Portfolio Formation in the new Financial World

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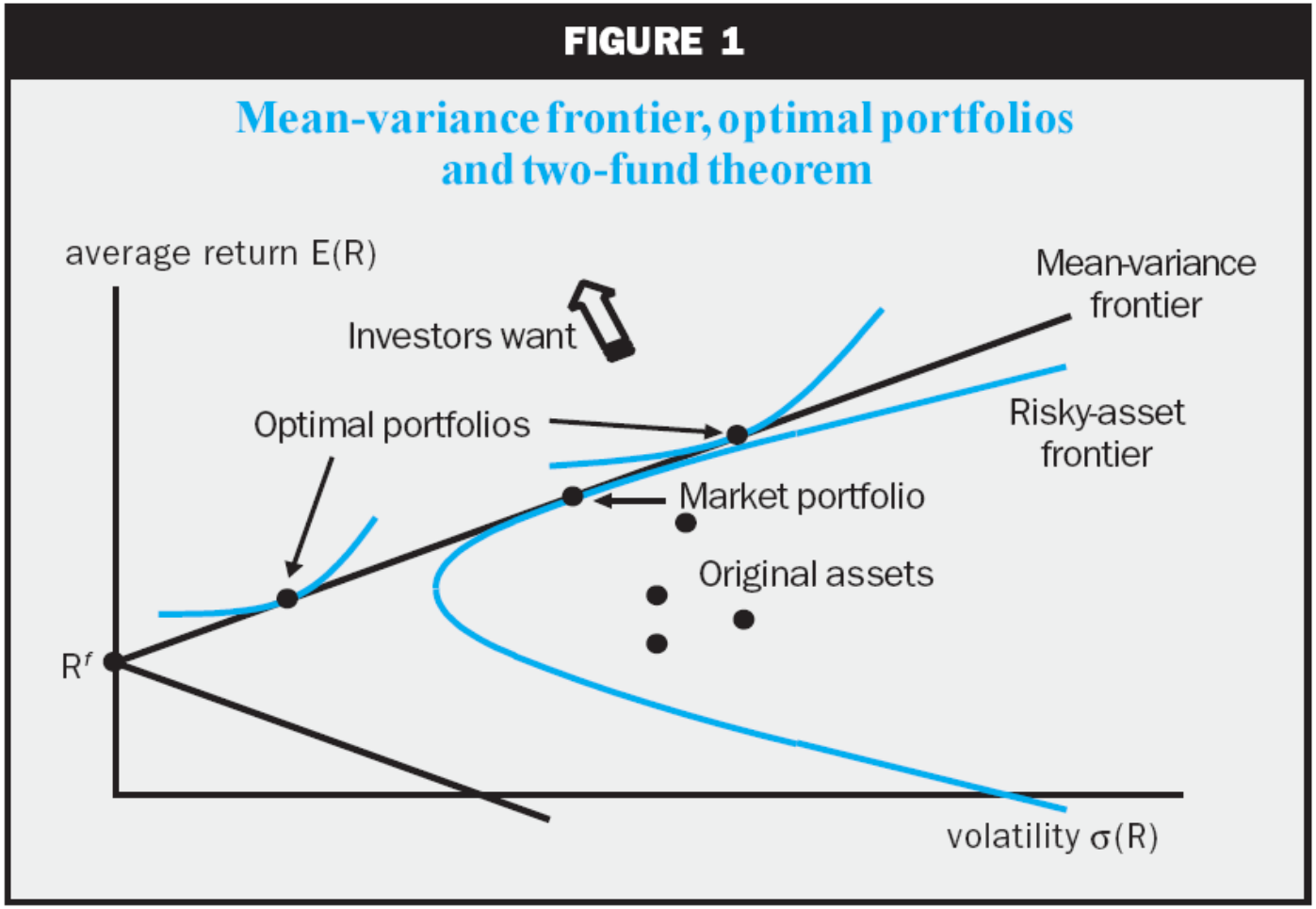
Mean-variance portfolios



Mean-variance portfolio insights

- *Assets* don't matter. Only the *portfolio* matters.
- *Names and styles* don't matter per se. Only means, betas, covariances matter.
- Two fund theorem" puts us all out of business.
- To come: revive tailored portfolios (and all our salaries)?

Mean-variance portfolio rule

- Rule 1:

$$\text{risky share} = \frac{1}{\text{risk aversion}} \frac{\text{expected return - riskfree rate}}{\text{return variance}}$$

- Example 60/40

$$0.6 = \frac{1}{2.0} \times \frac{0.06 - 0.02}{0.18^2}$$

- *The average investor must hold the market portfolio.*
- $\Rightarrow$Think about how you are *different* from everyone else.
- Rule 2:

$$\text{risky share } = \frac{\text{Average risk aversion}}{\text{Your risk aversion}}$$

The CAPM

- Alpha, beta decomposition (still very useful)
  1. A risk decomposition

$$\text{Return} = \text{alpha} + \text{beta} \times \text{market return} + \text{idiosyncratic}$$

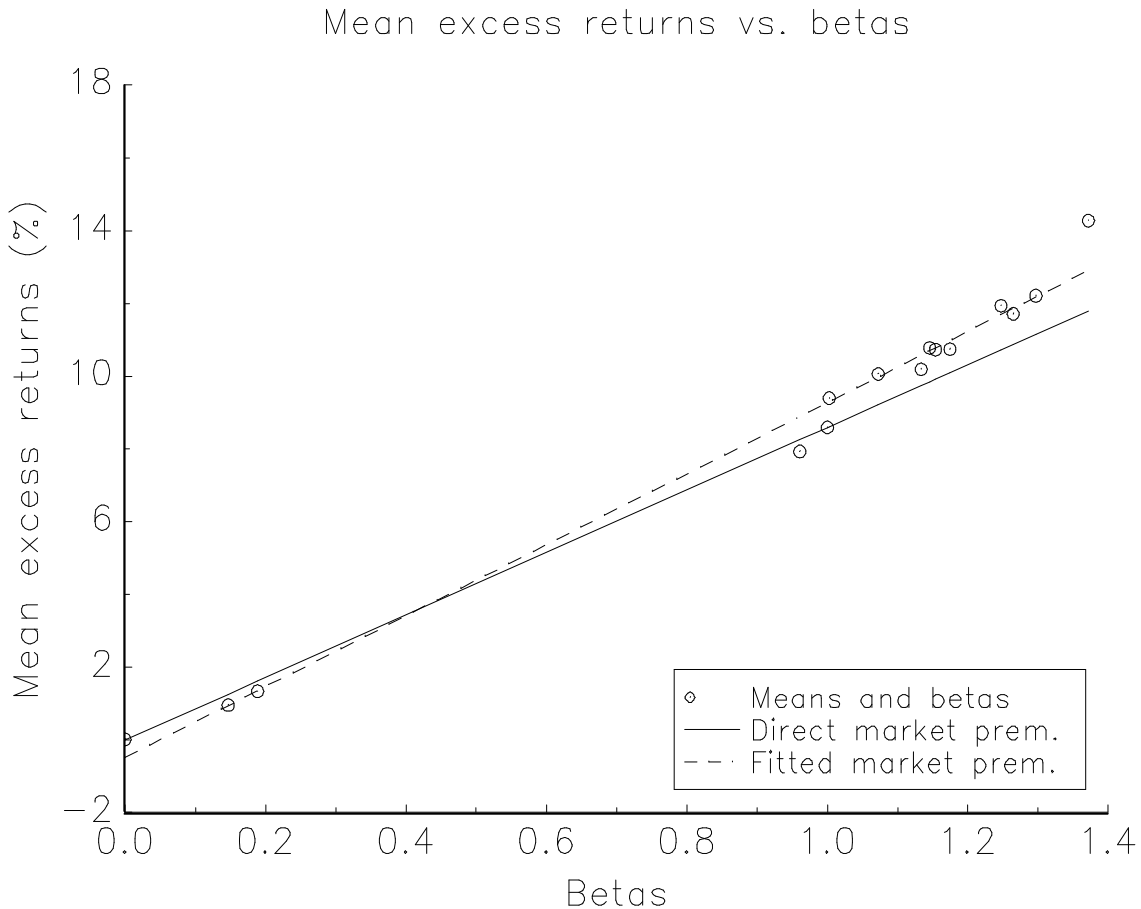
  2. A statement about *expected* future returns

$$\text{Expected Return} = (\text{alpha}) + \text{beta} \times \text{market premium}$$

- Still useful, and still the first step.
  1. Compare any strategy to index
  2. Manage and offset beta risks
  3. Separate portfolio into "passive" "systematic" and "active" components.

The CAPM

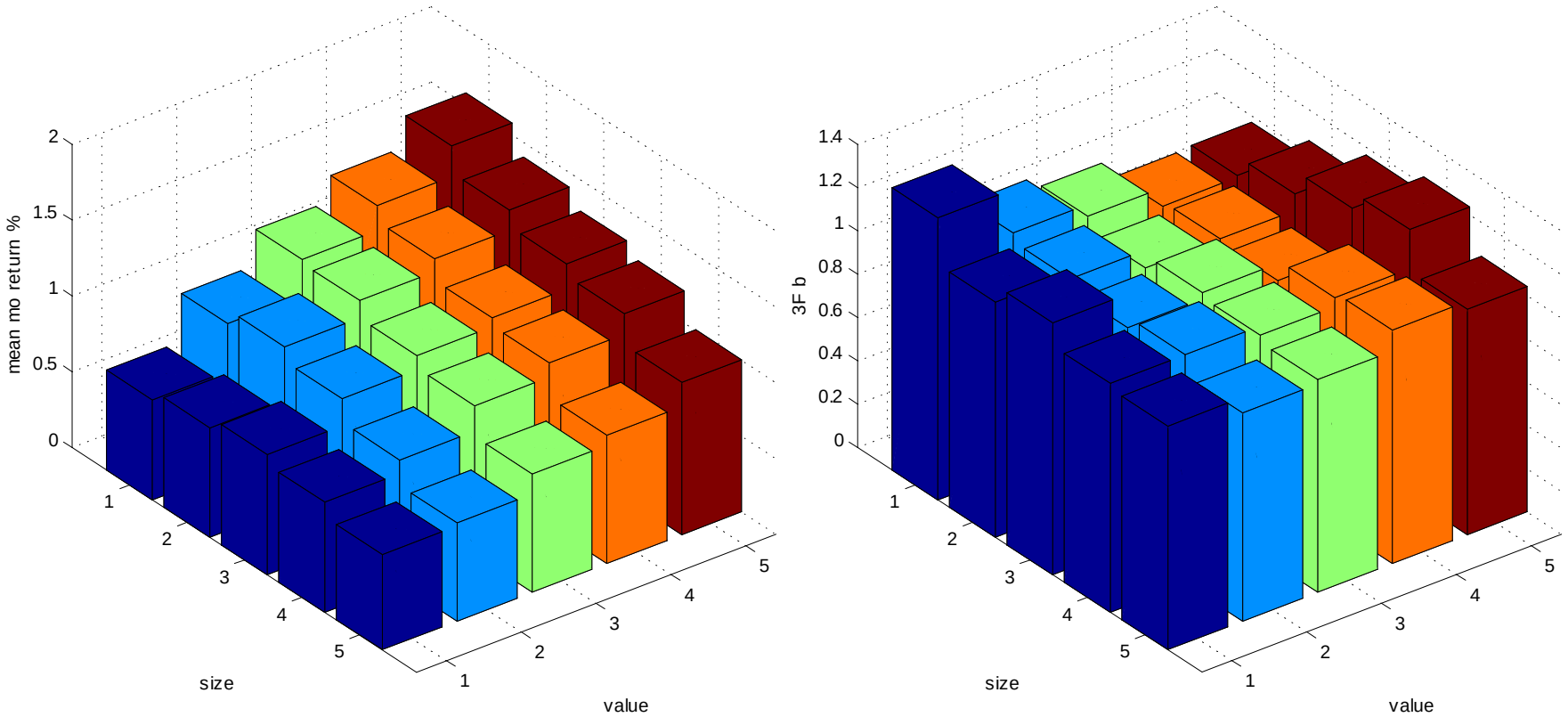
The CAPM still works quite well for many assets, strategies, purposes



Multifactor models

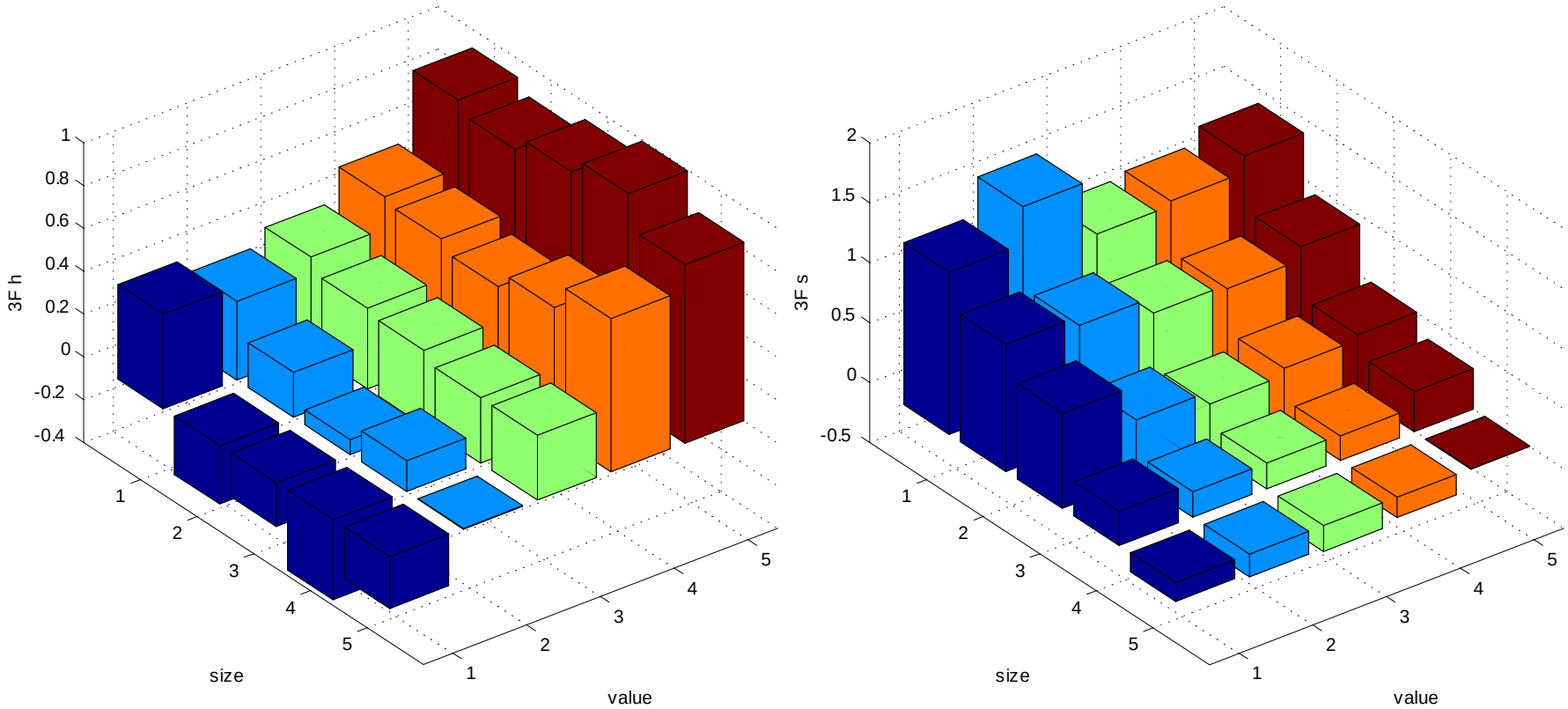
- $$\text{Return} = (\text{alpha}) + \text{beta} \times \text{market}$$
$$+ \text{value beta} \times \text{value index} + \text{small beta} \times \text{small index} \Leftarrow \textbf{new}$$
$$+ \ldots + \text{idiosyncratic risk}$$
- A partial list:
value, growth, small, momentum, bond long/short, credit spread, liquidity, option-writing, currency carry.
- Just like the CAPM / index but many more terms to think about!
- Some sense of the evidence.....

Value – CAPM failure



High average returns (left) do not correspond to high betas (right)

Three-factor model



High average returns *do* correspond to higher small and value betas.

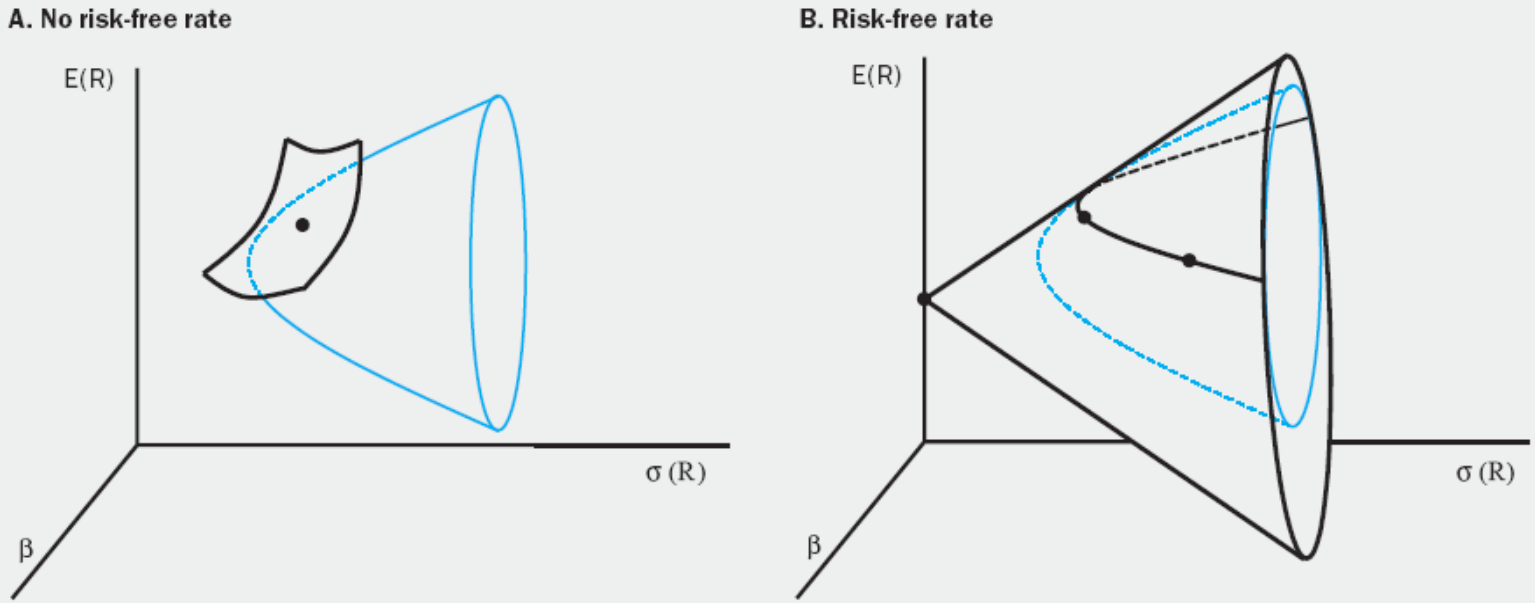
What does the three-factor model mean?

- *The average investor must hold the market,* and cannot buy value.
- Story: job, business, outside income, etc. *Value stocks must pay higher returns because they are dangerous to many investors.*
- Portfolios: people with less value-sensitive outside risk take more, people with more value-sensitive outside risks take less.
- Portfolios: Just like before, but many more steps
  1. How much market risk (risk aversion) – market index?
  2. How much value/growth tilt – value index?
  3. Keep going – 10 other factors!
- If you're no different than average, you still hold the market index! You take each case, only if you're *different* than average!
- What happened to the MV picture, Rule 1 and Rule 2?....

Portfolios and multifactor models

FIGURE 2

Portfolio theory in a multifactor world



Notes: Panel A shows an indifference surface and optimal portfolio in the case with no risk-free rate. The dot marks the optimal portfolio where the indifference surface touches the multifactor efficient frontier. Panel B shows the set of multifactor efficient portfolios with a risk-free rate. The two cone-shaped surfaces intersect on the black line with two dots. The two dots are the market portfolio and an additional multifactor-efficient portfolio; all multifactor-efficient portfolios on the outer cone can be reached by combinations of the risk-free rate, the market, and the extra multifactor-efficient portfolio.

Portfolios in a multifactor world

- 2 fund theorem $\Rightarrow$ N - fund theorem.
- Rule 1

$$\text{portfolio} = \frac{1}{\text{risk aversion}}\left(\frac{\text{expected mkt return - rf}}{\text{market variance}}\right) \times \text{mkt. index} +$$

$$+ \text{“state-variable aversion”} \times \text{factor index} \quad \Leftarrow \textbf{new terms}$$

- “state variable aversion” = how much you care if, say, value stocks tank.
- Rule 2

$$\text{portfolio} = \frac{\text{average risk aversion}}{\text{your risk aversion}} \times \text{mkt. index} +$$

$$+(\text{your “state-variable aversion”} - \text{average}) \times \text{factor index} \quad \Leftarrow \textbf{new term}$$

- It’s all just as before, but with many more “styles” to consider

Hedging outside income

- Observation 1: Many nonpriced factors.

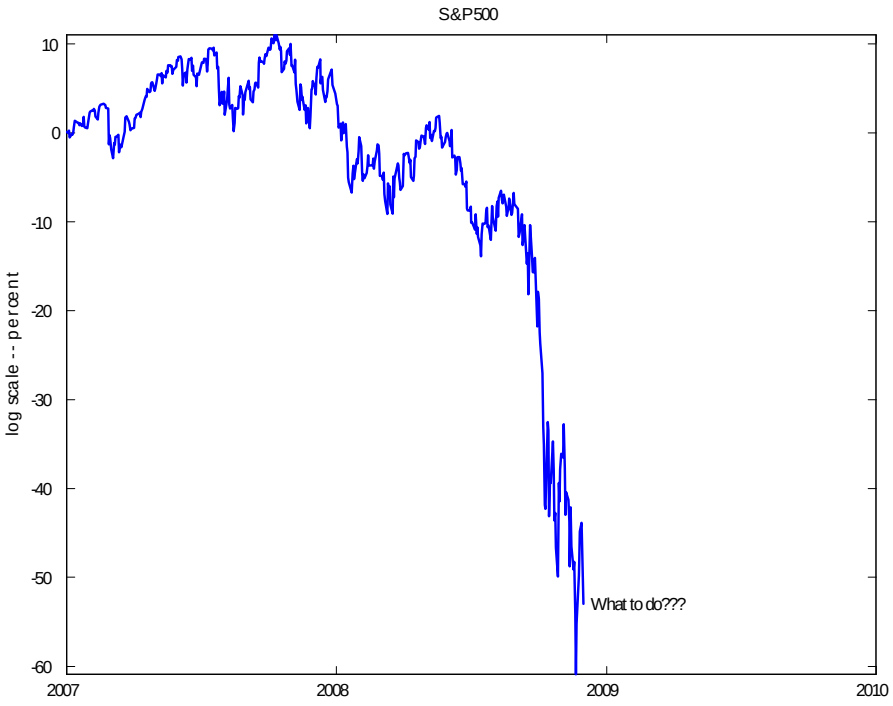
$$\begin{aligned}\text{Return} \quad = \quad & \text{alpha} \ + \text{beta} \times \text{market} \ + \ \text{h} \times \text{value index} \ + \ldots\ldots \\ & + \textbf{(coefficient)} \times \textbf{industry portfolio} + .. \Leftarrow \textbf{new term}\end{aligned}$$

- Observation 2: *Don't hold company / industry stock* (if you don't have to) Institutions: *think about the risk and time structure of liabilities*, and the cost of mismatch (Pensions, endowments)
- 1+2: *Find industry or other portfolios that best mimic the risks of your job/business. At least get rid of these. Better yet, short them. This is like buying house insurance.*
- This is just the nosecone again, but even more factors.
- This seems incredibly hard. It is, and that's good news! A revival of "tailored portfolios" – and fees, and tuition – with no need for magic alpha.

Portfolios over time.

- Questions:
  1. Rebalance?
  2. Tactical asset allocation – P/E, P/D, volatility signals for market/cash? Other signals to move between markets?
- Caution: *The average investor must hold the market portfolio.*
  1. We can't all rebalance!
  2. We can't all chase P/E, tactical signals.
  3. Start with "why does passive make sense," identify how you are different.
- A case study....

Fall 2008


S&P500
log scale -- percent
10
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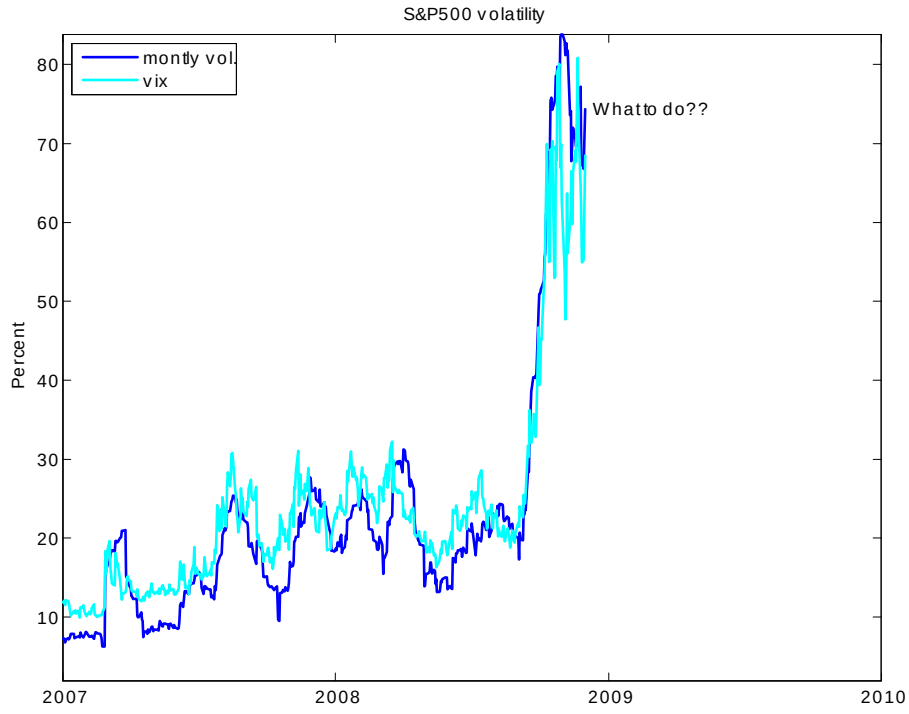
2007
2008
2009
2010
What to do???


S&P500 volatility
Percent
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What to do??
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2007
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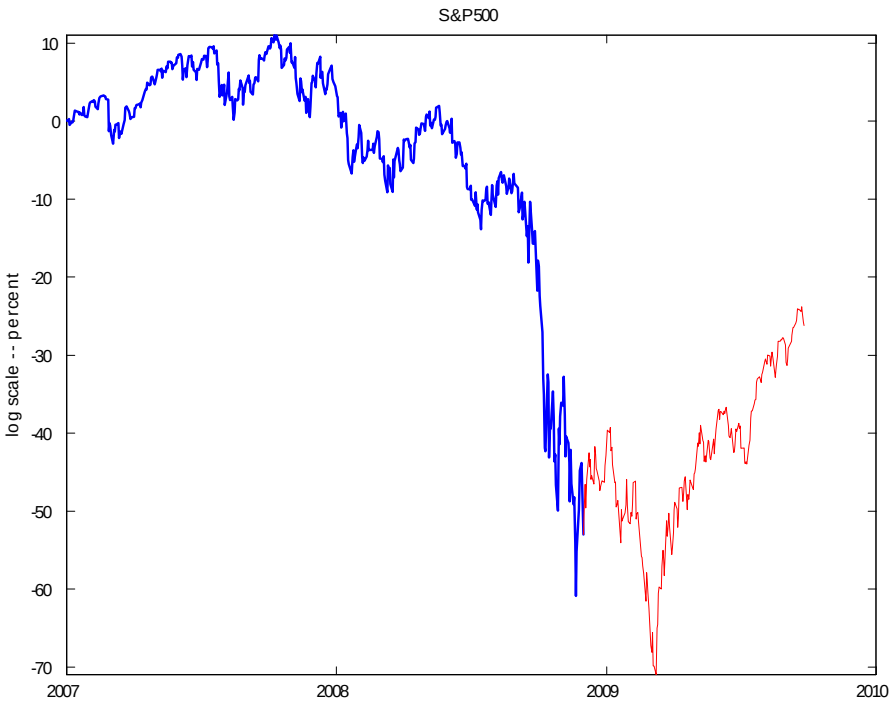
Fall 2008


S&P500
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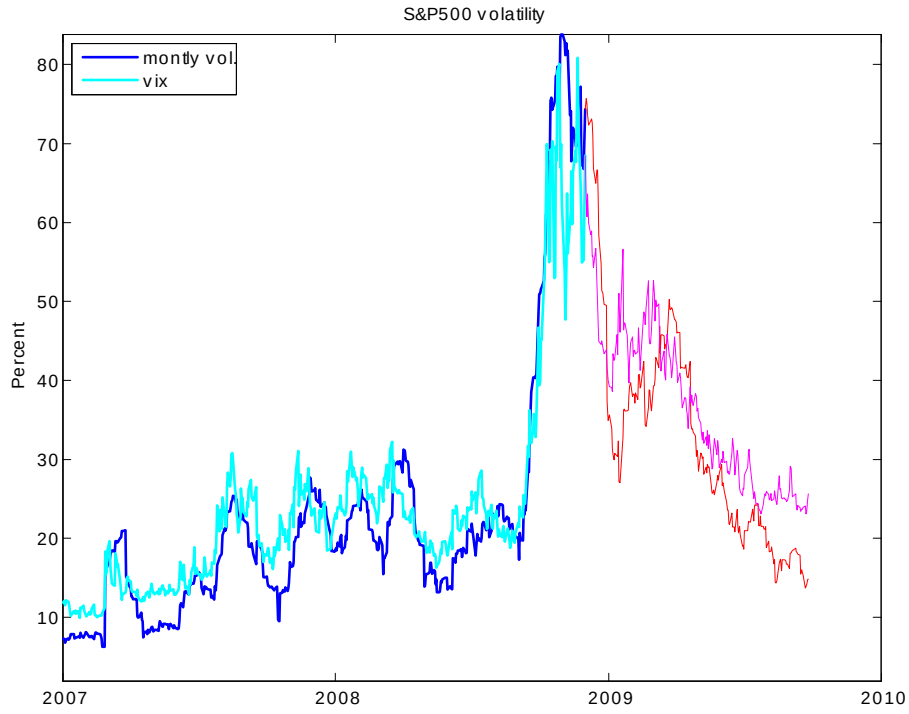
S&P500 volatility
montly vol.
vix
Percent
80
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40
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2007
2008
2009
2010

Fall 2008 – classic advice?

- $$\text{stock share} = \frac{1}{\text{risk aversion}} \frac{\text{expected return - riskfree rate}}{\text{return variance}}$$

$$\text{was: } 0.6 = \frac{1}{2.0} \times \frac{0.06 - 0.02}{0.18^2}$$

$$\text{is: } \frac{1}{2.0} \times \frac{0.06 - 0.02}{\mathbf{0.70}^2 \Leftarrow \text{change}} = 0.04!$$

4% equities????

- Mean increase is not nearly enough.

$$\begin{aligned} 0.6 &= \frac{1}{2.0} \times \frac{x - 0.02}{0.70^2} \\ x &= 0.61 = 61\%!! \end{aligned}$$

- How can "hold the market" make any sense?....

Fall 2008:

- Answer: *we're using the wrong formula*

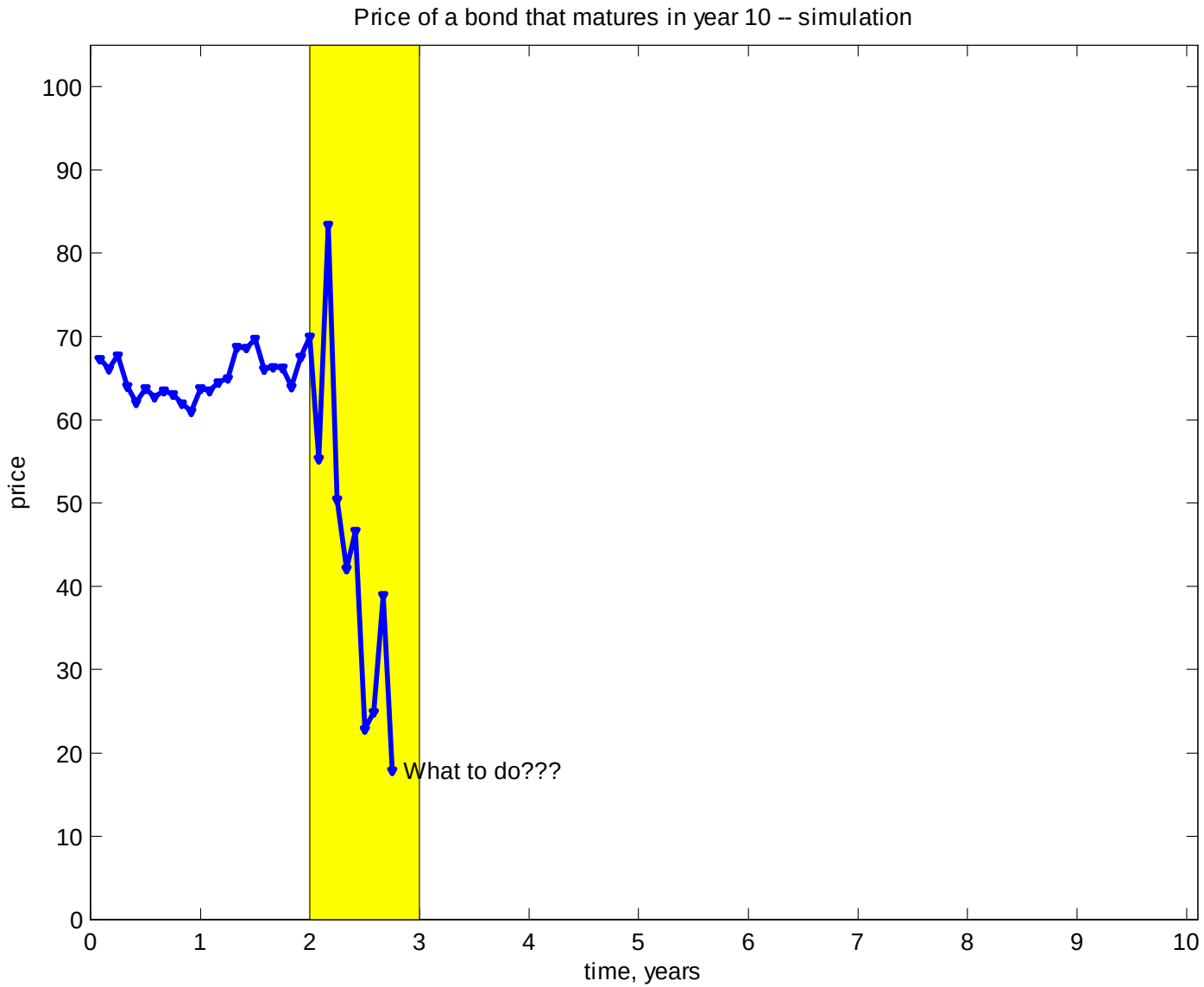
$$\text{stock share} = \frac{1}{\text{risk aversion}} \frac{\text{expected return - riskfree rate}}{\text{return variance}}$$

$$+\text{state variable aversion} \times \text{cov.(Market, state variable)}$$

- Point: the old formula is very, very wrong. This isn't just a second order academic squabble.
- What's the state variable, how to use this? Let's try another story...

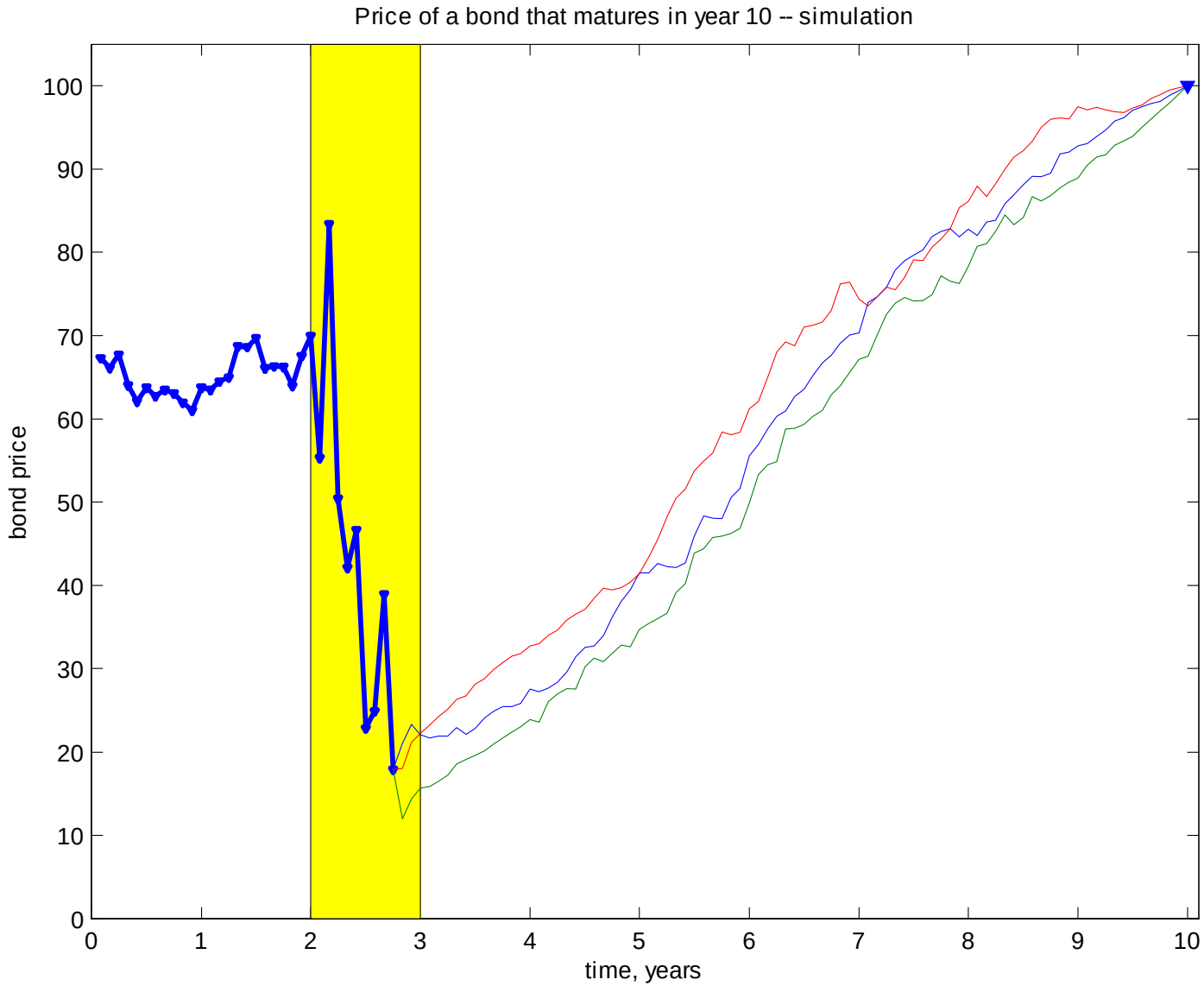
The long term bond investor

- Liability in 10 years, 10 year zero coupon TIP.



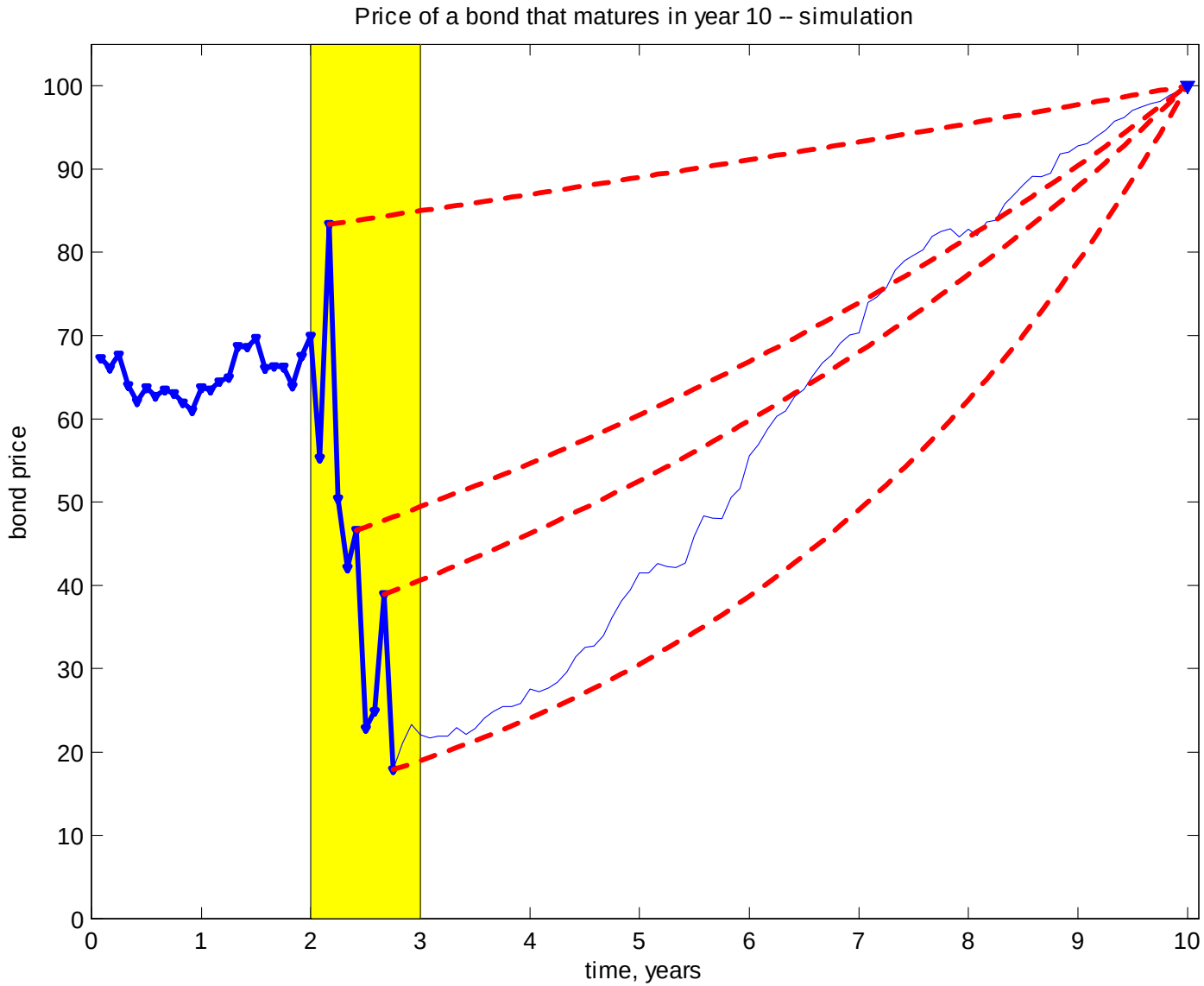
Bonds:

Answer: *Do nothing*



Bonds:

Do nothing

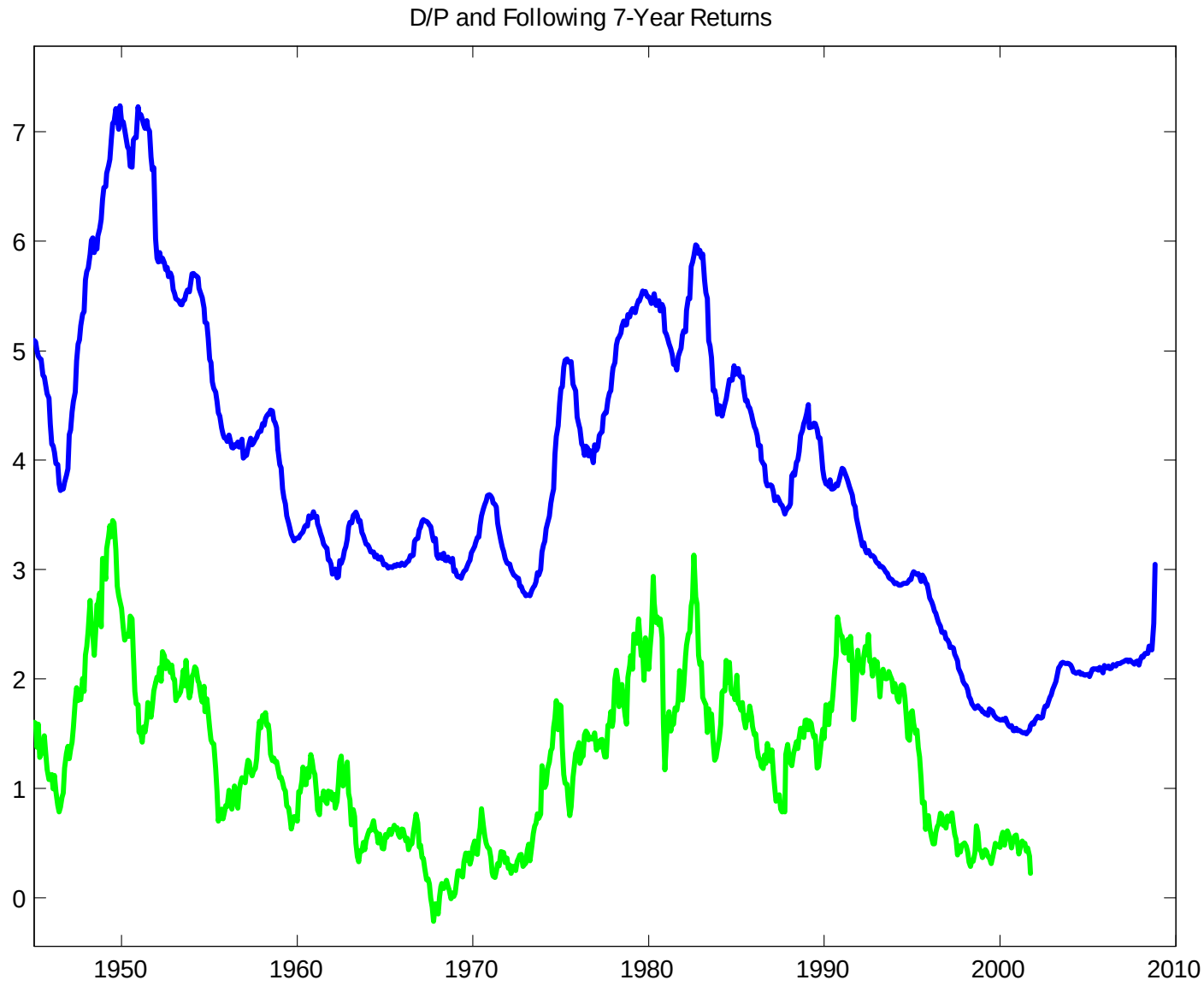


Bonds:

Do nothing

- $$\text{risky share} = \frac{1}{\text{r.a.}} \frac{\text{expected return - riskfree rate}}{\text{return variance}}$$
$$+ \text{“aversion to yield change”} \times \text{cov.(return, yield change)}$$
- Bonds are a perfect “hedge” against the “state variable”, yield.
- Looking directly at cashflows is much simpler than these one period formulas.
- For most investors the risk free asset is a coupon-only long-term TIP, not a money market fund, and they should ignore its price fluctuations!
- Are stocks a bit like bonds, so “do nothing” is at least partially right? Does a price decline mean higher yield (return)?...

Are stocks a bit like bonds? Yes



Stocks a bit like bonds? Yes

- Low prices relative to dividends, earnings, book, do mean higher long-run returns.
- Long term investors can ignore "temporary" price movements, "short term risk" .
- Aha, then maybe we should *buy* when prices crash? Market timing?...

Tactical asset allocation and market timing

- If low P/D means higher returns, buy more?
- How this is done. Step 1: run a regression

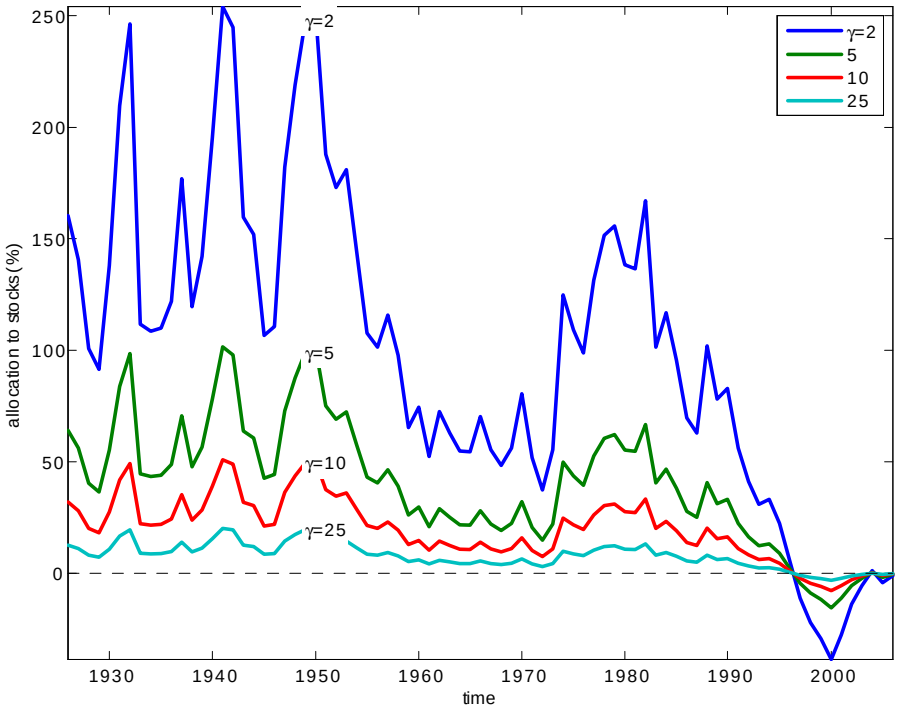
$$\begin{array}{cccccc} R_{t+1} - R_t^f = & -7.20 & + & 3.75 & D/P_t & + & \varepsilon_{t+1} \\ \text{(t-stat:)} & (-1.20) & & (2.66) & & \sigma_\varepsilon^2 = & 19.81\% \end{array}$$

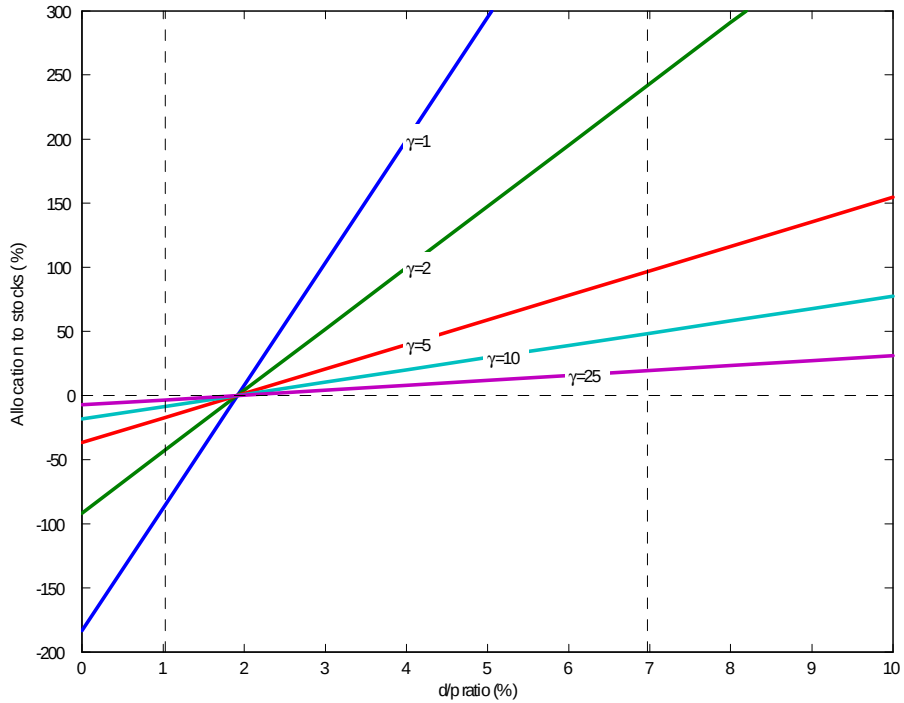
- Step 2. Use portfolio optimizer

$$\text{equity share} = \frac{1}{\text{risk aversion}} \frac{-7.20 + 3.75 \times (D/P_t)}{0.1981^2} +$$

$$+\text{state variable terms}$$

Typical results: incredibly strong timing!

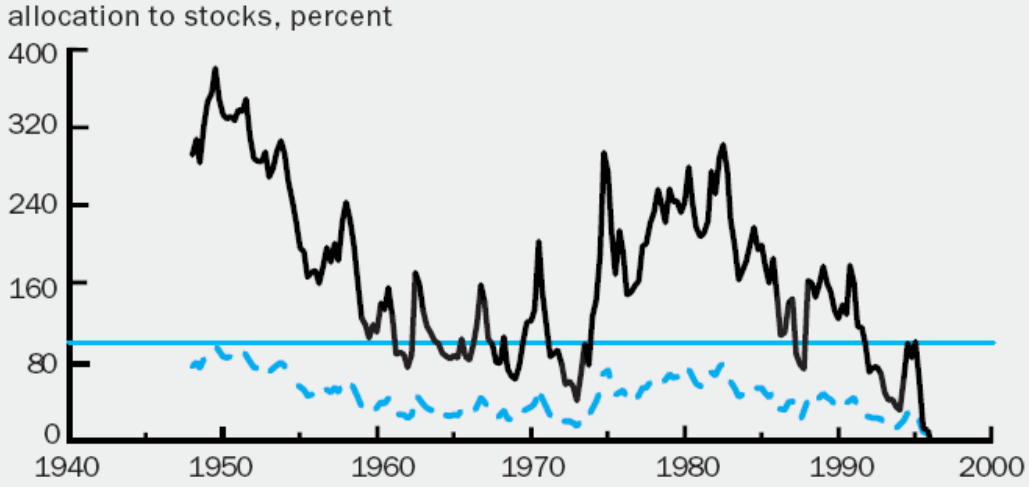




Typical results: incredibly strong timing!

FIGURE 6

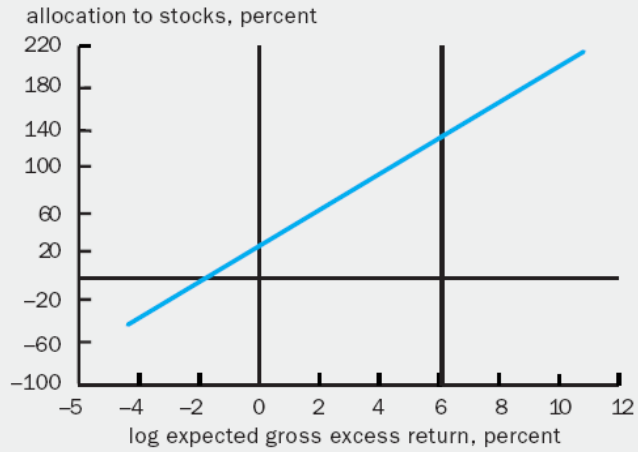
Optimal allocation to stocks based on dividend/price ratio



Notes: Risk aversion $\gamma = 4.00$ (black line) and $\gamma = 20.00$ (colored dashed line).
Source: Campbell and Vicera (1999).

FIGURE 5

Optimal allocation to stocks



Notes: Optimal allocation to stocks as a function of the expected return implied by a regression that forecasts stock returns from dividend/price ratios. The line extends from a d/p ratio two standard deviations above its mean (low expected returns) to one standard deviation below its mean (high expected returns). Risk aversion is 4.0.
Source: Campbell and Vicera (1999).

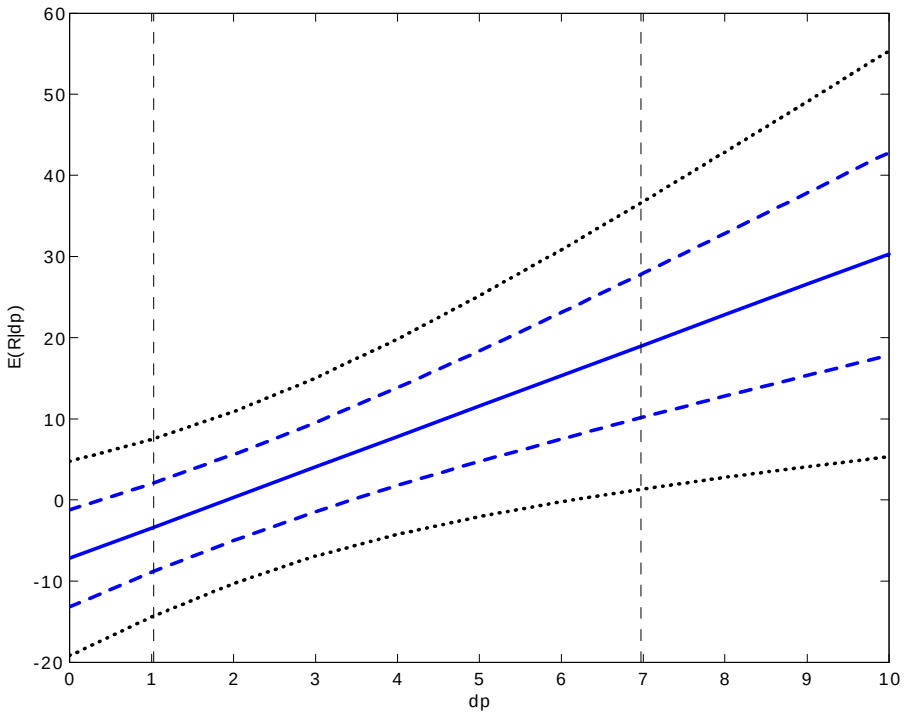
Market timing doubts

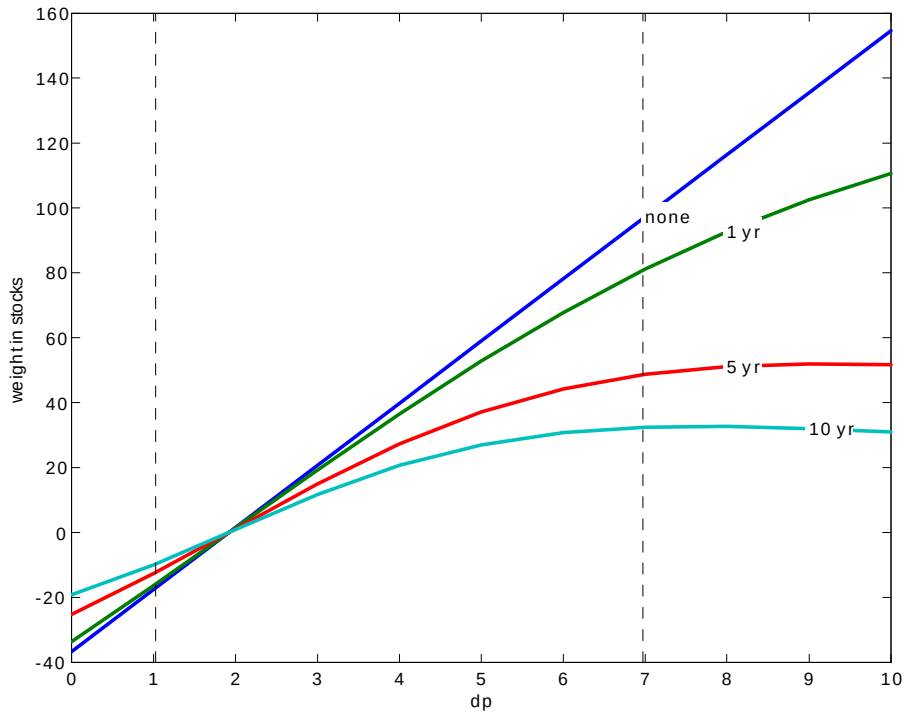
- Doubt 1: *The average investor holds the market*, not even rebalancing. Who is selling?
  1. Stocks fall in recessions!
  2. Thus, only if you are less worried about recessions than average.
  3. Requires "contrarian" outlook – sitting out the boom, buying in the panic. Most can't do this. It's the time version of value – another "risk factor."
- Doubt 2: Statistical uncertainty is risk to you, leads to less aggressive portfolios. "Bayesian portfolio theory"

$$\text{risky share} = \frac{1}{\text{r.a.}} \times \frac{\text{expected return - riskfree rate}}{\text{return var.} + \textbf{uncertainty about E return} \Leftarrow}$$

- Calculations...

Effect of model uncertainty on portfolio advice





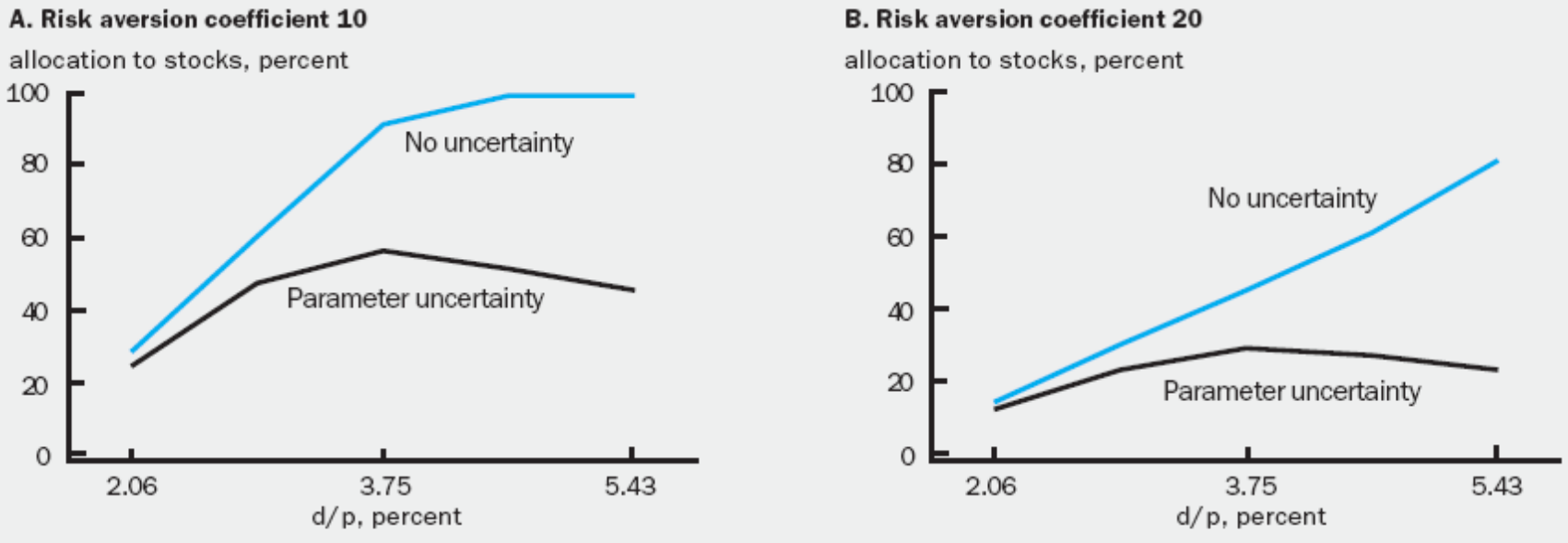
Left: statstical relation between return and D/P (regression line) with statistical uncertainty bars

Right: Weight in stocks as a function of D/P. Flatter line means less market timing. yr=horizon, $\gamma = 5$

Effect of model uncertainty on portfolio advice

FIGURE 7

Allocation to stocks as a function of dividend/price ratio, with parameter uncertainty



Notes: The colored line ignores parameter uncertainty, as in Campbell and Vicera (1999).
The black line includes parameter uncertainty, as in Barberis (1999). Data sample is in months (523).

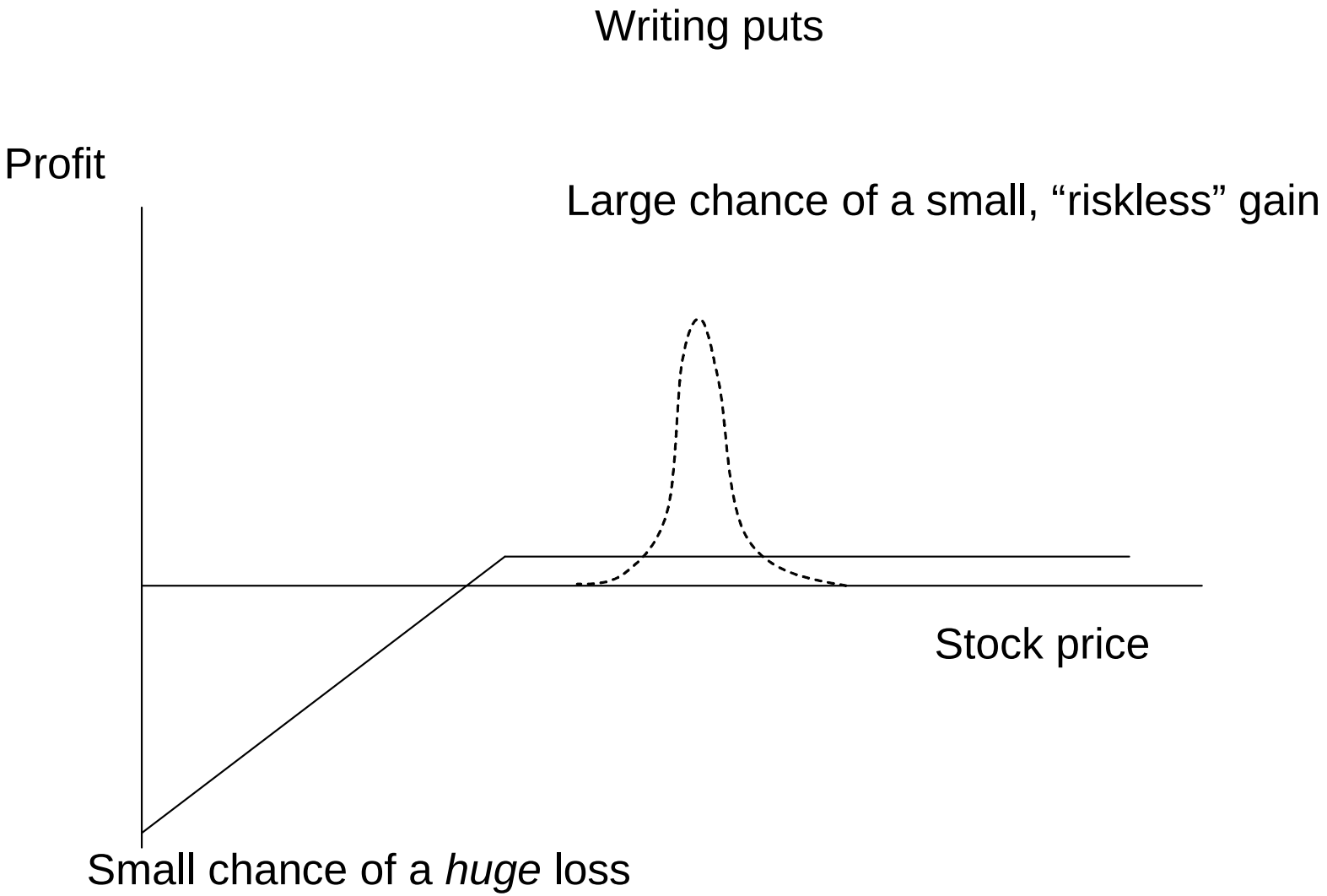
Market timing summary

- Huge literature, lots of quant advice suggests strong timing and aggressive quantitative asset allocations. I'm less enthusiastic:
  1. The average investor must hold the market, not even rebalancing. Why are you different?
  2. Model uncertainty adds a lot of risk. These things don't work so well out of sample.

Options

- Options are now a "style" too
- Writing puts (implicitly) is a very common strategy. It gives a small steady profit most of the time, but occasional huge losses. The profits are more than the losses, so you can enhance return by "providing liquidity to markets." Warren Buffet does it.
- It's even better if you can get your investors or taxpayer to take the losses!

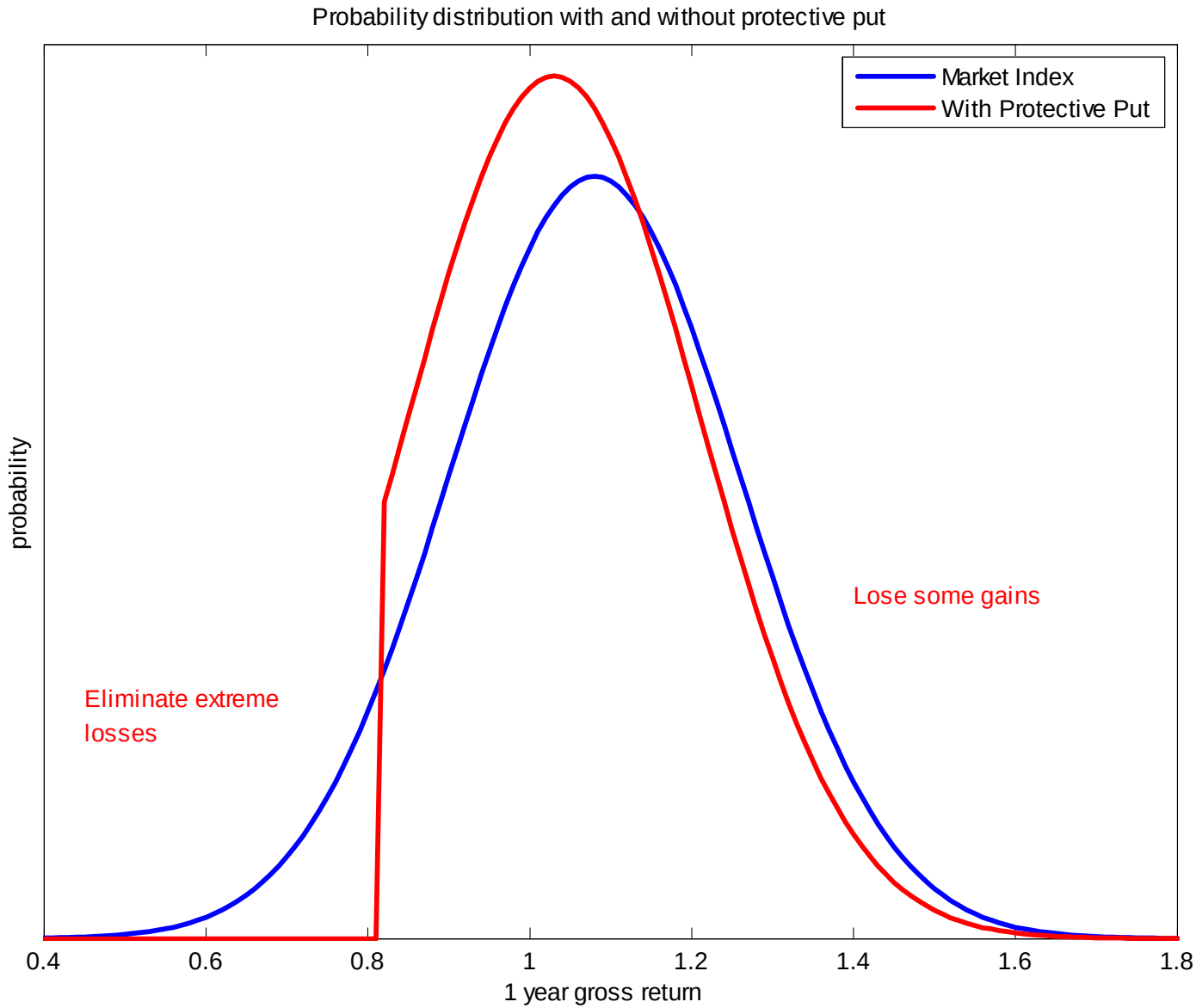
Options


Writing puts
Profit
Large chance of a small, “riskless” gain
Stock price
Small chance of a *huge* loss

Options

- Write put options? But *the average investor holds the market.* Why are put option premiums so high?
- A: there is a lot of demand to *buy* put options despite the high premium. Very sensibly!
  1. Leverage. "If we lose more than 20%, we default on our debt"
  2. "If we lose more than 20% we have to cut core functions."
  3. "If we lose more than 20%, our sponsors will give up and fire us."

Put options are attractive – despite the cost



Options

- Now buying starts to look good! Buy vs. write options? Get the premium or buy insurance despite the large premium?
- A: Are you more or less able to take crash risks than the average investor? Really, now?
- Big picture: You can tailor the entire shape of the return distribution to take account of your ability to take risks of any size, and the premiums offered to you for doing so.

Bottom line

- The traditional CAPM / mean-variance framework survives *very much generalized*
  1. Market index → multiple factors (hedges for outside income/risks, value, small, momentum, options, bond long/short, international, etc. etc.)
  2. Two funds → many many funds
  3. Index based on your risk aversion vs. market → many dimensions of you vs. market
- Takeaway deep thoughts
  1. *The average investor holds the market*. Understand how you are different to do otherwise
  2. Understand the economic function of a class of investment
  3. Bond investor story – a long-horizon, cashflow-based perspective
  4. Hedge outside risks, non-priced factors! Match liability risk profile. Very important, very overlooked, and free.
- This is hard, needs quantification? Yes! A reason for us to exist without winning the zero-sum alpha chase.