

Raison D'etre for BOOK 2; The PDE of the Statistically Accurate Option Premium

The first four pages of the *Raison D'etre* is a first principles derivation of $rV - V_t = \frac{1}{2}\sigma^2 S^2 V_{SS} + (\mu + \frac{1}{2}\sigma^2) S V_S$, the **partial differential equation** (PDE) of a **statistically unbiased and accurate option premium** V for an option to buy, or an option to sell, an **exponential Brownian motion** market asset S at time T for a fixed and predetermined price k . The premium V , as the solution to this equation $rV - V_t = \frac{1}{2}\sigma^2 S^2 V_{SS} + (\mu + \frac{1}{2}\sigma^2) S V_S$, is the accurate premium for someone who wants the option market derivative and the associated payoff profile, i.e., ownership of the right, but not the obligation, to buy or sell the market asset S for k at time T . It is reminded that a person who buys an option, and whom **wants the option** exposure and the **payoff profile** of the option, **must not take an offsetting position in the underlying asset** [which essentially nulls the position]. If it is not blatantly obvious already, if you don't want the position, then don't take the position in the first place [and you particularly should not have to kill your position in order to fund an idiotically mispriced and debased option: people are being told and taught that they must, and this is the *Raison D'etre* (the reason I debunked risk-neutral valuation)].

A proportional (exponential) Brownian motion for market returns has diffusion equation

$$\frac{dS_t}{dt} = \left(\mu + \frac{1}{2}\sigma^2\right) S_t + \sigma S_t \frac{dB_t}{dt}$$

where B_t is standard Brownian motion, $B_t \sim N(0, t)$.

(1) The Transition Distribution of the Market Asset

Taking the logarithm of the diffusion variable S_t for the underlying additive Brownian motion $\log S_t$; by a Taylor series, the total derivative of the transformed variable $\log S_t$ is

$$\begin{aligned} \frac{d \log S_t}{dt} &= \frac{\partial \log S_t}{\partial t} \frac{dt}{dt} + \frac{\partial \log S_t}{\partial S_t} \frac{dS_t}{dt} + \frac{1}{2} \frac{\partial^2 \log S_t}{\partial S_t^2} \frac{(dS_t)^2}{dt} + \dots \\ &= \frac{\partial \log S_t}{\partial t} + \frac{\partial \log S_t}{\partial S_t} \frac{dS_t}{dt} + \frac{1}{2} \sigma^2 S_t^2 \frac{\partial^2 \log S_t}{\partial S_t^2} + \frac{o(dt)}{dt} \end{aligned}$$

since $(dS_t)^2 = \sigma^2 S_t^2 dt + o(dt)$ and $(dS_t)^n = o(dt)$ for $n > 2$.

$$\text{From (1) } \frac{\partial \log S_t}{\partial t} = 0 \quad (2) \quad \frac{\partial \log S_t}{\partial S_t} = \frac{1}{S_t} \quad (3) \quad \frac{\partial^2 \log S_t}{\partial S_t^2} = -\frac{1}{S_t^2} \quad \text{and} \quad \frac{o(dt)}{dt} \rightarrow 0$$

$$\begin{aligned} \frac{d \log S_t}{dt} &= \frac{1}{S_t} \left(\left(\mu + \frac{1}{2}\sigma^2\right) S_t + \sigma S_t \frac{dB_t}{dt} \right) + \frac{1}{2} \sigma^2 S_t^2 \left(-\frac{1}{S_t^2} \right) \\ &= \mu + \sigma \frac{dB_t}{dt} \end{aligned}$$

which is an ordinary Brownian motion in the variable $\log S_t$. Conditioning at time t [the backward time variable] and integrating over the transition interval from t to T [option expiry at the forward time variable] for the forward transition distribution

$$\int_t^T \frac{d \log S_y}{dy} dy = \int_t^T \left(\mu + \sigma \frac{dB_y}{dy} \right) dy$$

which results in

$$\begin{aligned} \left[\log S_y \right]_t^T &= \left[\mu y + \sigma B_y \right]_t^T \\ \log S_T - \log S_t &= \mu(T - t) + \sigma(B_T - B_t) \\ \log S_T &= \log S_t + \mu(T - t) + \sigma(B_T - B_t) \\ S_T &= \exp(\log S_t + \mu(T - t) + \sigma(B_T - B_t)) \end{aligned}$$

From distribution theory, conditional on $S(t) = S_t$ at time t is a constant

$$B_T - B_t \sim N(0, T - t)$$

$$\sigma(B_T - B_t) \sim N(0, \sigma^2(T - t))$$

$$\log S_t + \mu(T - t) + \sigma(B_T - B_t) \sim N(\log S_t + \mu(T - t), \sigma^2(T - t))$$

and exponentiating for a log-normal

$$\exp(\log S_t + \mu(T - t) + \sigma(B_T - B_t)) \sim \log N(\log S_t + \mu(T - t), \sigma^2(T - t))$$

Hence, the transition distribution is log-normal

$$S_T | S_t \sim \log N(\log S_t + \mu(T - t), \sigma^2(T - t))$$

The density function of this distribution, that of the market asset S to deliver at time T given that the spot price is S_t at time t , is

$$f_{S(T)|S(t)}(x | S_t) = \frac{1}{x \sigma \sqrt{T - t} \sqrt{2\pi}} \exp\left(-\frac{[\log x - \log S_t - \mu(T - t)]^2}{2\sigma^2(T - t)}\right)$$

(2) The Backward Equation of the Transition Density of the Market Asset

Again, taking logarithms for the additive process $\log S$ which has a normal transition distribution

$$\log S_T | \log S_t \sim N(\log S_t + \mu(T - t), \sigma^2(T - t))$$

The transition MGF (moment generating function) of the additive process $\log S$ is then

$$M_{\log S_T | \log S_t}(\theta) = \exp\left(\theta \log S_t + \mu(T - t)\theta + \frac{1}{2}\sigma^2(T - t)\theta^2\right)$$

Differentiating the MGF partially with respect to the backward time variable t

$$\frac{\partial}{\partial t} M_{\log S_T | \log S_t}(\theta) = \left(-\mu\theta - \frac{1}{2}\sigma^2\theta^2\right) M_{\log S_T | \log S_t}(\theta)$$

Differentiating the MGF partially with respect to the logarithm of the backward diffusion variable $\log S_t$

$$\frac{\partial}{\partial \log S_t} M_{\log S_T | \log S_t}(\theta) = \theta M_{\log S_T | \log S_t}(\theta)$$

and again

$$\frac{\partial^2}{\partial \log S_t^2} M_{\log S_T | \log S_t}(\theta) = \theta^2 M_{\log S_T | \log S_t}(\theta)$$

Substituting in the expressions for $\theta M_{\log S_T | \log S_t}(\theta)$ and $\theta^2 M_{\log S_T | \log S_t}(\theta)$ into the time derivative

$$\frac{\partial}{\partial t} M_{\log S_T | \log S_t}(\theta) = \left(-\mu \frac{\partial}{\partial \log S_t} - \frac{1}{2}\sigma^2 \frac{\partial^2}{\partial \log S_t^2}\right) M_{\log S_T | \log S_t}(\theta)$$

and inverting the MGF for the transition density function

$$-\frac{\partial}{\partial t} f_{\log S_T | \log S_t}(\log x | \log S_t) = \frac{1}{2}\sigma^2 \frac{\partial^2}{\partial \log S_t^2} f_{\log S_T | \log S_t}(\log x | \log S_t) + \mu \frac{\partial}{\partial \log S_t} f_{\log S_T | \log S_t}(\log x | \log S_t)$$

which is the backward equation of the underlying additive Brownian motion $\log S$ where

$$f_{\log S_T | \log S_t}(\log x | \log S_t) = \frac{1}{\sigma \sqrt{T - t} \sqrt{2\pi}} \exp\left(-\frac{[\log x - \log S_t - \mu(T - t)]^2}{2\sigma^2(T - t)}\right)$$

Transforming the partial derivatives and the diffusion variable

$$(1) \frac{\partial}{\partial \log S_t} = S_t \frac{\partial}{\partial S_t} \quad (2) \frac{\partial^2}{\partial \log S_t^2} = \frac{\partial}{\partial \log S_t} \left(\frac{\partial}{\partial \log S_t} \right) = S_t \frac{\partial}{\partial S_t} \left(S_t \frac{\partial}{\partial S_t} \right) = S_t^2 \frac{\partial^2}{\partial S_t^2} + S_t \frac{\partial}{\partial S_t}$$

and noting the Jacobian of the transformation in the forward diffusion variable is $|J| = x$

$$f_{\log S_T | \log S_t}(\log x | \log S_t) = x f_{S_T | S_t}(x | S_t)$$

for

$$-\frac{\partial}{\partial t} x f_{S_T | S_t}(x | S_t) = \frac{1}{2} \sigma^2 \left(S_t^2 \frac{\partial^2}{\partial S_t^2} + S_t \frac{\partial}{\partial S_t} \right) x f_{S_T | S_t}(x | S_t) + \mu S_t \frac{\partial}{\partial S_t} x f_{S_T | S_t}(x | S_t)$$

This equation is the backward equation and hence a partial differential equation of the backward diffusion variables. The Jacobian, on the other hand, is a function of the forward diffusion variable. Therefore, the Jacobian can be moved outside the partial derivatives. So upon simplification and cancelation of the Jacobian this becomes [mathematical technique original to this PhD (and hence should have been passed straight away)]

$$-\frac{\partial}{\partial t} f_{S_T | S_t}(x | S_t) = \frac{1}{2} \sigma^2 S_t^2 \frac{\partial^2}{\partial S_t^2} f_{S_T | S_t}(x | S_t) + \left(\mu + \frac{1}{2} \sigma^2 \right) S_t \frac{\partial}{\partial S_t} f_{S_T | S_t}(x | S_t)$$

This is the backward equation of the market asset to deliver S . **In this page and the next (pages 3 and 4) the dependent variable f of this equation is transformed, by the technique for the premium which is original to my thesis [after sorting out which variables are which], to that of the statistically accurate option premium V**

$$rV(T, k | S_t, t) - \frac{\partial}{\partial t} V(T, k | S_t, t) = \frac{1}{2} \sigma^2 S_t^2 \frac{\partial^2}{\partial S_t^2} V(T, k | S_t, t) + \left(\mu + \frac{1}{2} \sigma^2 \right) S_t \frac{\partial}{\partial S_t} V(T, k | S_t, t)$$

[noting that the notion of forward and backward time and diffusion variables in the transition density of diffusion is from Lord Rayleigh]. This equation $rV - V_t = \frac{1}{2} \sigma^2 S^2 V_{SS} + (\mu + \frac{1}{2} \sigma^2) S V_S$ is the purpose and reason, and hence the *Raison D'etre*, for BOOK 2 of this PhD Dissertation. This makes it unequivocally clear, as it became clear to me early in 2010 [and presented in late 2010 at the University of Sydney Finance PhD Colloquium] and as it should be to any sensible intelligent person [such as those who enter finance], that the debased option premium is not a sensible premium and that the Black-Scholes-Merton equation $rV^{debased} - V_t^{debased} = \frac{1}{2} \sigma^2 Y^2 V_{YY}^{debased} + r Y V_Y^{debased}$ is not a sensible equation for derivatives, exactly as the Communist Manifesto is not sensible economics for advanced economies. There is nothing deep and abstract about risk-neutral valuation which makes this theory of a debased premium sensible [and it is time to move on]; the equation without a mean is wrong, as are the deductions made by risk-neutral valuation and all the things that got muddled as a result of the fact that it was wrong in the first place (1973). The only sensible alternative, for the given assumptions of the market asset, is the PDE (partial differential equation) of the unbiased and statistically accurate premium that fully recognizes the economic value of derivatives,

$$rV - V_t = \frac{1}{2} \sigma^2 S^2 V_{SS} + (\mu + \frac{1}{2} \sigma^2) S V_S$$

This equation is consistent with the Wealth of Nations and should be the standard in finance. This equation is derived now by the correct and proper method of my thesis. This equation also holds similarly for premiums for layers of insurance and reinsurance subject to various boundary conditions.

(3) The Backward Equation of the Statistically Accurate Call Option Premium

An option is the right to buy or sell the market asset S for the predetermined price k at time T . The option premium at time t is the present value of the first limited moment above or below the exercise price k depending on whether the option is a call or a put. For a right to call the asset S to buy for k at time T in $T - t$ periods time, the option premium is

$$\begin{aligned} V(T, k | S_t, t) &= e^{-r(T-t)} E(\max(S_T - k) | S_t) \\ &= e^{-r(T-t)} \int_k^\infty (x - k) f_{S(T) | S(t)}(x | S_t) dx \end{aligned}$$

which evaluates upon integration (omitted) to the statistically accurate call option premium

$$V(T, k | S_t, t) = S_t e^{(\mu + \frac{1}{2} \sigma^2 - r)(T-t)} \bar{F}_U(u_k - \sigma \sqrt{T-t}) - k e^{-r(T-t)} \bar{F}_U(u_k)$$

where T and t are the forward and backward time variables respectively, S_t is the backward diffusion variable and spot price of the underlying market asset at time t , $\bar{F}_U(\cdot)$ is the complementary cumulative distribution function of a standard unit normal $U \sim N(0, 1)$

$$\bar{F}_U(u) = 1 - F_U(u) = \int_u^\infty \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}x^2} dx$$

and u_k is a normal pivot of the exercise value k log-standardized by the transition cumulants (mean and variance) of the market asset S

$$u_k = \frac{\log k - \log S_t - \mu(T-t)}{\sigma\sqrt{T-t}}$$

From the backward equation of the market asset to deliver

$$-\frac{\partial}{\partial t} f_{S_t|S_t}(x|S_t) = \frac{1}{2}\sigma^2 S_t^2 \frac{\partial^2}{\partial S_t^2} f_{S_t|S_t}(x|S_t) + \left(\mu + \frac{1}{2}\sigma^2\right) S_t \frac{\partial}{\partial S_t} f_{S_t|S_t}(x|S_t)$$

multiplying by the intrinsic value, which is a function of the forward diffusion variable x , and integrating over the range of the forward diffusion variable corresponding to the region of option moneyness, which for a call, is anything greater than the exercise price k for which the asset can be called to buy at time T

$$-\int_k^\infty (x-k) \frac{\partial}{\partial t} f_{S_t|S_t}(x|S_t) dx = \int_k^\infty (x-k) \left(\frac{1}{2}\sigma^2 S_t^2 \frac{\partial^2}{\partial S_t^2} f_{S_t|S_t}(x|S_t) + \left(\mu + \frac{1}{2}\sigma^2\right) S_t \frac{\partial}{\partial S_t} f_{S_t|S_t}(x|S_t) \right) dx$$

Taking the integrals inside the partial derivatives which are derivatives in the backward variables

$$-\frac{\partial}{\partial t} \int_k^\infty (x-k) f_{S_t|S_t}(x|S_t) dx = \left(\frac{1}{2}\sigma^2 S_t^2 \frac{\partial^2}{\partial S_t^2} + \left(\mu + \frac{1}{2}\sigma^2\right) S_t \frac{\partial}{\partial S_t} \right) \int_k^\infty (x-k) f_{S_t|S_t}(x|S_t) dx$$

and discounting both sides over the forward transition of $T-t$ periods from T to t at the cash rate r with the discount factor $e^{-r(T-t)}$

$$-e^{-r(T-t)} \frac{\partial}{\partial t} \int_k^\infty (x-k) f_{S_t|S_t}(x|S_t) dx = e^{-r(T-t)} \left(\frac{1}{2}\sigma^2 S_t^2 \frac{\partial^2}{\partial S_t^2} + \left(\mu + \frac{1}{2}\sigma^2\right) S_t \frac{\partial}{\partial S_t} \right) \int_k^\infty (x-k) f_{S_t|S_t}(x|S_t) dx$$

Taking the discount factor $e^{-r(T-t)}$ inside the partial derivatives; that in the backward time variable adds a source (by derivative of parts) as a diminishing sink as option maturity at time T nears for increases in t and the effect of the discounting diminishes

$$\left(r - \frac{\partial}{\partial t} \right) e^{-r(T-t)} \int_k^\infty (x-k) f_{S_t|S_t}(x|S_t) dx = \left(\frac{1}{2}\sigma^2 S_t^2 \frac{\partial^2}{\partial S_t^2} + \left(\mu + \frac{1}{2}\sigma^2\right) S_t \frac{\partial}{\partial S_t} \right) e^{-r(T-t)} \int_k^\infty (x-k) f_{S_t|S_t}(x|S_t) dx$$

With $V(T, k | S_t, t) = e^{-r(T-t)} \int_k^\infty (k-x) f_{S(T)|S(t)}(x|S_t) dx$ this is the PDE of the statistically unbiased and accurate call option premium

$$\left(r - \frac{\partial}{\partial t} \right) V(T, k | S_t, t) = \left(\frac{1}{2}\sigma^2 S_t^2 \frac{\partial^2}{\partial S_t^2} + \left(\mu + \frac{1}{2}\sigma^2\right) S_t \frac{\partial}{\partial S_t} \right) V(T, k | S_t, t)$$

i.e.,

$$rV(T, k | S_t, t) - \frac{\partial}{\partial t} V(T, k | S_t, t) = \frac{1}{2}\sigma^2 S_t^2 \frac{\partial^2}{\partial S_t^2} V(T, k | S_t, t) + \left(\mu + \frac{1}{2}\sigma^2\right) S_t \frac{\partial}{\partial S_t} V(T, k | S_t, t)$$

subject to the boundary condition of the value of the option if the asset to deliver S is called to buy

$$V(T, k | S_T, T) = \max(S_T - k, 0)$$

The PDE of the accurate call option premium is $rV - V_t = \frac{1}{2}\sigma^2 S^2 V_{SS} + (\mu + \frac{1}{2}\sigma^2) S V_S$ written in shorthand for the option premium V as the dependent variable and the partial derivatives with respect to t and S [time t and underlying value S] as subscripts. The derivation is similar for a put option (omitted).

If one alternatively demeans [debases] the asset S upon which the option is written by removing all return net of cash so that it is a debased asset with full market risk, then does all this maths again for demeaned asset Y [the oxymoron risky bank account – oxymoron because it has full risk and no return: fixed interest is not considered to have risk yet this variable (the so called “risk-neutral measure”) does and so is completely wrong for finance and for what is valued for a premium by risk-neutral with the Black-Scholes equation]

$$\log Y = \log S - (\mu + \frac{1}{2}\sigma^2 - r)(T-t) \quad Y_T | Y_t \sim \log N\left(\log Y_t + (r - \frac{1}{2}\sigma^2)(T-t), \sigma^2(T-t)\right)$$

then one arrives at the debased Black-Scholes-Merton PDE $rV_t^{debased} - V_t^{debased} = \frac{1}{2}\sigma^2 Y^2 V_{YY}^{debased} + rY V_Y^{debased}$ and the Black and Scholes put and call debased prices $V^{debased}$ (1973) [which are premiums for fixed interest that have full market risk]. This occurs by holding the portfolio returns fixed flat at r , and is alternatively obtained by putting a debasing sink on the variable S that then kills all of the return and zeroes market return μ wherever it would otherwise occur [in the proper theory of derivatives developed by my thesis]. This debased function of S is a debased market asset Y , an oxymoron¹ *risky bank account* [the “risk-neutral measure”] and a stochastically dominated asset at all orders. This idiotic notional asset (Y) is termed, by risk-neutral valuation, the risk-neutral measure which is a total misnomer [given that it is debased of return, not risk]. Hence, the debased PDE and premiums are wrong for the market asset to deliver S ; The debased PDE is a premium for an option priced on the wrong asset [the debased market variable], that of fixed interest with full risk. The independent variable for the equation in this case is Y [fixed interest with full risk] rather than S [market asset] unless it is being subsidized by trading S in which case the replicating asset attempts to subsidize the mispricing in the debased option premium with trading returns. This is the so-called return to the real world where the debased premium is subsidized by trading returns earned by nullifying [flat-lining] the option position. This subsidization has nothing to do with being risk free, but rather only **flatlining the option and killing all incentives to be in the option markets** and turning derivatives into a **redundant asset class**. The argument about an option portfolio being risk free is flawed and only results in a debased option portfolio and a mispriced option. This is what markets have been indicating since 1973 with continual observations of the volatility skew and debased put-call parity not holding for market prices; this is a result of market prices (which recognize return since derivatives are not redundant) systematically deviating from the debased prices of Black and Scholes (as noted in Black and Scholes 1973 for call options). The market knows better (which is why there is a volatility skew). Note that they got a Nobel prize for ‘a method of valuing derivatives’ not for ‘a method of having no risk in derivatives’. There is no such thing as derivatives without risk, despite risk-neutral’s claims and myriad of papers; what it really is is nothing other than ‘a method that reverts finance to communism’ [surreptitiously by holding returns of portfolios fixed flat at r which kills the dependence on market return μ with a slack variable Δ introduced from the constraint on the portfolio Π ... kills a whole lot of other functions as well, all of which depend on μ , which would otherwise be very interesting to derivative finance].

Risk-neutral valuation and communism are diametrically opposed to efficient markets and a technically adept industry. I don’t think it was wrong of me to try and assign the disgrace of communism to history [which wasn’t the original intention only after the examiner report 1] especially how slack they were being to people [who were trying to be sensible] and especially given that it was not even right. Pepsi or Coke? AC (Westinghouse and Tesla) or DC (Edison)? Earth centered (Ptolemy) or Sun centered (Copernicus/Kepler)? Communism (Marx) or free efficient markets (Smith)? Which is better, which should be the standard? The answer is unequivocal:

The accurate PDE just derived $rV - V_t = \frac{1}{2}\sigma^2 S^2 V_{SS} + (\mu + \frac{1}{2}\sigma^2) S V_S$ is the PDE for the correct price of an option derivative. The important point about this equation is that it has the correct infinitesimal mean (μ) which is the return on the underlying market asset and the whole point of being in the markets. **Market return μ is only absent if the premium has been debased [by the surreptitious slack variable introduced from the constraint placed on $d\Pi$]. How this occurs will now be shown mathematically in detail on the next several pages.**

A. Diffusion Equation of the Statistically Accurate Option Premium

This is an intermediate step to deducing the return on replicating the option with an offsetting delta position in the underlying asset. If one reasons what the portfolio earns net of the delta update (market return on market asset, cash rate on option), then this and the next step (A and B) can be skipped. Do so at your own peril, though, as risk-neutral valuation has and my thesis has demonstrated both in discrete time and continuous time.

Expanding the option premium in a Taylor series

$$\begin{aligned} \frac{dV_t}{dt} &= \frac{\partial V_t}{\partial t} \frac{dt}{dt} + \frac{\partial V_t}{\partial S_t} \frac{dS_t}{dt} + \frac{1}{2} \frac{\partial^2 V_t}{\partial S_t^2} \frac{(dS_t)^2}{dt} \\ &= \frac{\partial V_t}{\partial t} + \frac{\partial V_t}{\partial S_t} \frac{dS_t}{dt} + \frac{1}{2} \sigma^2 S_t^2 \frac{\partial^2 V_t}{\partial S_t^2} \end{aligned}$$

The total derivative is forward moving through time, over which (1) the option moves closer to expiry and (2) the backward variables of the option premium move toward the forward variables located at the option expiry at time T . The dynamics in the option premium V is that of time decay [in the premium for both risk and return] and the partial time derivative of the option premium that describes this is that of the backward equation, that of the diffusion side of the backward equation with a source for time decay in the discount factor. This is

$$\text{partial derivative } \frac{\partial V_t}{\partial t} = rV_t - \left(\mu + \frac{1}{2}\sigma^2\right) S_t \frac{\partial V_t}{\partial S_t} - \frac{1}{2}\sigma^2 S_t^2 \frac{\partial^2 V_t}{\partial S_t^2} \quad V_t = V(T, k | S_t, t)$$

¹ oxymoron [noun]: an intra-vernacular contradiction.

For which my derivation is the correct method, which is why it is statistically accurate and unbiased [and the debased nonsense is obviously wrong], and original to my thesis [and for which my thesis should have been passed without further deliberation immediately upon submission, now more than 11 years ago]. Substituting this equation for the partial time derivative $\partial V_t / \partial t$ of the option [which risk-neutral valuation backs out of portfolio returns after debasing it by misevaluating the portfolio returns] into the **total derivative**

$$\frac{dV_t}{dt} = \left(rV_t - (\mu + \frac{1}{2}\sigma^2)S_t \frac{\partial V_t}{\partial S_t} - \frac{1}{2}\sigma^2 S_t^2 \frac{\partial^2 V_t}{\partial S_t^2} \right) + \frac{\partial V_t}{\partial S_t} \frac{dS_t}{dt} + \frac{1}{2}\sigma^2 S_t^2 \frac{\partial^2 V_t}{\partial S_t^2}$$

which is the **diffusion equation (stochastic differential equation) of the option premium** [original, in this form, to this thesis and how I derived the formulae for the correct returns on a portfolio that is left to vary with market return (rather than being constrained) with a statistically accurate premium]

total derivative $\frac{dV_t}{dt} = rV_t - (\mu + \frac{1}{2}\sigma^2)S_t \frac{\partial V_t}{\partial S_t} + \frac{\partial V_t}{\partial S_t} \frac{dS_t}{dt}$ where $\frac{\partial V_t}{\partial S_t} = h_t$ is the **instantaneous option delta**.

time decay in pricing of return $\rightarrow$ Note the market return time decay term in the premium; this is in proportion to delta and is the **economic value of the derivative**. Note also that the statistical distribution of the option premium which is the same distribution as the market asset S to within scale and center due to the dS term. Note that this can be written in terms of the market basis function dB

$$\begin{aligned} \frac{dV_t}{dt} &= rV_t - (\mu + \frac{1}{2}\sigma^2)S_t \frac{\partial V_t}{\partial S_t} + \frac{\partial V_t}{\partial S_t} \frac{dS_t}{dt} \\ &= rV_t - (\mu + \frac{1}{2}\sigma^2)S_t \frac{\partial V_t}{\partial S_t} + \frac{\partial V_t}{\partial S_t} \left((\mu + \frac{1}{2}\sigma^2)S_t + \sigma S_t \frac{dB_t}{dt} \right) \\ &= rV_t - (\mu + \frac{1}{2}\sigma^2)S_t \frac{\partial V_t}{\partial S_t} + \left((\mu + \frac{1}{2}\sigma^2)S_t \frac{\partial V_t}{\partial S_t} + \sigma S_t \frac{\partial V_t}{\partial S_t} \frac{dB_t}{dt} \right) \\ &= rV_t + \sigma S_t \frac{\partial V_t}{\partial S_t} \frac{dB_t}{dt} \end{aligned}$$

return given up by deferring the spot transaction return earned by taking up the **pecuniary interest in the market asset for deferring the transaction** (converting it into a derivative)

The term $(\mu + \frac{1}{2}\sigma^2)S_t \frac{\partial V_t}{\partial S_t}$ is the **economic value of making a market in the derivative**, that is, for deferring the spot

transaction. It is the **profit carrier** [an actuarial life insurance term²], and the overall profit signature of the derivative, and the **economic value provided to the economy for making a market in the derivative**. Note that this is the item that is given up by going long in the derivative to defer the spot transaction and defer the pecuniary interest in the market asset until the transaction date of the derivative; this is taken up by the market maker who replicates and takes up the pecuniary interest in the asset by trading it over the deferral period. This, the economic value of the derivative, is what risk-neutral valuation, and communism, inadvertently attempts to flatline [the heart (μ) of the derivative].

B. Return on Replicating the Statistically Accurate Option Premium

Taking an offsetting position in the underlying asset S_t (to null the position in, and hence flatline, the option) with delta h_t units of the market asset to replicate the instantaneous option delta and null the option V_t payoff profile. Conditional on S_t the portfolio Π_t is then

$$\Pi_t = h_t S_t - V_t$$

It is now proved that the replicating portfolio Π need not earn a flat rate of return at cash r and only does so if it has been debased, either with a debased asset Y or a debased option [priced for Y and replicated by either Y or S]. Otherwise, it earns the market rate of return on the market asset S and incurs the cash rate on the short option V net of the delta update due. Noting that $dS_t d\Delta_t$ is not $o(dt)$

$$\frac{d\Pi_t}{dt} = (S_t + dS_t) \frac{dh_t}{dt} + h_t \frac{dS_t}{dt} - \frac{dV_t}{dt}$$

² Taught to me by Bruce Edwards [who started KPMG Actuaries] in ACST401 (Control Cycle II), and is in Jim Farmer's work as well, as well as much of the older UK literature – actuaries have been in finance for well over a century.

Ignoring the update $(S_t + dS_t)dh_t/dt$ [which must be paid up continuously with continuous trading] the total portfolio change for a fixed Δ is

$$\frac{d\Pi_t}{dt} = h_t \frac{dS_t}{dt} - \frac{dV_t}{dt}$$

noting that rigor requires the [continual] update and $o(dt)$ with limits [which is not possible since trades always occur discretely]. The results are the same and I have left these out purely to keep the important arguments succinct. Note that the portfolio total differential it is **not** $o(dt)$ in higher order variation **if the portfolio rebalance/update is not made at every infinitesimal**. Substituting in the total derivative of the option

$$\begin{aligned} \frac{d\Pi_t}{dt} &= h_t \frac{dS_t}{dt} - \left(rV_t - (\mu + \tfrac{1}{2}\sigma^2)h_t S_t + h_t \frac{dS_t}{dt} \right) \\ &= (\mu + \tfrac{1}{2}\sigma^2)h_t S_t - rV_t \end{aligned}$$

which shows that the portfolio earns the **market rate of return on the market asset S** and **incurs the cash rate on the short option V** . In other words, the portfolio does not earn the cash rate ($d\Pi_t \neq r\Pi_t dt$) unless and only unless it has been debased by either a debased asset or a debased premium, both of which occur by setting $d\Pi_t = r\Pi_t dt$, i.e., constraining the portfolio dynamics fixed flat at nothing [since, if you did not take the position, you would be holding it in cash; the cash rate r is nothing other than inflation at best (at least in modern times)]. Whenever the portfolio has not been debased and the premium is accurate for the market asset to deliver, the replicating portfolio **earns the market return on the market asset** and **incurs the cash rate on the short option** $d\Pi_t = (\mu + \tfrac{1}{2}\sigma^2)h_t S_t - rV_t dt$. Anything else is wrong, and if it is debased by setting the dynamics fixed flat, $d\Pi_t = r\Pi_t dt$, then it is also debased and communist.

The market return, in proportion to the option delta, is **the instantaneous economic value of the financial derivative** derived from taking up the **pecuniary interest in the economic asset** for the **deferred spot transaction of the derivative**. A debased return flat at r implies that the derivative has no economic value and is consequently a redundant security and redundant asset class consistent only with communist markets that have no value. Here the non-communist and accurate mathematics is again; this is the **total differential** of the **market asset**

$$\frac{dS_t}{dt} = \left(\mu + \tfrac{1}{2}\sigma^2 \right) S_t + \sigma S_t \frac{dB_t}{dt}$$

this is the **total differential** of the **option premium**

$$\frac{dV_t}{dt} = rV_t + \sigma S_t \frac{\partial V_t}{\partial S_t} \frac{dB_t}{dt}$$

and hence, this is the **total differential** for the **portfolio** $\Pi = hS - V$ of a delta position ($h = \partial V / \partial S$) in the market asset and a short option

$$\begin{aligned} \frac{d\Pi_t}{dt} &= \frac{\partial V_t}{\partial S_t} \frac{dS_t}{dt} - \frac{dV_t}{dt} \\ &= \frac{\partial V_t}{\partial S_t} \left(\left(\mu + \tfrac{1}{2}\sigma^2 \right) S_t + \sigma S_t \frac{dB_t}{dt} \right) - \left(rV_t + \sigma S_t \frac{\partial V_t}{\partial S_t} \frac{dB_t}{dt} \right) \\ &= \left(\mu + \tfrac{1}{2}\sigma^2 \right) \frac{\partial V_t}{\partial S_t} S_t - rV_t \\ &= \left(\mu + \tfrac{1}{2}\sigma^2 \right) h_t S_t - rV_t \end{aligned}$$

which is therefore the market return μ on the market asset and the cash rate r on the short option. It is only the cash rate on the market asset if the portfolio has been debased by killing the return on the market asset by mispricing the premium [which is **priced for fixed interest r with full market risk σ**]. Risk neutral valuation inadvertently does this by surreptitiously introducing a slack variable by holding the portfolio returns fixed flat at r which debases the portfolio and then surreptitiously attempts to revert Western finance to communism [that is, killing the mean μ to reduce variance].

C. Backing out the PDE of the Option Premium V from $d\Pi$

If one debases the portfolio by constraining its dynamics fixed flat at the cash rate, $d\Pi_t = r\Pi_t dt$, then you **debase the portfolio** of the **benefits of trading the market asset** and the **benefits of participating in the economic activity of the financial markets**. All functions that depend on μ , for which there are many, are then killed. One does this, as you are told and taught you must, essentially just to subsidize the mispriced option which is priced for fixed interest with full market risk (hence underpriced for calls [upside] and overpriced for puts [downside]). This results in either a **debased asset** or a **debased premium**, in either case, a premium that is debased of its mean μ net of cash; if the asset has not been debased, the premium debases it by sinking the return of the asset from the mispricing in the debased premium [with the so-called return to the real world that subsidizes the mispriced premium from trading the real world market asset].

If the PDE of the option premium is reversed out of the debased portfolio fixed flat $d\Pi_t = r\Pi_t dt$, the PDE is that of the debased premium, the Black-Scholes-Merton equation. If the PDE is reversed out of the correct returns on the portfolio, which were just proved to be $d\Pi_t = \left(\left(\mu + \frac{1}{2}\sigma^2\right)h_t S_t - rV_t\right)dt$, then the PDE of the correct and statistically accurate premium is obtained. From the correct return components (1#) the PDE of the **accurate premium** is backed out from the portfolio that has not been debased [that accurate for the option and the market asset], and from the debased fixed flat return components (2#) the PDE of the **debased premium** is backed out from the portfolio debased with the slack variable Δ [and hence no portfolio dynamics and no return on investment on S (because it is killed by the mispriced option {underpriced call option or overpriced put option})]

$$(1\#) \quad d\Pi_t = \left(\left(\mu + \frac{1}{2}\sigma^2\right)h_t S_t - rV_t\right)dt \quad (\text{portfolio not debased with slack } \Delta)$$

$$(2\#) \quad d\Pi_t = r\Pi_t dt \quad (\text{portfolio debased with slack } \Delta)$$

where $r\Pi_t dt = (rh_t S_t - rV_t)dt$. From $d\Pi_t = (S_t + dS_t)dh_t + h_t dS_t - dV_t$, again expanding the total derivative of the option in a Taylor series

$$\begin{aligned} \frac{d\Pi_t}{dt} &= (S_t + dS_t) \frac{dh_t}{dt} + h_t \frac{dS_t}{dt} - \left(\frac{\partial V_t}{\partial t} \frac{dt}{dt} + \frac{\partial V_t}{\partial S_t} \frac{dS_t}{dt} + \frac{1}{2} \frac{\partial^2 V_t}{\partial S_t^2} \frac{(dS_t)^2}{dt} \right) \\ &= (S_t + dS_t) \frac{dh_t}{dt} - \frac{\partial V_t}{\partial t} - \frac{1}{2} \sigma^2 S_t^2 \frac{\partial^2 V_t}{\partial S_t^2} \end{aligned}$$

after canceling the deltas, the replicating delta with the instantaneous option delta. Note that this is not risk free because the replicating delta must be instantaneously and continually updated in dt with $(S_t + dS_t)dh_t/dt$ if it is to be kept matched with the instantaneous option delta for the assumed exponential market asset. The delta update $(S_t + dS_t)dh_t/dt$ has both mean and variance; this then maintains the instantaneously delta neutral portfolio, which is impossible in practice, and any single un-neutralized market fluctuation **puts gamma** [higher order variances] **into the cashflows**. Financial derivatives ALWAYS have risk, exactly similarly as the spot markets. This is evidenced by the fact that even futures have basis risk, as noted by every derivative exchange around the world, all of which **require margin calls**. Holding the delta constant for the differential transition interval from t to $t + dt$ (ignoring $(S_t + dS_t)dh_t/dt$), this is just another expression for the total portfolio change net of the update

$$(\#) \quad \frac{d\Pi_t}{dt} = -\frac{\partial V_t}{\partial t} - \frac{1}{2} \sigma^2 S_t^2 \frac{\partial^2 V_t}{\partial S_t^2}$$

This only differs from that of the portfolio return components in that it has not had the PDE of the option substituted into it for

$$\frac{\partial V_t}{\partial t}$$

and instead, it is just reversed out again when this is equated as an identity ($d\Pi_t \equiv d\Pi_t$) to the portfolio return components for which the PDE has been substituted for (exactly similarly for the binomial portfolio $\Delta\Pi_j \equiv \Delta\Pi_j$ i.e., a portfolio that is the same either way so that it has **no dynamics** and **no return on investment**³ [and hence totally communist]);

³ not surprisingly and proved by me to be about half a dozen alternative methods [all of which are **original equations** to me and my thesis], the return on investment when the portfolio is not debased is (on average) the market return $pu + qd - 1$

(1) equating (#) to the correct portfolio returns (1#)

$$\begin{aligned} -\frac{\partial V_t}{\partial t} - \frac{1}{2}\sigma^2 S_t^2 \frac{\partial^2 V_t}{\partial S_t^2} &\equiv (\mu + \frac{1}{2}\sigma^2)h_t S_t - rV_t \\ -\frac{\partial V_t}{\partial t} &= \frac{1}{2}\sigma^2 S_t^2 \frac{\partial^2 V_t}{\partial S_t^2} + (\mu + \frac{1}{2}\sigma^2)S_t \frac{\partial V_t}{\partial S_t} - rV_t \end{aligned}$$

correct PDE (PDE of statistically accurate option)

$$rV - V_t = \frac{1}{2}\sigma^2 S^2 V_{SS} + (\mu + \frac{1}{2}\sigma^2) S V_S$$

which just reverses out the PDE (and pretends that $\equiv$ is equivalent to $=$ which isn't really proper maths) which was substituted into the total derivative of the option premium and consequently into the total derivative of the portfolio; one PDE correct, the other PDE wrong as a result of debasing the portfolio of market return with $d\Pi_t = r\Pi_t dt$. **This is how an option premium gets [surreptitiously] debased and the justification to [inadvertently] try and convert Western finance to communism.** It is shown in the binomial context as well [original to my thesis]. Theoretically, debasing the portfolio with $d\Pi_t = r\Pi_t dt$ introduces a slack variable Δ into the mean which debases the mean and portfolio return to the cash rate r ; $\mu' = \mu - \Delta$

$$\begin{aligned} \mu' + \frac{1}{2}\sigma^2 &= r & d\Pi_t &= r\Pi_t dt \\ (\mu - \Delta) + \frac{1}{2}\sigma^2 &= r & &= ((\mu' + \frac{1}{2}\sigma^2)h_t S_t - rV_t)dt \\ \Delta &= \mu + \frac{1}{2}\sigma^2 - r & &= ((\mu - \Delta + \frac{1}{2}\sigma^2)h_t S_t - rV_t)dt \end{aligned}$$

i.e., the economic return on the portfolio $\mu + \frac{1}{2}\sigma^2$ is debased to $\mu' + \frac{1}{2}\sigma^2 = \mu + \frac{1}{2}\sigma^2 - \Delta = r$. The slack variable Δ is then backed out again⁴ with implied volatility and results in the volatility skew $\alpha(\Delta, k)$ over k and term to maturity. To me, this was obvious.

How does one get an accurate price from a debased price? One does so, as a better alternative to skewing volatility in that it backs the slack out directly rather than trying to compensate for it [and hence being minimum variance], by **re-meaning the backward variable** by adjusting the spot price S_t to its future value [as suggesting by the 'efficient markets' derivative crystal ball (somewhat obvious, yet still an original idea to my PhD work) for the future of the spot markets]

$$S_t e^{(\mu + \frac{1}{2}\sigma^2 - r)(T-t)}$$

and using this as the spot price in the debased formula, for either a put or a call. This is one of several methods of converting the statistically inaccurate, debased and communist PDE $rV^{debased} - V_t^{debased} = \frac{1}{2}\sigma^2 Y^2 V_{YY}^{debased} + rY V_Y^{debased}$ of Black, Scholes, and Merton to the statistically accurate and correct PDE $rV - V_t = \frac{1}{2}\sigma^2 S^2 V_{SS} + (\mu + \frac{1}{2}\sigma^2) S V_S$ derived by BOOK 2 of this thesis (and again in **pages 1 to 4** in this *Raison D'etre*) and the resulting solution for the accurate premium. An empirically observed value of this quantity (the adjusted spot) can be obtained from market observed put-call parity

$$S_t e^{(\mu + \frac{1}{2}\sigma^2 - r)(T-t)} = \hat{C} - \hat{P} + k e^{-r(T-t)}$$

of the statistically accurate formula where $\hat{C} - \hat{P} + k e^{-r(T-t)}$ is observed from market prices $\hat{C}$ and $\hat{P}$ (where the hats denote empirical quantities). Interestingly, **matching market put-call parity** [rather than **debased put-call parity**] will mean that one will then never have problems with **put-call parity violations** given that **put-call parity of markets** is not **debased put-call parity**, i.e., not **put-call parity of the debased price**. Note that matching market put-call parity

on the market asset and the cash rate r on the short option [for a market maker, but not for someone who wants or needs the option on their balance sheet]. In discrete time, the market asset S earns $pu + qd - 1$, on average, and the portfolio earns $pu + qd - 1$ on the market asset whether it was an upstep or a downstep. This is elaborated on in the additional commentary. On average of S , and the delta position returns dynamically in proportion to delta whereby the dynamics is provided by the continual trading to keep the delta position in the market asset matched to the delta of the option [essentially infinite trading to match the option variance with variance sourced directly from balance sheet equity]; very hard and expensive work indeed, and for which risk-neutral valuation says is valueless other than to subsidize mispriced and debased options.

⁴ a bad habit of risk-neutral valuation; backing out variables and equations after making bad judgement in equating various quantities, which are then trashed with slack to maintain the constraint.

implies a market rate of return, inferred from the derivative markets as the **crystal ball of the spot markets** [easy to do, yet idea and formula original to my thesis], of

$$\mu + \frac{1}{2}\sigma^2 - r = \frac{1}{T-t} \log \frac{\hat{C} - \hat{P} + ke^{-r(T-t)}}{S_t} \quad \text{or} \quad \mu + \frac{1}{2}\sigma^2 = r + \frac{1}{T-t} \log \frac{\hat{C} - \hat{P} + ke^{-r(T-t)}}{S_t}$$

net of cash (where S_t is the spot price). This is a **better method than implied volatility**; both have the same motivation [to get a **good premium consistent with the market**], but this one is **minimum variance** and more intuitive and to-the-point [and given that it is easier to understand, will allow for **greater competence** in its use, particularly given that it has an **analytical form** and is always defined unlike implied volatility]. I am also advocating **implied return-volatility regions** from statistically accurate formulae for V from $rV - V_t = \frac{1}{2}\sigma^2 S^2 V_{SS} + (\mu + \frac{1}{2}\sigma^2) S V_S$, those with both mean and variance, equated to market prices. This gives another indicator of return on the region somewhere around market volatility calculated directly from market data on the underlying asset. My thesis also works out formulae for confidence intervals and regions for option prices with respect to returns and volatility. This thesis advocating strongly that **return be fully recognized in the derivative markets as extensions to the spot markets** as deferred transactions of those markets, **and consequently, that the economic value of derivatives be fully recognized rather than being considered as debased and redundant securities and Western finance communist [which people didn't like which is why their intuition told them to use implied volatility (given that the requisite mathematics for the context did not exist before my PhD)]**. Under risk-neutral valuation, if it worked which it doesn't, all options are dead options; why? idiotically to subsidize the debased price by killing the options payoff profile with trading for an offsetting position and a **cross subsidy of trading returns**. The connotation? the PDE of the unbiased and statistically accurate option premium $rV - V_t = \frac{1}{2}\sigma^2 S^2 V_{SS} + (\mu + \frac{1}{2}\sigma^2) S V_S$ is the sensible PDE for derivatives and for the Wealth of Nations, not that which has been debased of market return and debased of the economic benefits of a security derived from the spot markets, i.e., not the PDE for redundant and communist option securities, that of Black Scholes and Merton which have no value $rV^{debased} - V_t^{debased} = \frac{1}{2}\sigma^2 Y^2 V_{YY}^{debased} + r Y V_Y^{debased}$ which is just an equation for a **market with no value** but with **full market risk σ** [i.e., “no return” not “no risk”].

Note also that, as I say in the main books of my PhD, **these deltas of the debased premiums carry no return and have no future value with respect to the market, which is why they have been considered as probabilities rather than discounted future values. In the theory of accurate premiums from the thesis, the deltas are essentially dollar value futures.**

(4) The Binomial Context

All of this mathematics, as relevant to the *Raison D'etre*, is the same in the binomial context. Everything is the same except for the fact that, unlike financial markets, the binomial model is intrinsically **under-dispersed**. Hence, the binomial context is equally invalid for the pricing of options and by no means a theoretical support for the debasement of financial derivatives. There are many relevant and important equations, derived by my thesis, that show that the debasement of derivatives is as equally invalid for the binomial model as for the continuous time mathematics. In some aspects, debasing a binomial walk is even worse than continuous time theory because of the fact that binomial random walks are under-dispersed for any $p > 0.5$. The equations presented here in the *Raison D'etre* are those that show definitively that debasing derivatives via the binomial step probabilities is seriously wrong in the context of **the efficient markets hypothesis**, and is **anti-markets** and **communist**, and **contrary to the known relation that more return only comes at the cost of more risk** [and hence is even worse than the Black and Scholes which is purely debasement]. The equations, I am presenting here in the *Raison D'etre* [rather than all several hundred of them in the PhD books, showing that the binomial model is wrong for any variations in step probability p], are the **mean and variance** of the random walk, essentially **return and volatility** of the binomially distributed market asset. These two functions, **mean and variance**, are inversely related in binomial random walks, as functions of the up-step probability p which, for variation in p , flies in the face of what is definitively known about risk and return, namely, that the relation between risk and return is positive. **More return is only earned by taking on more risk**. Binomial variables are the opposite (and are under-dispersed already). This is why the idiotic qualitative extrapolations have been made from debasing binomial option portfolios, such as alternative probability worlds that don't exist and infinite profits if not debased, which never played out in practice given that market prices have never been debased [Black and Scholes] prices. **Derivatives of the-se functions for random walk mean and variance**, with respect to p , are shown next and prove definitively this wrong correlation regarding risk and return, as a function of p . This is an absolute truth that invalidates risk-neutral valuation in its entirety. Every actuary knows that binomials are under-dispersed. The mean and variance of the exponential walk are

$$E(S_1 | S_0) = (pu + qd)S_0 \quad (\text{monotonic in } p) \quad \text{Var}(S_1 | S_0) = S_0^2 pq(u-d)^2 \quad (\text{a maximum at } p=0.5)$$

where $q = 1 - p$, and for the return (μ) and variance (σ) of return

$$E((S_1 - S_0)/S_0 | S_0) = pu + qd - 1 \quad \text{Var}((S_1 - S_0)/S_0 | S_0) = pq(u-d)^2$$

where **the mean return is monotonically increasing as a function of p** and **the variance is monotonically decreasing as a function of p** (for any $p > 0.5$; for example, $p = 0.8$ for the market and then $p = 0.6$ when debased of return). This is proved by differentiation [in case the relation is not immediately obvious on inspection] with respect to p [original mathematics from me, as usual]. For the mean

$$\frac{\partial}{\partial p} E((S_1 - S_0)/S_0 | S_0) = u - d > 0 \quad (u > d)$$

which shows that there is **more return** for **increases in p** . For the variance

$$\frac{\partial}{\partial p} \text{Var}((S_1 - S_0)/S_0 | S_0) = -(p - q)(u - d)^2 < 0 \quad (p > q)$$

which shows that there is **less risk** for **increases in p** , which is the wrong direction, i.e., more return is associated with less risk, and not just that, this relation is not linear either; **risk is quadratically decreasing for linear increases in return** [unlike, for example, how these cumulants (mean and variance) sum (linearly) when they are compounded into a forward transition and then exponentiated (from returns to prices)]. This means that the further away the actual market in S is from communism, the more idiotic debasing the binomial model via p is and is particularly marked given that these are just the infinitesimals that get compounded **exponentially**. Here is the not-so-difficult, but never-the-less original, mathematics again

linear in p		$ \begin{aligned} E((S_1 - S_0)/S_0 S_0) &= pu + qd - 1 \\ &= pu + (1 - p)d - 1 \\ &= p(u - d) = d - 1 \end{aligned} $ $ \begin{aligned} \frac{\partial}{\partial p} E((S_1 - S_0)/S_0 S_0) &= u - d \\ &> 0 \end{aligned} $	$ \begin{aligned} \text{Var}((S_1 - S_0)/S_0 S_0) &= p(1 - p)(u - d)^2 \\ &= p(u - d)^2 - p^2(u - d)^2 \end{aligned} $ $ \begin{aligned} \frac{\partial}{\partial p} \text{Var}((S_1 - S_0)/S_0 S_0) &= (u - d)^2 - 2p(u - d)^2 \\ &= (1 - p)(u - d)^2 - p(u - d)^2 \\ &= q(u - d)^2 - p(u - d)^2 \\ &= -(p - q)(u - d)^2 \\ &< 0 \end{aligned} $
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quadratic in p

which, if you simulate it, shows just how idiotically stupid debasing a binomial option portfolio is via the step probability p [to the alleged “alternative Q world that does not exist”] and the idiotic deductions made by risk-neutral valuation by doing so [but is “true in every world” and so on]. This fact, together with the above continuous time mathematics of this *Raison D'etre*, **invalidates entirely financial communism in derivatives** arising from the second and third of the references, namely Black and Scholes (1973) [these authors got it wrong (by holding the portfolio Π fixed flat at r), it is as simple as that] and Cox, Ross, and Rubinstein (1979) [then further with the binomial model similarly with discrete Π by inadvertently priming p with Δ in chaining back to the premium]. The mathematics of this *Raison D'etre*, with the removal of the slack variable Δ in returns which otherwise turns options into redundant securities, paves the way for a **bright future for derivatives and non-communist finance**.

(5) References

- 1) Lloyd-Jones, A., (2011) *Stochastic Calculus and Option Valuation: A Perspective from Mathematical Statistics*, Ph. D. Dissertation. Discipline of Finance, the University of Sydney.
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- 3) Cox, J. C., Ross S. A. and Rubinstein, M., (1979) Option Pricing: A Simplified Approach. *Journal of Financial Economics*, Vol. 7, No. 3 (Sep., 1979), pp. 229-263.

I am not political but if there is one thing that can "make America great again", it is the new theory of financial derivatives [especially for John Wiley]. This is especially so in the context of removal of the ionization-(geiger-counter)-type smoke detectors that are scalping very large numbers of people in finance. Finance will be smarter, wealthier, more sophisticated, and better looking [and longer lived].

ADDITION COMMENTARY AND THEORY

The purpose of an option replicating portfolio $\Pi = hS - f$ is to nullify an option payoff profile by the time it expires, by essentially taking up the position in the market asset for which the spot transaction [and hence long position] is being deferred by the derivative. This is the **value of derivatives** as a **non-redundant asset class**. The variation in the offsetting position, financed from equity, in the market asset matches the variation of the position in the option. The variation, otherwise **born passively** from the option position in return for premium, is then **sourced actively** from Cash at Bank and hence Equity. The positions are essentially just the same thing, other than the market asset being more expensive (and requires trading), but the trading of one (the option), as a market asset, can't be made until maturity. The offsetting position essentially **exits the position in the option**, but given that the option is uncertain, so is the position required to exit the position in the option [which must be **actively maintained** with a **continuous dynamic source** from equity]... the point being that if you **don't want the option(?), don't take the position in the first place** and save yourself a hell of a lot of trouble and trading [which would otherwise be earning you return]; if you're doing it to make a market [as a market maker], then you had might as well earn a return by taking the right side of the market. Trying to ban this [by coercion or teaching] is communism, and **using trading returns to subsidize premiums** [of the securities that you are killing in doing so], as a result of debasing them, is totally idiotic. It is a supremely idiotic circularity as a result of not knowing what the correct mathematics was, which has now been provided by my PhD work together with sensible economic arguments backing it and making the theory of financial derivatives consistent with all other facets of finance [including efficient markets] and consistent with the Wealth of Nations. **This is the new [sophisticated] and proper [non-communist] theory of derivatives.**

This mathematics will become part of all actuarial syllabi throughout the world [as for the log-normal theory of mortality from my Honours thesis], and for those who are not actuarial, it will be a case of adapt or perish [or seriously looked down on]. Note that the competent risk management of derivatives trading, in addition to statistical accuracy, requires something more sophisticated than first order diffusion; it requires diffusion calculus of arbitrary order as per BOOK3 of my PhD research [premiums calculated from ARIMAs which I have wanted to do since 2005 in my degrees in actuarial studies and statistics ... my thesis has provided all the formulae, all that was standing in the way was financial communism... I was studying, in actuarial studies, Hull and White [and Loss Models] (for ACST399) [for financial derivatives] at the same time as times series (for STAT328) [for ARIMAs], in 2005, and knew that **calculating premiums for derivatives based on ARIMAs** would be a **brilliant thing to do**, which is essentially what I ended up doing with my 2008-2013 PhD (and what Buchen tried to prevent me from doing and failed me for it too... and then ripped my research after claiming it was unoriginal)... the thesis robber claimed, in failing my thesis, that it is doubtful that these would be useful for finance... I would bet that right now, now that he has realized (by what he sees other people are thinking), he has forgotten about his idiot report and (rather than retracting his report) is publishing it with fakes dates in the online literature... he might not have intended academic misconduct but that is what it became, in the extreme]. Note that generalizing to arbitrary order is not possible with risk-neutral valuation. Risk-neutral valuation is a dead end, for research and for markets, as is communism. Nobody wants net-zero-earnings [which is also not a valid excuse to defraud a PhD candidate].

[This is not directed at Hull and White:] Here is the mathematics for any communist [such as the idiot examiner1 (the thesis robber)] that is considering mending their ways, desisting in offending with debased probabilities [and lying all the time], and converting to **non-communism** and **efficient markets for derivatives**; any communist that wants to keep debasing and offending with debased probabilities should do it in the closet and keep it to themselves or risk deportation to Cuba [or less facetiously, being made a damn fool out of].

This is the mathematics of chaining back for a premium V without priming p with debasing slack: The market asset S earns $pu + qd - 1$, on average, and the portfolio earns $pu + qd - 1$ on the market asset whether it was an upstep or a downstep. This is mathematics from the discrete work of BOOK2. The replicating portfolio is

$$\Pi_0 = hS_0 - f_0$$

If an upstep occurs, $S_1 = S_u = S_0u$ and $f_1 = f_u$, then

$$\Pi_u = hS_0u - f_u$$

If a downstep occurs, $S_1 = S_d = S_0d$ and $f_1 = f_d$, then

$$\Pi_d = hS_0d - f_d$$

So if, instead of taking the rigorous route, you reason what the returns are by saying that because it is known that **(1)** the market asset earns the market return on average and **(2)** the offsetting position [which essentially exits the option position] matches the variance of the derivative leaving only cash value in the option, **the portfolio must earn the market rate of return on the market asset and incur the cash rate on the short option** [as per the *Raison d'etre*, and as proved by me by five different methods as an alternative to reasoning the obvious]

$$\Pi_1 = (pu + qd)hS_0 - (1 + r)f_1$$

noting that $(pu + qd)hS_0$ is the economic value of the derivative, earned for taking up the pecuniary interest in the spot market asset, ownership for which the derivative is deferring [until the maturity date]; this is essentially the same as taking up the **basis risk** of a future [by **maintaining a continuous stream of margin calls**]. Alternatively, the average value of the portfolio is $E(\Pi_1 | \Pi_0) = p\Pi_u + q\Pi_d$, i.e.,

$$\begin{aligned} E(\Pi_1 | \Pi_0) &= p(hS_0u - f_u) + q(hS_0d - f_d) \\ &= (pu + qd)hS_0 - (pf_u + qf_d) \end{aligned}$$

but the offsetting delta position [variance sourced from Cash at Bank] matched the variance of the option so the only non-zero cumulant is the mean so that $E(\Pi_1 | \Pi_0) = \Pi_1$ and therefore

$$\Pi_1 = (pu + qd)hS_0 - (pf_u + qf_d)$$

With $\Pi_1 \equiv \Pi_1$, putting $\Pi_1 = (pu + qd)hS_0 - (1+r)f_1$ equal to $\Pi_1 = (pu + qd)hS_0 - (pf_u + qf_d)$ then backing out a relation for the premium

$$\begin{aligned} (pu + qd)hS_0 - (1+r)f_1 &= (pu + qd)hS_0 - (pf_u + qf_d) & \Pi_1 &\equiv \Pi_1 \\ (1+r)f_1 &= pf_u + qf_d & \text{cancelling } (pu + qd)hS_0 &\text{ from both sides} \\ f_1 &= pvf_u + qvf_d & \text{putting into present values with } v &= (1+r)^{-1} \end{aligned}$$

which is the backwards recursion of the accurate premium i.e., the relation to chain back within spreadsheets of binomial replicating portfolios, $f_1 = pvf_u + qvf_d$, **without a debasing slack variable** surreptitiously introduced into the portfolio and premium via the step probability p [I also derived this exactly analogously for continuous time ... all of the accurate maths, binomial and continuous time, **without debasement or requiring backing out from Π** , was **original to my thesis**]]. Debasement this parameter is the wrong thing to do.

DON'T EVER CHAIN BACK WITH PRIMED p TO GET A PREMIUM [RISK-NEUTRAL VALUATION]

This relation is backed out erroneously with step probability surreptitiously debased with slack when the **portfolio returns are debased** by setting them fixed flat at r which **imply that derivatives and investment in market variables [in the context of derivatives] have no value**. The risk-neutral probability measure p' (primed p) is another risk-neutral misnomer [worse than continuous time]. This is

$$p' = \frac{v^{-1} - d}{u - d} = \frac{(1+r) - d}{u - d}$$

which is really just the step probability p debased by the slack variable Δ where

$$\Delta = \frac{pu + qd - v^{-1}}{u - d}$$

which is **introduced surreptitiously by holding the returns fixed flat** at r i.e., backing it out after **debasement and fixing flat** the portfolio returns $\Pi_1 = (1+r)\Pi_0$. Hence, this is the constraint that primes the **portfolio** with debasing slack, primes the **premium** with debasing slack, and **inadvertently debases derivatives** in the discrete theory of binomial returns [ironically, the binomial model of returns that have been debased of return (not risk) and the reason that risk-neutral practitioners consider derivatives as redundant assets]. Expressing the debased walk parameter then as $p' = p - \Delta$ (that debased with the slack variable Δ)

$$p' = p - \Delta = p - \frac{pu + qd - v^{-1}}{u - d} = \frac{v^{-1} - d}{u - d}$$

as above [and similarly for $q' = 1 - p' = q + \Delta$], which shows it not a change of risk [other than in the wrong direction] but a change in return, and then only an idiotic parameter debased with Δ which does nothing other than debase the walk variable of flux and the premium of return [and a whole lot of other functions], similarly with Δ , and gets the relationship between risk and return totally muddled [which is why there were such idiotic suggestions about everyone in

derivatives becoming infinitely rich if traders were allowed to earn return on derivative portfolios hence being told and taught they must avoid profits for zero cash flow with mispriced premiums], killing all cashflows in doing so including the economic value of the derivative.

Priming the step probability p with slack Δ does nothing other than debase a binomial replicating portfolio, the premium, and all associated cashflows, and get the relationship between risk and return totally muddled [around the wrong way].

The fact that p primed with slack can go negative means that it is **not a valid probability** and is entirely analogous to the fact that **implied volatility is not always defined [because of the slack]**, that is, implied volatility can also go negative which is nonsensical for a standard deviation.

Calling $p' = p - \Delta$ the **risk-neutral probability measure** is hence another total misnomer, in the binomial context as well as the continuous time mathematics. In fact, it is even more worse in discrete time given the wrong direction between risk and return when portfolio returns are debased via p [rather than returns in the mean directly in continuous time] and the idiotic confuddlement between risk and return; it was thought that it was a **change of probability distributions** when all they were doing was **debasing everything [derivatives and people (like the smoke detectors)]**, and not only was it a **debasement and communism**, what was being preaching about risk and return was totally around the wrong way. With the so called return to the P world, with a nonexistent communist Q world asset (after matching in the Q world to P world data for fixed interest with full market risk), and the totally idiotic market asset **with all return and no risk** [market asset with no risk priced for fixed interest with full market risk] that then is required to subsidize the idiotically mispriced premium with the return to the real world [which then has **all return and no risk**, that is, a market asset with **all return and no market volatility** because of the dispersion properties of the binomial random walk for variations in p]. There is no such thing as a market asset that has all return ($\mu \gg 0$) and no risk ($\sigma = 0$) and so cannot be traded to fund the underpriced premium (priced for Y) with the so-called “return to the real world” by trading S (rather than Y) to fund the mispricing premium. Not one thing about risk-neutral valuation is right [in its attempts to ban return in derivative pricing and trading], in either the discrete or continuous contexts. Implied volatility just acknowledges (surreptitiously) that it is wrong and was never right in the first place. It is a totally idiotic muddle of nonsense as a result of backing out the wrong equation from $d\Pi$ or $\delta\Pi$; muddling one thing after another to cover up for the fact that it was wrong to begin with [in 1973]. It is no wonder those that perpetuated this nonsense thought it was ‘no risk’ when they **thought a market asset earns more return by taking on less risk** [after matching market data to debased theory, matching real world data to the debased communist Q world, and then changing back to the real world to subsidize the premium with an idiotic asset from the Q world that doesn’t exist but with no risk and all return (which is supposed to be in the real world!)]]. This can be seen easily with random walk simulations. 3 lines of MATLAB code is all it takes.

Like how hard is it to look at mean and variance? the obviously wrong and inaccurate theory had 40 years to sort itself out [now 50 years]. Why didn’t they even look at the most rudimentary of all statistics [mean and variance] and most obvious measures of a models worth? Because they were too busy spending their careers being bastards to people who wanted μ in their premiums [and too sleep deprived to do proper mathematics][wouldn’t surprise me if people have even been killed over it, with the same sort of insanity as holy wars]. That was the reason, Raison D’etre, to debunk risk-neutral valuation and the reason for the vitriolic language. I would have left it as well. If someone wants to be an idiot with wrong formulae that doesn’t have μ , then so be it. But forcing everyone else to as well? That’s what was happening.

Risk-neutral valuation was an entrenched slack variable, through Δ , in finance. This was especially so for New York finance and has ended up everywhere else, similarly as the slack variables of the neutron-irradiated Uranium in smoke detectors scalping large numbers of people.

Risk neutral valuation is communist and is in denial about hating derivatives, i.e., turning derivatives into redundant securities. Confuddled theory from accidentally backing out the wrong thing [debased PDE of premium V] from portfolio returns $d\Pi$, and then further and ironically, totally mixing up known facts about risk and return with the binomial model and the misnomers of ‘risk-neutral measures’ that have **all risk and no return** (which is totally around the wrong way for finance [fixed interest with full market risk]) and then cross-subsidizes by notional trading assets with **all return and no risk** that are supposed to fund the mispricing [with the alleged return to the real world] to fund the mispriced option with assets that never will exist in the financial markets and so can never be traded as an offsetting option delta positio].

All risk-neutral valuation is is a misguided idea getting satisfaction by discrediting people trying to be sensible and non-communist for trying to have premiums with μ . Every time someone would get discredited, it was thought that risk-neutral valuation had been proved; it was no such thing, and just ended up being academic misconduct and dishonesty and a major slack variable on people trying to be sensible.

Not one person doesn't look at a debased premium and say to themselves 'hey, something is wrong here'. Whenever someone thinks that to themselves, they are right. In fact, if someone does not think that to themselves, whenever they see a premium that does not contain μ , then there they are a simpleton. There is no uncertainty about it; risk-neutral valuation and premiums that do not contain μ are wrong. It is obvious. There is nothing deep and abstract about risk-neutral valuation that makes communism and the idiotic sensible; it is simply wrong.

Without any idiotic nonsense of alternative probability worlds or idiotic misnomers [such as the risk-neutral measure], debased option pricing matches market data to $p' = p - \Delta$ for the debased premium and then notionally takes the slack out of p which keeps the premium as is but just notionally changes the step probability p for the offsetting replicating asset [from Y (fixed interest with full market risk) to S (market return with associated market risk)] essentially remaining it. The parameters have been matched with $p' = p - \Delta$ to data but then have Δ removed so that the replicating asset, for all intensive purposes, has this **impossible attribute of all return and no variance** for the **subsidization of the debased premium** [still containing Δ]. The idiotically mispriced premium, still containing Δ , then sinks all of the return that the **idiotic impossible nonexistent asset with all return and no risk** is supposedly earning [if it could be traded, which it cannot (because then it has all return and no market risk)]. This wrong direction between risk and return, in the subsidizing asset, is because of the **dispersion properties of binomial basis functions** and renders debasing [risk-neutral valuation] binomial replicating portfolios **invalid and obsolete**. The lesson? DON'T CHAIN BACK WITH PRIMED p TO GET A PREMIUM and never say 'no risk' in derivatives [risk-neutral valuation]. No more debasement of derivatives [risk-neutral valuation]. People don't want zero net cash flows and traders don't want to be told they have to avoid profits.

When chaining back without slack in the step probability p , this probability parameter should be as near as $\frac{1}{2}$ as possible for proper dispersion (maximal binomial dispersion consistent with markets).

The correct return components are also proved [by me], **by several other means**, including combinatorial mathematics with the binomial PMF (probability mass function) analogous to that with the continuous time premium. These are the rigorous methods [rather than backing out a PDE from Π]. If you also put lattices of portfolio returns on your spreadsheet together with the chained back premium, you will see that the delta position in **the market asset earns the market rate of return while the short option incurs the cash rate**. This is dynamic, not fixed flat at r , in proportion to the dynamic source of delta updates sourced actively (and continuously) from equity. I have proved all of it (with formulas for everything)... every conceivable thing anyone could think of or have uncertainties about I have proved with analytical formulae, some difficult and some not-so-difficult, and all for which I should have been passed more than five years ago [now 11 years].

It became clear to me that **risk-neutral valuation** was **debasement** [debasement of return rather than risk], immediately upon deriving (originally) the continuous time premium [early 2010] by the correct and direct method from the backward equation [rather than backing it out from a portfolio] with the concept of forward and backward variables from Lord Kelvin and Lord Rayleigh and then deducing the correct return components in continuous time, as per this *Raison d'etre*, and as it should become clear to anyone who can understand that mathematics, which is not difficult once it becomes familiar [but original from me at the time]. I then saw that this was also the case in binomial lattices, then did the maths and worked out all of the formulae and matched it back to the numerics to verify it. As soon as I started playing around with spreadsheet lattices and varying p with the accurate premium and portfolio to benchmark against, I immediately knew that there was something wrong. I then knew it was just a matter of time until I found it [and it is now just a matter of time until everyone realizes it (which, with retrospect, has taken something of the order of 11 years)]. I knew that it was debasement as opposed to having 'no risk', and also then found that the debased binomial premium is practically the same by any of the methods that debase returns (convert $pu + qd - 1$ to r). I had originally called it de-meaning (as in degrading) the variable, but then changed to terming it de-basing (similar to currency) since it is in the context of finance. I knew that there was **something seriously wrong** going on with the **dispersion properties when debasing by p** . **Everyone knows that binomials are underdispersed**, and further, the more further away from $p = 0.5$ you are, the more underdispersed it becomes which I was seeing clearly with simulations [and is the same reason that risk and return are in the wrong direction for variations in p]. In case one needs to brush up on discrete statistics, here it is; for $X \sim B(n, p)$ the mean is $E(X) = np$, the variance is $Var(X) = npq$, and the dispersion is

$$Var(X)/E(X) = npq/np = q = 1 - p < 1$$

So when $p = 0.5$, the dispersion is $Var(X)/E(X) = 1 - p = 0.5$,
 when $p = 0.6$ (> 0.5), the dispersion is $Var(X)/E(X) = 1 - p = 0.4$ (< 0.5), and
 when $p = 0.8$ (> 0.6), the dispersion is $Var(X)/E(X) = 1 - p = 0.2$ (< 0.4) and so on.

The larger p [the greater the return], the smaller the dispersion [for which it was already under-dispersed]. It was no wonder there were claims of no risk [despite not playing out in the real world since the binomial model was wrong for

markets and what is definitely known about risk and return (unless it is set and kept at $p = 0.5$). And as I said before, the further away from communism it is (for variations in p), the more accentuated this **mathematical idiosyncrasy [under-dispersion]** becomes for binomial random walks. This becomes unequivocally obvious when one simulates binomial random walks [which I was doing a lot of for the COMPENDIUM OF RANDOM WALKS of BOOK1 of my thesis] and change p around [to sort out what was going on with the mean and variance]. MATLAB is the software I was doing this in. Anything too far from $p = 0.5$ and simulated paths look nothing like financial variables; they are practically straight lines, or exponential singularities when compounded as they are in the binomial model of returns.

There is no un-muddling the theory of option premiums without μ , to un-muddle the confuddlement between risk and return for example. If you get the relation between risk and return in the correct direction, to debase a portfolio via return factors [me trying to un-muddle it [risk-neutral valuation]], then it doesn't work either. No matter what you do. I have considered all the possibilities. It is just wrong. You can't un-muddle communism, all you can do is choose the only sensible alternative and leave methodology that omits μ behind. There is not one single reason why debased premiums shouldn't be dispensed with in favour of that consistent with the Wealth of Nations, and my PhD, and earning a return for **providing a financial service and contributing to the economy by making a market in a derivative** [which is what has been notionally barred for 40 years (now 50)]. Anyone who does not see that a derivative premium without μ is wrong will be looked down upon by the new superior theory [and by traders, for example, who need to earn a return for their livelihood]. This applies equally to binomial premiums that are debased via slack in p .

Actuaries value insurance and reinsurance with log-normal risk all the time. They would never use a debased mean to do so. Underpricing contingent insurance liabilities as such would end up bankrupting their employer. I doubt very much an employer would be too pleased about having to pull money from investment earnings to subsidize the mis-priced premiums either.

In the binomial context as well as the continuous context, the only **statistically accurate and unbiased premium** is that obtained with **none of the parameters debased with slack** [there is only one for the assumptions and that is the one that contains μ , that is, that not containing Δ]. In this case, the portfolio always **earns the market return on the market asset** and **incurs the cash rate on the short option. Anything else is wrong** [for reasons including, but not limited to, that of accuracy].

Because the Brownian motion is proportional (exponential), a model for an option portfolio can earn anything you like, however you misprice the premium [whatever parameter one chooses for the mean in the premium and fix the model to]; not that it will ever play out in the markets if it is not μ , and if it does not contain this parameter for market return μ , then it is statistically inaccurate and it is also communist.

The lesson here is '**don't chain back with probabilities debased with a slack variable**' to the communist premium, particularly given that debasing via the step probability is contrary to what is known about financial markets, namely the positive relation between risk and return [and each of the changes in probability change the probability correlations in the wrong directions]. Even if risk and return wasn't muddled and around the wrong way, it is still in no way a valid reason to debase derivatives, turn them into redundant securities and revert Western finance into communism. So what if you could earn a return, that is the whole purpose for being in the markets and the whole purpose of economic activity by the **value added definition of GDP (Gross Domestic Product)**. Debasing derivatives, however it is done, is communist and results in the redundancy of an asset class with premiums and reasoning not consistent with non-communist markets. **Option replicating portfolios are for market makers** and can also be utilized for **future derivatives** as well [for which the premium is not the spot price], and should not be used to subsidize mispriced premiums. Earning return for the financial service of making markets in derivatives, in the context of academia, rather should be used to tactfully imbue students with the right ideology, namely, that **gearing the economy towards growth** is a good thing as this **provides for a living [via returns] for those in the markets** and those whom depend on the markets, and makes good things possible for its citizens which **improves quality of life and quality of living**. This is everything that communism is not [especially under Stalin]. It should also be pointed out again that market makers are not in the markets to 'avoid profits' nor are people in the markets to subsidize other people's premiums with their hard earned trading returns. Those that enter the markets because they want the option must not take an offsetting position in the underlying asset [from cash at bank], otherwise they will be killing their position.

Note that Karl Marx's Communist Manifesto attempts to ban private property and returns, and this is what trying to ban μ in derivatives is. There is no such thing as communist finance. Communism makes finance redundant, exactly as how risk-neutral valuation makes derivatives redundant [if it worked, which it doesn't, and hence there still being derivative markets despite being considered redundant securities in the context of killing μ with slack].

Anyone wanting to continue to offend by chaining back with debased probabilities [or telling others that they must], and then killing their positions with an idiotic subsidy, or teaching students to do so [or coercing traders or researchers to do so and failing perfectly adequate PhDs], should put their money where their mouth is and leave academia and go out into markets and become infinitely rich as the idiotic risk-neutral theory is suggesting, given that prices are not debased

and never have been [as evidenced by debased put-call parity never holding for markets and debased prices being calculated with **implied volatility** rather than **market volatility**].

Risk-neutral valuation is not 'no risk' in derivatives, it is just debasement of μ ; essentially using derivatives as a means to revert Western markets and finance to communism. **Whenever you see μ in a derivative premium [which was never until my PhD research and thesis because the only way to get the premium (in the context of a PDE) was to back it out from $d\Pi$ or $\Delta\Pi$], it is not risk-neutral valuation.** That is saying that Karl Marx is really Adam Smith which is idiocy and academic dishonesty.

The (notional) debasement of derivatives [Risk-neutral valuation] goes against practically everything advanced economies ordinarily stand for. **The teaching of risk-neutral valuation must be stopped at once [together with a total removal of the head scalping smoke detectors].** Here is what is required

- (1) for any sort of derivative that depends on the market, there must be no premium that does not have market return in it [risk-neutral valuation], i.e., a premium must always contain μ , otherwise it is risk-neutral, debased, and communist. In the contrived binomial walk of returns, this means that it must have the correct step probability p which is not debased with slack [risk-neutral valuation]. There must be no coercion [risk-neutral valuation] against statistical accuracy in derivatives, or return in the derivative markets.
- (2) **DON'T EVER CHAIN BACK WITH PRIMED p [DEBASED p] TO GET A PREMIUM** and use a step probability as close to 0.5 as possible (where binomials are maximally dispersed as consistent with markets), and for higher returns, make the upstep return factor u larger [or visa-versa].
- (3) there must be no statements of 'no risk' [risk-neutral valuation] for any form of financial derivative; whenever a spot market is risky, then so too are positions in securities that defer spot trades (as financial laybuy); this is said without any proviso at all; if you do not have derivative risk, then you do not have a position in derivatives exactly as the spot markets.
- (4) it must be explicitly recognized and taught that, by taking an offsetting position in proportion to an option's delta, that you are **nullifying the option**, i.e., [imperfectly] **exiting the position in the option**, and that if you **want the option**, then **you must not take an offsetting position** [by matching variance from Cash at Bank].
- (5) there must be no teaching or coercion [risk-neutral valuation] that forces people to nullify their option positions to subsidize premiums that have been debased of return [risk-neutral valuation].
- (6) it must be explicitly recognized that earning a return by **making a market in derivatives** is a **financial service** that is a **contribution to economic GDP**, and there must be absolutely no attempts to ban this with coercion [risk-neutral valuation] or by any other means such as teaching [risk-neutral valuation]; in the case of derivatives, recognizing economic value in derivatives means *earning the market rate of return on the market asset and incurring the cash rate on the short option* [the new theory of derivatives].

Anything else is **academic misconduct and dishonesty, communist**, an impediment to sensible mathematics and education, and contrary to Adam Smith and the Wealth of Nations.

Just one more point: as a personal opinion, for derivatives not to be weapons of mass financial destruction, derivatives should be plain vanilla and be at or relatively near-the-money. This also promotes standardization, liquidity, and efficient markets.