expected return (% p.a.)

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This is a compelling story but it is not complete

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Problems with the theory

- CAPM is reliant on very restrictive assumptions; in particular

  - It assumes that all investors have the same single period investment horizon

  - There is difficulty defining "the market"

- However, the real problems arose from evidence gathered by researchers

  - Small company and value effects

  - Risk decreasing for longer horizons

  - Predictability in relation to variables that related prices to accounting variable, e.g. P/E ratios, dividend yields, book-to-market ("value") and market value to replacement cost (Tobin's q)

  - The momentum effect

- That is, a number of predictions that are suggested by CAPM just do not hold in reality

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Where does that leave trackers and active management?

For market trackers

+ve   "On average" investors must still hold the market

-ve   The "anomalies" weaken their justification considerably

-ve   A market tracker cannot give an investor all the benefits from investing in equities

-ve   **If mean and variance are the only criteria for an investor, the market is *not* the appropriate risky portfolio**

For active managers

+ve   Evidence suggests that the returns of managed funds are sensitive to elements of risk (size and value) that a market-wide tracker is not. In this sense, a market tracker and an active fund are not directly comparable

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A model for asset prices should predict excess returns. The challenge for any model is to explain the excess returns of 25 portfolios formed on book-to-market and size. The single-factor CAPM does a poor job

Observed mean excess return versus single-factor CAPM expected return

For a robust asset pricing model these observations should cluster around a 45° line from the origin
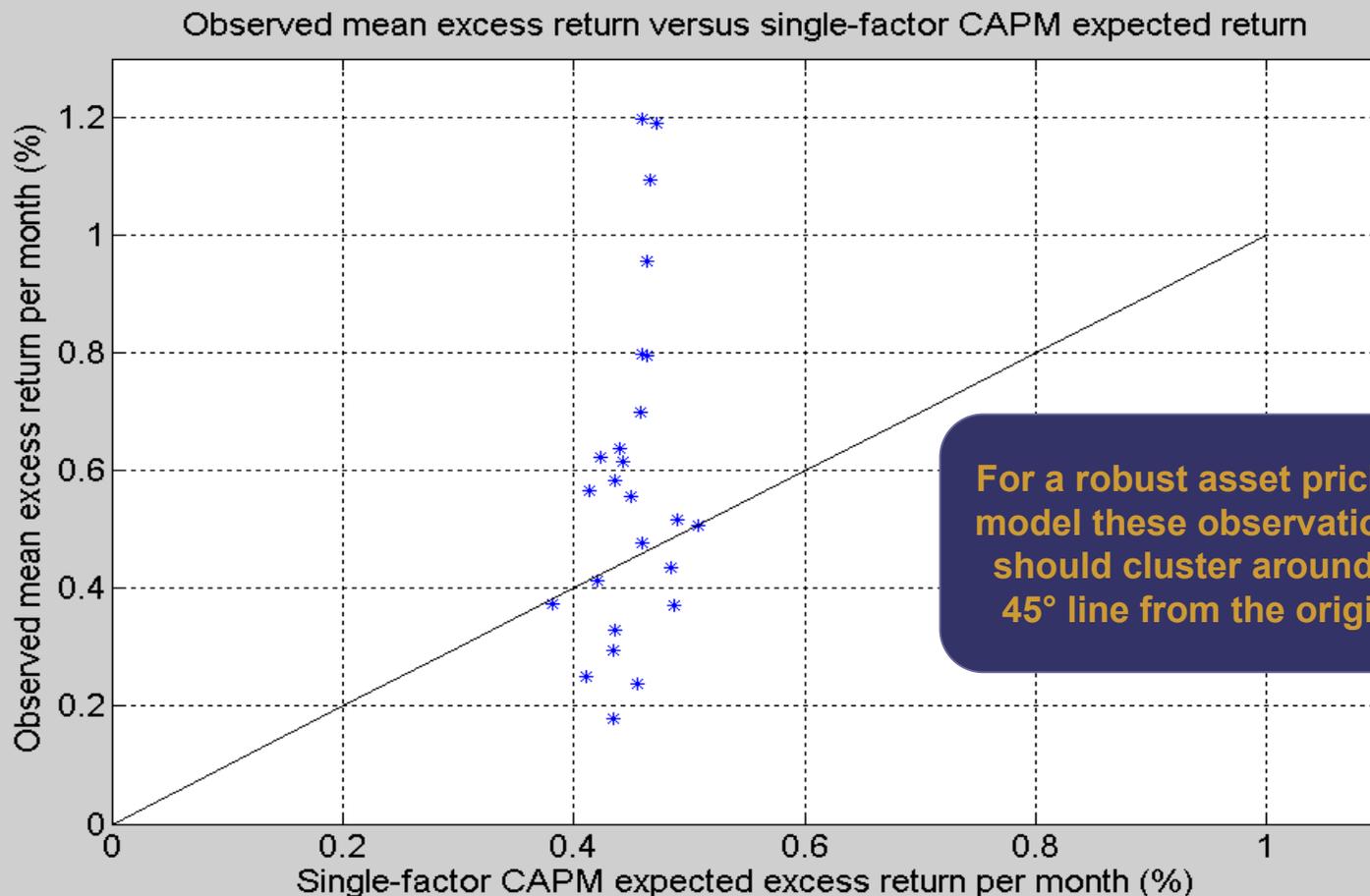
A two-factor UK model based on Fama-French (1993) does a very good job. Recent research ties these factors to economic effects, i.e. recession aversion and the "ad hoc" criticism has largely fallen away
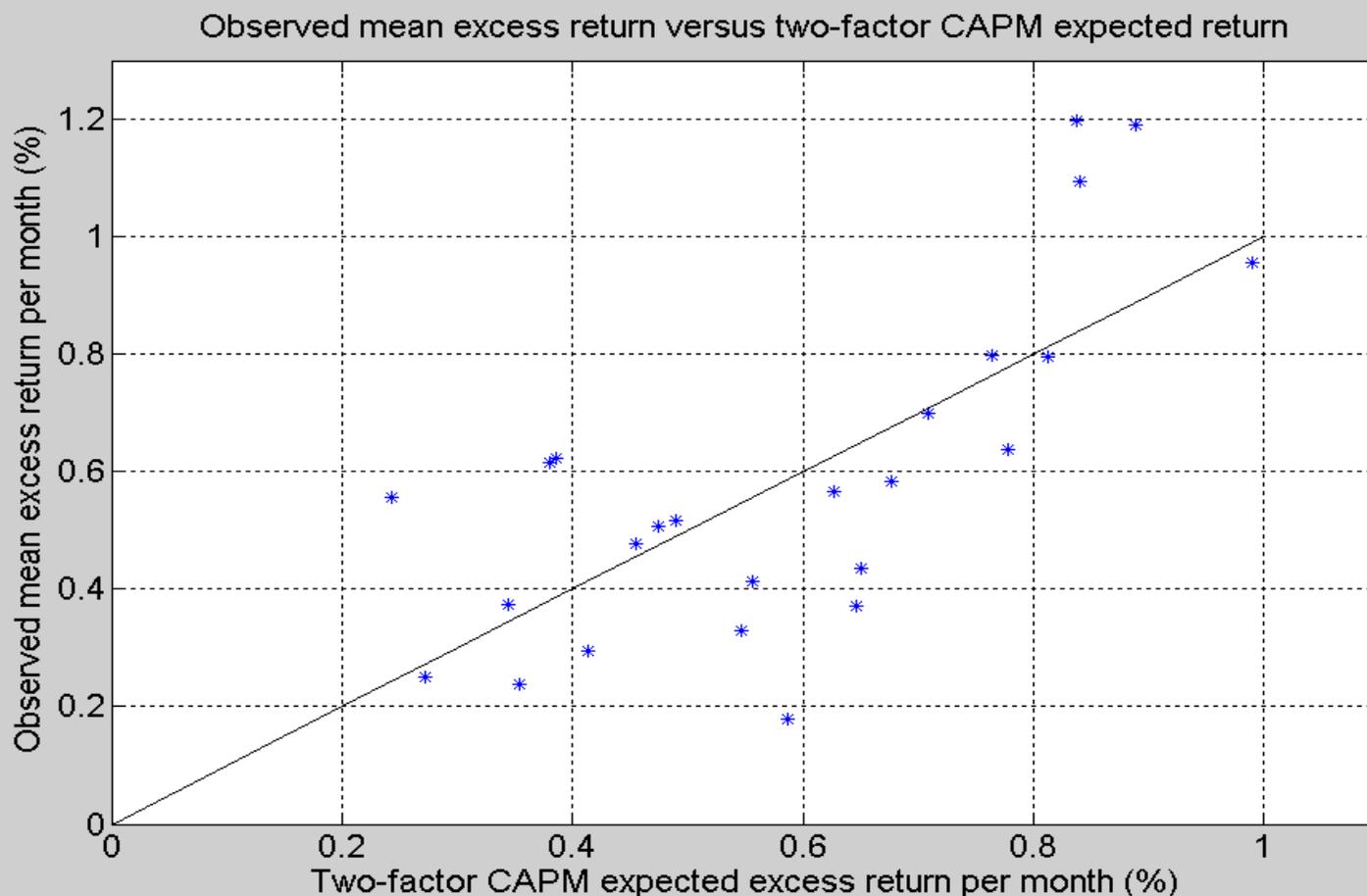
Observed mean excess return versus two-factor CAPM expected return

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Multi-factor models and theory

A number of competing multi-factor model have been proposed

- Intertemporal-CAPM, (Merton (1973)) – (I-CAPM)

- Arbitrage Pricing Theory (Ross ((1976)) – (APT)

- Consumption-CAPM (Breeden (1979)) – (C-CAPM)

Given the evidence (see following slides) there is a growing belief that the Fama-French model is best characterised as a C-CAPM model

However, it is generally agreed that from an empirical perspective all such multi-factor models are, for practical purposes, almost indistinguishable

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Multi-factor models – objections

One early criticism of the Fama French model is that the factors are ad hoc and lack a theoretical basis

This criticism is misplaced and is now overtaken by recently published evidence

- For example, Liew and Vassalou (2000) provide persuasive evidence that the relationship between the Fama-French factors and GDP is significant in most countries tested, including the UK

- Subsequent research by Vassalou and Xing (2004) establishes that much of the effect arises from default risk

- This research provides a valuable link between the findings of Fama and French and the established theoretical framework

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Multi-factor models – objections (2)

A further objection to the Fama-French model is that the factor premia may represent mis-pricing

- However, this argument trivialises the significance of the model

- The joint hypotheses problem, which has been accepted for many years, states that it is impossible to distinguish between risk premia and mis-pricing

- The real question is whether a model better explains returns over time – and if such explanation can be repeated in different markets and in periods subsequent to the initial observations

- These conditions are true for these models

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Multi-factor asset allocation

Does the methodology just go out the window?

- No, the methodology can be extended to multi-factor models (see Fama 1996)

- We can demonstrate this graphically using a two-factor CAPM model

- There are surprising implications for investors who are neutral in regard to risks other than market risk

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If risk is two-dimensional, the efficient frontier becomes a parabolic cone. All investors will choose some point on this surface

Return versus two-factor risk (risky assets alone)
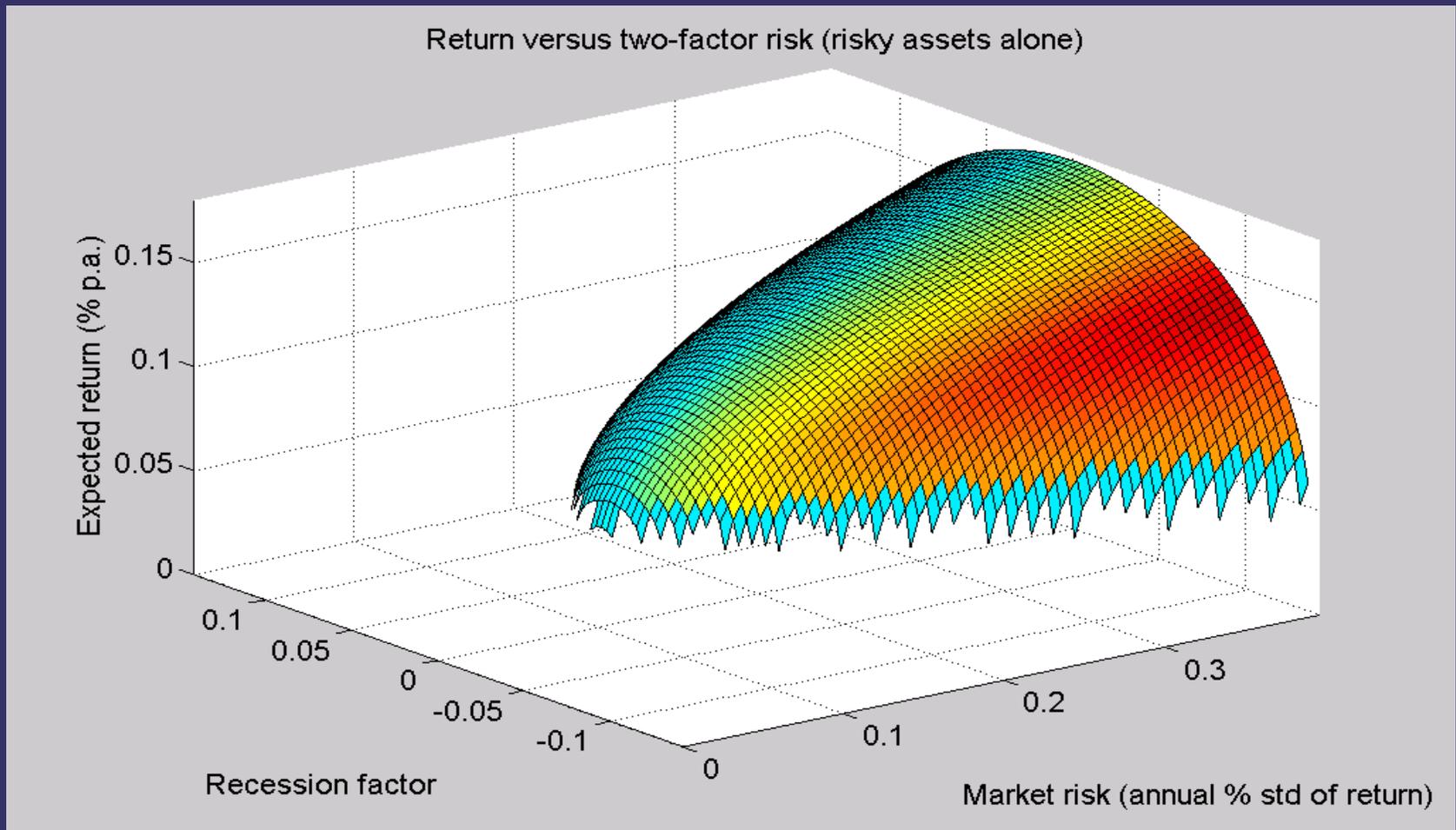
Given a riskless asset all investors should choose a point that is at the tangential intersection of the parabolic cone and a linear cone. This will deal with market risk, but this intersection is a curve not a point
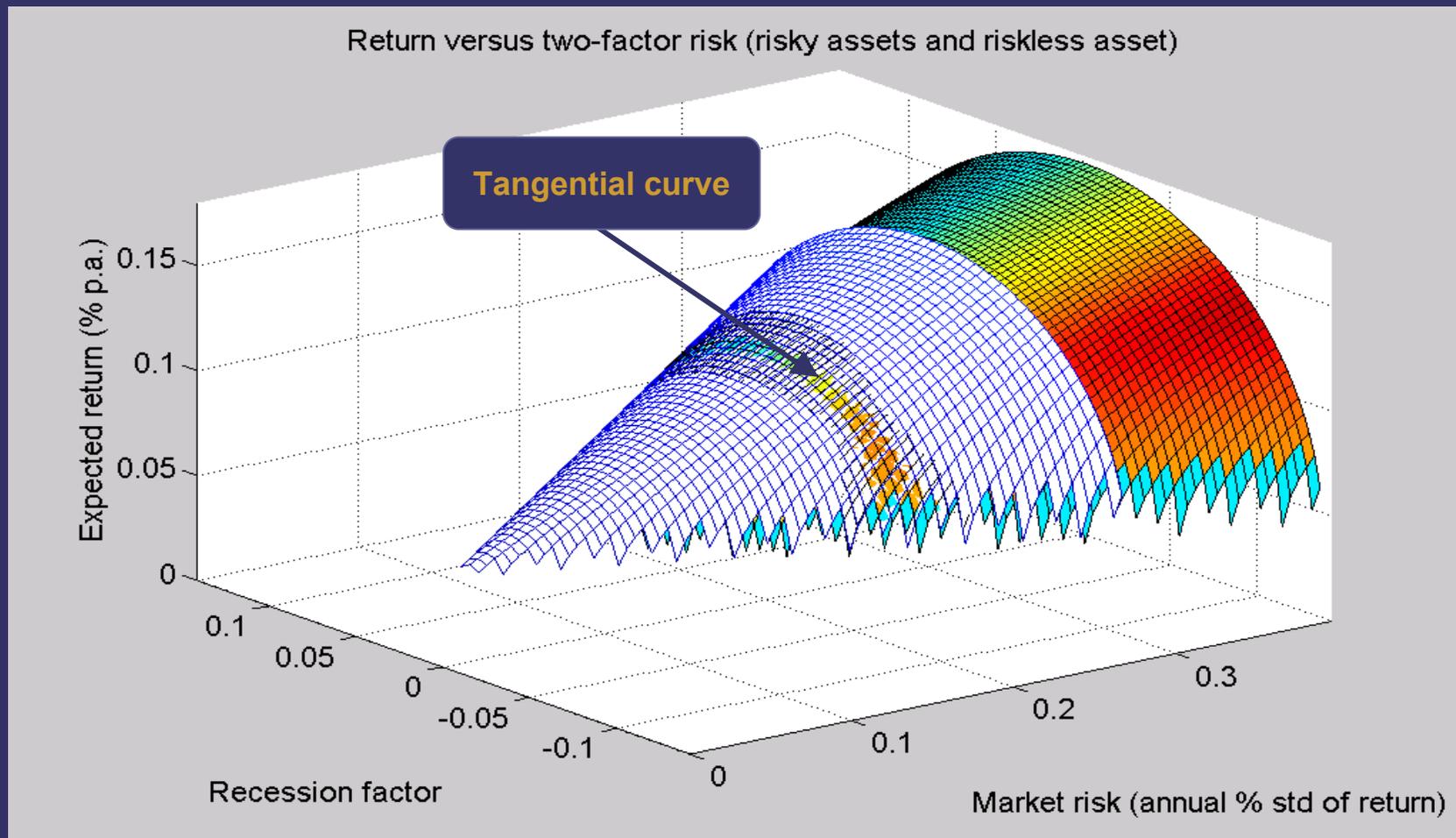
Return versus two-factor risk (risky assets and riskless asset)

Tangential curve

Expected return (% p.a.)

0.15
0.1
0.05
0

Recession factor
0.1
0.05
0
-0.05
-0.1

Market risk (annual % std of return)
0.3
0.2
0.1
0

Return versus two-factor risk (risky assets and riskless asset)

Return versus two-factor risk (risky assets and riskless asset)
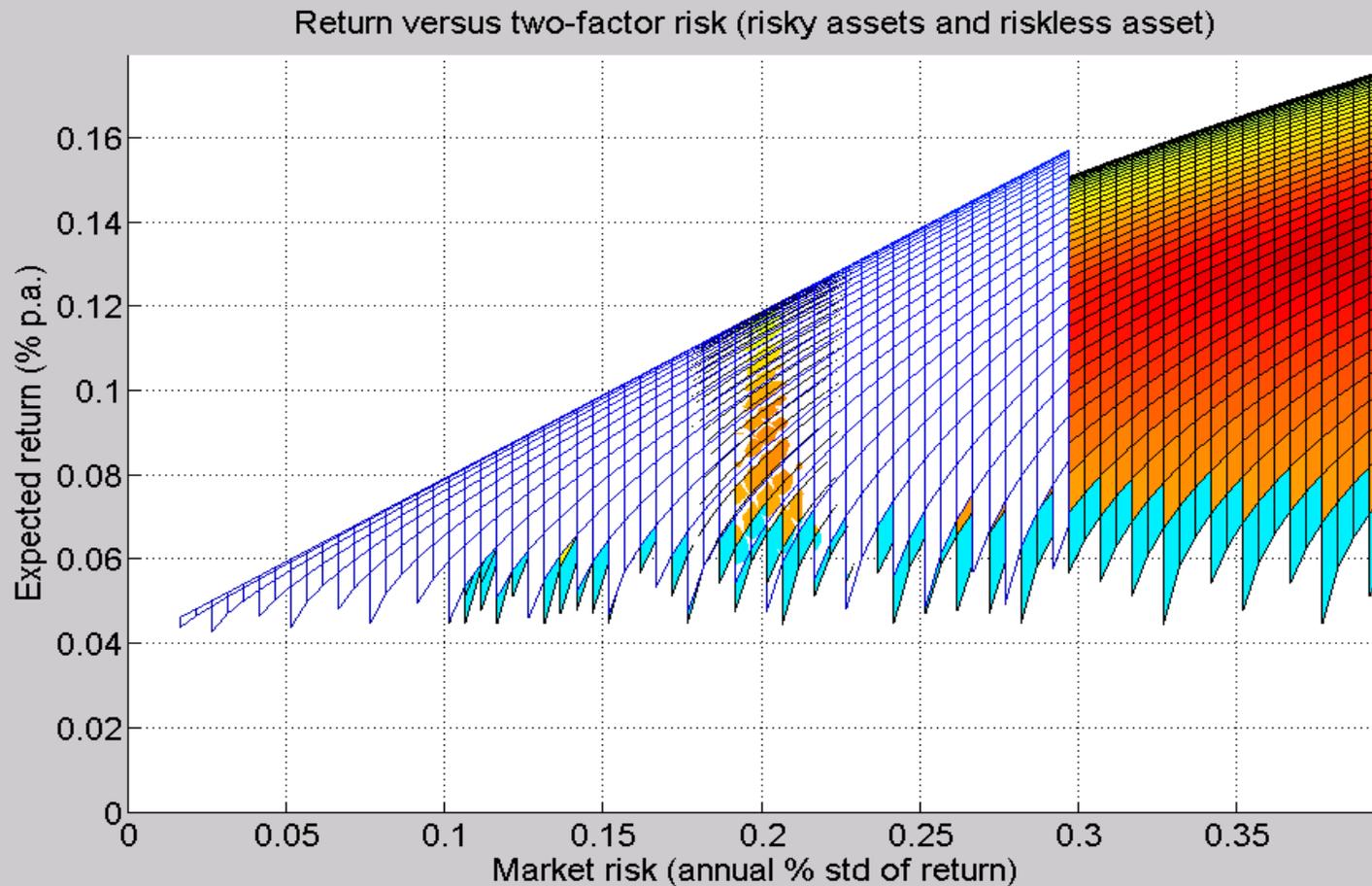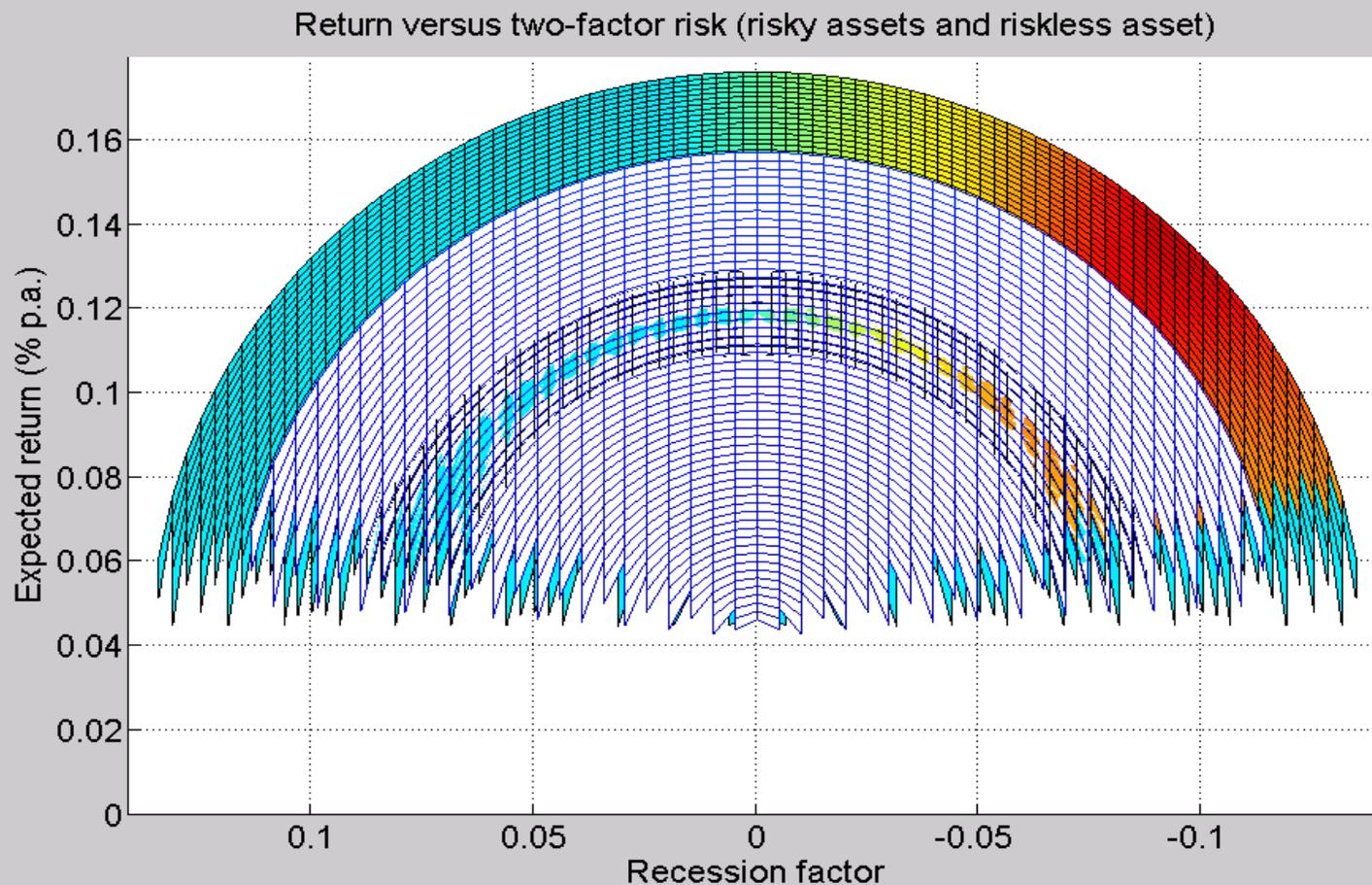
One of the most important implications is that the "market" cannot be the most efficient risky portfolio for pure mean-variance efficient investors

A: The efficient portfolio for mean-variance investors who are neutral to recession risk

B: The efficient portfolio for investors who are more averse to recession risk than the average investor

C: If A and B are true then the average portfolio (the "market") must be off-centre and cannot be pure mean-variance efficient
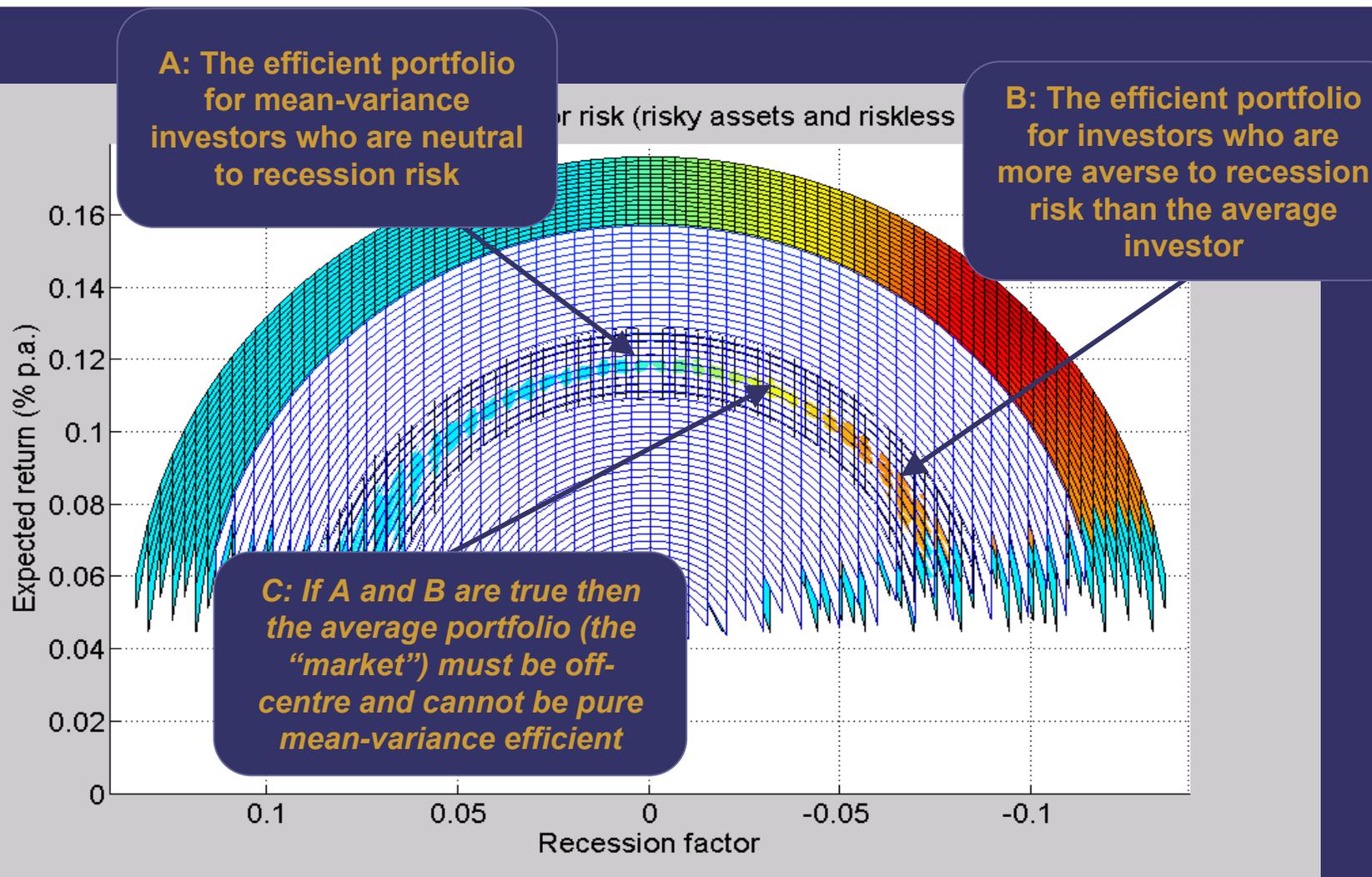
Conclusions

- **The single-factor CAPM is being supplanted by multi-factor extensions**

- **The "market" cannot be automatically adopted as the ideal risky portfolio for all investor**

- **"Neutral" advice can be difficult to give without some analysis of the investors risk preferences**

- **There is no longer a single solution that fits all**

- **But, much of this is tractable**

- **All this refocuses investment advice on "marginal" risk**