

TRACKING ERROR AND ACTIVE MANAGEMENT



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C O N T E N T S

- I. Tracking Error : Definition and Meaning
- II. Tracking Error and Active Management
- III. Identification Issues
- IV. Value Tilted Asset Management : 1998-2000
- V. Alpha Forecasting Risk
- VI. Conclusions



I. TRACKING ERROR:
DEFINITION AND MEANING



TRACKING ERROR : BROAD SENSE

- This is the definition which truly matters to the investors.

- Definition

It is the probabilistic distribution of the difference in returns between the portfolio and its benchmark over some time period.

- Important parameters:

- Systematic drift (first moment),
- Volatility (second moment),
- Asymmetry (third moment).



TRACKING ERROR : RESTRICTIVE SENSE

- **Definition**

It is the volatility, expressed in terms of (annualized) standard deviation, of the difference in returns between the portfolio and its benchmark over a time period.

- It is the second moment of the distribution.

- It can be retrospective (ex-post): it is then a measure over a past time period.

- It can be prospective (ex-ante): it is then a forecast for a future time period.



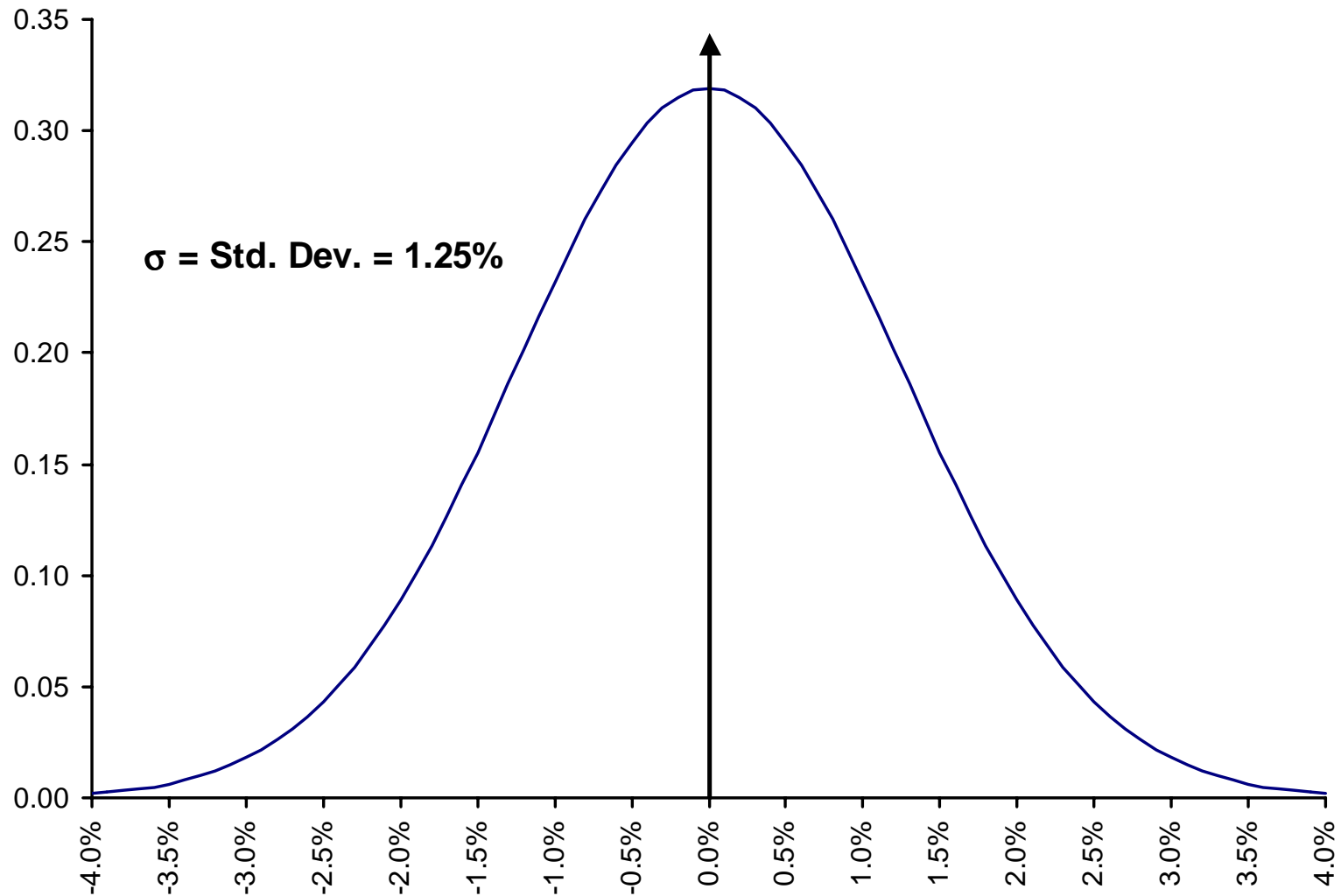
EX-ANTE TRACKING ERROR

- Ex-ante Tracking Error are usually provided by multi-factor risk models.
- These risk models are based on (sophisticated) statistical analysis of past empirical evidence
- It's a forecast which as such can be correct or incorrect:



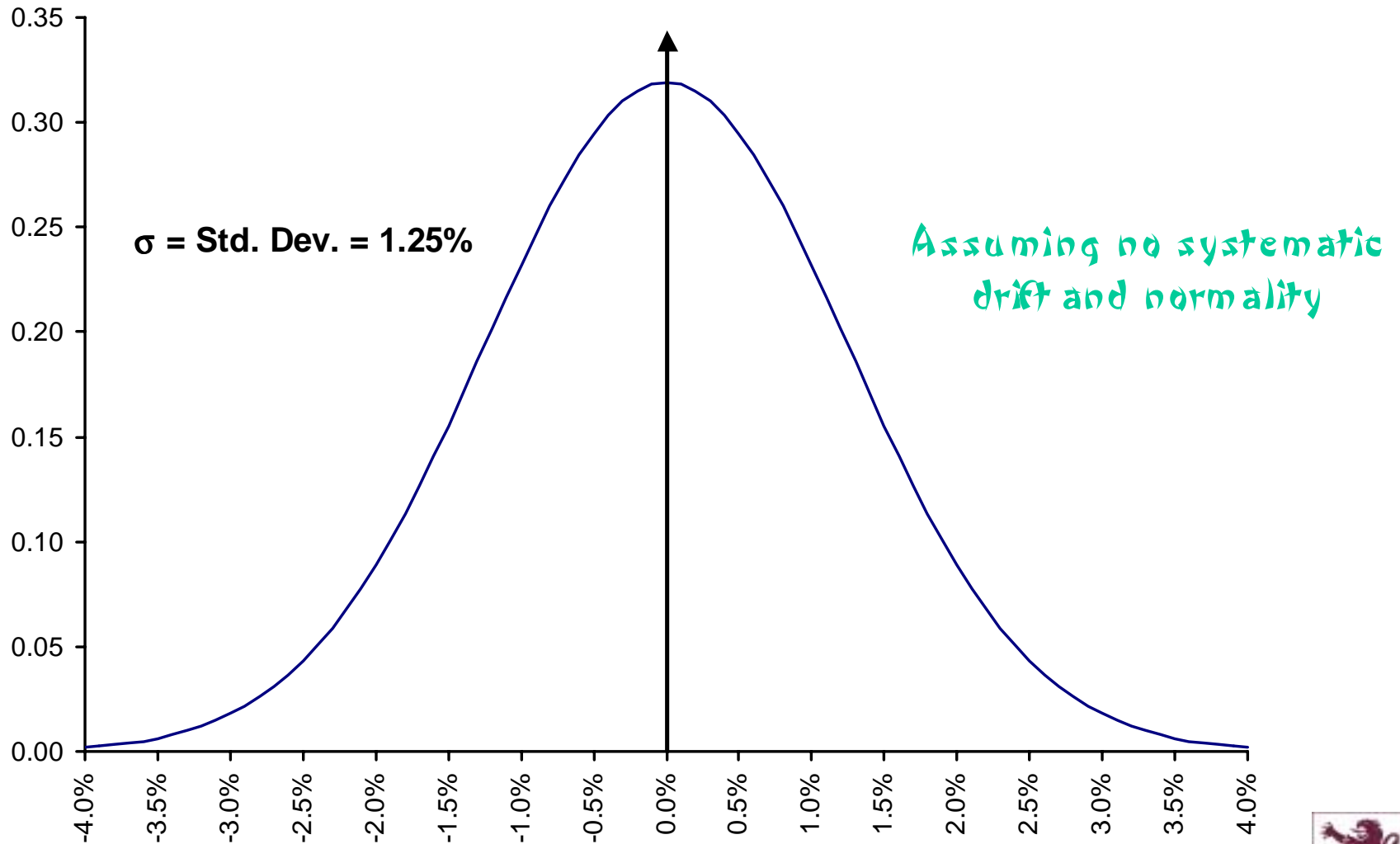
EX-ANTE TRACKING ERROR : MEANING

Ex-Ante Tracking Error : 1.25%



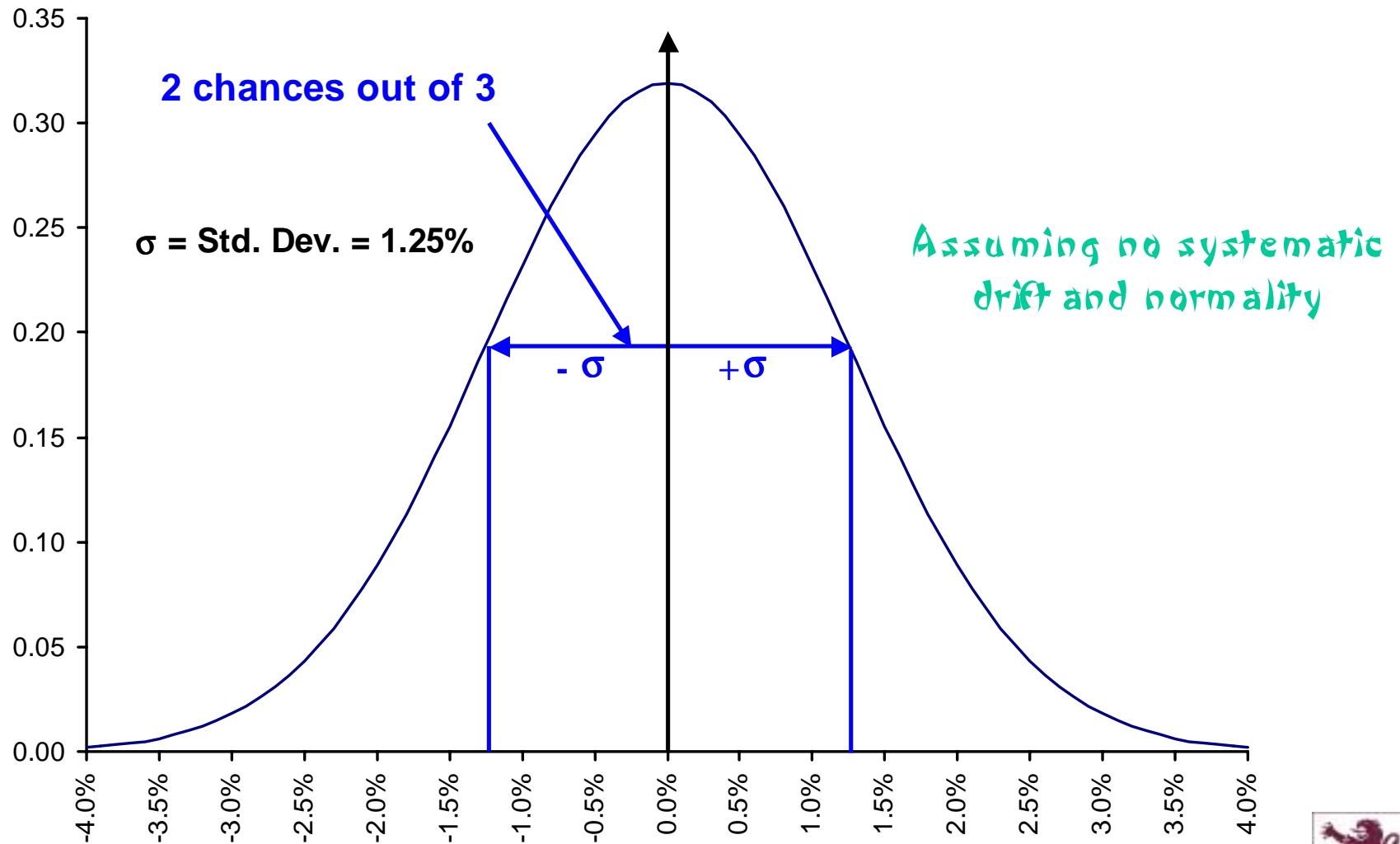
EX-ANTE TRACKING ERROR : MEANING

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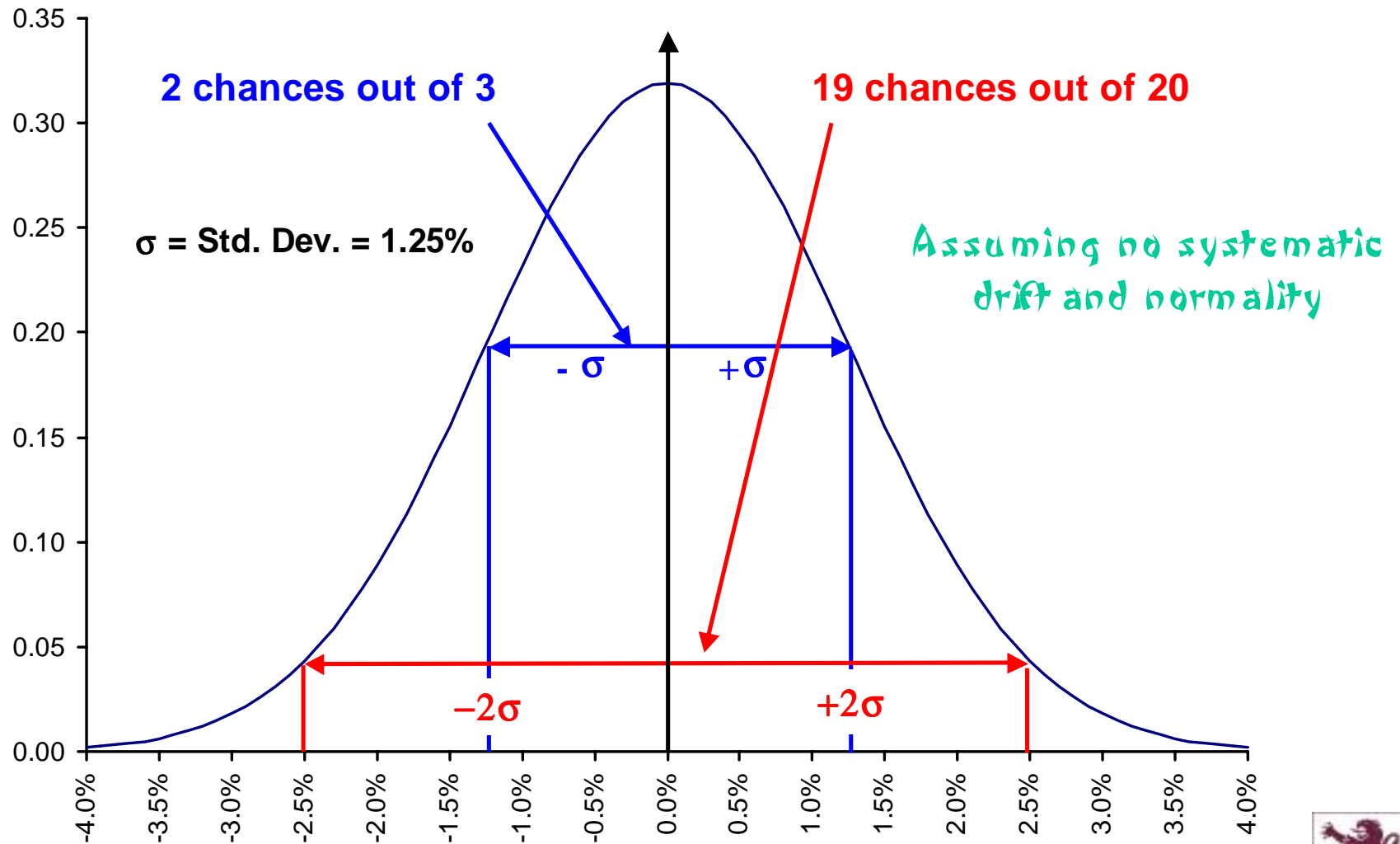
EX-ANTE TRACKING ERROR : MEANING

Ex-Ante Tracking Error : 1.25%



EX-ANTE TRACKING ERROR : MEANING

Ex-Ante Tracking Error : 1.25%



II. TRACKING ERROR AND ACTIVE MANAGEMENT



PORTFOLIO ACTIVE RETURN

- **Definition:** It is the difference in return between the portfolio and its benchmark.

- **Ex-ante:** $R_{\text{Ex-Ante}}^{\text{P-B}} = \alpha_{\text{Ex-Ante}} + \text{random shock}$

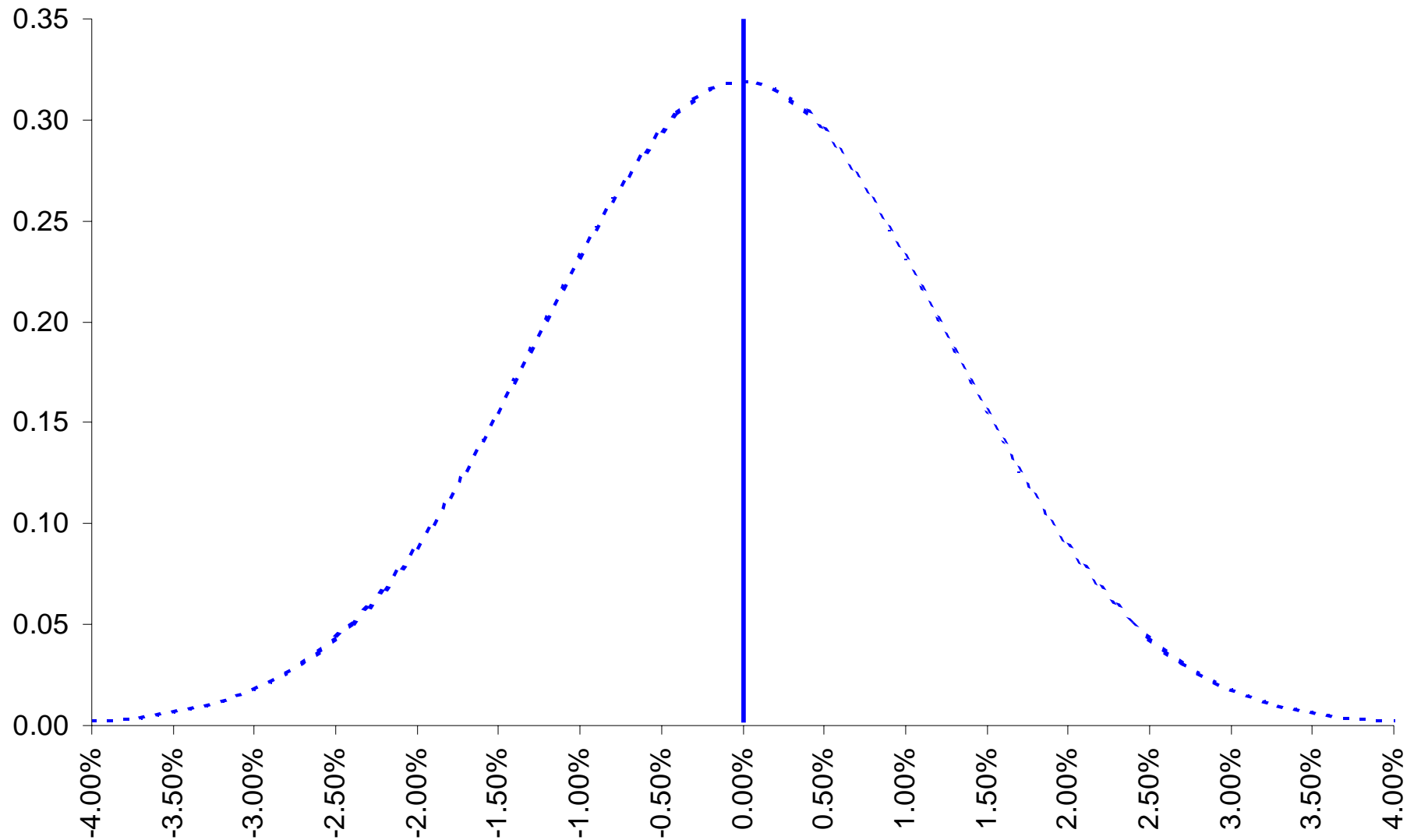
Forecast Risk

$\approx \text{Distribution}(0, \text{TE}_{\text{Ex-Ante}}^{\text{P-B}})$

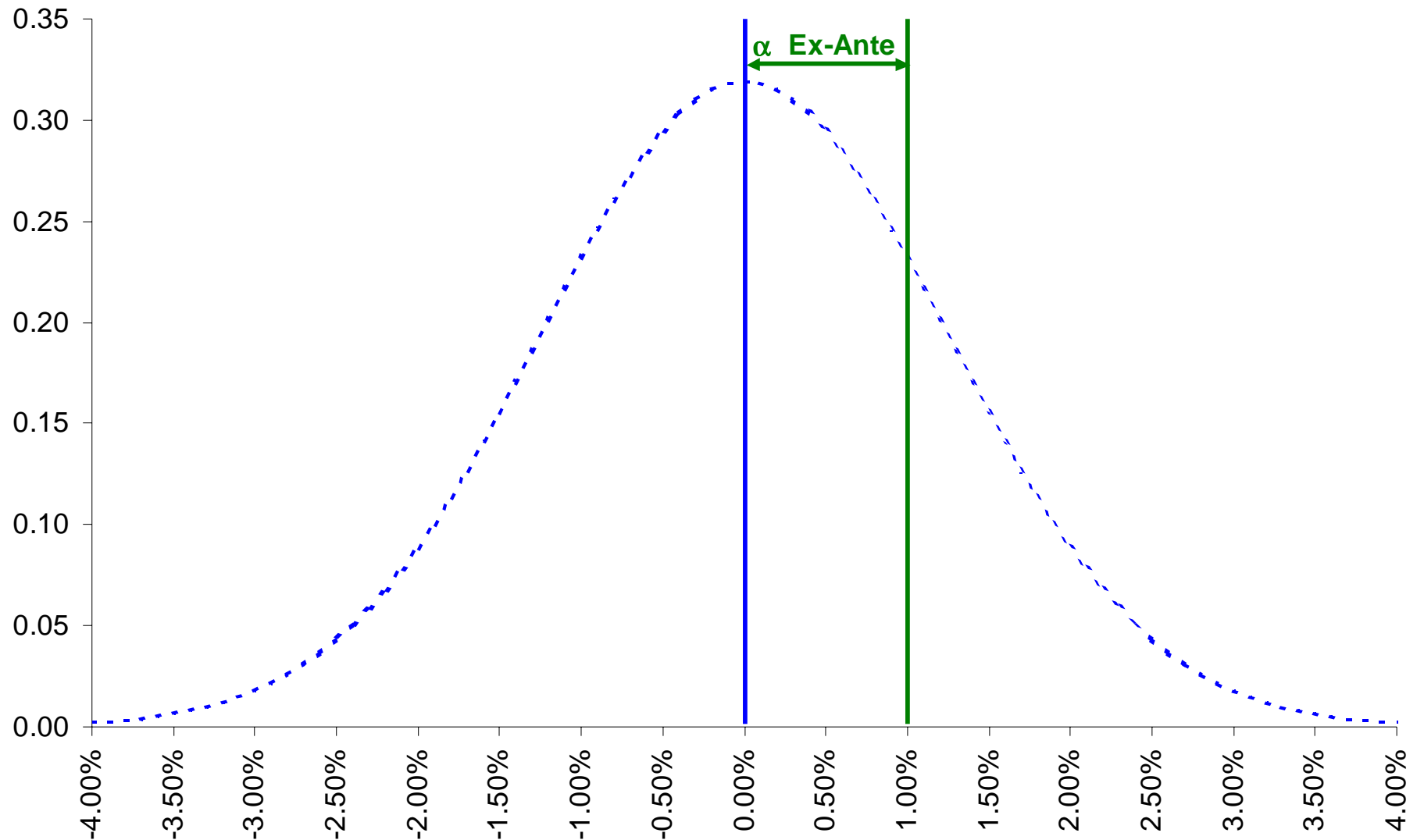
- **Ex-post:** $R_{\text{Ex-Post}} = \alpha_{\text{Ex-Post}} + \text{realized random shock}$



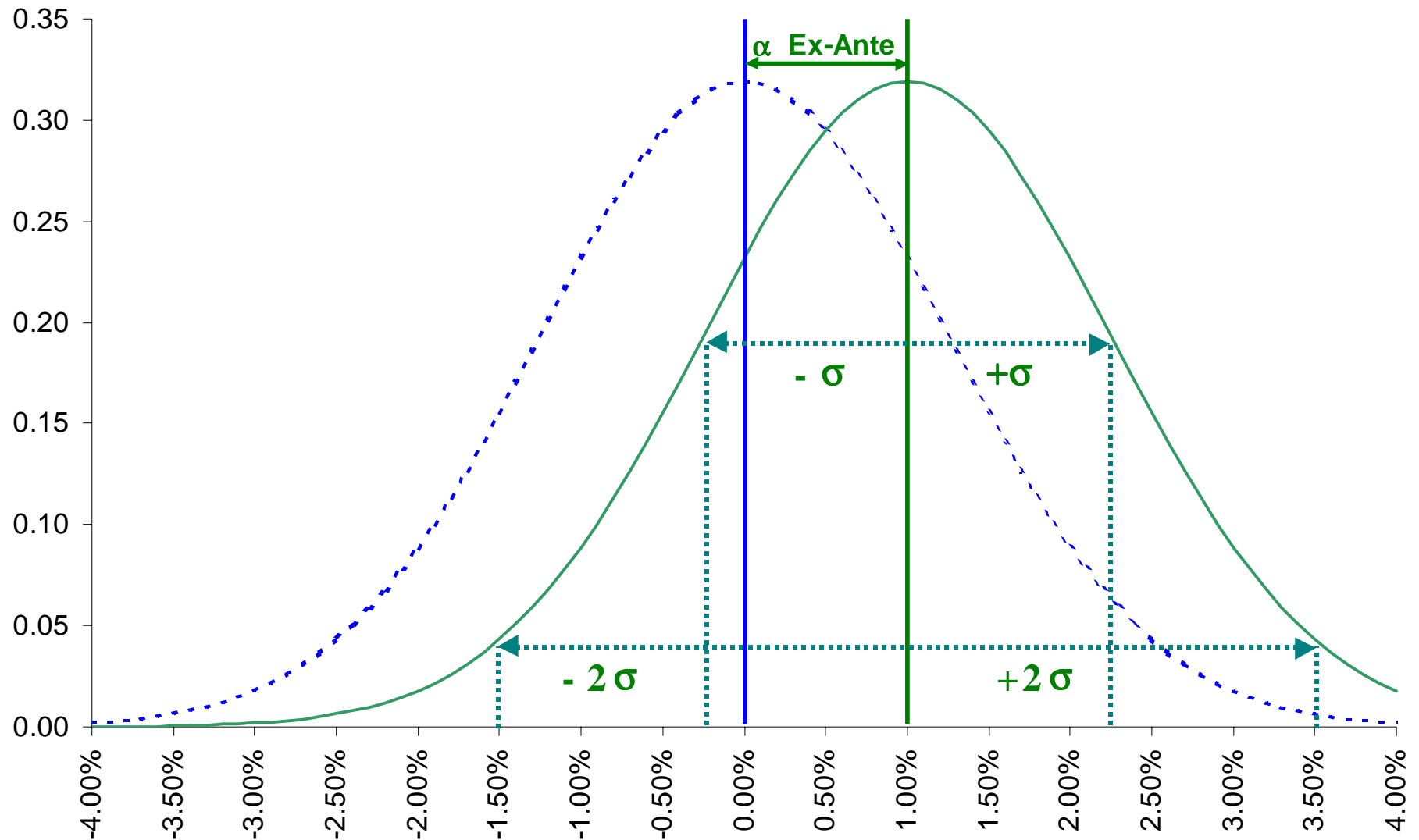
TRACKING ERROR: TRADITIONAL ACTIVE PORTFOLIO MANAGER'S VIEW



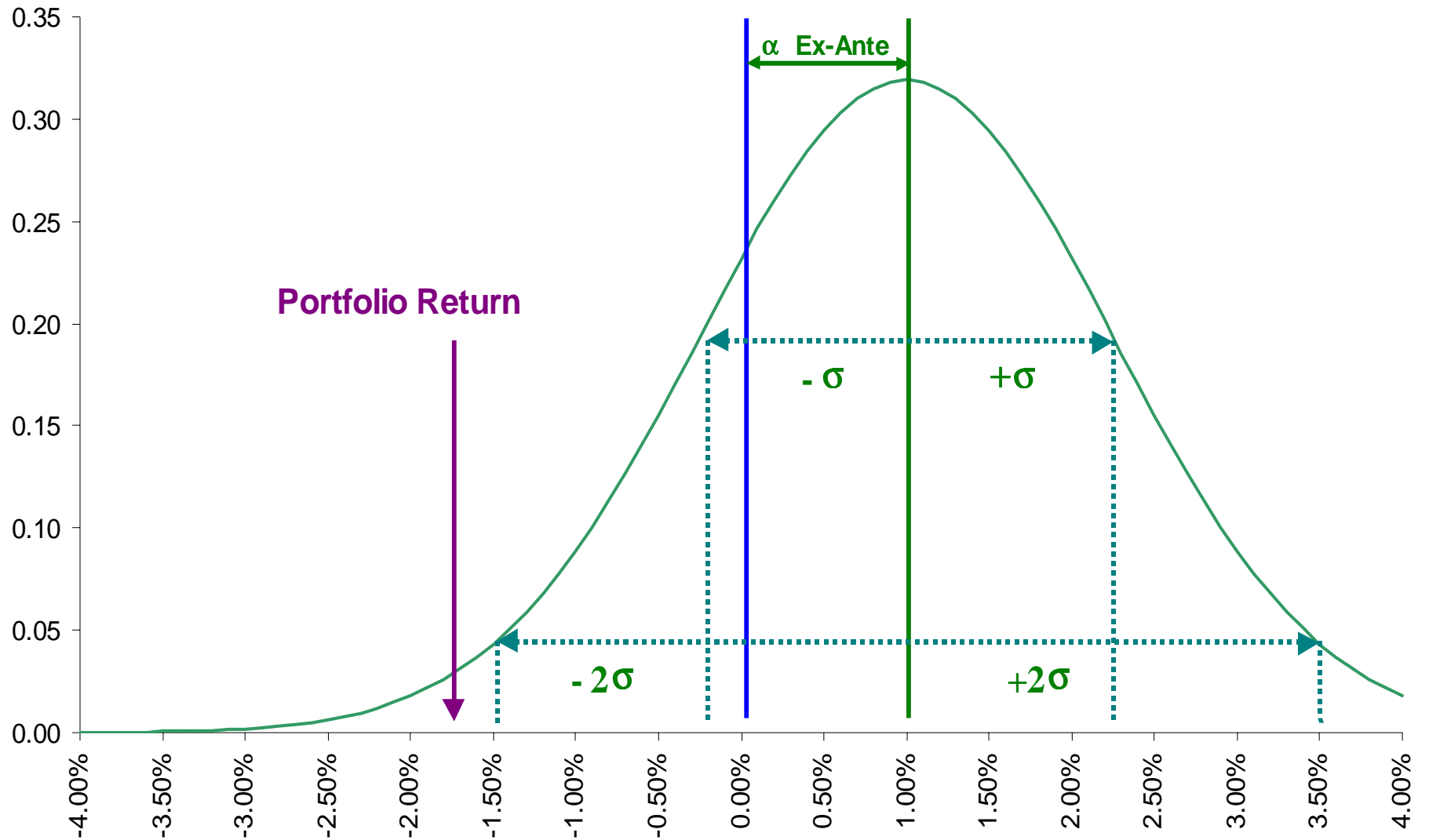
TRACKING ERROR: TRADITIONAL ACTIVE PORTFOLIO MANAGER'S VIEW



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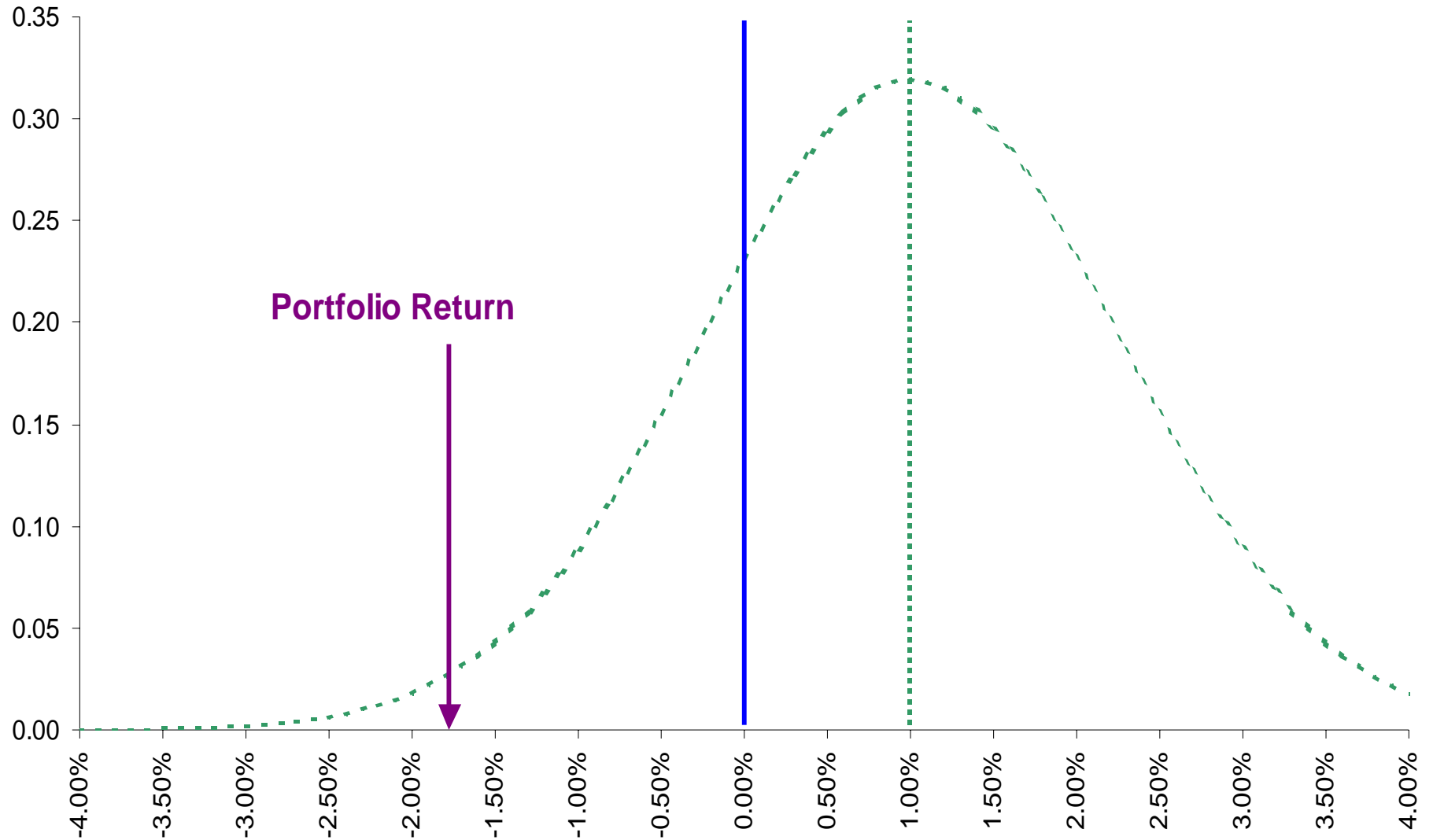


TRACKING ERROR: OUTCOME (I)



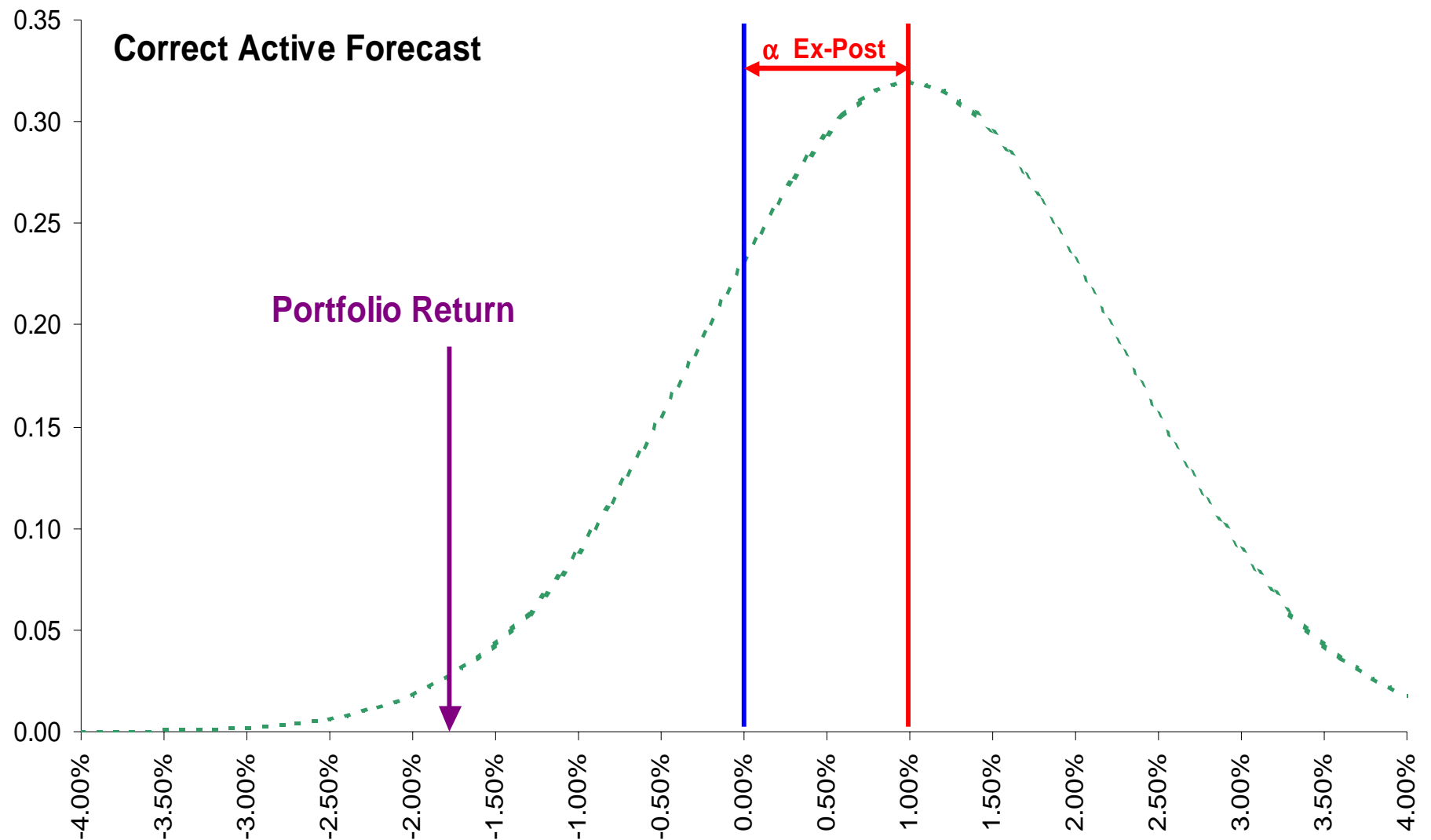
TRACKING ERROR: OUTCOME (II)

INTERPRETATION (A) :



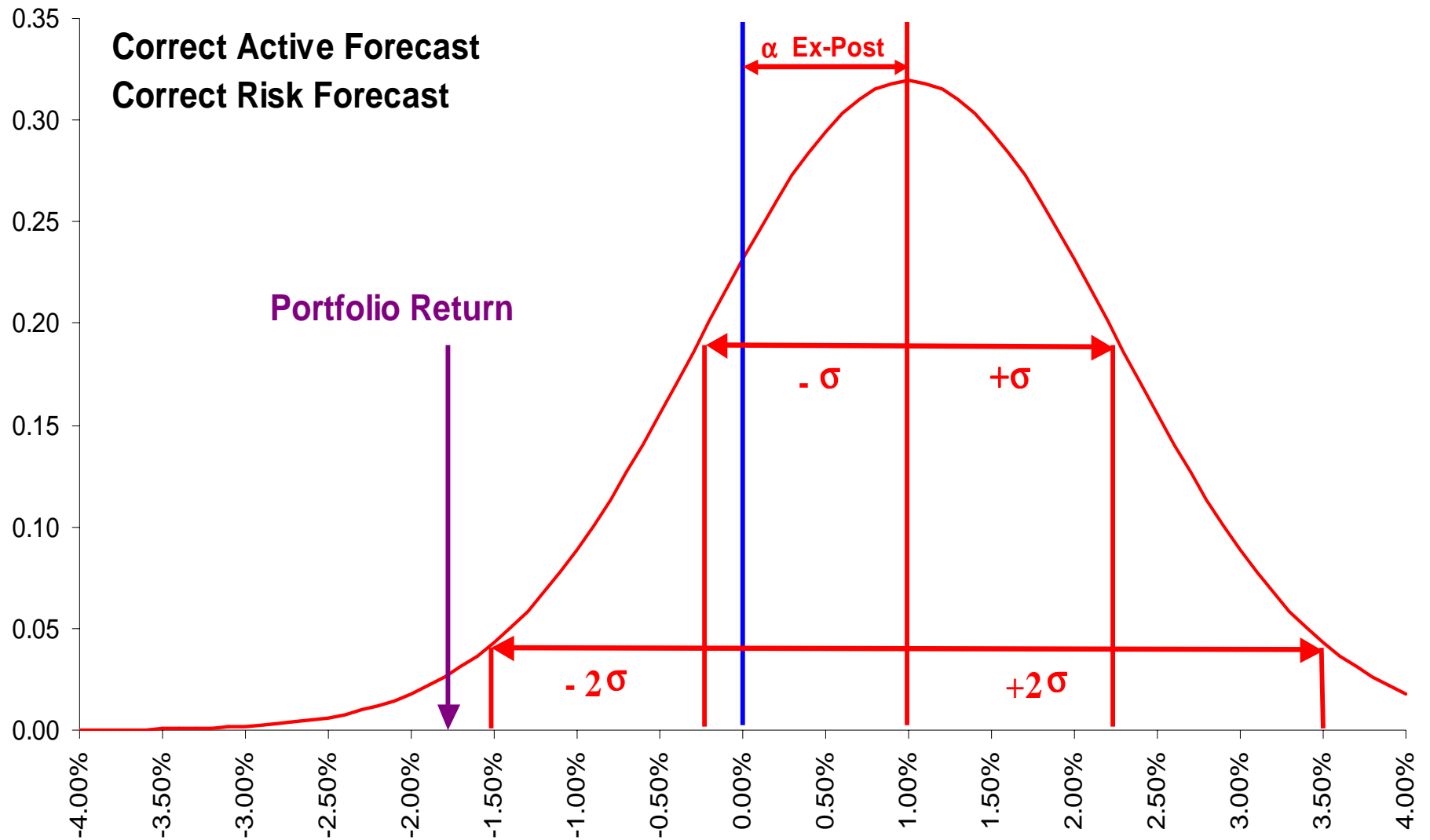
TRACKING ERROR: OUTCOME (II)

INTERPRETATION (A) :



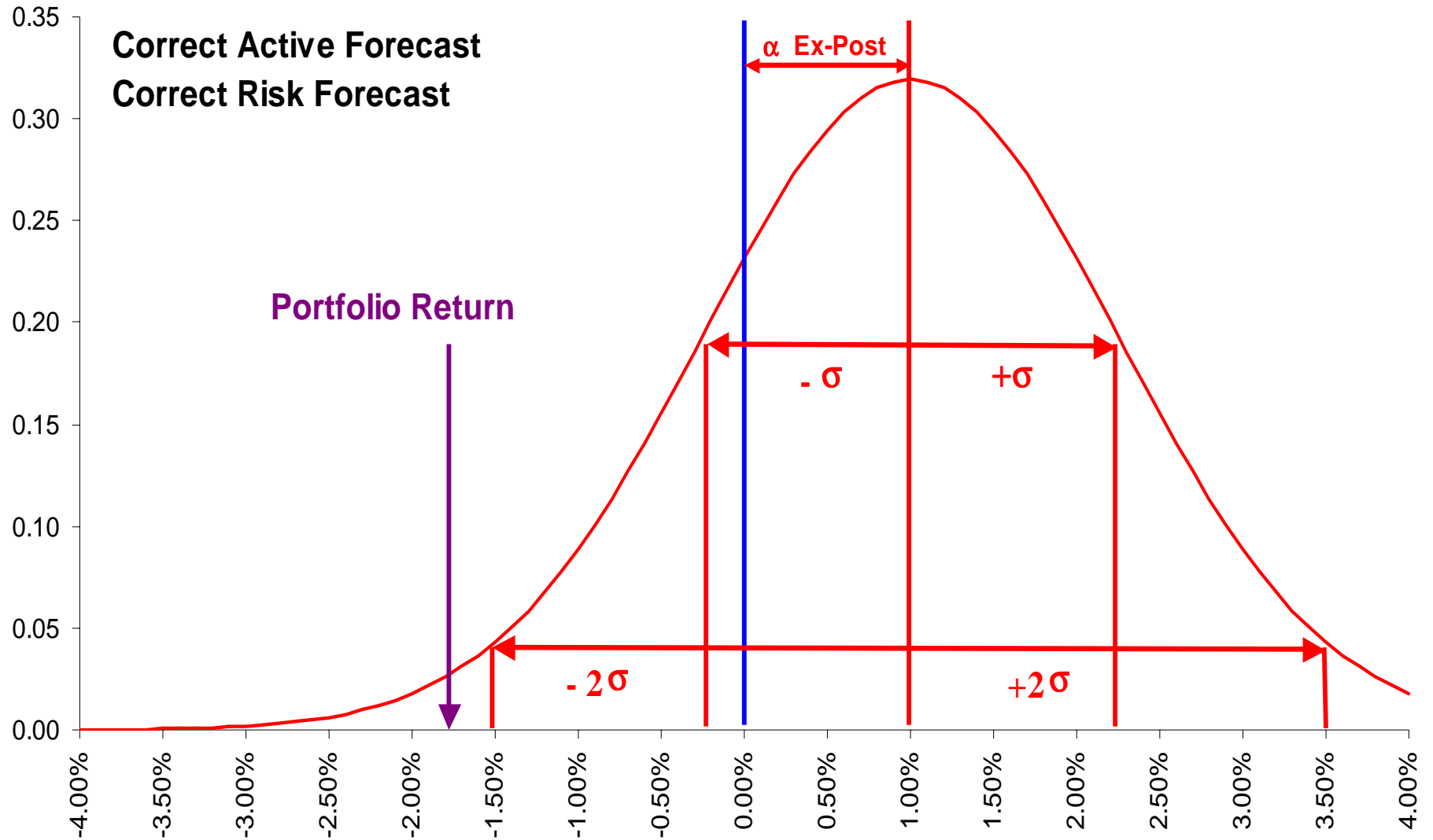
TRACKING ERROR: OUTCOME (II)

INTERPRETATION (A) :



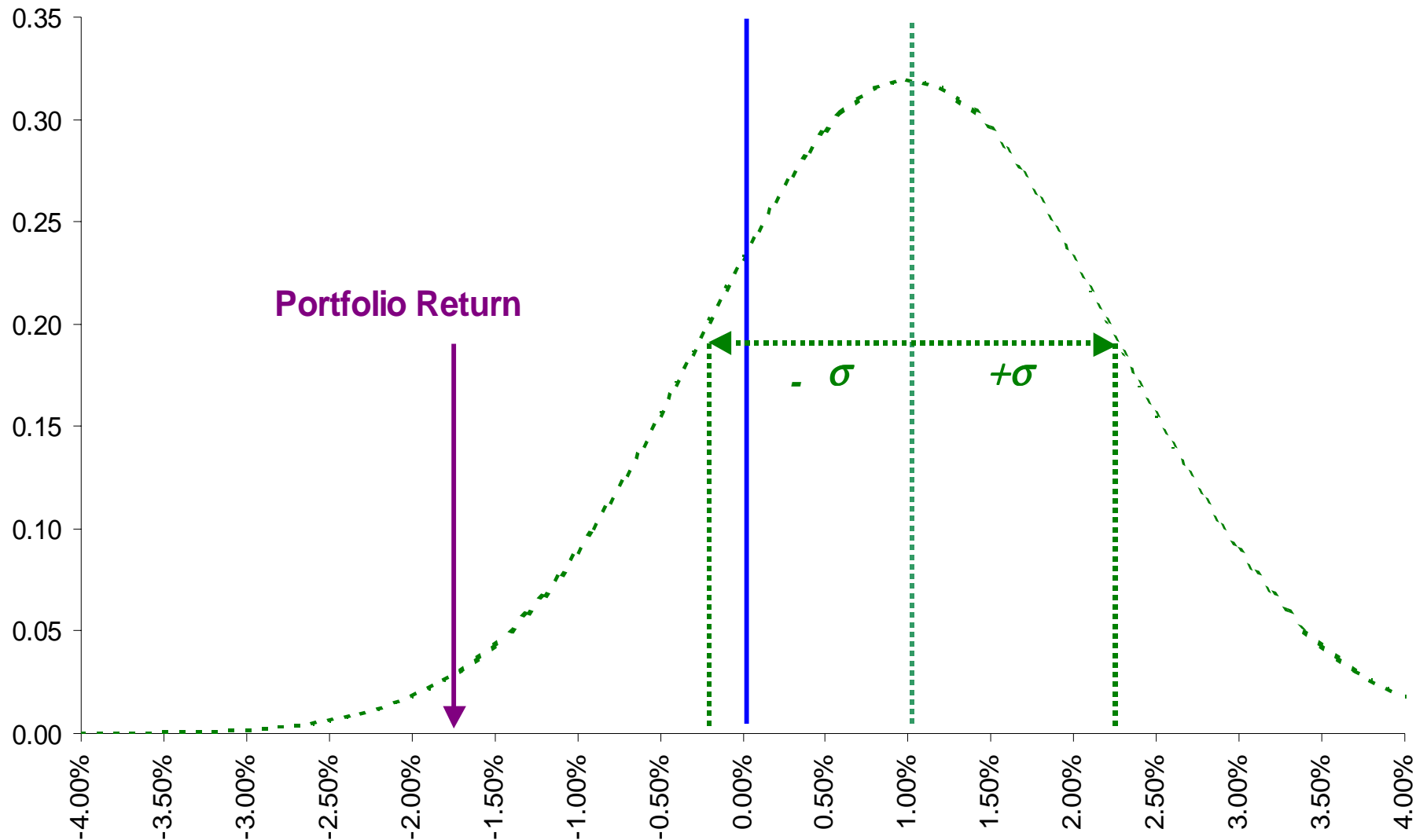
TRACKING ERROR: OUTCOME (I)

INTERPRETATION (A) : 2-SIGMA EVENT



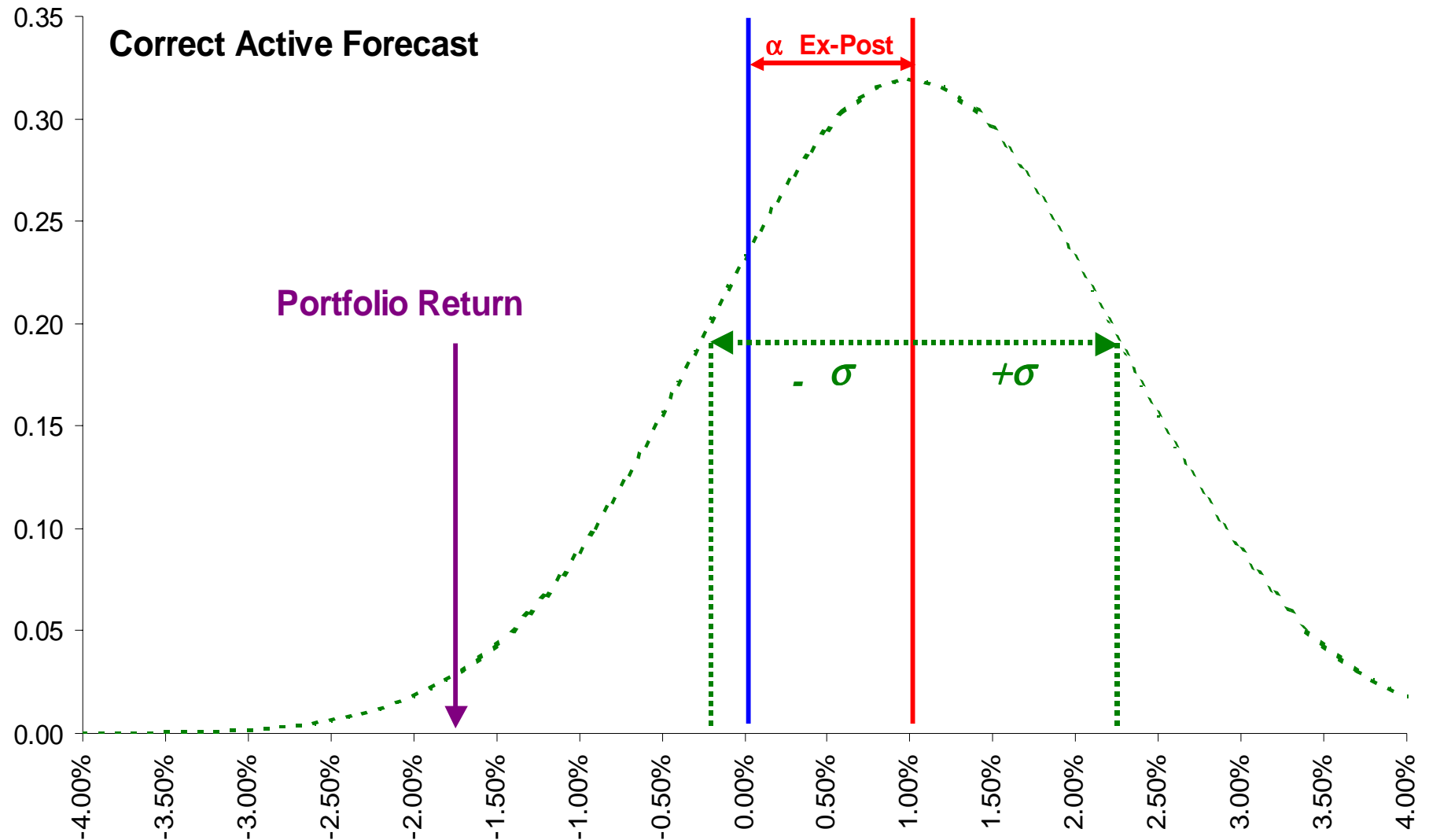
TRACKING ERROR: OUTCOME (II)

INTERPRETATION (B) :



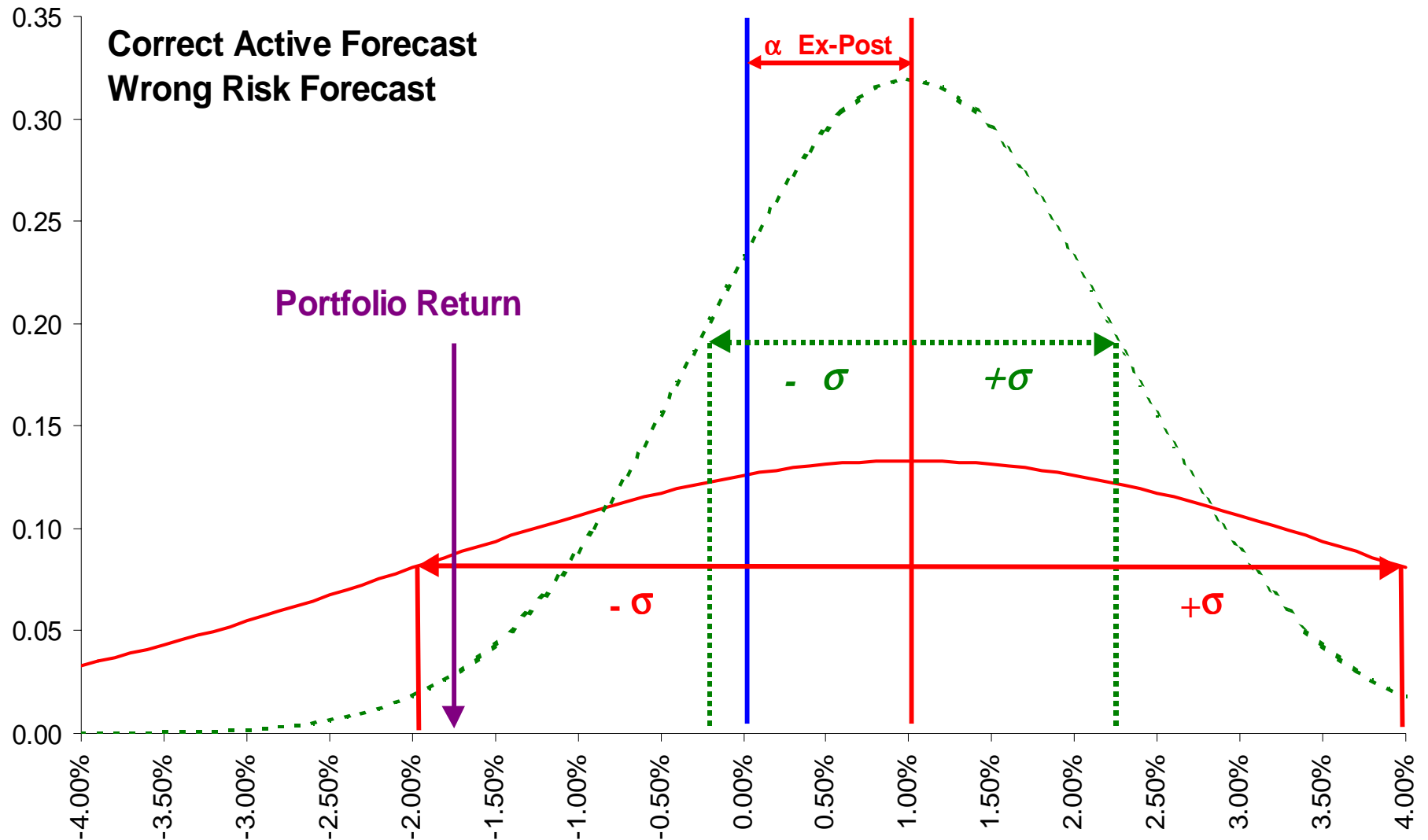
TRACKING ERROR: OUTCOME (I)

INTERPRETATION (B) :



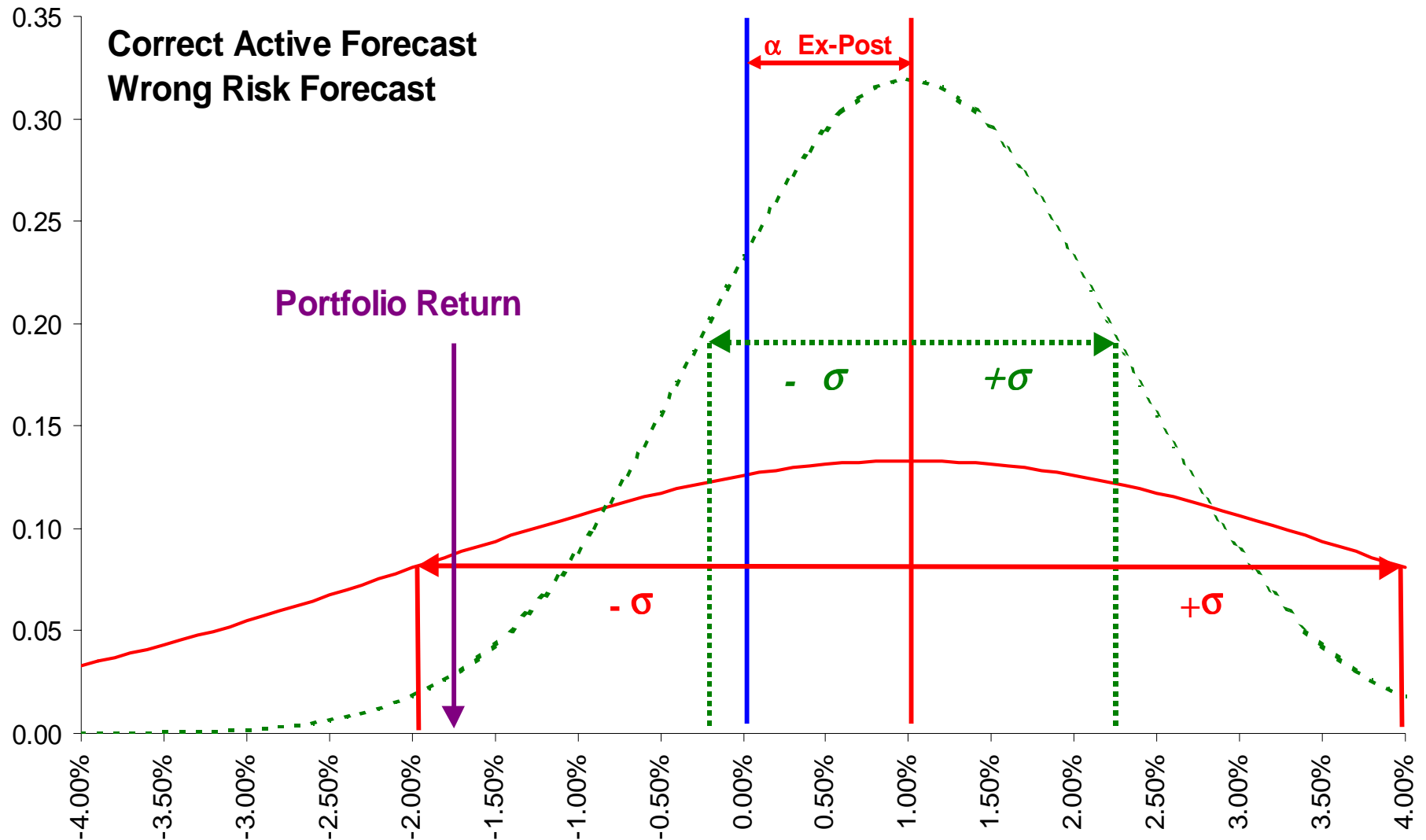
TRACKING ERROR: OUTCOME (I)

INTERPRETATION (B) :



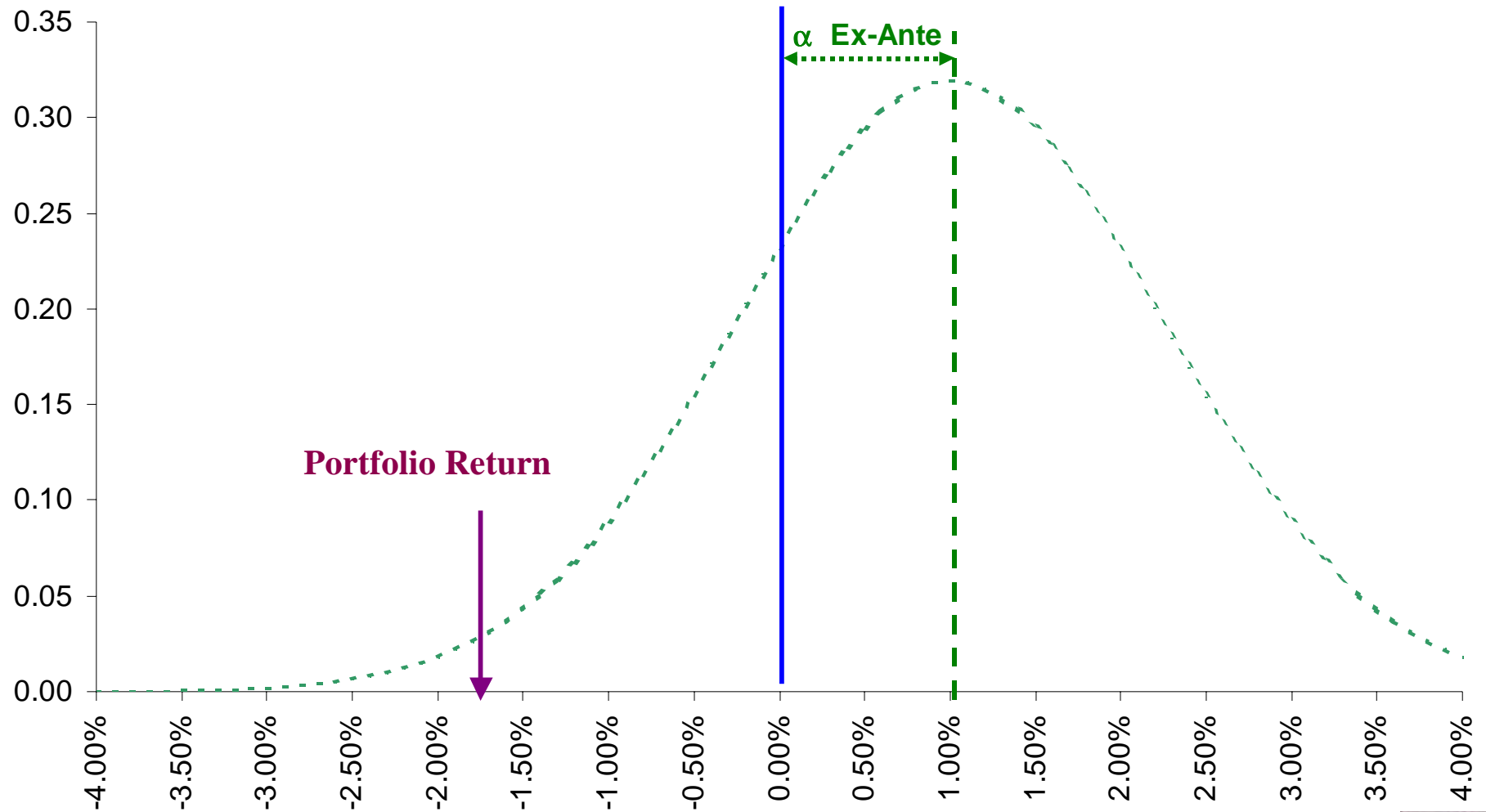
TRACKING ERROR: OUTCOME (II)

INTERPRETATION (B) : RISK MODEL FAILED

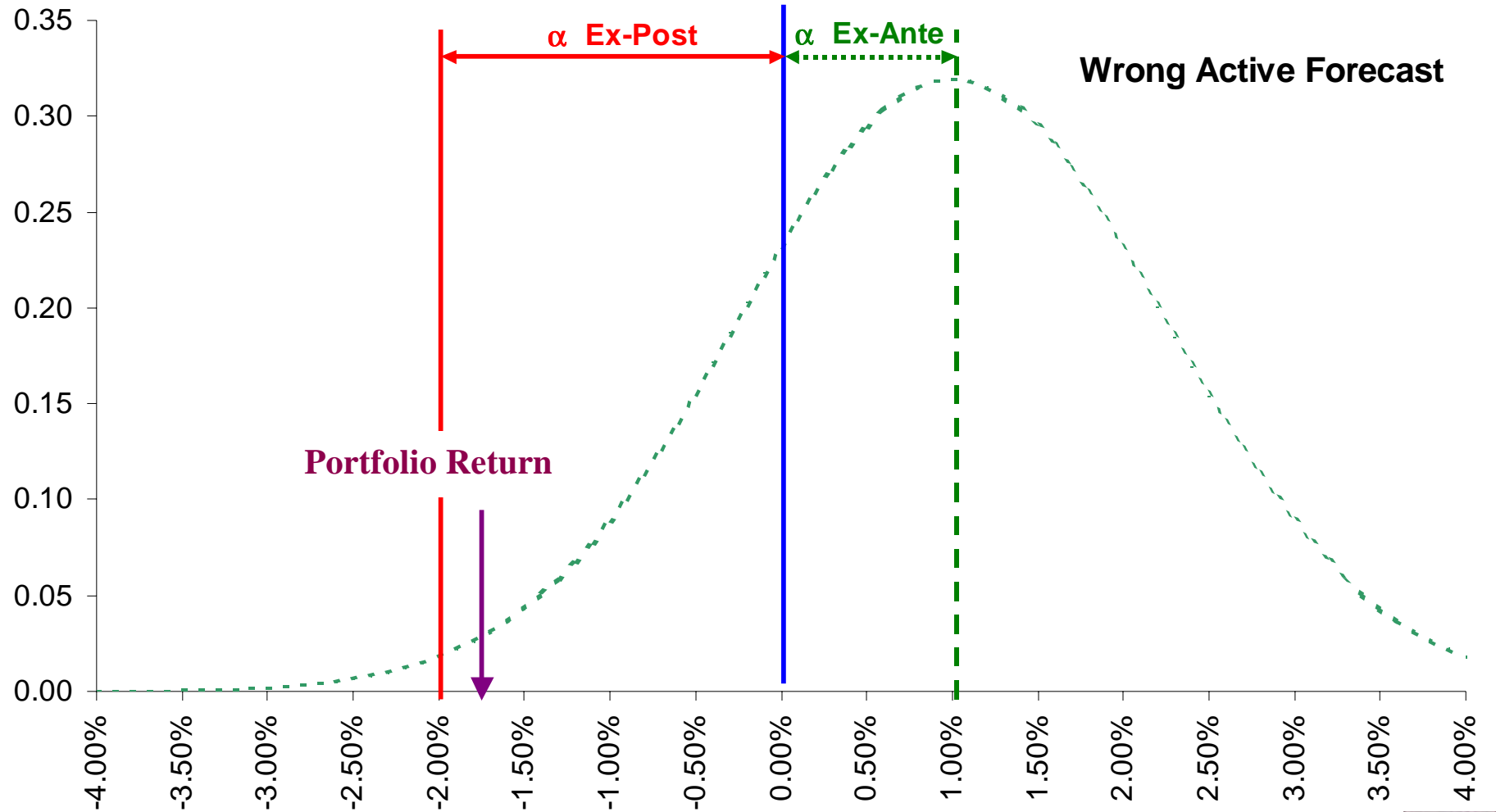


TRACKING ERROR: OUTCOME (II)

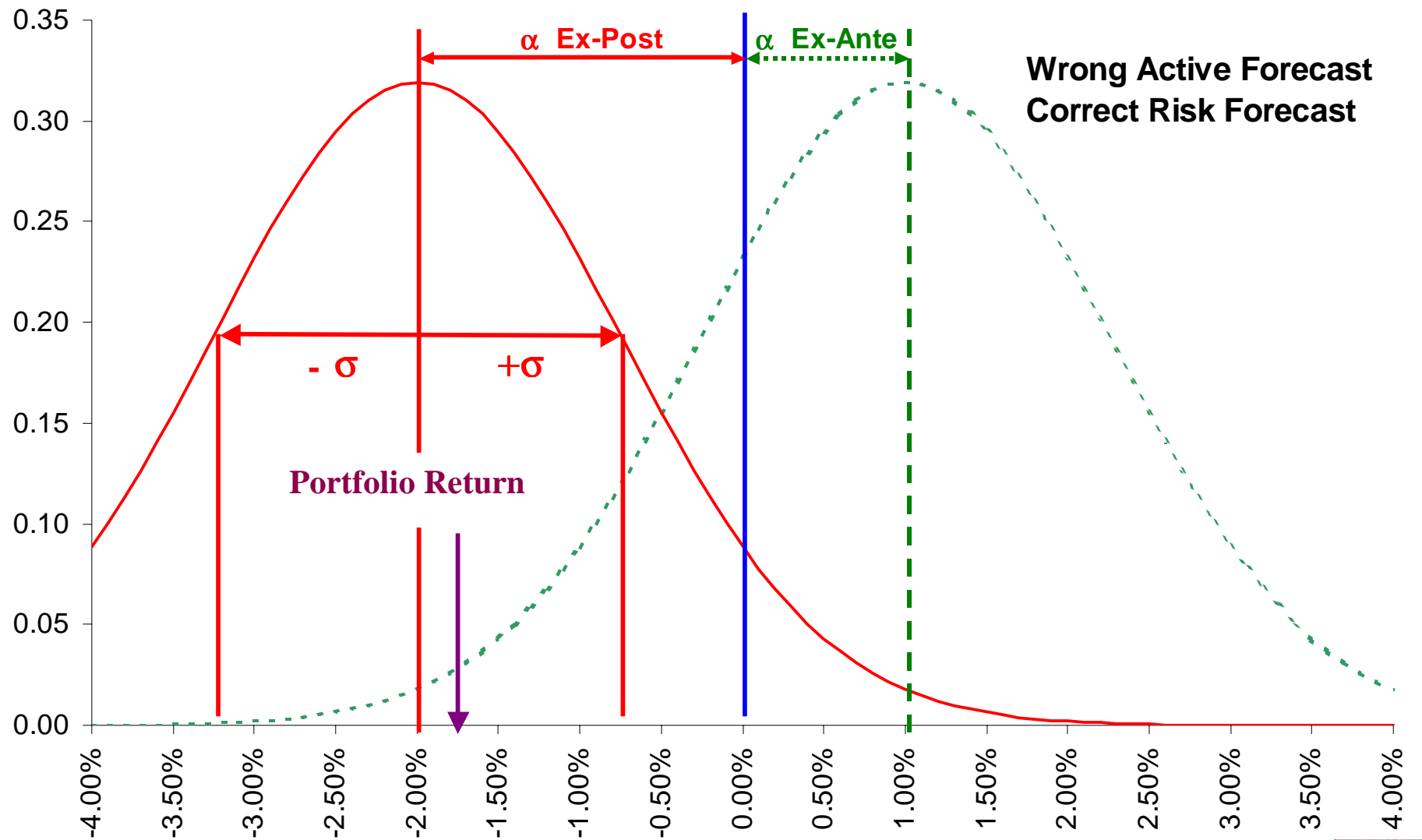
INTERPRETATION (C) :



TRACKING ERROR: OUTCOME (I) INTERPRETATION (C) :

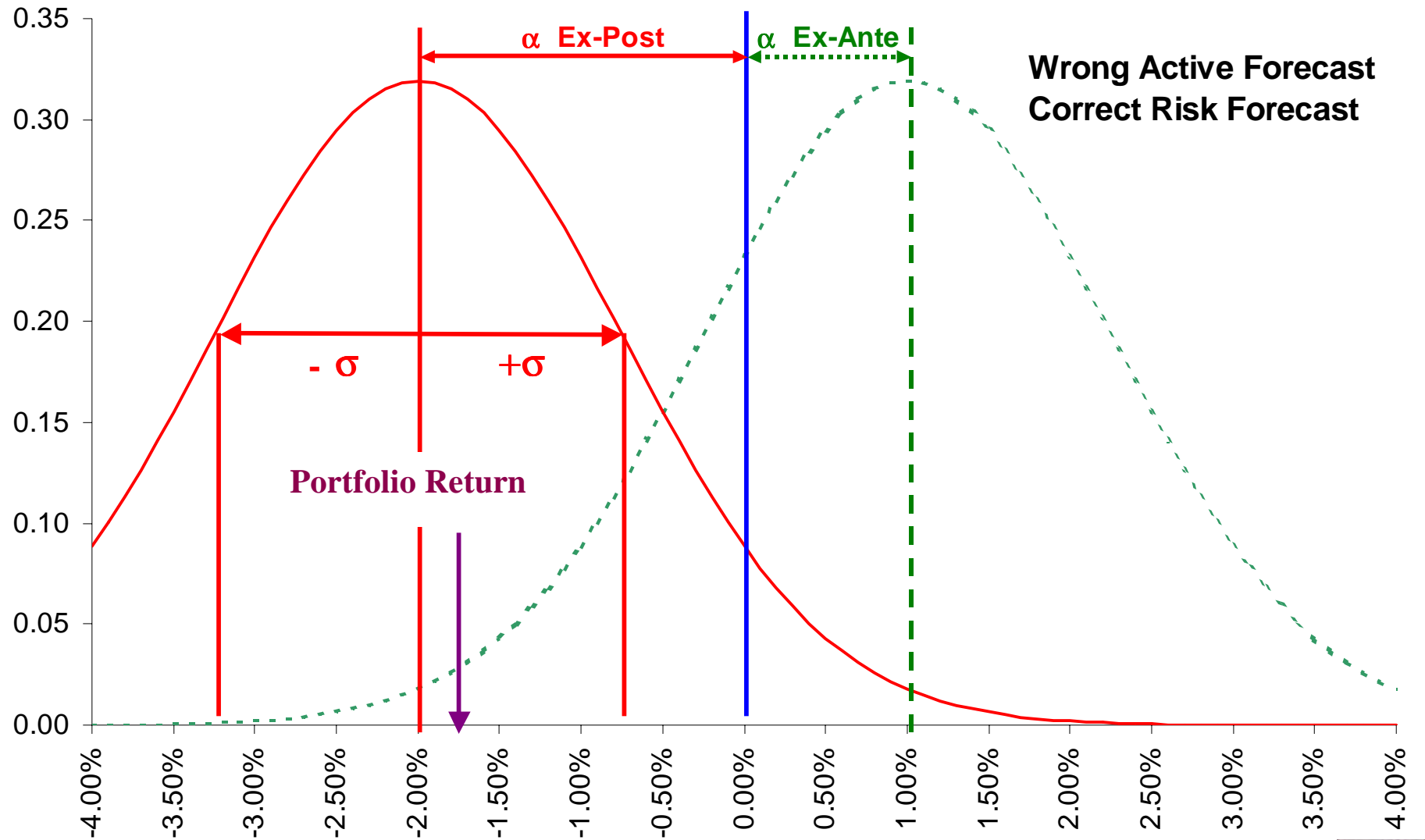


TRACKING ERROR: OUTCOME (I) INTERPRETATION (C) :

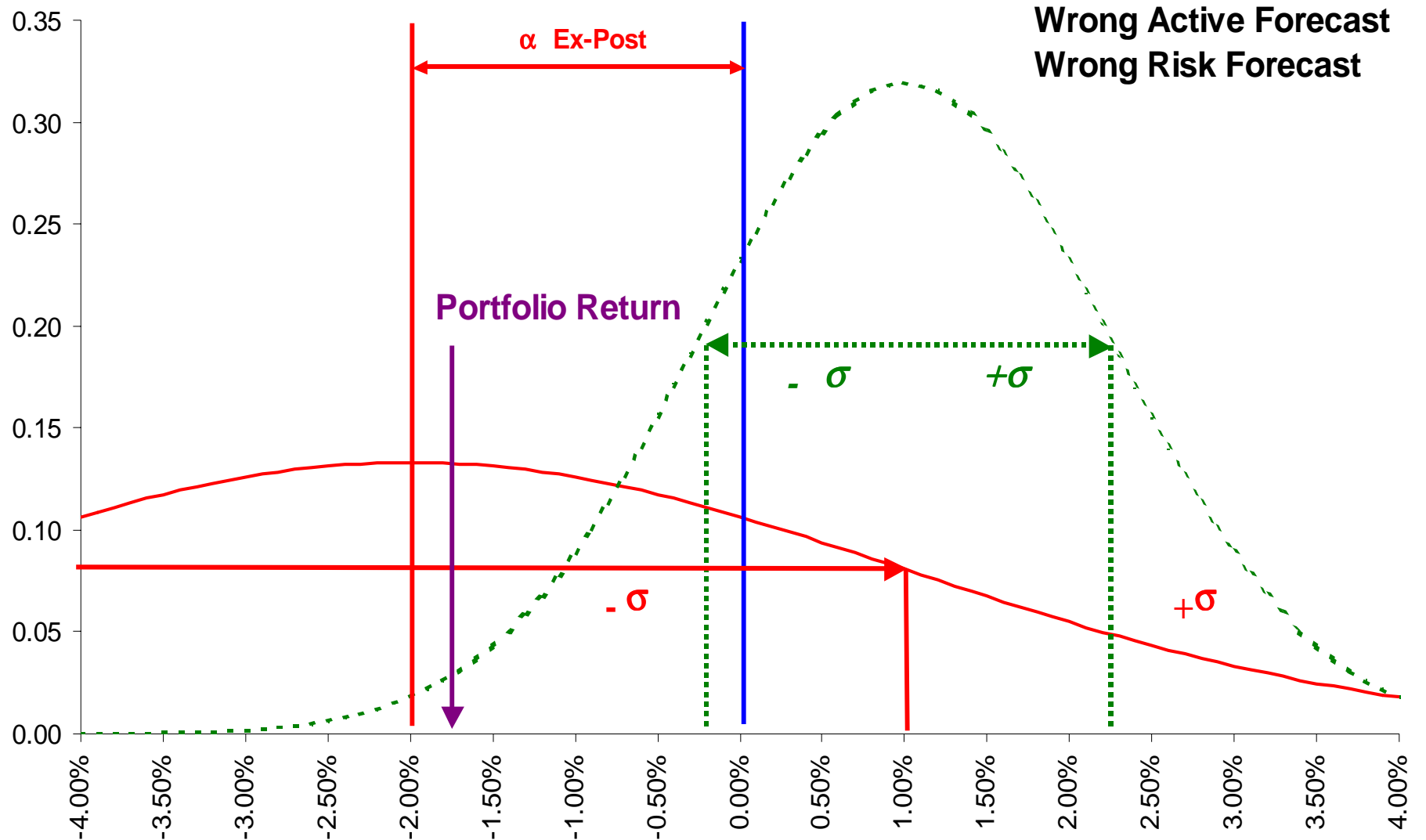


TRACKING ERROR: OUTCOME (II)

INTERPRETATION (C) : ACTIVE POLICY FAILED



TRACKING ERROR: OUTCOME (II) INTERPRETATION (D) : ALL WRONG

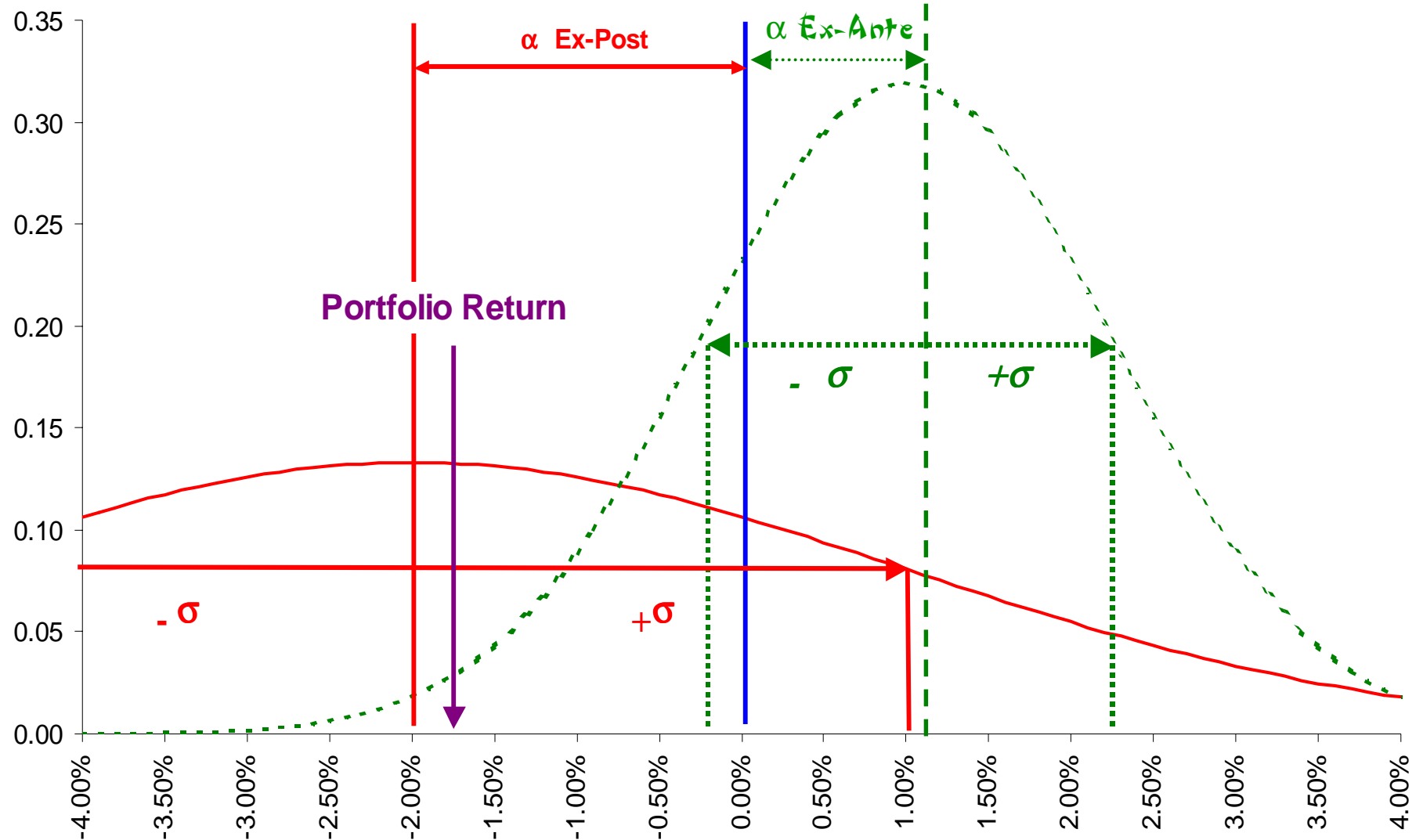


III. IDENTIFICATION ISSUES

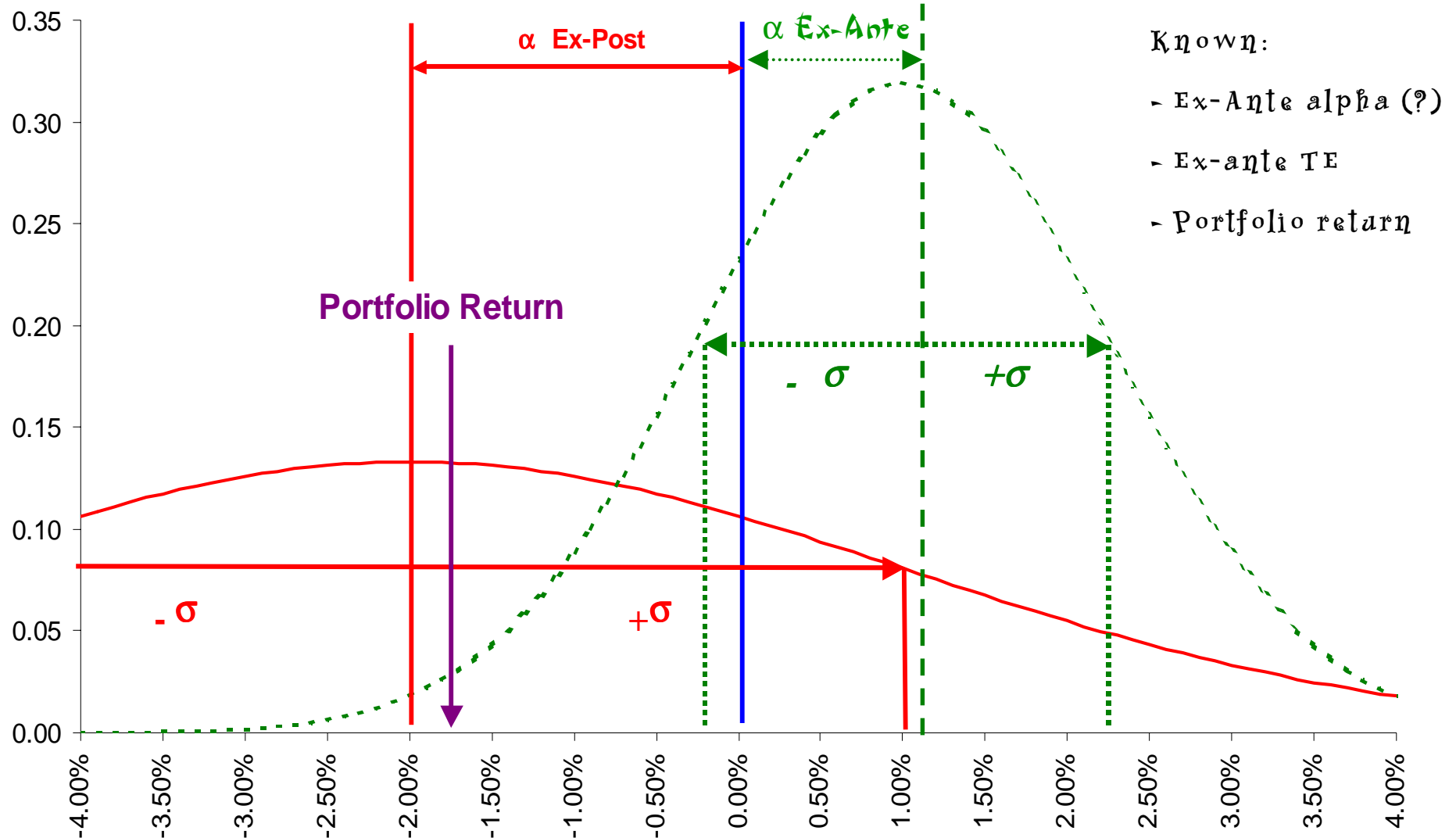


TRACKING ERROR: IDENTIFICATION PROBLEM (I)

WHAT IS KNOWN AND UNKNOWN (A)

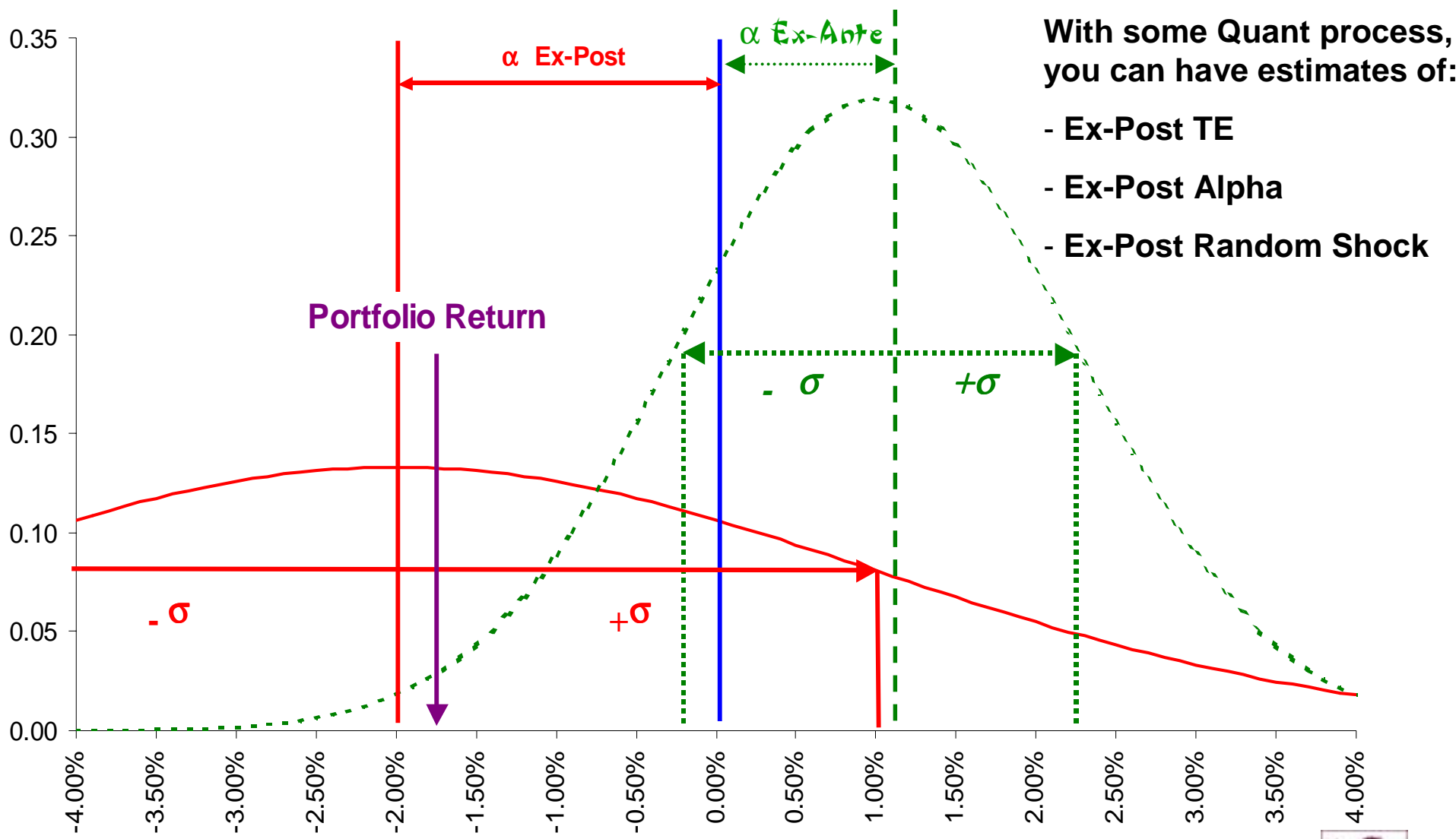


TRACKING ERROR: IDENTIFICATION PROBLEM (I) WHAT IS KNOWN AND UNKNOWN (A)



TRACKING ERROR: IDENTIFICATION PROBLEM (I)

WHAT IS KNOWN AND UNKNOWN (C)

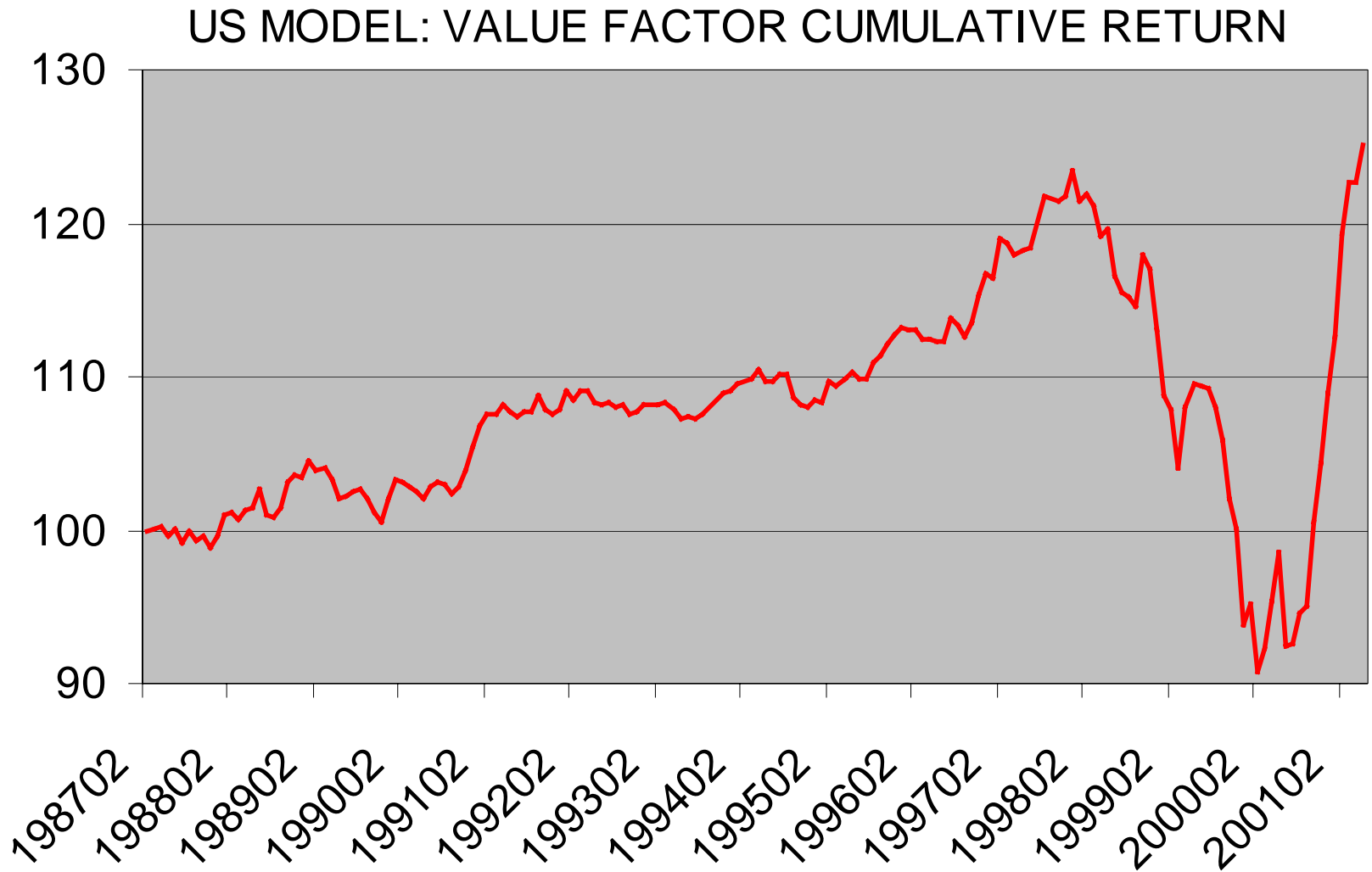


IV. VALUE TILTED ASSET MNGT:
1998-2000



VALUE TILTED ASSET MANAGEMENT: 1998-2000

US MARKET: VALUE FACTOR



VALUE TILTED ASSET MANAGEMENT: 1998-2000

US MARKET: CHANGES IN TREND

- Statistics on the monthly return of the Value factor:

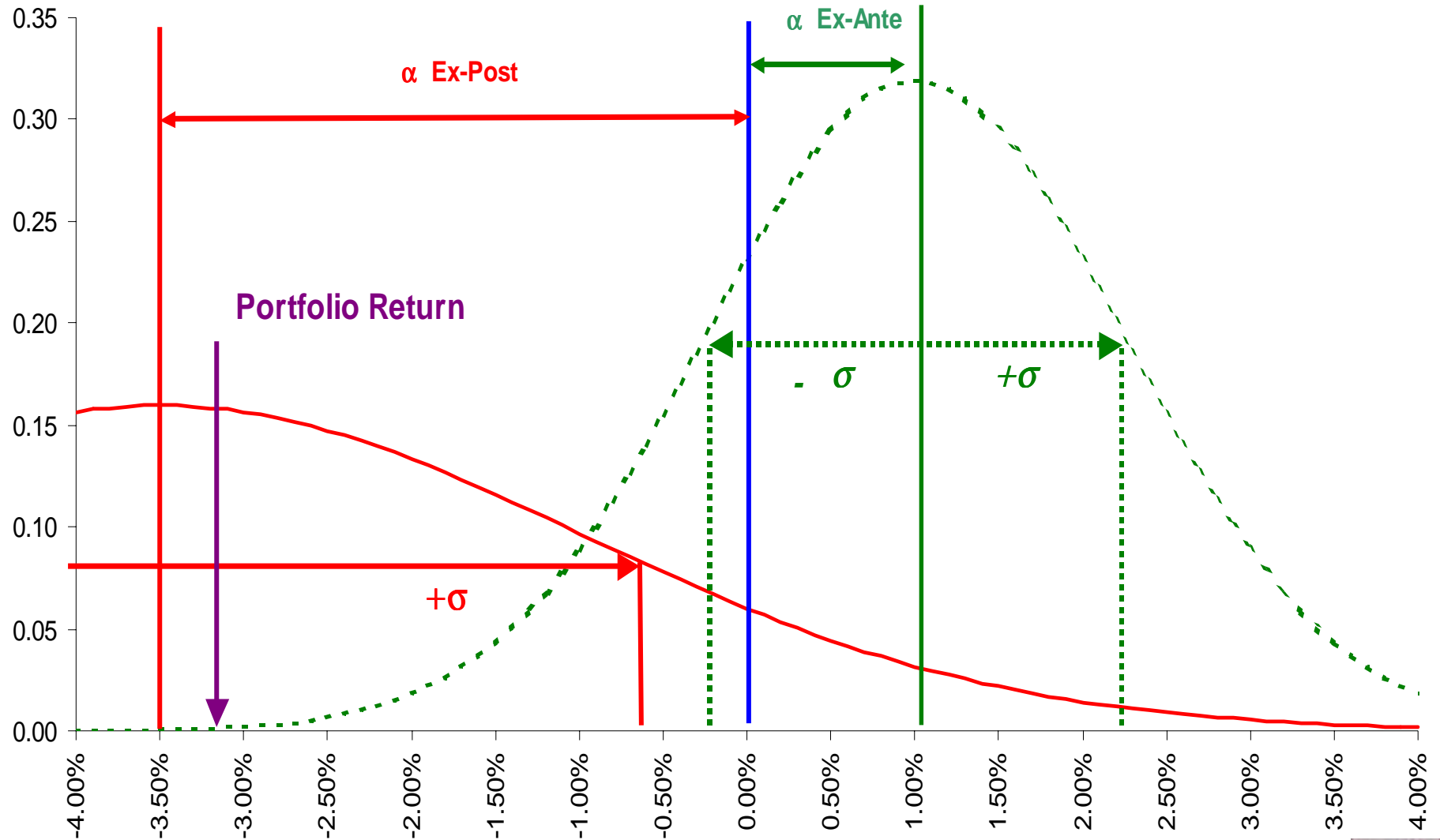
Period	Monthly return (%)	
	Mean	Std. Dev.
March 87 - December 97	0.16	0.68
January 98 - February 2000	-1.15	2.26
March 2000 - May 2001	2.20	2.95

- Between the two first periods:
 - Large increase in volatility (3 x).
 - Even larger increase in the systematic drift (-7x).
 - For the same active bet, in terms of weight deviation, the alpha component of the active return is much larger in the second period



VALUE TILTED ASSET MANAGEMENT: 1998-2000

WHAT HAPPENED TO MANY MANAGERS IN 98-99



V. ALPHA FORECASTING RISK



ALPHA FORECASTING RISK (I)

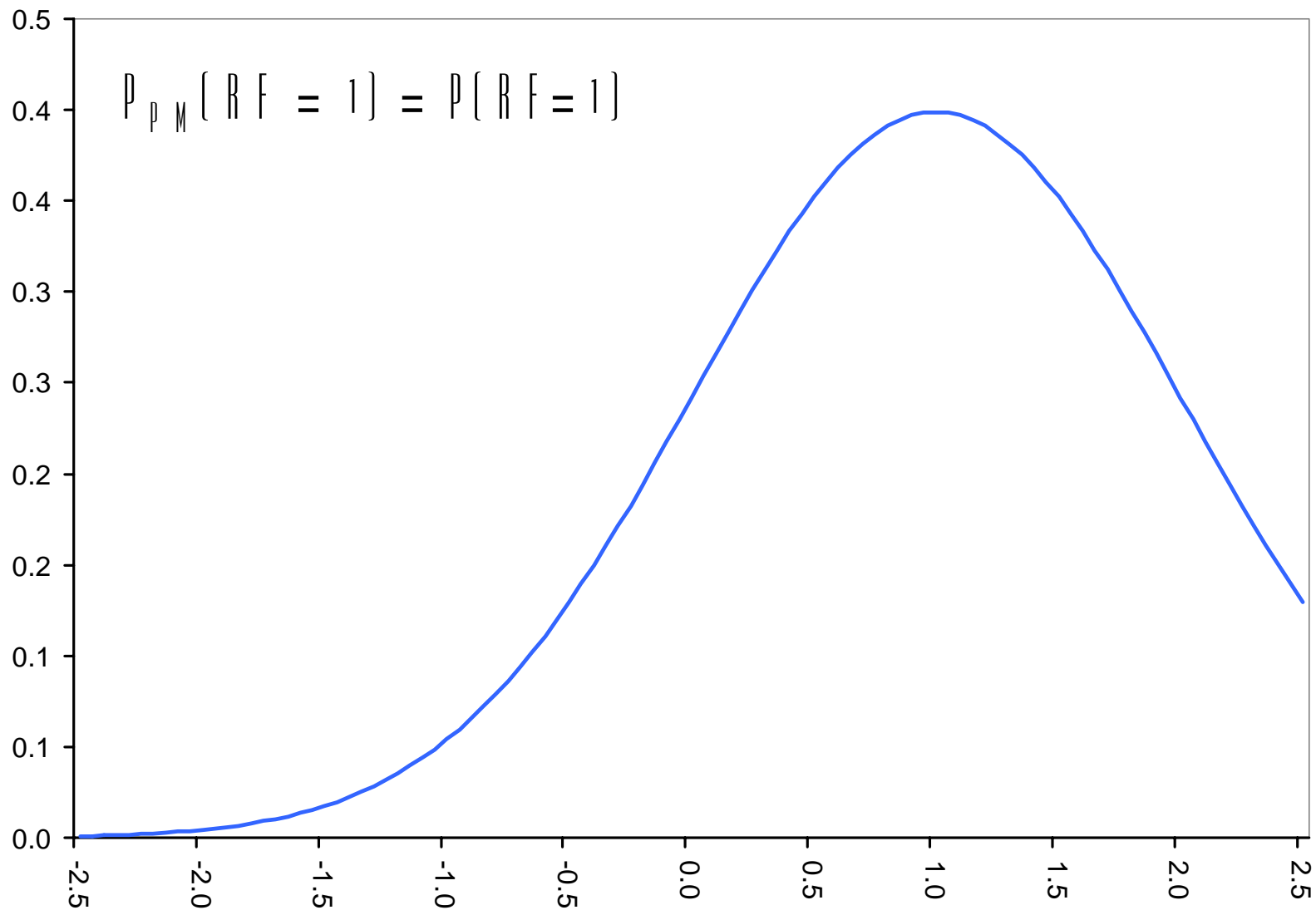
A THOUGHT EXPERIMENT (A)

- We suppose that an active portfolio manager:
 - Manages his portfolios based on the forecast of single factor
 - Knows with certainty the absolute value of the factor return
 - Is uncertain about the sign of factor return
 - Maintains a constant information ratio
- We also suppose that he is using a risk model which is forecasting correctly the tracking error



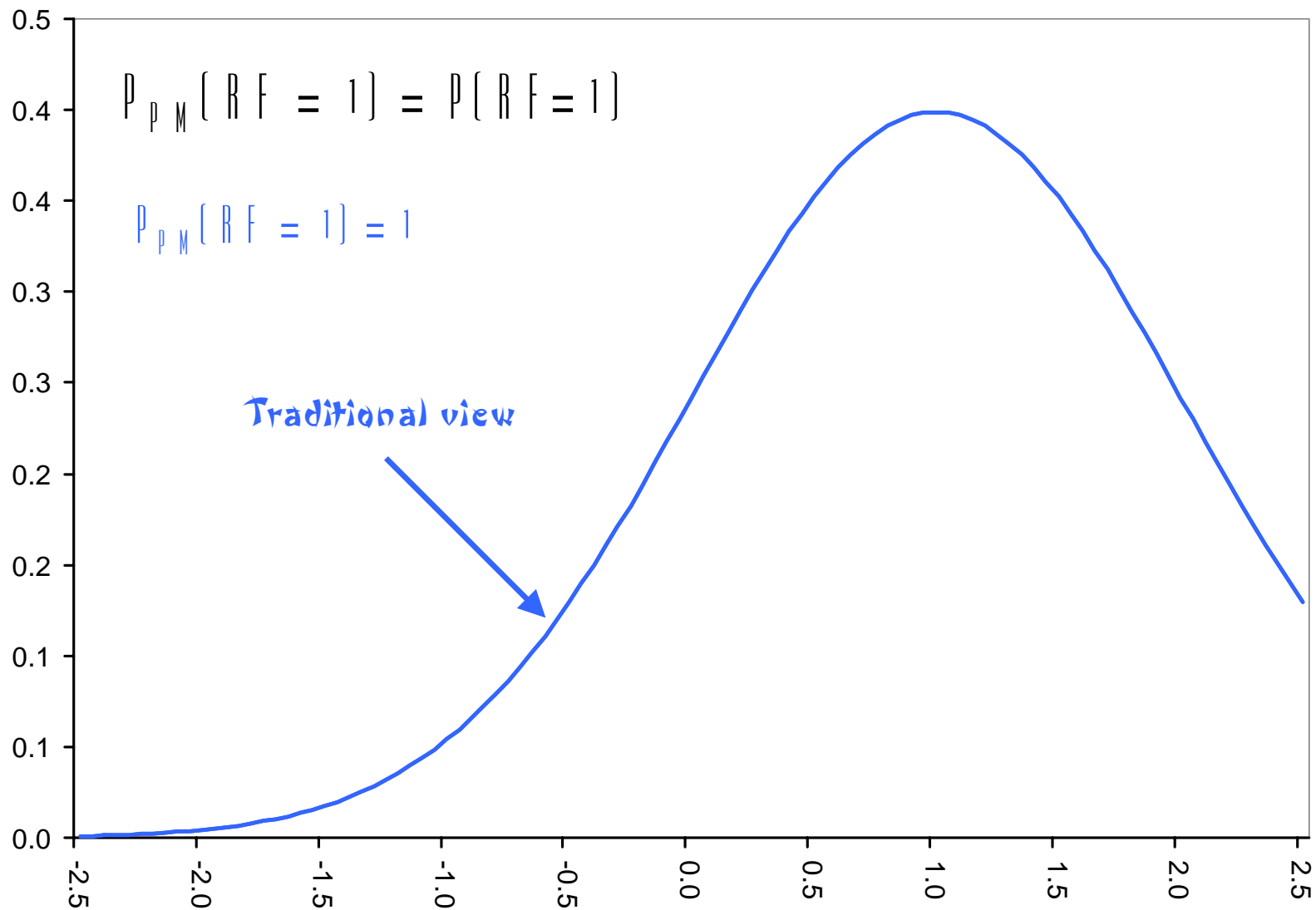
ALPHA FORECASTING RISK (II)

PORTFOLIO MANAGER ; CORRECT PERCEPTION (A)



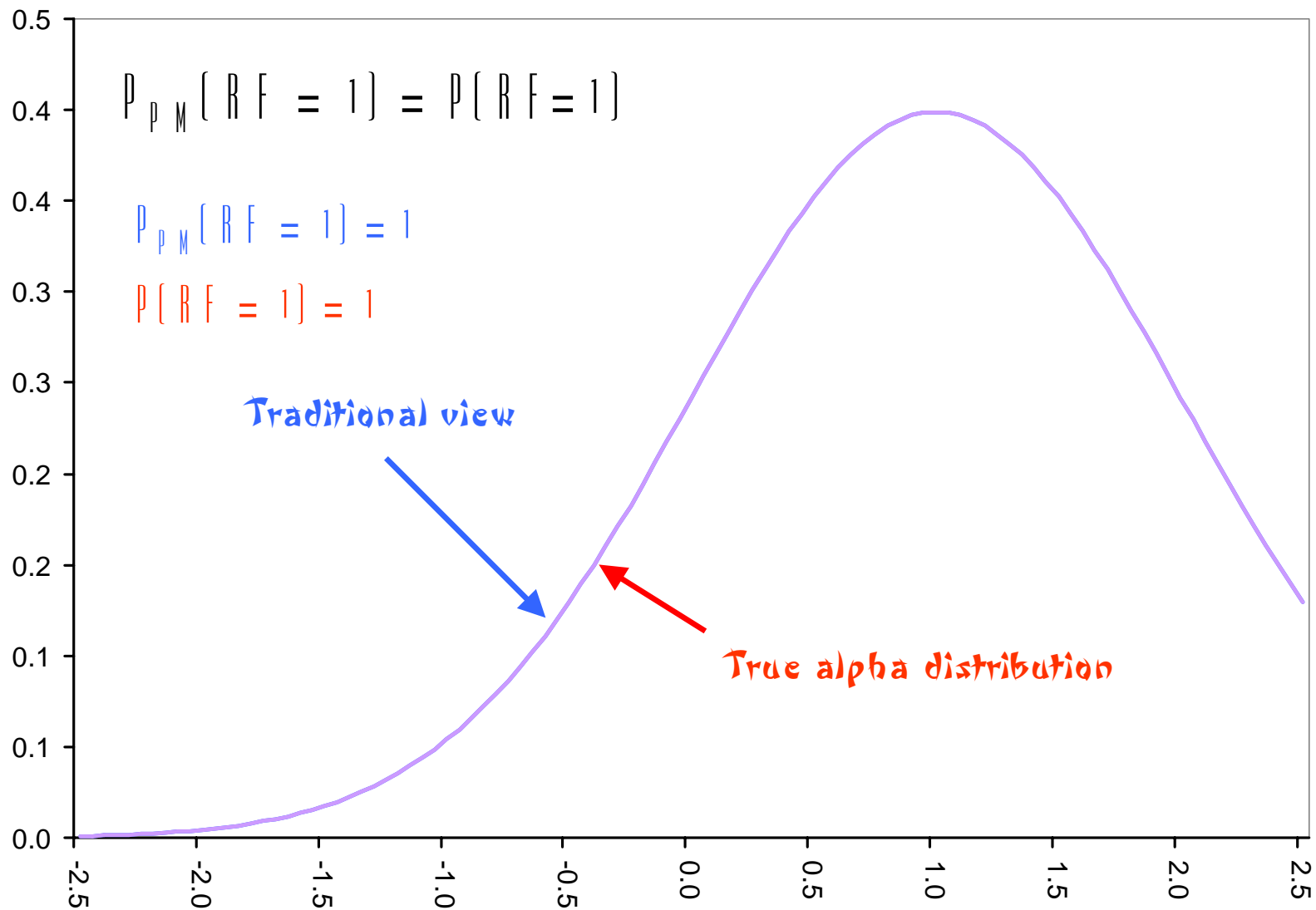
ALPHA FORECASTING RISK (II)

PORTFOLIO MANAGER ; CORRECT PERCEPTION (A)



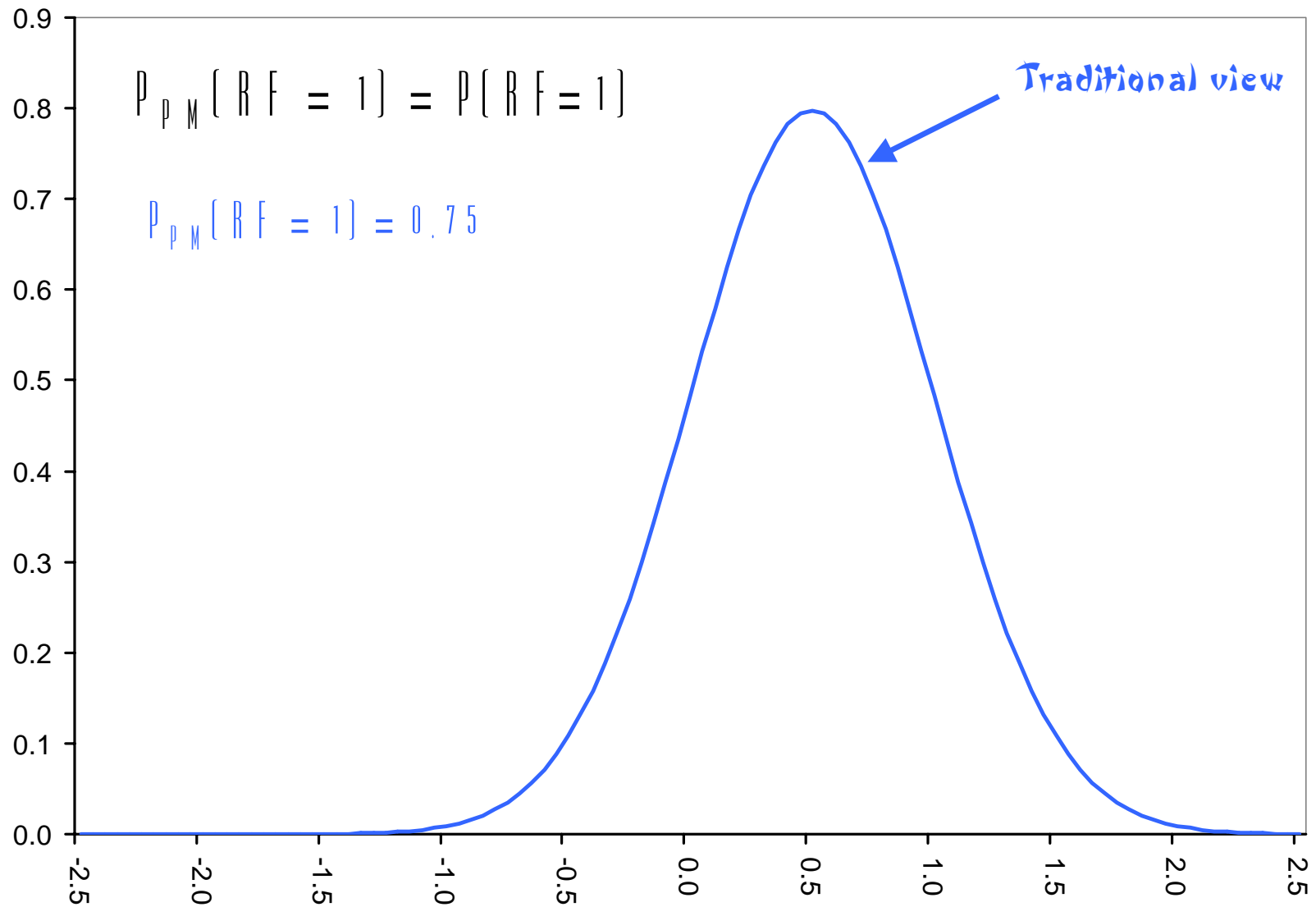
ALPHA FORECASTING RISK (II)

PORTFOLIO MANAGER ; CORRECT PERCEPTION (A)



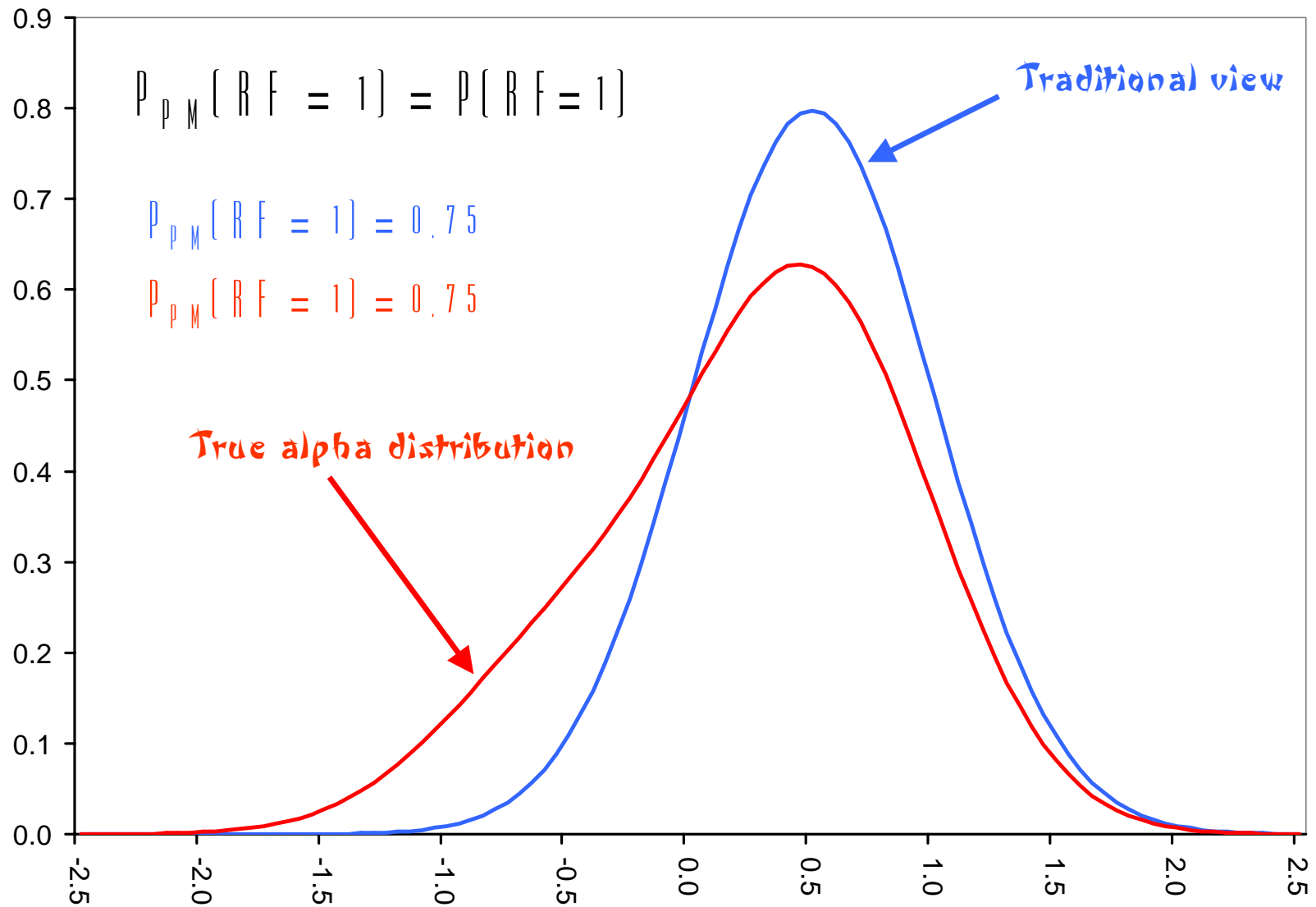
ALPHA FORECASTING RISK (II)

PORTFOLIO MANAGER ; CORRECT PERCEPTION (B)



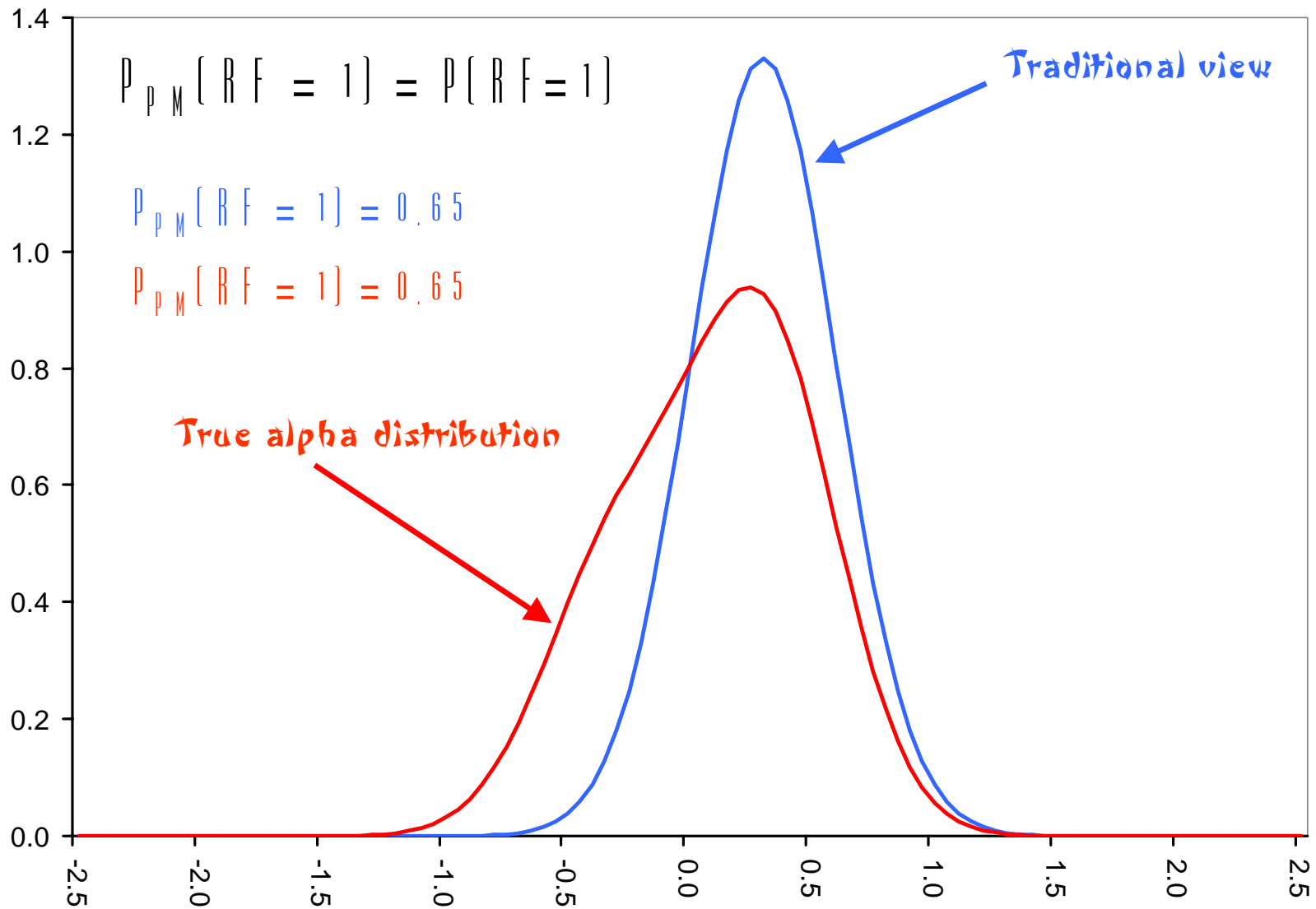
ALPHA FORECASTING RISK (II)

PORTFOLIO MANAGER ; CORRECT PERCEPTION (B)



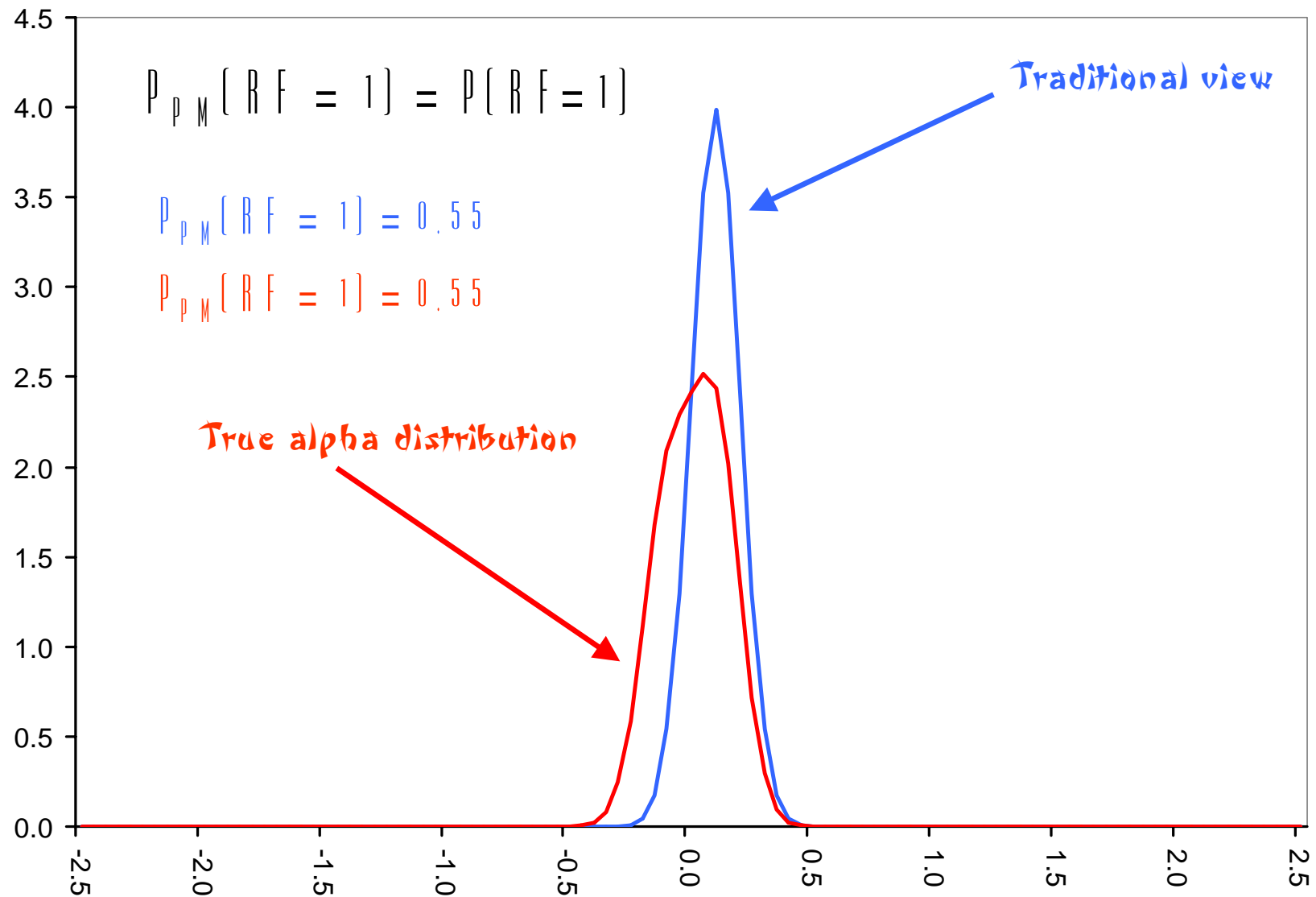
ALPHA FORECASTING RISK (II)

PORTFOLIO MANAGER ; CORRECT PERCEPTION (C)



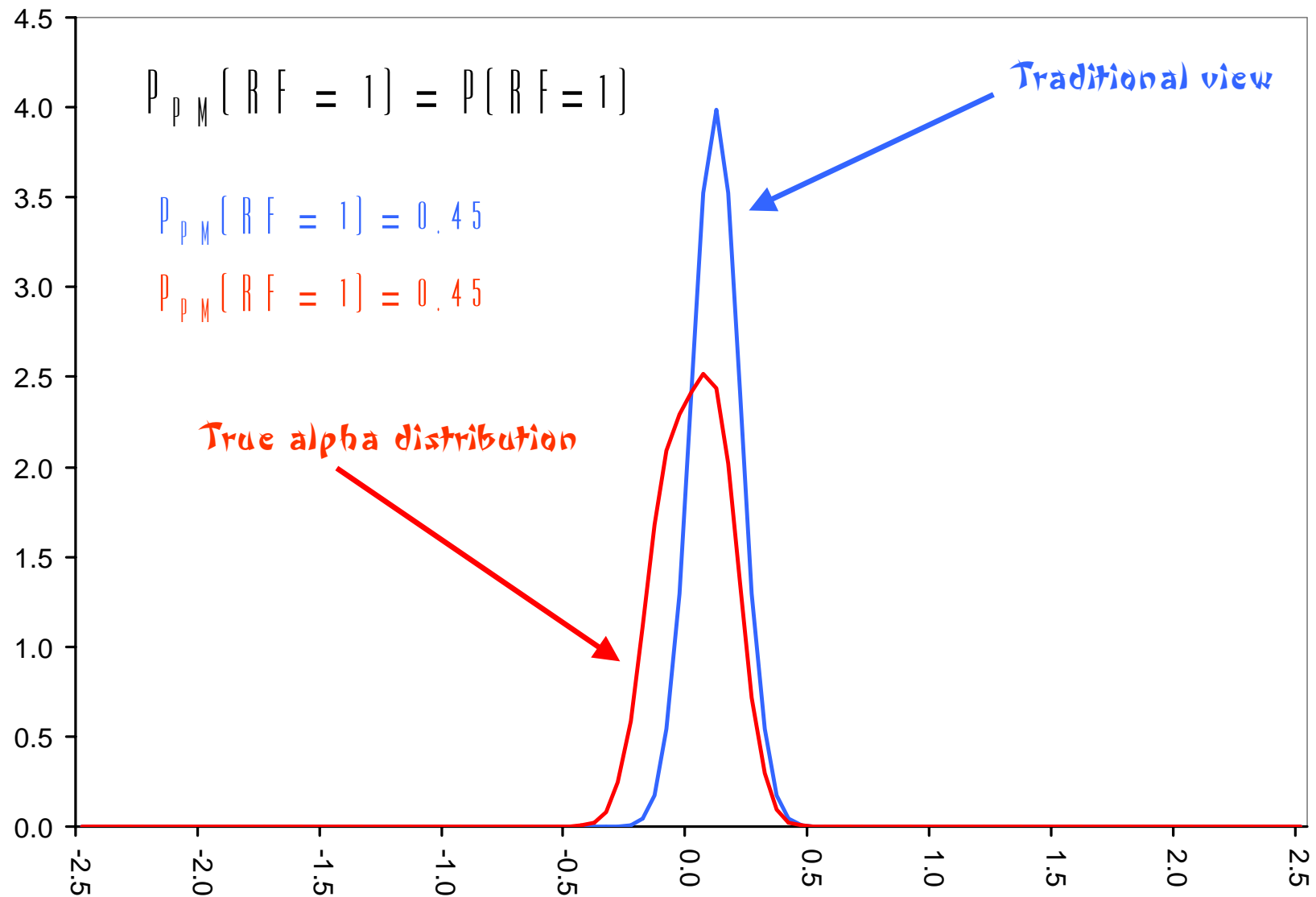
ALPHA FORECASTING RISK (II)

PORTFOLIO MANAGER ; CORRECT PERCEPTION (D)



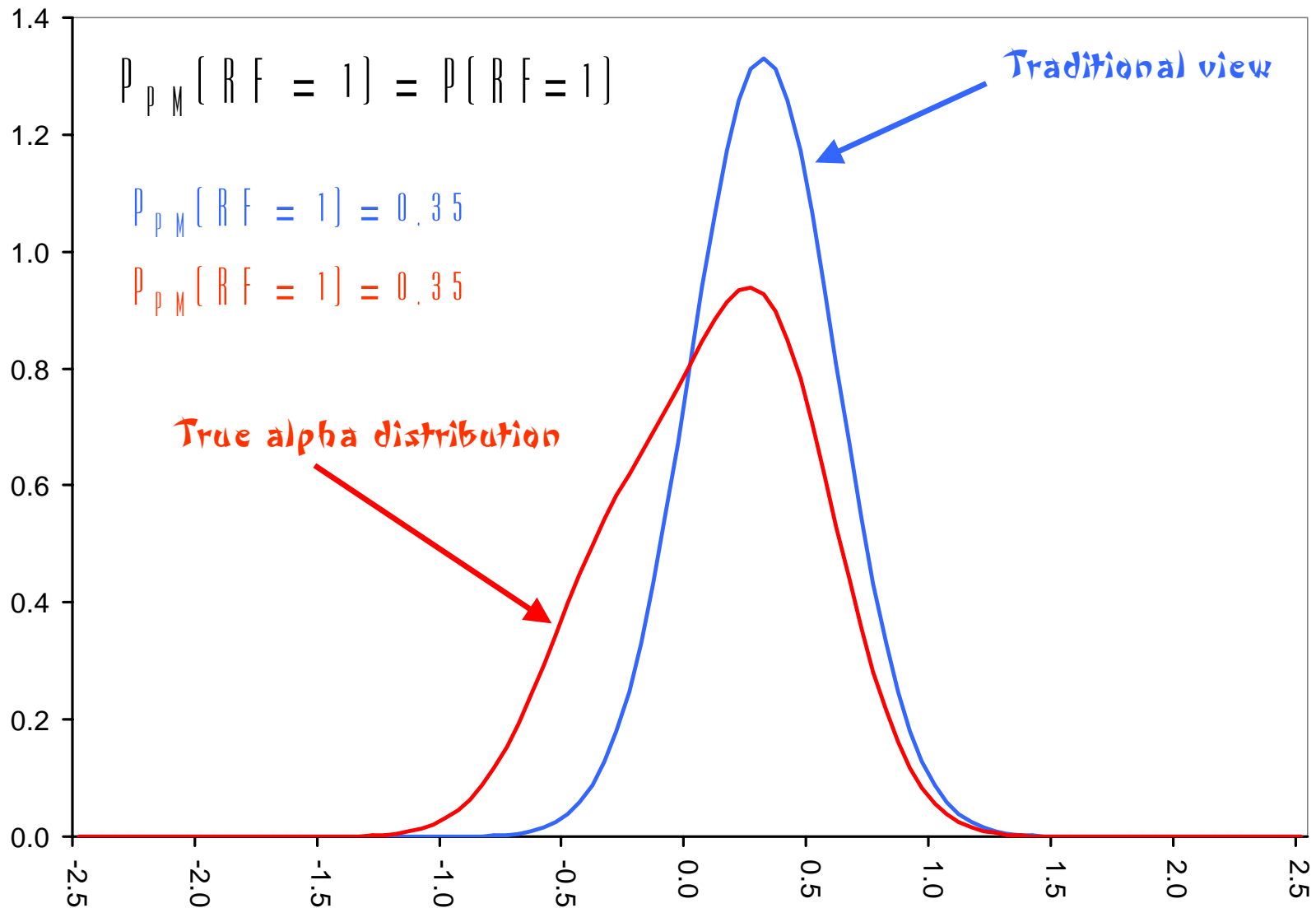
ALPHA FORECASTING RISK (II)

PORTFOLIO MANAGER ; CORRECT PERCEPTION (E)



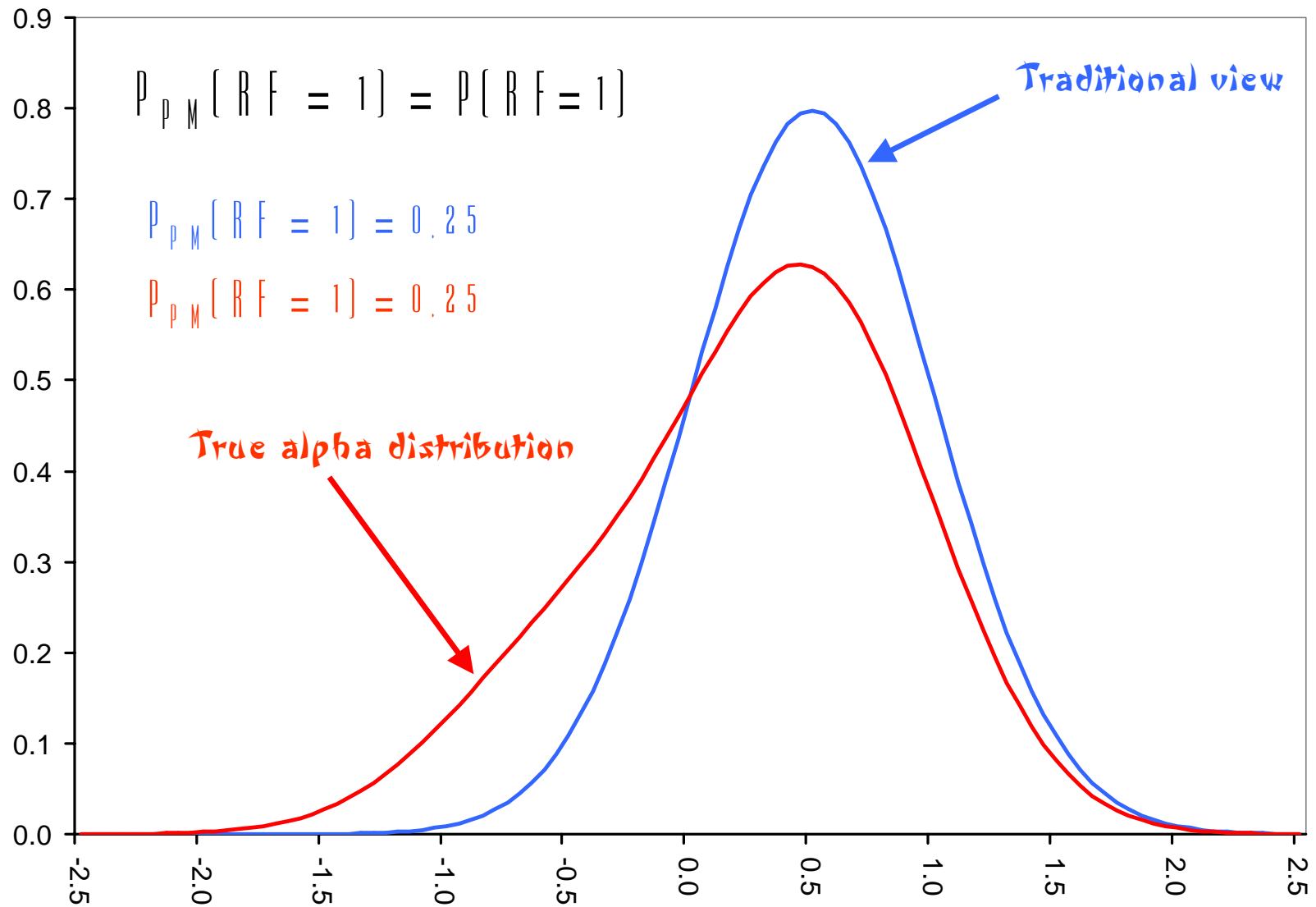
ALPHA FORECASTING RISK (II)

PORTFOLIO MANAGER ; CORRECT PERCEPTION (F)



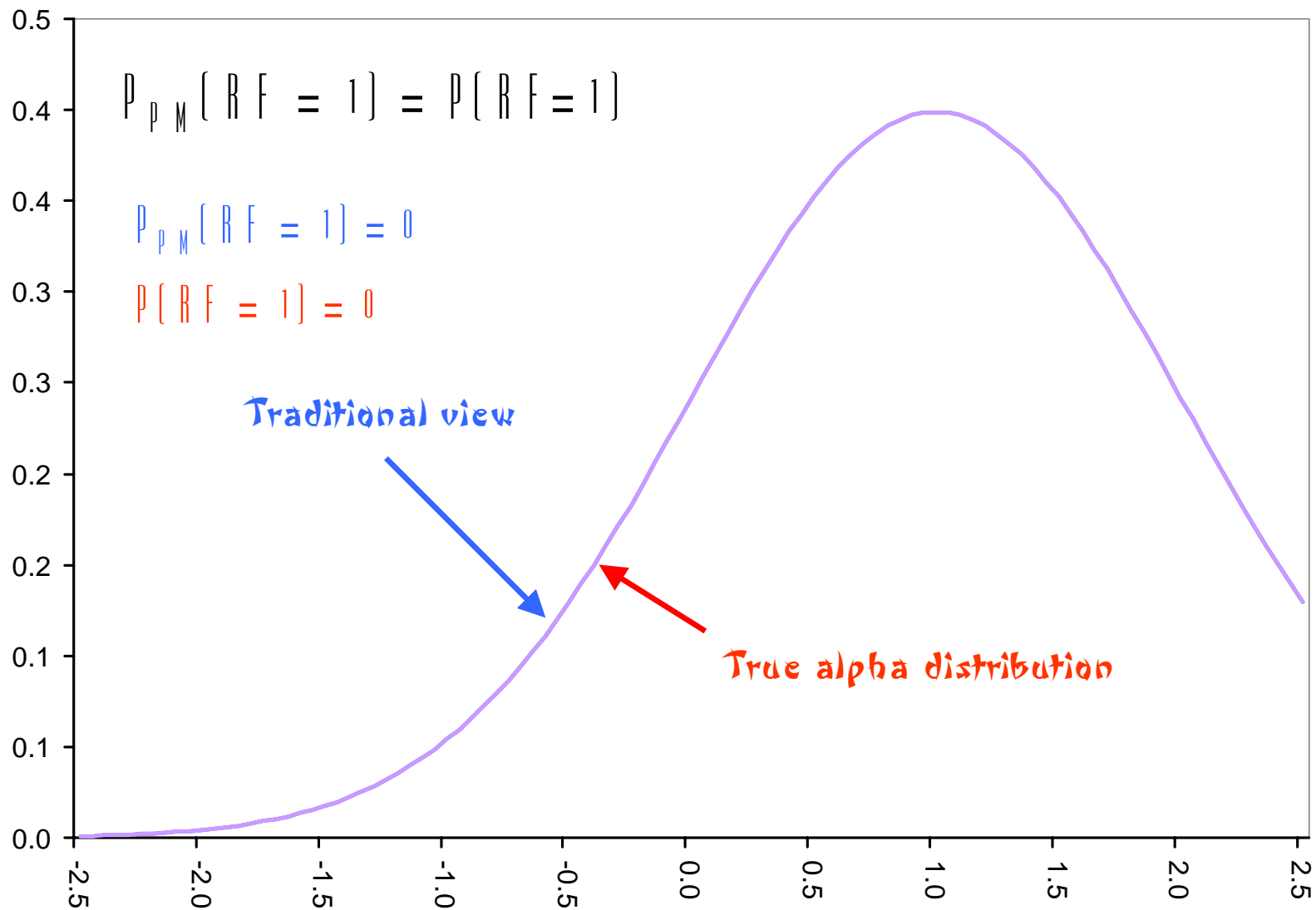
ALPHA FORECASTING RISK (II)

PORTFOLIO MANAGER ; CORRECT PERCEPTION (G)



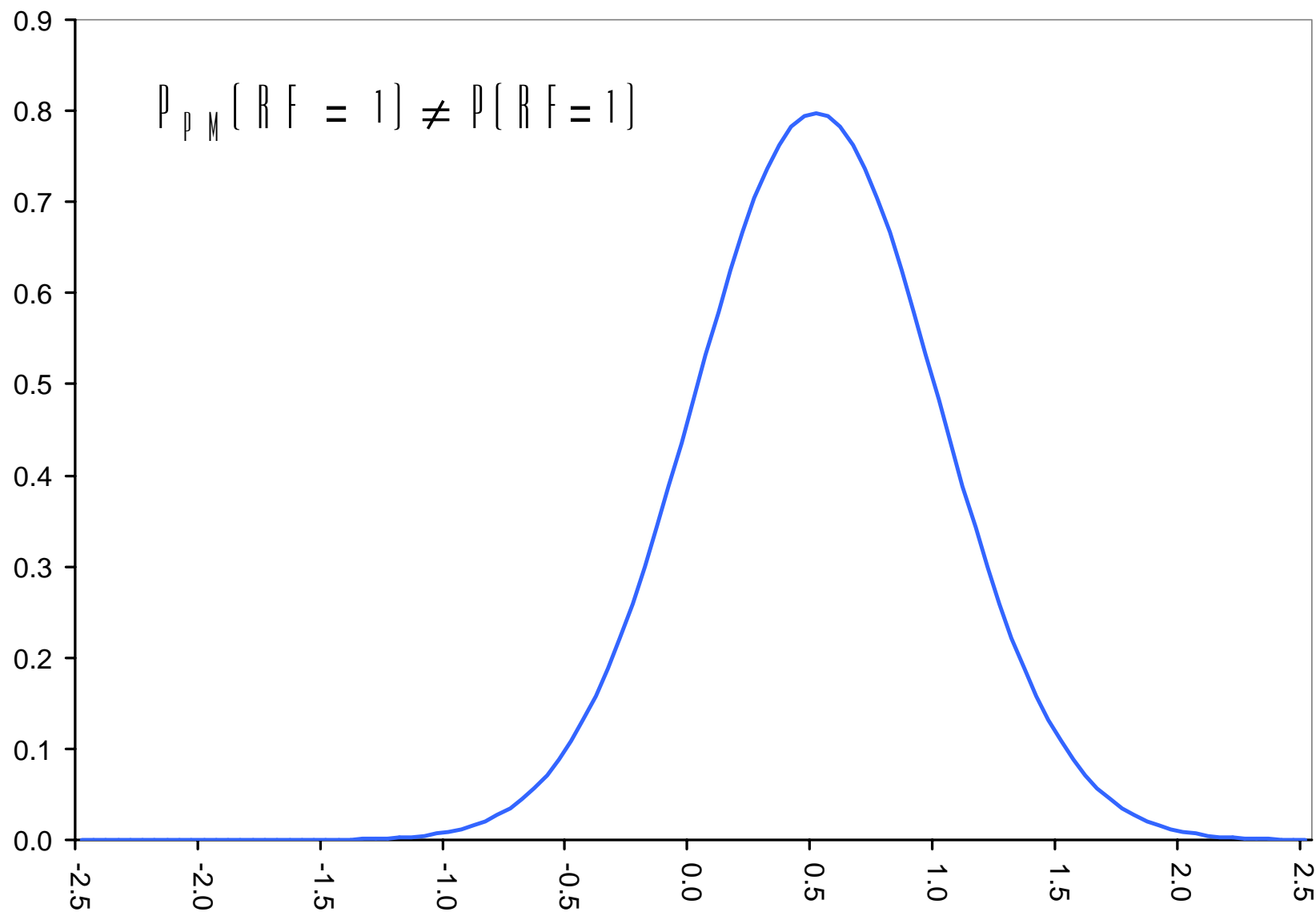
ALPHA FORECASTING RISK (II)

PORTFOLIO MANAGER ; CORRECT PERCEPTION (H)



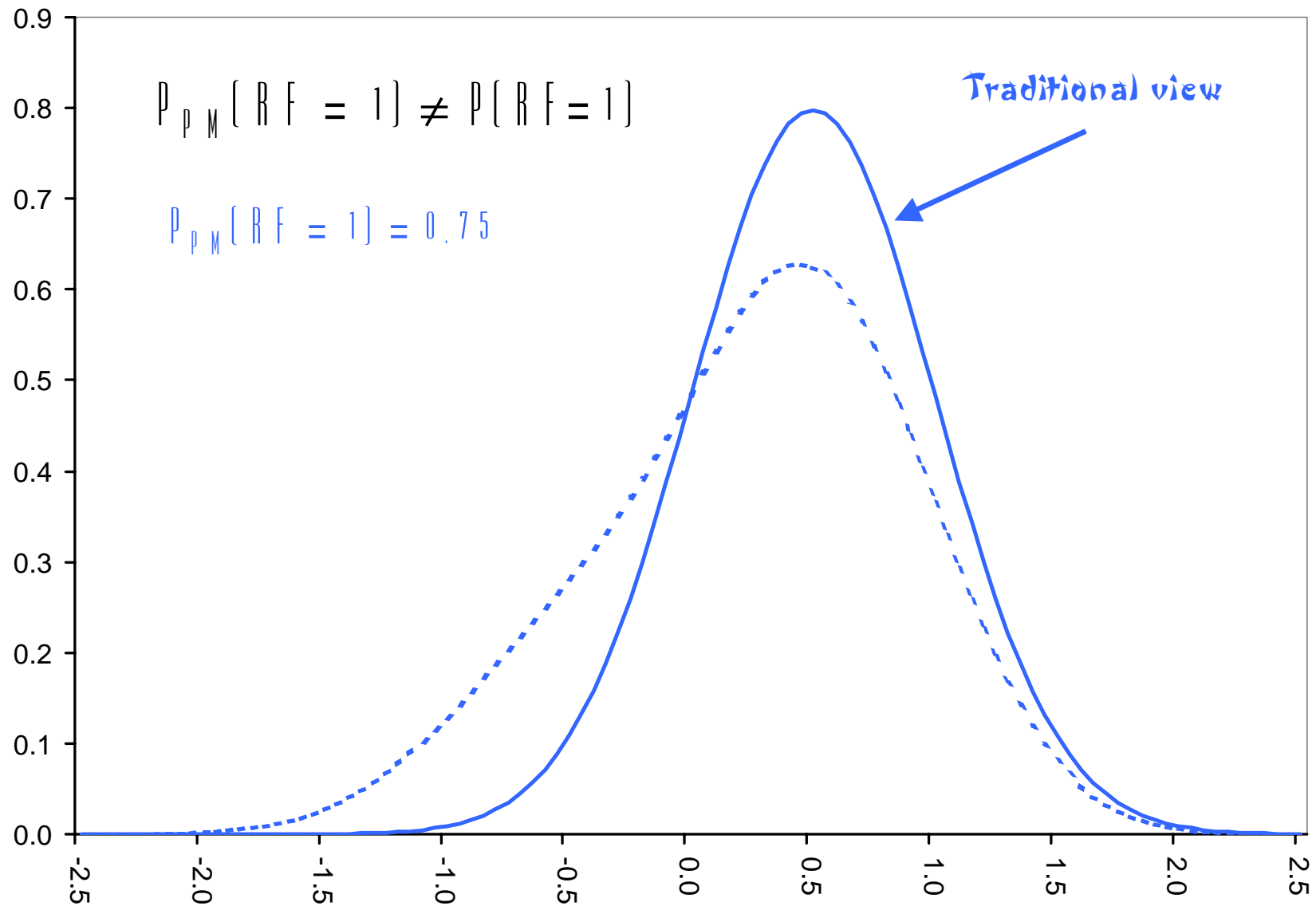
ALPHA FORECASTING RISK (II)

PORTFOLIO MANAGER ; INCORRECT PERCEPTION



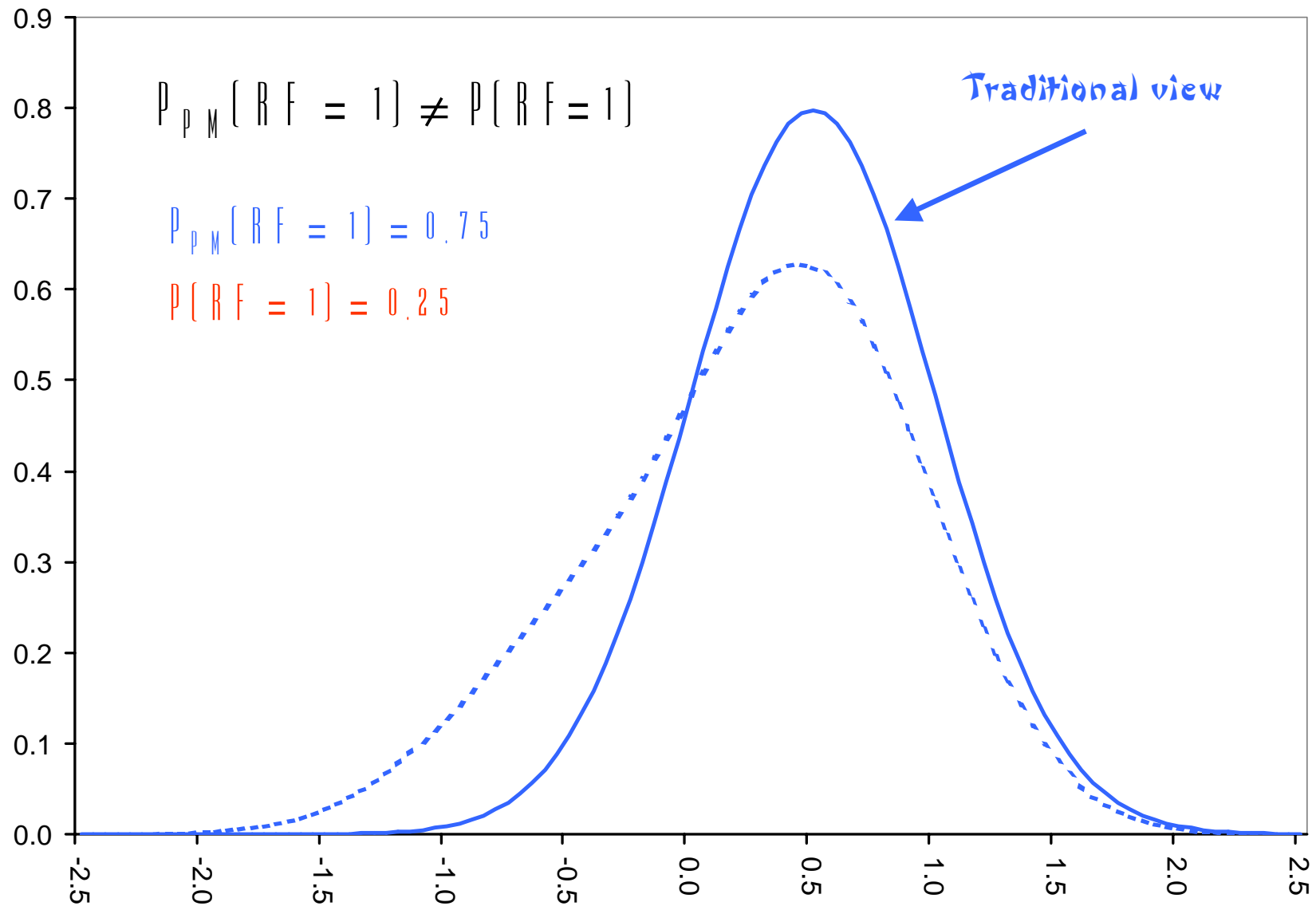
ALPHA FORECASTING RISK (II)

PORTFOLIO MANAGER ; INCORRECT PERCEPTION



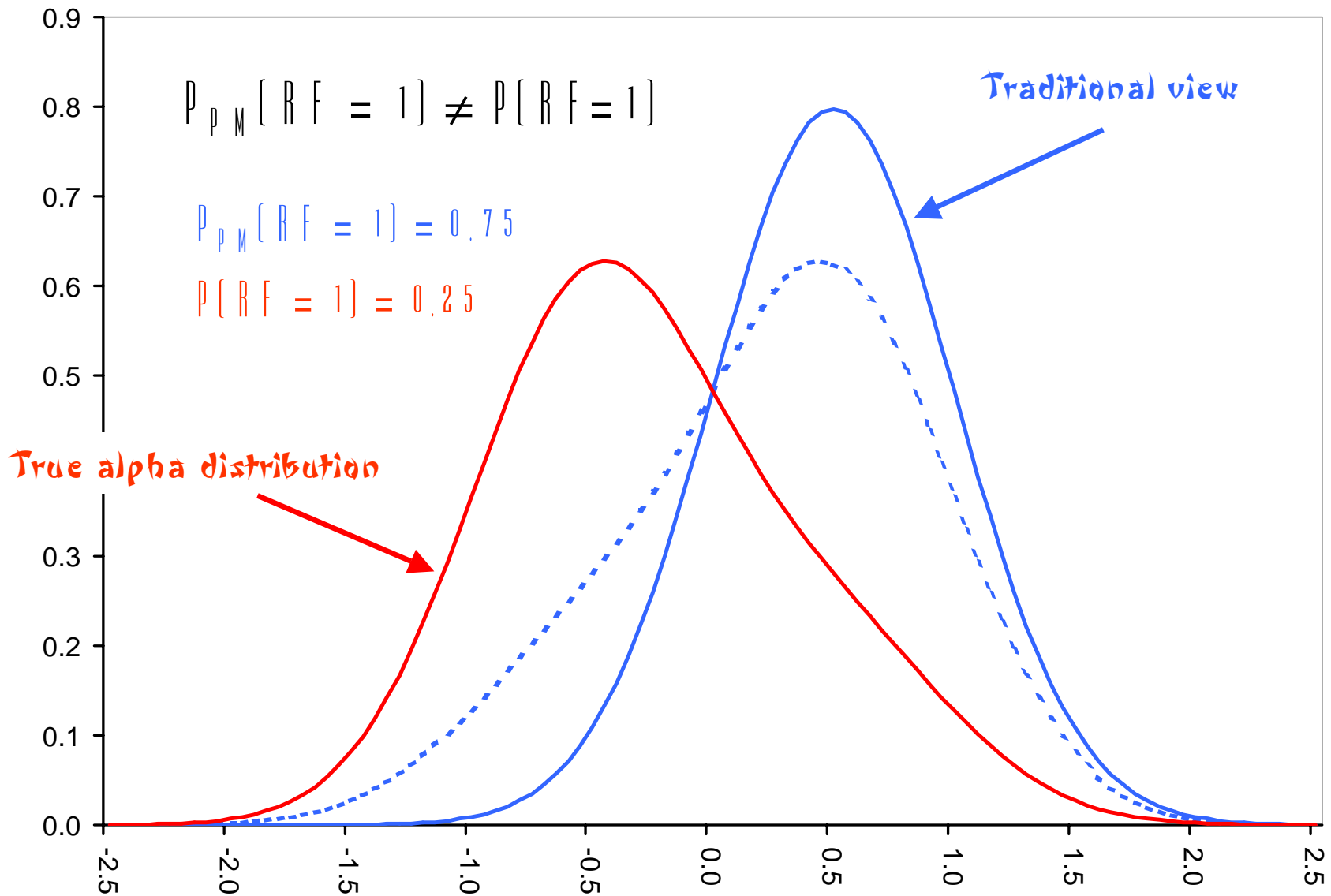
ALPHA FORECASTING RISK (II)

PORTFOLIO MANAGER ; INCORRECT PERCEPTION



ALPHA FORECASTING RISK (II)

PORTFOLIO MANAGER ; INCORRECT PERCEPTION



VI. CONCLUSIONS



C O N C L U S I O N S (I)

T H E B A D N E W S F O R A C T I V E M A N A G E M E N T (A)

- When practicing active management, the portfolio's active return depends on the:
 - Realized random shocks,
 - Ex-post active alpha.
- Even if the risk model forecasts correctly the volatility of the random shock, unexpected large ex-post active alphas can generate extraordinary events in terms portfolio' active returns.
- The extraordinary events (unexpected large ex-post alphas) should not be interpreted as a failure of the risk model.



C O N C L U S I O N S (I)

T H E B A D N E W S F O R A C T I V E M A N A G E M E N T (B)

- **The ex-ante tracking error:**
 - **Forecasts the volatility of the random shocks in active returns**
 - **Does not take into account the alpha forecasting risks**
 - This can be the source of acute problems when**
 - **There are powerful trends at work**
 - **There is a timing uncertainty about the sign of the trend**
- **Controlling the ex-ante tracking error may not shield the investor against too frequent extraordinary events in terms of active performance.**



CONCLUSIONS (II)

THE GOOD NEWS FOR ACTIVE MANAGEMENT (B)

- Both the ex-ante and ex-post portfolio's alphas are indirectly controlled through the ex-ante tracking error.
 - If a portfolio manager acts efficiently, i.e. maximizes the information ratio of his portfolios, his only way to increase the ex-ante alpha of a portfolio is to increase its ex-ante tracking error.
 - $\alpha_{\text{Ex-Ante}} = \text{IR}^* \cdot \text{TE}_{\text{Ex-Ante}}$
 - In case of powerful trends, a portfolio manager can bridge the ex-ante and ex-post alphas by lowering the ex-ante tracking error.

