

The Implied Volatility Surface as a Decision-Support Framework for Systematic Cash-Secured Put Strategies

*From the Black-Scholes-Merton Model
to Volatility Surface Normalisation*

by
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Abstract

The *Black-Scholes-Merton* model remains one of the most influential developments in modern financial economics. Whilst its mathematical formulation continues to provide the benchmark for pricing *European* options, one of its central assumptions — namely that volatility remains constant throughout the life of an option — is persistently contradicted by observed market prices.

Rather than constituting a weakness of the model, these discrepancies reveal valuable information regarding investors' expectations, market sentiment and the pricing of downside risk. The resulting *volatility skews* and *smiles* have therefore become essential components of both academic research and professional option trading.

This paper argues that the *implied volatility surface* should not be viewed solely as a pricing adjustment. Its geometry and, more importantly, its evolution over time may provide additional information capable of assisting investment decisions. Attention is devoted to cash-secured *short put* strategies, for which the level of *implied volatility* alone frequently proves insufficient.

Drawing upon preliminary observations obtained from listed *CAC 40* index options across several maturities, the article explores whether the gradual normalisation of the *implied volatility surface* may constitute a useful decision-support indicator. Rather than proposing a predictive pricing model, the objective is to examine whether changes in the structure of *implied volatility* can contribute to a more disciplined framework for identifying favourable market environments in which to initiate systematic *put-selling* strategies.

Keywords: *Black-Scholes-Merton; implied volatility; volatility surface; volatility skew; option pricing; cash-secured puts; decision support; risk management.*

1. Introduction

Among the numerous quantities derived from option prices, *implied volatility* occupies a rather singular position. Although introduced merely as the unknown parameter required to reconcile observed market prices with the *Black-Scholes-Merton* valuation model, it has progressively become one of the most closely monitored indicators within financial markets. Today, *implied volatility* is commonly interpreted not simply as a pricing parameter, but as a market-based measure of uncertainty, reflecting the aggregate expectations of thousands of market participants.

For investors employing cash-secured *short put* strategies, *implied volatility* plays an obvious practical role. Higher *implied volatility* generally translates into higher option premiums, thereby increasing the potential income associated with selling options. This simple observation has encouraged many practitioners to associate elevated *implied volatility* with favourable selling opportunities.

Experience, however, suggests that such a conclusion is frequently incomplete.

Periods characterised by exceptionally high *implied volatility* often coincide with episodes of considerable financial stress, during which uncertainty continues to increase and option premiums expand further. Entering short option positions solely because *implied volatility* appears elevated may therefore expose investors to significant mark-to-market losses before market conditions eventually stabilise.

The question addressed in this article is therefore slightly different.

Rather than asking whether *implied volatility* is high, it may be more appropriate to ask whether the behaviour of the *implied volatility surface* itself contains additional information capable of assisting investment decisions.

More specifically, does the gradual normalisation of the *volatility surface* indicate that the market is beginning to emerge from a period of stress whilst option premiums remain comparatively attractive?

If such behaviour can be observed consistently, the *volatility surface* ceases to be merely an output of an option pricing model. Instead, it becomes a potential decision-support framework, capable of complementing more traditional criteria such as premium level, *strike* selection or time to maturity.

The purpose of the present article is not to challenge the theoretical foundations of the *Black-Scholes-Merton* model. On the contrary, the model remains indispensable, since *implied volatility* itself is extracted from its pricing equation. The objective is rather to investigate whether the systematic departures observed between theoretical assumptions and market prices may themselves convey exploitable information regarding the timing of systematic cash-secured *put* strategies.

Figure 1. Transfer of Risk Between Option Buyer and Option Seller

Options create value by transferring risk between market participants with opposite expectations.



This simplified representation focuses on the risk transfer mechanism. Actual outcomes depend on market conditions and option terms.

Figure 1. Options transfer market risk between two counterparties with fundamentally different expectations. Whilst the buyer acquires protection against adverse price movements, the seller receives an option premium in exchange for assuming the corresponding contingent obligation. This transfer of risk constitutes the economic foundation upon which option markets operate and explains the central role played by option premiums in systematic short-put strategies.

The following sections revisit the theoretical foundations of *implied volatility* before examining why market observations systematically depart from the assumptions of *constant volatility*. Attention is subsequently devoted to the informational content embedded within *volatility skews* and *smiles*, leading to the introduction of a practical analytical framework intended to investigate whether changes in the *implied volatility surface* may contribute to the identification of favourable environments for systematic cash-secured *put-selling*.

2. The Black-Scholes-Merton Framework: An Elegant Model Built upon Simplifying Assumptions

Since its publication in 1973, the *Black-Scholes-Merton* model has become one of the most influential achievements in financial economics. Beyond providing a closed-form solution for the valuation of *European* options, it established a rigorous mathematical framework linking derivative prices to the stochastic behaviour of the underlying asset. More than half a century later, despite the emergence of increasingly sophisticated numerical models, *Black-Scholes* remains the common language of option markets.

Its enduring success stems from the remarkable intuition underlying the model. Rather than attempting to forecast future prices directly, *Black-Scholes* demonstrates that an option may be replicated through a continuously adjusted portfolio combining the underlying asset and a risk-free investment. Under a specific set of assumptions, this replication argument leads to a unique theoretical option value independent of investors' individual expectations.

These assumptions are well known. Asset prices are assumed to follow a geometric Brownian motion with *constant volatility*. Markets are perfectly liquid and frictionless, allowing continuous trading

without transaction costs or taxes. Interest rates remain constant throughout the life of the contract, whilst *European* options can only be exercised at maturity. Finally, market participants are assumed to behave rationally and possess homogeneous expectations.

From a practical perspective, few of these assumptions are fully satisfied in real financial markets. Transaction costs exist, volatility varies continuously, liquidity fluctuates and investors frequently react in heterogeneous ways to new information. Nevertheless, the model remains extraordinarily useful because it provides a coherent reference framework from which market observations may subsequently be interpreted.

One of its most significant contributions lies in the concept of *implied volatility*. Rather than treating volatility as an observable market variable, the *Black-Scholes* equation can be solved inversely. By inserting the observed option premium together with the remaining market parameters, it becomes possible to determine the level of volatility required for the theoretical model to reproduce the market price exactly. This inferred quantity is known as *implied volatility*.

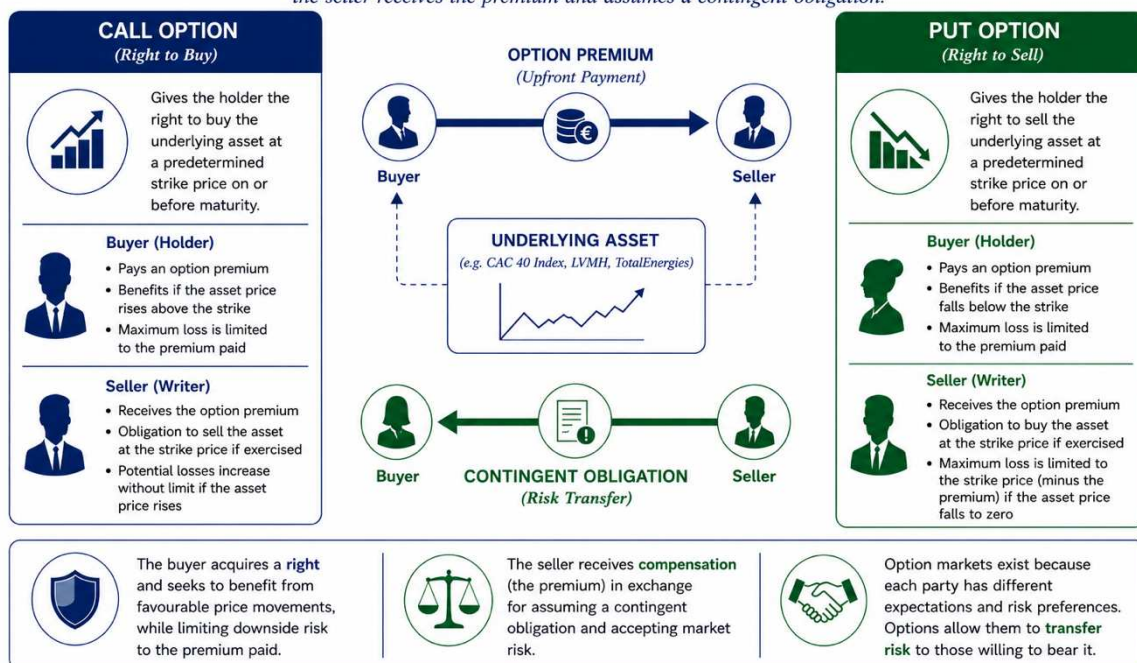
Implied volatility therefore represents considerably more than a simple mathematical parameter. It embodies the level of uncertainty collectively embedded within option prices by market participants. Every quoted option premium implicitly reflects the market's assessment of future price variability, making *implied volatility* one of the most informative indicators available to option traders.

Yet an important observation immediately follows.

If the assumptions of the *Black-Scholes* model were perfectly satisfied, every option sharing the same maturity would exhibit the same *implied volatility*, irrespective of its *strike price*. Reality tells a rather different story.

Figure 2. Call and Put: The Economic Foundations of Option Contracts

An option is a right, not an obligation. The buyer pays a premium to acquire this right; the seller receives the premium and assumes a contingent obligation.



European-style options can be exercised only at maturity; American-style options may be exercised at any time up to maturity.

Figure 2. A call option grants its holder the right, but not the obligation, to purchase the underlying asset at a predetermined strike price. Conversely, a put option grants the right to sell the underlying asset under identical contractual conditions. In both cases, the buyer acquires a right by paying an option premium, whilst the seller receives that premium in exchange for assuming the corresponding contingent obligation.

3. *Implied volatility*: From a Single Parameter to a Market Indicator

The original formulation of *Black-Scholes* implicitly assumes that volatility constitutes a characteristic of the underlying asset itself. If this were strictly true, every option written on the same asset and sharing an identical maturity would produce the same *implied volatility* once observed market prices are introduced into the valuation equation.

Empirical evidence has demonstrated otherwise.

When *implied volatilities* are computed across a range of *strike prices*, they rarely remain constant. Instead, they exhibit systematic patterns whose shape varies according to both the underlying asset and prevailing market conditions. These observations, initially regarded as anomalies, have gradually become recognised as fundamental characteristics of option markets.

The discrepancy is not accidental. It reflects the collective behaviour of investors rather than any mathematical imperfection within the pricing equation itself.

Institutional investors, pension funds and asset managers frequently purchase *out-of-the-money put* options to protect equity portfolios against severe market declines. This persistent demand for downside insurance increases *put* premiums relative to those predicted under *constant volatility* assumptions. Consequently, *implied volatilities* extracted from these option prices become progressively higher as *strike prices* decrease.

The resulting asymmetry gives rise to what practitioners commonly describe as the *volatility skew*.

Rather than representing a flaw in *Black-Scholes*, the *skew* reveals how financial markets collectively price extreme downside events. It therefore provides direct insight into investors' perception of risk, their appetite for protection and the relative scarcity of option sellers willing to assume such exposure.

Viewed from this perspective, *implied volatility* ceases to be merely an intermediate calculation. It becomes a market variable, capable of conveying valuable information regarding the balance between fear and confidence prevailing amongst market participants.

4. From the *Volatility smile* to the *Volatility skew*

When *implied volatilities* are calculated across a range of *strike prices* for a given maturity, the resulting profile rarely corresponds to the horizontal line predicted by the *Black-Scholes-Merton* model. Instead, distinct empirical patterns emerge according to both the underlying asset and prevailing market conditions.

The earliest observations concerned currency and commodity options, where *implied volatility* frequently followed a symmetrical U-shaped profile. Deep *in-the-money* and deep *out-of-the-money* options exhibited higher *implied volatilities* than contracts whose *strike prices* were close to the prevailing market price. This phenomenon rapidly became known as the *volatility skew*, reflecting the characteristic curvature obtained when *implied volatilities* were plotted against *strike prices*.

Although initially regarded as an anomaly, the *volatility skew* gradually became recognised as a natural consequence of market behaviour. Financial returns do not follow the perfectly lognormal distribution assumed by the *Black-Scholes-Merton* framework. Instead, empirical distributions exhibit heavier tails, occasional jumps and varying degrees of asymmetry, all of which contribute to systematic differences in *implied volatility* across *strike prices*.

Equity index options, however, generally display a markedly different pattern.

Rather than producing a symmetrical *smile*, *implied volatility* typically increases as *strike prices* decrease. Conversely, *call* options with higher *strike prices* tend to exhibit progressively lower *implied volatilities*. The resulting profile no longer resembles a *smile* but rather a downward-sloping curve commonly referred to as the *volatility skew*.

This asymmetry is far from accidental.

It reflects the structural demand for downside protection that characterises modern equity markets. Pension funds, insurance companies, institutional asset managers and other long-term investors regularly purchase *out-of-the-money put* options to protect diversified equity portfolios against severe market downturns. Such contracts effectively operate as insurance policies against extreme market events.

As demand for these protective *puts* increases, their market prices rise beyond the levels predicted by constant-volatility models. Once these prices are translated back into *implied volatilities* through the *Black-Scholes* equation, lower *strike prices* systematically exhibit higher *implied volatility*.

The *volatility skew* therefore represents considerably more than a graphical curiosity. It provides a direct visual representation of how financial markets collectively price downside risk.

Rather than indicating that the *Black-Scholes* model has failed, the *skew* demonstrates that investors attribute different probabilities to upward and downward market movements. In practice, the cost of insuring against a sharp decline is significantly greater than the cost of participating in an equally pronounced upward movement.

For option sellers, this distinction is of particular importance.

The additional premium associated with *out-of-the-money put* options constitutes the primary source of return for many systematic *short-put* strategies. Yet this additional premium simultaneously reflects the market's perception of elevated downside risk. The option seller is therefore continuously confronted with a fundamental trade-off: richer premiums are generally accompanied by greater uncertainty.

Understanding this relationship represents the first step towards interpreting *implied volatility* not merely as a pricing parameter, but as a genuine source of market information.

Figure 3. Black-Scholes formula with continuous dividend yield

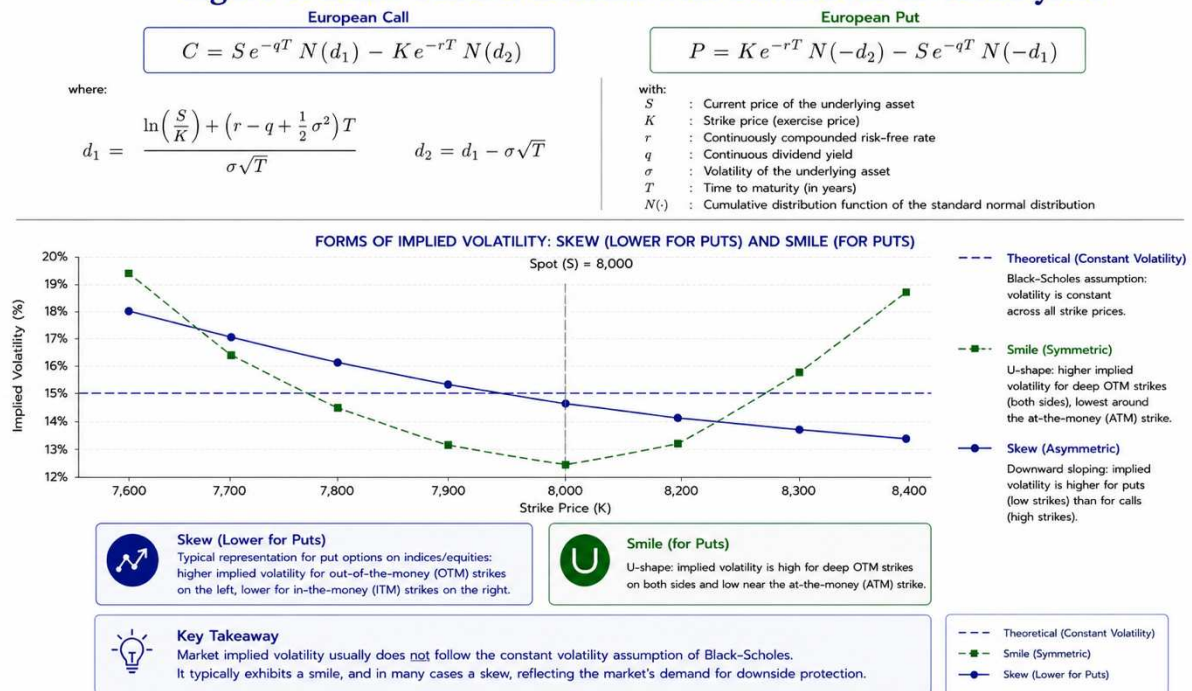


Figure 3. Under the Black-Scholes assumption of constant volatility, implied volatility should remain identical across strike prices. Empirical observations reveal two distinct market structures: the volatility smile, historically observed in several currency option markets, and the downward volatility skew that characterises most equity index options.

5. The *Volatility skew* as a Measure of Collective Risk Perception

Traditional option pricing theory treats *implied volatility* as a parameter required to value derivative contracts. Market practitioners increasingly adopt a rather different perspective. For many traders, *implied volatility* has progressively become an observable market variable.

Its level reflects the price investors collectively assign to uncertainty, whilst its distribution across *strike prices* reveals how that uncertainty is allocated between favourable and unfavourable market scenarios. This distinction is fundamental.

If all future price movements were regarded as equally probable, the *volatility surface* would remain broadly symmetrical. The persistent existence of a downward *skew* instead demonstrates that investors consistently attribute a greater economic significance to adverse market movements than to equivalent upward fluctuations.

In this respect, the *volatility skew* may be interpreted as a continuously updated measure of collective risk aversion.

Unlike conventional market indicators, which frequently rely upon historical observations, *implied volatility* incorporates forward-looking expectations embedded directly within option prices. Every transaction reflects the judgement of buyers and sellers regarding future uncertainty. The resulting

volatility surface therefore aggregates thousands of independent market assessments into a single observable structure. From the perspective of a systematic *put* seller, the implications are immediate.

Periods during which the *skew* becomes exceptionally steep frequently coincide with heightened demand for downside protection. Conversely, a gradual flattening of the *skew* may indicate that the market is beginning to reassess the likelihood of extreme adverse scenarios.

The central hypothesis explored throughout the remainder of this article is based precisely upon this observation. Rather than considering *implied volatility* in isolation, greater attention may usefully be devoted to the evolution of the entire *volatility surface*.

6. Looking Beyond *Implied volatility*: Can the *Volatility surface* Become a Decision-Support Tool?

For most option practitioners, *implied volatility* is primarily regarded as a pricing variable. Whether calculated directly from market quotations or displayed by professional trading platforms, it is generally interpreted as a measure of the market's expectation of future uncertainty. Consequently, trading decisions often rely upon a relatively simple observation: higher *implied volatility* produces higher option premiums.

For investors writing cash-secured *puts*, this relationship is naturally attractive. Selling options during periods of elevated *implied volatility* allows the collection of larger premiums whilst maintaining identical contractual obligations. Yet this apparent advantage immediately raises a practical difficulty.

Periods characterised by elevated *implied volatility* rarely occur in isolation. They are frequently associated with deteriorating market sentiment, increasing downside risk and heightened investor demand for protection. In such circumstances, high option premiums merely compensate sellers for assuming substantially greater uncertainty. The absolute level of *implied volatility* therefore provides only a partial description of market conditions. A more informative question may instead concern the behaviour of *implied volatility* itself.

Is the *volatility surface* continuing to deteriorate? Has it reached a plateau? Or has it begun to return progressively towards more stable market conditions?

These questions introduce an important distinction between two different approaches to option selling. The first consists simply of identifying expensive options based on their *implied volatility*. The second seeks to determine whether market conditions themselves have begun to evolve in favour of the option seller. The distinction is subtle but potentially significant.

A market characterised by high *implied volatility*, and an increasingly steep *volatility skew* reflects persistent demand for downside protection. Under such circumstances, option premiums may continue to increase despite already appearing historically elevated.

Conversely, if *implied volatility* remains relatively high whilst the overall structure of the *volatility surface* begins to normalise, market expectations may be undergoing a gradual transition. Although uncertainty remains elevated, the balance between buyers and sellers of protection may already be changing.

From the perspective of a systematic option seller, such an environment appears fundamentally different. The option premium remains attractive, yet the dynamics of market expectations may already be evolving towards greater stability. This observation forms the central hypothesis explored in the present work.

Rather than evaluating *implied volatility* solely through its absolute level, the proposed approach investigates whether the progressive normalisation of the *implied volatility surface* may itself constitute useful information capable of assisting the timing of cash-secured *short put* strategies.

Importantly, this hypothesis should not be interpreted as an attempt to forecast future market prices. No volatility model can predict future market movements with certainty. Instead, the objective is considerably more modest.

The purpose is to investigate whether the collective information continuously embedded within option prices can be organised into a coherent analytical framework capable of improving the selection of favourable option-selling environments.

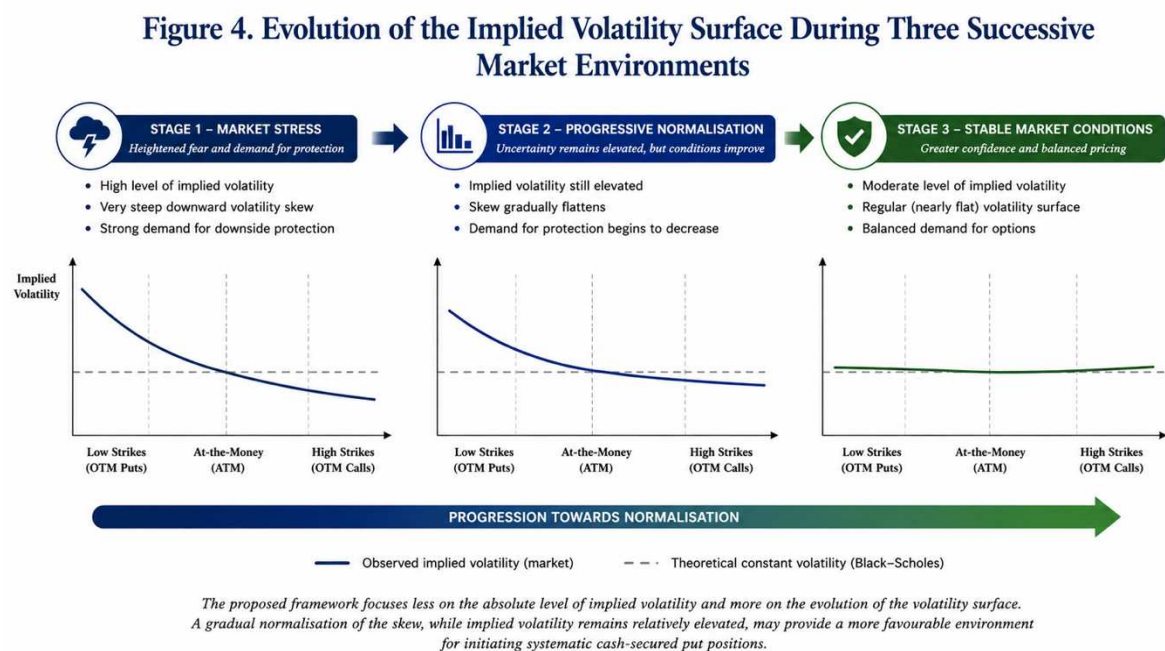


Figure 4. The proposed framework focuses less on the absolute level of implied volatility than on the evolution of the volatility surface itself. A gradual normalisation of the skew whilst option premiums remain comparatively elevated may provide a more favourable environment for initiating systematic cash-secured put positions.

7. Towards a Decision-Support Framework Based on *Volatility surface* Dynamics

The preceding discussion naturally raises a practical question: if the geometry of the *implied volatility surface* reflects the collective assessment of market risk, can its evolution also provide useful information regarding the timing of option-selling strategies?

This question forms the starting point of the present investigation. Rather than considering *implied volatility* as a static variable observed at a single point in time, the proposed framework examines the *volatility surface* as a dynamic structure whose characteristics evolve continuously in response to changing market expectations.

The distinction is important.

Most market participants focus primarily on the absolute level of *implied volatility*. Elevated *implied volatility* is generally interpreted as an opportunity to collect richer option premiums, whilst low *implied volatility* often discourages option-selling strategies.

Such reasoning, however, overlooks an essential aspect of market behaviour.

Two market environments may exhibit comparable average *implied volatilities* whilst reflecting fundamentally different underlying conditions.

In the first case, *implied volatility* may still be increasing, accompanied by a progressively steeper *volatility skew* and a persistent demand for downside protection. In the second, *implied volatility* may remain elevated, but the *volatility surface* itself may already be beginning to stabilise, suggesting that market participants are gradually reassessing the probability of extreme downside events.

From the perspective of a systematic *put* seller, these two situations should not necessarily be regarded as equivalent. Although option premiums may appear similarly attractive, the evolution of collective market expectations differs substantially.

The working hypothesis explored throughout this study is therefore deliberately modest.

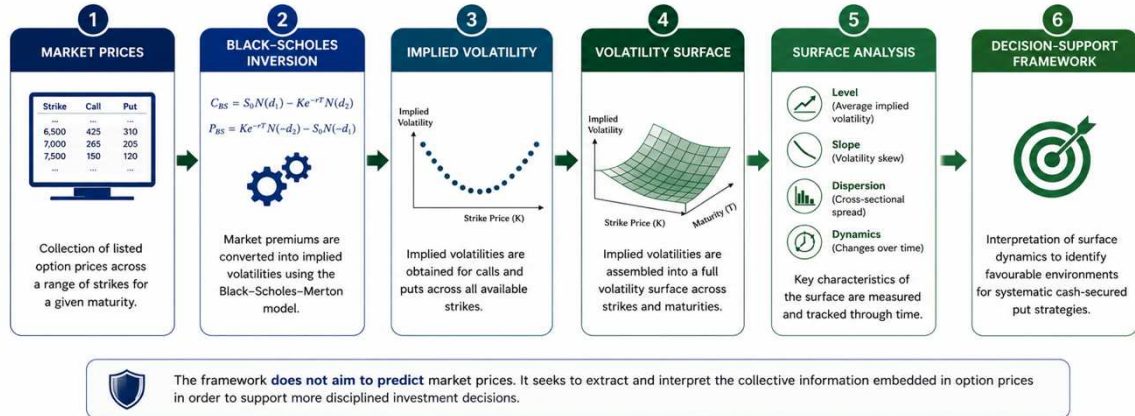
Rather than attempting to predict future market prices, the objective is to determine whether the progressive normalisation of the *implied volatility surface* may provide additional information capable of assisting the selection of favourable market environments for initiating cash-secured *short put* positions.

In this respect, the *volatility surface* is not viewed as a forecasting instrument.

Instead, it is interpreted as a continuously updated representation of market sentiment whose evolution may contribute to a more disciplined investment process.

Figure 5. General Workflow of the Proposed Analytical Framework

From market quotations to decision-support insights



Each step transforms raw market data into a layer of information. The value of the approach lies in analysing the evolution of the volatility surface over time rather than in relying on any single metric in isolation.

Figure 5. General workflow of the proposed analytical framework. Market option prices are first converted into implied volatilities using the Black-Scholes-Merton model. The resulting volatility surface is subsequently analysed through a series of descriptive indicators before being interpreted within a decision-support framework for systematic cash-secured put strategies.

8. Methodological Approach

The methodology developed in this work follows a sequence of analytical steps intended to transform raw market quotations into interpretable market indicators.

The process begins with the systematic collection of listed option prices for a given underlying asset and maturity. Preference is given to highly liquid option contracts to minimise distortions resulting from wide bid-ask spreads or infrequent trading activity.

Observed market premiums are then converted into *implied volatilities* through the inverse application of the *Black-Scholes-Merton* pricing equation. Once computed across the available *strike prices*, these *implied volatilities* collectively define the observed *volatility surface* for the selected maturity.

Rather than analysing each *implied volatility* independently, several global characteristics of the *surface* are examined simultaneously.

Attention is devoted to:

- the overall level of *implied volatility*;
- the slope of the *volatility skew*;
- the degree of cross-sectional dispersion across *strike prices*;
- the temporal evolution of these characteristics between successive market observations.

The purpose of this multidimensional approach is to characterise market conditions more comprehensively than would be possible through the observation of *implied volatility* alone.

Naturally, not all option markets exhibit comparable behaviour.

The preliminary investigations presented in this article suggest that market liquidity and option maturity play a decisive role in determining the regularity of the resulting *volatility surface*. Highly liquid equity index options with medium- to long-term maturities appear particularly well suited to this type of analysis, whereas shorter maturities or less actively traded underlying assets may generate substantially noisier *implied volatility* structures.

These observations should not be interpreted as definitive conclusions. Rather, they provide an empirical motivation for the exploratory analyses presented in the following section.

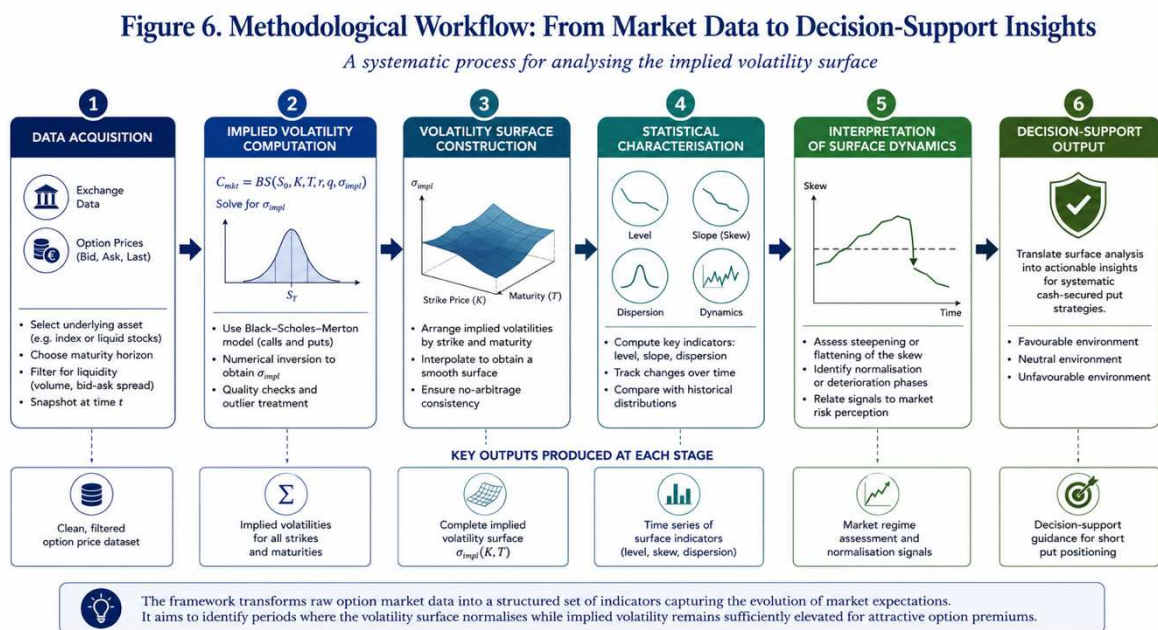


Figure 6. Illustrative workflow describing the successive stages of the proposed methodology: market data acquisition, implied volatility computation, volatility surface construction, statistical characterisation and decision-support interpretation.

9. Preliminary Empirical Observations

The analytical framework presented above was subsequently applied to listed option data to examine whether the proposed interpretation of the *implied volatility surface* could be observed under actual market conditions.

At this stage, the objective was not to perform an exhaustive statistical validation of the methodology. Rather, the purpose was to investigate whether the dynamics of the *implied volatility surface* exhibited sufficiently regular behaviour to justify further quantitative analysis.

Several option chains were therefore examined, covering different underlying assets and maturities.

Attention was devoted to the *CAC 40* index, whose option market offers a high level of liquidity across a broad range of *strike prices*. Additional observations were conducted on selected individual equities to assess the robustness of the approach under different market conditions.

The first observation concerns the influence of option maturity.

Short-dated options, particularly those approaching expiration, frequently generated irregular *implied volatility* profiles. Individual quotations occasionally produced local distortions, whilst relatively small pricing discrepancies resulted in disproportionately large variations in calculated *implied volatility*. Such behaviour appears consistent with the increasing influence of time decay and the reduced amount of remaining time value as maturity approaches.

Consequently, short maturities should be interpreted with caution when constructing continuous *volatility surfaces*. A markedly different picture emerged for longer maturities.

Options with approximately six months to one year remaining until expiration generally produced substantially smoother *implied volatility* structures. The resulting *volatility skews* exhibited the regular downward slope commonly described in the empirical literature, with only limited local distortions across neighbouring *strike prices*.

These observations proved particularly apparent for the *CAC 40* index.

The high liquidity of the option market appeared to facilitate a more stable estimation of *implied volatility*, thereby providing a significantly more coherent representation of the underlying *volatility surface*. An equally important observation concerns the distinction between index options and individual equity options.

Whilst the *CAC 40* generated relatively stable and interpretable volatility structures, several individual equities produced substantially noisier results. In certain cases, isolated market quotations generated implausibly high or even negative *implied volatility* estimates, suggesting either temporary pricing inconsistencies or insufficient market liquidity.

Such observations reinforce an important practical consideration.

The proposed methodology appears particularly well suited to highly liquid option markets where quoted premiums reflect continuous interaction between buyers and sellers. Conversely, less liquid markets may introduce local pricing distortions capable of obscuring the global characteristics of the *volatility surface*.

These preliminary observations do not constitute definitive statistical conclusions.

Nevertheless, they suggest that both liquidity and maturity represent essential prerequisites when analysing *implied volatility surfaces* for decision-support purposes.

Figure 7. CAC 40 Index Options: Implied Volatility Curves for Different Maturities

Same date snapshot – same scale on all charts

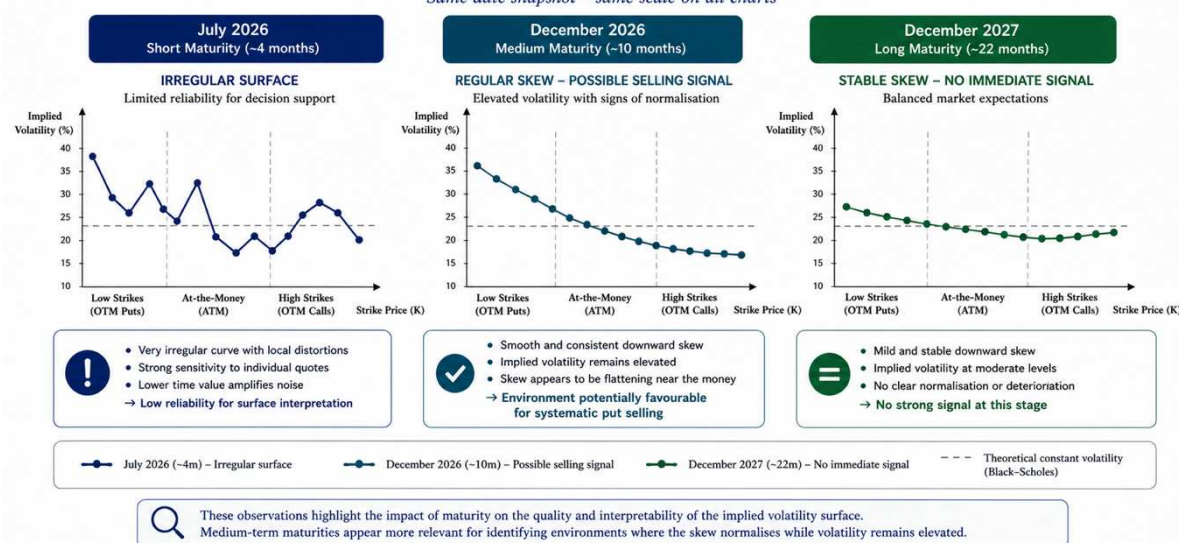


Figure 7. Comparison of implied volatility curves obtained for different maturities. Short-dated maturities frequently exhibit irregular local behaviour owing to limited time value and increased pricing sensitivity. Longer maturities generally produce smoother volatility skews, thereby facilitating the interpretation of surface dynamics.

A further observation emerged during the analysis: although several *volatility surfaces* displayed the expected downward *skew*, not all of them generated identical decision-support signals.

Certain maturities exhibited a progressive flattening of the *skew* whilst *implied volatility* remained at comparatively elevated levels. Others retained a persistent steep slope despite similar average volatility levels. This distinction proved particularly informative. If confirmed through broader empirical investigation, it suggests that the overall geometry of the *volatility surface* may contain additional information beyond the absolute level of *implied volatility* alone. From the perspective of systematic option selling, this observation may prove significant.

A market characterised by elevated *implied volatility*, and a progressively normalising *volatility surface* appears fundamentally different from one in which both *implied volatility* and downside protection demand continue to increase simultaneously.

The former may correspond to a market gradually returning towards equilibrium. The latter may still reflect an environment dominated by uncertainty.

Consequently, analysing the dynamics of the *volatility surface* rather than its static characteristics alone may provide a richer description of prevailing market conditions.

The following section illustrates how these observations may be translated into a practical decision-support framework for systematic cash-secured *put* strategies.

10. Discussion

The preliminary observations presented above suggest that the practical usefulness of the *implied volatility surface* depends upon two essential conditions: the quality of market data and the maturity of the option contracts under consideration.

The first point appears relatively intuitive.

Implied volatility is not directly observable. It is inferred from quoted option prices through the inverse application of the *Black-Scholes-Merton* model. Consequently, any inconsistency in market quotations is immediately reflected in the calculated *implied volatilities*.

This phenomenon proved particularly evident during the exploratory analyses conducted on individual equities.

Whilst certain option chains generated coherent volatility structures, others produced isolated *implied volatility* values that were incompatible with neighbouring *strike prices*. In a limited number of cases, implausible or unstable *implied volatility* estimates were obtained despite apparently valid market quotations. Such behaviour most likely reflects temporary liquidity deficiencies, unusually wide bid-ask spreads or isolated transactions executed outside normal market conditions.

These observations underline an important methodological requirement.

The proposed framework should preferably be applied to option markets characterised by sufficient liquidity and a broad distribution of actively traded *strike prices*. Under such conditions, quoted premiums are more likely to represent the consensus valuation of market participants rather than isolated transactions.

The second observation concerns option maturity.

Short-dated contracts frequently produced irregular volatility profiles whose local fluctuations appeared dominated by pricing noise rather than genuine changes in market expectations. As expiration approaches, the remaining time value becomes progressively smaller, and option prices exhibit increasing sensitivity to relatively minor changes in the underlying asset. Consequently, the resulting *implied volatility* estimates become substantially less stable.

Conversely, medium- and long-dated maturities generally generated considerably smoother volatility structures.

The downward *skew* remained clearly identifiable whilst local distortions became significantly less pronounced. This regularity considerably facilitated the interpretation of the *surface* and its evolution over successive market observations.

Among the datasets examined, listed *CAC 40* index options consistently provided the most coherent results. Their combination of high liquidity, narrow bid-ask spreads and broad *strike* availability produced *volatility surfaces* whose overall geometry remained remarkably stable. This characteristic makes such instruments particularly well suited to exploratory research concerning the dynamics of *implied volatility*.

An additional observation deserves particular attention: not every regular *volatility surface* generated the same analytical conclusion.

Certain maturities displayed a progressive flattening of the *volatility skew* whilst *implied volatility* remained comparatively elevated. Others retained a persistent and pronounced downward slope despite exhibiting similar average volatility levels. This distinction appears especially interesting.

If future empirical analyses confirm these preliminary observations, the evolution of the *volatility surface* may provide information that cannot be obtained from the absolute level of *implied volatility* alone. Such a conclusion would carry practical implications for systematic option-selling strategies.

Rather than selecting opportunities exclusively according to premium levels or *historical volatility*, investors may benefit from incorporating the dynamics of the *implied volatility surface* into their broader decision-making process. Naturally, these findings should be interpreted with appropriate caution.

The present work remains exploratory in nature and does not claim to establish a predictive model. Instead, it proposes an analytical framework intended to organise market information already embedded within option prices into a more coherent decision-support process.

Further empirical investigation involving longer observation periods, multiple market regimes and additional underlying assets will naturally be required before more general conclusions may be drawn.

Figure 8. Evolution of the Implied Volatility Surface Across Successive Market Observations

Two contrasting market dynamics with similar levels of implied volatility

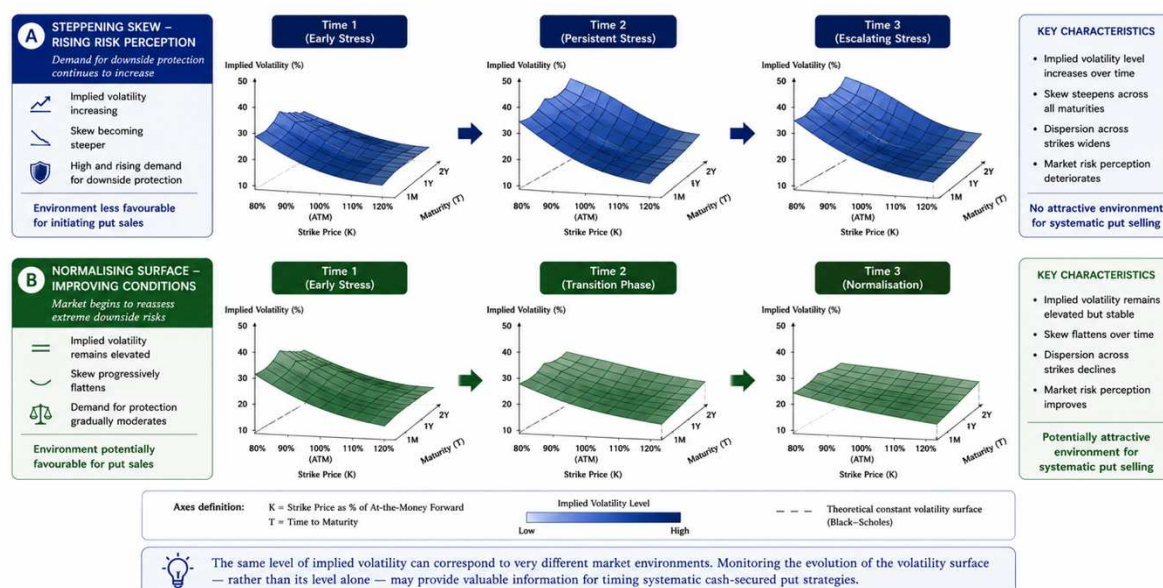


Figure 8. Evolution of the implied volatility surface across successive market observations. The figure illustrates the conceptual distinction between a market in which the volatility skew continues to steepen and one in which the surface progressively normalises whilst implied volatility remains comparatively elevated.

11. Practical Implications for Systematic *Put* Sellers

From a practical perspective, the observations discussed throughout this article suggest that *implied volatility* should perhaps be interpreted less as an isolated numerical indicator and more as one component of a broader analytical framework.

Option sellers have traditionally focused on premium maximisation. Although this objective remains entirely legitimate, premium alone provides only a partial description of prevailing market conditions.

The same premium may arise under markedly different market environments. One may correspond to an increasingly stressed market characterised by rapidly rising demand for downside protection. Another may reflect a market in which uncertainty remains elevated but has already begun to stabilise.

Distinguishing between these situations may prove particularly valuable when implementing systematic cash-secured *put* strategies. Rather than attempting to forecast market direction, the proposed framework encourages a more disciplined interpretation of the information continuously embedded within option prices.

In this respect, the *implied volatility surface* becomes considerably more than a graphical representation of option quotations. It evolves into a dynamic indicator describing the collective perception of risk within financial markets.

12. Conclusion

The *Black-Scholes-Merton* model remains the fundamental reference upon which modern option pricing is built. Although one of its central assumptions — *constant volatility* — is systematically contradicted by market observations, these apparent discrepancies have progressively become one of the richest sources of information available to option practitioners.

The *implied volatility surface* should therefore not merely be regarded as a technical consequence of option pricing theory. It reflects the collective judgement of market participants regarding future uncertainty, the asymmetrical pricing of downside risk and the continuously evolving balance between buyers and sellers of financial protection. The purpose of the present study has been to explore whether this information may be exploited beyond its traditional pricing function.

Rather than concentrating exclusively on the absolute level of *implied volatility*, this article has proposed a broader analytical perspective based upon the dynamics of the entire *volatility surface*. Attention has been devoted to the progressive evolution of the *volatility skew*, whose gradual normalisation may provide additional insight into changing market conditions.

The preliminary empirical observations presented throughout this paper suggest practical conclusions.

First, market liquidity appears to constitute a fundamental prerequisite for obtaining sufficiently stable *implied volatility surfaces*. Highly liquid option markets, such as listed *CAC 40* index options, produce considerably more coherent structures than many individual equity options, whose *implied volatilities* may occasionally be distorted by isolated transactions or limited trading activity.

Secondly, option maturity also plays a decisive role. Medium- and long-dated contracts generally generate smoother *volatility surfaces* that appear more suitable for structural analysis than very short-dated maturities, where the increasing influence of time decay frequently introduces substantial local irregularities.

Finally, and perhaps most importantly, the observations suggest that two markets exhibiting comparable average *implied volatility* levels may nevertheless convey markedly different information through the geometry of their respective *volatility surfaces*. This distinction may prove particularly relevant for systematic cash-secured *put* strategies.

Whilst elevated *implied volatility* undoubtedly increases option premiums, the progressive normalisation of the *volatility surface* may provide complementary information regarding the evolution of collective market expectations. The proposed framework should therefore not be interpreted as a predictive model. Financial markets remain inherently uncertain, and no analytical methodology can eliminate investment risk.

Instead, the approach presented here seeks to organise information already embedded within option prices into a structured decision-support framework capable of complementing more traditional valuation techniques. Viewed from this perspective, the *implied volatility surface* ceases to be merely a graphical representation of option prices. It becomes a dynamic description of market behaviour.

Understanding how this structure evolves through time may ultimately prove as informative as measuring its absolute level at any single observation date.

13. Limitations and Future Research

The present study should be regarded as an exploratory investigation rather than a definitive empirical validation. Several limitations naturally remain.

The observations reported here are based upon a limited number of underlying assets and observation dates. Broader empirical investigations covering multiple market regimes, longer historical periods and additional asset classes will be required before more general conclusions may be established. Future research could also investigate whether quantitative indicators describing the geometry of the *implied volatility surface* — such as *skew* slope, local curvature or cross-sectional dispersion — may be systematically incorporated into algorithmic decision-support models for option-selling strategies.

Another promising avenue concerns the comparative behaviour of *implied volatility surfaces* across different asset classes, including equity indices, individual equities, exchange-traded funds and commodity options.

Finally, machine learning techniques may eventually provide complementary tools capable of identifying recurring patterns within the evolution of *volatility surfaces*. Such approaches, however, should be viewed as extensions of the present analytical framework rather than substitutes for the economic interpretation of market behaviour. Ultimately, the principal contribution of this work lies less in proposing a new pricing model than in suggesting an alternative way of interpreting information already contained within option markets. If the geometry of the *implied volatility surface* indeed reflects the collective perception of financial risk, then monitoring its evolution may offer valuable additional insight into the timing of systematic option-selling strategies.

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About the Author

Frédéric Valognes, CEFA®, is a lecturer in corporate finance, financial analysis, financial markets and derivatives, with more than twenty-five years of professional experience spanning financial management, higher education, research administration and executive training. He is a *Certified European Financial Analyst* (CEFA®), a professional designation awarded by the *European Federation of Financial Analysts Societies* (EFFAS), Frankfurt.

Throughout his career, he has combined operational responsibilities with academic activities, developing recognised expertise in corporate finance, financial analysis, business valuation, financial markets and derivative instruments. He previously held senior administrative and financial responsibilities at *École polytechnique*, where he oversaw the financial management of twenty-three research laboratories and contributed to the governance and development of one of France's leading scientific institutions.

His international experience includes economic assignments at the *Embassy of France in Japan*, together with management responsibilities within a major French asset management group. These positions have enabled him to combine strategic financial management with an international perspective on capital markets.

Alongside his professional career, he has taught finance for many years in leading French business schools, contributing to undergraduate, graduate and executive education in corporate finance, financial markets, valuation, financial analysis, and derivatives.

Between 2020 and 2024, he served as Series Director of the *Formation et Pratiques Pro* collection at *Éditions Ellipses*, supervising the publication of numerous professional books dedicated to finance, management and business administration.

A member of the *Société Française des Analystes Financiers* (SFAF), he has contributed to professional working groups on international accounting standards, financial analysis and business valuation.

His current research focuses on *implied volatility*, option market microstructure and the development of quantitative decision-support frameworks for systematic option-selling strategies, with particular emphasis on the empirical interpretation of *implied volatility surface* dynamics.

Selected Publications

Books authored:

- Valognes, F. (2024). Finance d'entreprise. Collection Formation et Pratiques Pro. Éditions Ellipses, Paris. ISBN 9782340087248.
- Valognes, F. (2019). Finance. Collection Formation et Pratiques Pro. Éditions Ellipses, Paris. ISBN 9782340035560.

Editorial Responsibilities:

- *Series Director — Collection Formation et Pratiques Pro (Éditions Ellipses, 2020-2024)*
 - Coaching et management (2023). ISBN 9782340078086.
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 - Diagnostic d'entreprise (2021). ISBN 9782340047532.
 - Action commerciale (2021). ISBN 9782340047556.
- *Editorial Director*
 - Devenir le profil irrésistible (2023). Éditions Ellipses. ISBN 9782340076259.

Author's Note

This article is intended solely for educational and research purposes. It presents the author's personal reflections on *implied volatility*, option pricing and systematic option-selling strategies. It should not be construed as investment advice or as a recommendation regarding any financial instrument or trading strategy.

The ideas developed in this article are the result of many years of teaching, professional practice and ongoing research in corporate finance, financial analysis, financial markets and derivatives. They have also been enriched by numerous discussions with academics, finance professionals and market practitioners, whose expertise, critical insights and constructive exchanges have played an important role in shaping the analytical framework presented here.

The author wishes to express his sincere gratitude to all those who have contributed, directly or indirectly, to the development of these ideas. Their encouragement, intellectual generosity and commitment to rigorous financial analysis have been a constant source of inspiration.

THE IMPLIED VOLATILITY EDGE: A SYSTEMATIC FRAMEWORK FOR CASH-SECURED PUT STRATEGIES

From Volatility Theory to Data-Driven Decisions

Markets are not perfectly efficient. Implied volatility embeds the collective expectations, fears and hedging behaviours of investors.

“

Volatility is not just a measure of risk, it is a price. And every price creates opportunities for those who understand it.

”

— Frédéric Valognes, CEFA®

1 THEORETICAL FOUNDATION

Black-Scholes-Merton Assumption

The Black-Scholes-Merton model assumes constant volatility. Under this assumption, implied volatility is flat across all strikes.

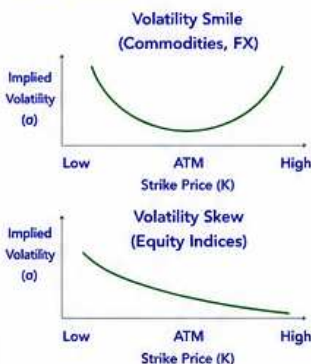


Key idea: In theory, all options should have the same implied volatility.

2 FROM SMILE TO SKEW

What We Observe in the Real World

Empirical evidence shows that implied volatility is not flat.



Equity markets display a negative skew: higher volatility for lower strikes (OTM puts).

3 WHY THE SKEW EXISTS

Market Microstructure & Behaviour

Investors buy out-of-the-money puts for protection. This structural demand pushes up put prices and, by inversion of Black-Scholes, leads to higher implied volatilities at lower strikes.



The skew is not a market anomaly. It is the price of insurance.

4 THE SHORT PUT ADVANTAGE

Get Paid for Others' Fear

The volatility skew means OTM puts are "rich". By selling them, you collect a premium that compensates you for the risk you accept.



Turn market fear into a systematic income stream.

5 DECISION FRAMEWORK

When Do We Sell?

We combine volatility analysis with market context and technical filters.

- High implied volatility (absolute or relative to its history)
- Favourable skew / rich put premiums
- Neutral to bullish market regime
- Strong support levels
- Sound underlying fundamentals

Objective: Identify situations where the reward (premium) justifies the risk (assignment).

6 RISK MANAGEMENT IS KEY

Survive First, Thrive Later



Defined risk. Defined plan. Consistent execution.

7 THE POWER OF SYSTEMATIC EXECUTION

Small Edges. Repeated. Consistently.

No guesswork. No emotions. Just a repeatable process.



Consistency beats intensity. Discipline beats emotion.

8 VOLATILITY ANALYSIS TOOLS

IV Rank / Percentile
Compare current IV to its historical range.

Skew Analysis
Evaluate richness of OTM puts vs ATM.

IV Surface
Understand the full picture, not just one point.

IV Term Structure
Check front vs back month volatility levels.

Better data. Better context. Better decisions.

9 MARKET REGIME MATTERS

Context Drives Outcomes

- Bull Market
Skew steepens on selloffs. Short puts can work well.
- Sideways Market
Time decay works in your favour.
- Bear Market
Be selective. Risk of assignment increases.
- Align your strategy with the prevailing regime.

10 BACKTEST. VALIDATE. IMPROVE

Data Don't Lie.

Backtesting and forward testing are essential to validate your edge.



11 RISK CONTROL PRINCIPLES

Protect Your Capital

- Defined Loss Limits
Know your max loss per trade and overall.
- Position Sizing
Size positions based on risk, not conviction.
- Adjust, Don't Predict
Manage positions proactively.
- Emotional Discipline
Stick to the plan. Ignore the noise.
- Capital preservation is Strategy #1.

12 THE BIG PICTURE

Volatility = Opportunity



A systematic approach transforms volatility from uncertainty into an edge.



ABOUT THE AUTHOR

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Lecturer in corporate finance, financial markets and derivatives. Certified European Financial Analyst (CEFA®), awarded by EFFAS (European Federation of Financial Analysts Societies, Frankfurt). His research focuses on implied volatility, option market microstructure and systematic investment strategies.

BLACK-SCHOLES-MERTON FORMULA WITH CONTINUOUS DIVIDENDS

CALL OPTION (C)

$$C = S_0 e^{-qT} N(d_1) - K e^{-rT} N(d_2)$$

Where:

- S_0 = Current stock price
- K = Strike price
- r = Risk-free interest rate (continuous)
- q = Continuous dividend yield
- T = Time to maturity (in years)
- σ = Volatility of the underlying (annualized)
- $N(\cdot)$ = Cumulative standard normal distribution

PUT OPTION (P)

$$P = K e^{-rT} N(-d_2) - S_0 e^{-qT} N(-d_1)$$

$$d_1 = \frac{\ln(S_0/K) + (r - q + \frac{1}{2}\sigma^2)T}{\sigma\sqrt{T}}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$