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Research Article

Attributing Illicit Gains in Trade Secret Misappropriation: A Typological and Economic Framework for Criminal Quantification

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Abstract

Trade secret protection in criminal law is increasingly oriented toward the quantification of illicit economic advantages rather than mere identification of informational misappropriation. The central challenge lies in attributing profits generated under multi-factor conditions, where gains result not only from unlawful use of trade secrets but also from capital input, managerial capability, brand effects, timing, and market demand. Illicit gains cannot be equated with accounting profits. Only the portion causally attributable to the unlawful acquisition, disclosure, or use of protected information constitutes relevant criminal gain. This requires a structured separation between lawful competitive returns and informational advantages. Trade secret misappropriation may be classified into disclosure-based, use-based, and hybrid forms involving overlapping causal pathways. Each category reflects distinct mechanisms of value realization and different levels of attribution complexity. A three-layer framework consisting of causal attribution, market benchmarking, and equitable adjustment enables the isolation of informational contributions within composite profits. Based on this structure, incremental profit analysis, counterfactual reconstruction, and contribution apportionment models function as complementary tools for quantification under different factual scenarios. This framework addresses the attribution problem in trade secret related criminal liability by distinguishing economic causation from accounting outcomes and clarifying the boundary between lawful competitive success and unlawfully acquired informational rents.

Keywords

Trade Secret Misappropriation, Illicit Gains, Criminal Attribution, Law and Economics, Economic Crime, Profit Quantification, Causation Theory.

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1. Introduction

This opening section defines the article's scope and contribution. It situates the inquiry within trade secret misappropriation cases involving profit-based criminal thresholds. The discussion then identifies why gain attribution requires a structured method rather than a simple accounting inquiry.

Trade secret enforcement has become a central site of conflict in the contemporary knowledge economy. Firms increasingly compete through process know-how, source code, manufacturing tolerances, customer analytics, supplier networks, and business strategies that are valuable precisely because they remain undisclosed.[1] The legal problem is no longer limited to a departing employee carrying away a customer list or a competitor copying a formula. In platform markets, advanced manufacturing, pharmaceuticals, artificial intelligence, and cross-border supply chains, confidential information may be extracted, licensed, embedded in a product, transferred through affiliated companies, or used as a shortcut to enter a market that would otherwise require years of research and investment. Criminal enforcement has therefore expanded because civil remedies may be too slow, too weak, or too dependent on proof of the victim's loss to address serious market distortion.[2]

This expansion creates a specifically trade secret quantification problem. This is not a general economic crime paper; it concerns the attribution of illicit gains where criminal seriousness depends on the profit generated by misappropriated confidential information. This article focuses specifically on trade secret misappropriation involving gain-based criminal liability assessment. In that setting, the defendant's profit may reflect lawful business capacity as well as unlawful informational advantage. A product that incorporates stolen production data may also depend on capital, factory efficiency, marketing channels, management, brand, and market demand. A customer list may open a door, but the eventual contract may also depend on price, service quality, reputation, and negotiation skill. A disclosure payment may be disguised as equity, consulting fees, cross-licensing, or intra-group transfers. Accounting profit is therefore not the same thing as criminal gain.

The traditional loss-based approach offers only a partial answer. US trade secret doctrine has long treated improper acquisition, innovation incentives, and remedies for misappropriation as distinct concerns rather than reducing the inquiry to a single measure of compensable loss.[3][4][5] Loss-based reasoning asks how far the trade secret holder's commercial position was impaired. It is familiar in civil damages and can be appropriate when misappropriation destroys secrecy or displaces identifiable sales. Yet trade secret value is often future-oriented and probabilistic. A victim may be unable to prove exact lost profits even though the defendant has clearly obtained an unlawful competitive advantage. Gain-based criminal thresholds therefore appear attractive because they focus on realised advantage, but they create a narrower attribution gap: the gain must be connected to the misappropriated secret in a way that is causal, measurable, and proportionate.

The research question is therefore deliberately narrow: How should illicit gains be attributed in trade secret misappropriation cases involving profit-based criminal thresholds where multiple causal factors interact? The question is not whether trade secrets deserve strong protection, nor how all economic crime profits should be calculated. It is how criminal law should identify the portion of economic advantage that may legitimately count as gain from a misappropriated trade secret when the factual chain contains multiple acts, assets, contributors, and markets. A workable answer must combine criminal attribution theory with economic reconstruction: the secret must be linked to a decisive informational advantage, that advantage must be estimated through market evidence, and the final figure must be limited by proportionality.

The analysis makes three contributions. First, it develops a typology of misappropriation modes. Disclosure-based misappropriation monetises secrecy by transferring information or control over information. Use-based misappropriation realises value by embedding the information in production, sales, or services. Hybrid misappropriation is limited to cases in which the same trade secret produces overlapping causal realisation pathways, such as disclosure value and use value arising from the same informational contribution. These categories are not merely descriptive. They identify different economic mechanisms, value pathways, and attribution risks.

Second, the framework develops a three-layer attribution structure. The first layer is a causal attribution rule, built on a but-for inquiry and a decisive contribution test. The second layer is a market benchmarking rule, using comparable licensing, industry profit baselines, historical profitability, and reconstructed counterfactuals. The third layer is an equity adjustment rule, applying proportionality and over-attribution control. The framework treats criminal gain as a legally reconstructed amount, not as a mechanical accounting entry.

Third, the analysis develops economic quantification tools for criminal gains. It distinguishes an incremental profit model, a counterfactual profit reconstruction model, and a contribution apportionment model. Each model has assumptions and limitations. The purpose is not to produce false precision, but to discipline judicial and prosecutorial reasoning in trade secret cases where profits are real, causation is complex, and conventional loss evidence is incomplete.

The argument is comparative and functional. It draws on law and economics, causation theory, unjust enrichment, intellectual property theory, and trade secret enforcement. The United States supplies a mature remedial vocabulary of actual loss, unjust enrichment, and reasonable royalty. The European Union contributes a proportionality-oriented enforcement framework. China supplies an example of criminal threshold design in which gain and loss can serve as independent indicators of seriousness. Chinese materials are used only as a supporting case, not as the theoretical centre. The broader claim is confined to trade secret criminal gain quantification: a structured attribution method is needed to separate unlawful informational advantage from lawful business success.

2. Conceptual Framework: Illicit Gains in Criminal Law

This section clarifies the legal meaning of illicit gains before the article turns to specific misappropriation types. It explains why profit-based thresholds require attention to causal contribution, market distortion, and economic attribution. The aim is to establish the conceptual basis for the typology developed in the next section.

Illicit gains occupy an uneasy position in criminal law. Traditional criminal liability often begins with harm: bodily injury, deprivation of property, damage to a victim, or public danger. Economic crime, however, frequently operates through advantage. The wrong is not always that a victim can prove a corresponding monetary loss at the moment of prosecution. It may be that the offender has captured a market opportunity, avoided investment costs, distorted competition, or obtained innovation rents without incurring the lawful costs of producing them. The movement from harm-based to gain-based liability reflects this shift in economic reality and echoes the law-and-economics insight that legal rules often allocate the costs of socially harmful activities through institutional proxies.[6][7][8] In markets organised around information, the offender's advantage can be a more visible proxy for disorder than the victim's immediately provable loss.[9][10][11]

Illicit gain should therefore be understood as a proxy for market distortion. The offender's gain matters not because criminal law exists to equalise commercial outcomes, but because wrongful gain may reveal that the actor has bypassed the competitive process. In trade secret misappropriation, the relevant distortion is the conversion of protected secrecy into market advantage without consent and without bearing the cost of lawful acquisition. The offender obtains a shortcut. That shortcut can reduce research expenditure, compress time to market, improve product performance, secure customers, or enable a competitor to underprice the innovator. When the gain is substantial, it may indicate that the misappropriation has impaired the incentive structure that trade secret law is designed to protect.

Yet a gain-based framework is not self-executing. Criminal law cannot simply confiscate all profit made after a wrongful act. The attribution problem is the central constraint. A defendant's profit may be caused partly by the secret and partly by lawful factors. If the law attributes all profit to the misappropriation, it punishes lawful production, commercial skill, and market conditions as if they were criminal. If the law requires proof of exact mathematical causation, serious cases may escape because intangible information rarely generates a clean accounting trail. The challenge is to construct a middle path: demanding enough causal connection to satisfy responsibility, but allowing enough economic reconstruction to make enforcement possible.

Causation theory helps identify that middle path. Hart and Honore showed that legal causation is not a purely scientific inquiry; it involves selecting legally significant causes from a field of

conditions.[12] In trade secret profit cases, this selection problem is acute because profit is always multi-causal. A trade secret may be necessary but not sufficient, sufficient in combination with other assets, or merely facilitative. The law must distinguish background conditions from decisive informational contributions. This distinction is familiar in private law and unjust enrichment, where liability is limited to enrichment at the claimant's expense and where restitutionary measurement often requires normative selection rather than full disgorgement of every benefit connected to the wrong.[13][14][15]

Multi-factor causation also creates evidential complexity. Consider three examples. First, a company uses a stolen catalyst formula to reduce production cost by ten percent. The causal link between the formula and cost saving may be relatively direct. Second, a salesperson uses a confidential customer list to contact clients, but wins contracts through lower prices and better after-sale service. The list is a gateway, not the whole cause of profit. Third, an engineer transfers source code to an affiliate, which combines it with independent modules, markets a new product, and pays the engineer through consultancy fees. The gain is layered, indirect, and potentially concealed. Each case requires a different attribution method.

The conceptual framework advanced here treats illicit gains as legally attributable economic advantage. Three implications follow. First, gain is not identical to gross revenue. Costs that are lawful and necessary to production may matter, while criminal costs should not reduce the wrongdoer-sensitive measure of gain. Second, gain is not identical to the market value of the secret in the abstract. The same secret may generate different gains depending on the mode of misappropriation, the market, and the defendant's capacity to exploit it. Third, gain is not identical to the victim's loss. Gain and loss may overlap, diverge, or exist independently. This is why a structured attribution framework is needed.

This framework is especially important in criminal law because monetary thresholds influence the boundary between civil and criminal responsibility. A gain figure can aggravate punishment, trigger confiscation, or define seriousness. It must therefore be more disciplined than a flexible civil settlement number. The law must ask not only what the defendant earned, but what part of that earning is fairly attributable to the prohibited informational advantage. The answer requires economic/legal hybrid analysis: accounting data, market benchmarks, and counterfactual modelling must be filtered through criminal responsibility, proportionality, and the avoidance of double counting.

3. A Typological Structure of Trade Secret Misappropriation and Value Realisation

This section organizes trade secret misappropriation according to the way illicit value is realized. The typology distinguishes disclosure-based, use-based, and hybrid forms because each generates a

different attribution problem. The following subsections therefore connect each type to its economic mechanism and causal complexity.

A typological framework is necessary because trade secret misappropriation does not realise value in a single way. The original confidential information may be technical, commercial, organisational, or strategic. The wrongful act may be disclosure, licensing, internal use, production, customer solicitation, or transfer through affiliated entities. The same accounting label may conceal different economic mechanisms. A typology therefore clarifies the path from secret to gain and identifies the attribution difficulty at each stage.

3.1. Disclosure-Based Misappropriation

The first category concerns cases in which the secret is monetized through transfer, disclosure, or licensing rather than through the defendant's own production activity.

Disclosure-based misappropriation is the first type. This category is defined by its distinct value-realization mechanism and attribution complexity. In this mode, the offender monetises the secret by transferring it, revealing it, licensing it, contributing it as equity, exchanging it for employment benefits, or otherwise converting informational control into consideration. The economic mechanism is commodification of secrecy. The offender does not necessarily make a product or operate in the downstream market. Instead, the offender sells access to a competitive advantage that belonged to another. The value realisation pathway is relatively direct: information becomes payment, equity, debt forgiveness, reciprocal technology, consultancy income, or another property benefit.

The apparent simplicity of disclosure-based misappropriation should not be overstated. If the offender receives a cash fee for transferring a formula, the gain may be measured by the fee, subject to review for collusion or sham pricing. But many modern transactions are not so transparent. A secret may be contributed to a start-up in exchange for shares. It may be embedded in a cross-licence that bundles lawful and unlawful assets. It may be transferred to an affiliate at an artificially low price while the real benefit appears as salary, consulting fees, or later dividends. In these cases, the attribution task is not merely to read the contract; it is to identify the fair market value of the benefit received for the secret.

The attribution difficulty in disclosure-based cases is therefore valuation and segregation. The law must distinguish consideration for the misappropriated secret from consideration for lawful assets, labour, reputation, or business risk. Comparable licensing can be useful when the market contains transactions involving similar technology, secrecy level, exclusivity, duration, and territory. Where comparable licences are unavailable, a reasonable royalty may provide a fallback measure, but only if it is reconstructed from realistic bargaining assumptions rather than chosen as a punitive number. For non-monetary benefits, the court must convert property interests into value and then apportion that

value according to the secret's contribution.

Disclosure-based misappropriation also raises a public-domain problem. If disclosure destroys secrecy, the harm to the trade secret holder may exceed the offender's immediate gain. The present analysis is confined to criminal gain quantification. The relevant gain is what the offender obtained through disclosure. A separate loss-based or harm-based measure may address the value destroyed by public disclosure. Combining the two without analysis risks double counting. The typology therefore separates the monetary pathway of disclosure from the broader injury to secrecy.

3.2. Use-Based Misappropriation

The second category turns from transactional monetization to operational exploitation, where the secret contributes to production, sales, customer acquisition, or overlapping value streams.

Use-based misappropriation is the second type. This category is defined by its distinct value-realization mechanism and attribution complexity. Here the offender realises value by using the secret in production, services, sales, or business operations. The economic mechanism is internal exploitation. The secret becomes an input that changes the defendant's cost structure, product quality, speed to market, customer conversion, or ability to compete. The value realisation pathway runs through operating profit. The defendant sells products or services, avoids research costs, reduces trial-and-error, improves yields, or captures customers. Unlike disclosure-based cases, the gain is rarely a single transaction price. It is embedded in business performance.

Use-based cases are the natural home of incremental profit analysis. If the defendant's profit rose after using the secret, the increase may identify the relevant profit pool. That pool must then be tested against alternative explanations: independent demand growth, management improvements, input price changes, brand recognition, or new distribution channels. Criminal attribution cannot assume that all post-misappropriation profit was caused by the secret. The legal question is whether the secret made a decisive contribution to the defendant's incremental advantage.

Technical information and commercial information often behave differently in use-based cases. Technical secrets such as formulas, source code, process parameters, manufacturing tolerances, and engineering drawings may be linked to measurable outputs: lower cost, higher yield, better performance, fewer defects, or faster product launch. Attribution can therefore rely on engineering analysis, cost comparisons, production data, and product performance differentials. Commercial secrets such as customer lists, pricing strategies, supplier terms, and marketing plans realise value more indirectly. They create opportunities and bargaining advantages, but the final profit may depend heavily on lawful sales effort, price, service quality, and customer preference.

The attribution difficulty in use-based cases is contribution apportionment. The court must determine the profit attributable to the secret within a larger business system. This requires separating

lawful production factors from unlawful informational advantage. A product may contain several modules, only one of which incorporates a secret. A manufacturing process may combine public domain technology with one confidential parameter. A sales campaign may use a misappropriated client database but also rely on lawful pricing and service. The gain figure should therefore be limited to the incremental or apportioned profit produced by the misappropriated element.

Use-based cases also require attention to the measure of profit. Gross revenue is almost never appropriate because it ignores lawful costs. Gross margin may still overstate gain where sales, management, distribution, and ongoing research costs are substantial. Operating profit usually better reflects commercial performance, but even operating profit may need adjustment where the defendant manipulates costs or uses below-market transfer prices. The relevant measure is not accounting profit as reported, but legally reconstructed profit after excluding lawful unrelated factors and correcting distortions that conceal the benefit of the secret.

3.3. Hybrid Misappropriation

Hybrid misappropriation systems are the third type. This category is defined by its distinct value-realization mechanism and attribution complexity. Hybrid misappropriation refers only to cases involving overlapping causal realisation pathways of the same trade secret, not merely multiple acts. A former employee may acquire a secret, transfer it to a new company, help that company use it in production, receive equity, and later route profits through affiliates. A competitor may obtain a process, use it internally, license it to a supplier, and then purchase lower-cost inputs from that supplier. A company may disclose the same core secret to a joint venture while also using it in its own product. These systems are increasingly common because information assets move through corporate groups and supply chains rather than through isolated transactions.

The economic mechanism of hybrid misappropriation is profit stacking. The same underlying secret can generate multiple apparent gains: a disclosure fee, an equity interest, production profit, affiliate profit, consulting payments, and downstream market share. Some of these gains are cumulative because they reflect distinct exploitations. Others are overlapping because they are different expressions of the same causal contribution. The value realisation pathway is therefore layered. Information is first converted into access, then embedded in production, then transformed into sales, and finally distributed through contracts or corporate arrangements.

The attribution difficulty in hybrid cases is double counting and causal layering. If a court adds every payment and every profit stream, it may count the same value twice. If it recognises only one stream, it may miss substantial wrongdoing. A principled approach must identify the primary value-realisation pathway, determine whether secondary transfers represent independent additional gains or merely redistribution of the same profit, and decompose overlapping causal contributions.

Hybrid cases require profit decomposition rather than mechanical aggregation.

The typology can be summarised as follows. Disclosure-based misappropriation asks: what did the offender receive for transferring or revealing the secret? Use-based misappropriation asks: what incremental or apportioned profit did the offender earn by exploiting the secret in business activity? Hybrid misappropriation asks: how should overlapping gains from disclosure, use, and affiliated transfers be decomposed without under- or over-attribution? These questions define the architecture of the attribution framework developed in the next section.

4. A Three-Layer Framework for Criminal Gain Attribution

This chapter develops the normative attribution framework proposed in the previous discussion. Rather than focusing on specific calculation models, it identifies the legal principles governing the attribution of illicit gains. The framework consists of three interconnected layers, each addressing a different aspect of criminal gain attribution.

Section 4 establishes normative attribution principles, while Section 5 operationalizes quantitative models for implementation. The proposed framework has three layers: causal attribution, market benchmarking, and equity adjustment. The causal layer supplies the liability basis by asking whether the secret made a legally significant contribution to the gain. The market layer supplies the estimation tool by valuing that contribution through observable or reconstructed economic data. The equity layer supplies the correction mechanism by preserving proportionality and preventing over-attribution. The framework does not pretend that criminal gain can be measured with scientific certainty. It instead supplies a disciplined method for reasoned approximation.

4.1. Causal Attribution as Legal Threshold

The causal layer supplies the threshold inquiry because criminal gain cannot be attributed unless the trade secret materially contributes to the defendant's advantage.

The first layer is the causal attribution rule. It begins with a but-for inquiry: would the defendant have obtained the same gain at the same time and in the same manner without the misappropriated secret? If the answer is yes, the profit is not attributable. If the answer is no, the inquiry continues. But-for causation is necessary because criminal gain should not include profit that would have occurred anyway. Yet it is not sufficient because many conditions are but-for causes. A delivery truck, an employee's labour, and market demand may all be necessary conditions for profit. Criminal law must identify the condition that carries normative significance.

For that reason, but-for causation must be supplemented by a decisive contribution test. The secret must have materially changed the defendant's competitive position, not merely appear somewhere in the factual background. Decisive contribution may be shown where the secret enabled

market entry, reduced development time, supplied a critical technical parameter, created a measurable cost saving, secured access to customers that would otherwise have been unavailable, or allowed the defendant to obtain consideration in a disclosure transaction. The test is not metaphysical. It asks whether the informational advantage was a substantial and operative source of the gain.

Counterfactual reasoning gives the causal layer analytical discipline. The decision-maker should ask whether a lawful alternative scenario would have produced the same gain at the same time: reliance on public domain technology, independently developed substitutes, lawful licensing, or ordinary customer acquisition. At this stage, the point is not yet to run a quantitative model, but to decide whether the secret is a legally material source of the advantage. Relevant evidence includes the defendant's pre-misappropriation performance, development timelines, comparable substitutes, expert technical analysis, and market data.

4.2. Market Benchmarking and Economic Reconstruction

Once causal attribution is established, market benchmarking provides the evidentiary bridge between legal responsibility and economic estimation.

The second layer is the market benchmarking rule. Once the secret's causal role is established, the law must estimate its economic contribution. Market benchmarks reduce arbitrariness by anchoring the calculation in observable transactions or industry data. In disclosure-based cases, comparable licensing is often the starting point. The benchmark should account for exclusivity, duration, territory, development stage, secrecy measures, technological centrality, and bargaining position. A licence for a peripheral improvement cannot benchmark a core bottleneck technology. A distressed intra-group transfer cannot benchmark an arm's-length market transaction.

In use-based cases, market benchmarking may rely on industry profit baselines, historical profit comparisons, and comparable products. The right holder's normal profit margin may be relevant when the defendant's product substitutes for the right holder's product. The defendant's own historical profit before misappropriation may be useful when the business remained otherwise stable. Industry averages may serve as a fallback, but they require adjustment for scale, geography, product lifecycle, capital intensity, and innovation level. The benchmark is a tool of reconstruction, not a substitute for legal judgment.

Economic reconstruction must also correct distortions. A defendant may sell below market price to gain share, route sales through affiliates, inflate costs, understate transfer prices, or classify profit as consulting fees. The market benchmarking rule should permit normalisation. Prices may be adjusted to arm's-length levels. Costs may be reviewed for reasonableness. Affiliate transactions may be collapsed where they lack commercial substance. The point is not to punish by assumption, but to prevent the offender from making the gain invisible through accounting form.

4.3. Proportionality and Equitable Adjustment

After causation and market evidence are assessed, proportionality operates as the corrective layer that prevents over-attribution.

The third layer is the equity adjustment rule. Even after causal attribution and benchmarking, the reconstructed amount may overstate criminal gain. Proportionality requires a final check. The court should ask whether the number includes profits attributable to lawful factors, whether the same causal contribution has been counted more than once, whether the secret was only one component of a complex product, whether market-wide demand inflated profits independently of the secret, and whether uncertainty should lead to a conservative estimate. This layer reflects the criminal law concern that punishment should track responsible wrongdoing.

Equity adjustment does not mean leniency without analysis. It is a method of over-attribution control. It may reduce a calculated figure where the secret was a gateway rather than the profit engine. It may exclude profit from products or markets not causally connected to the secret. It may apportion profit according to technical contribution, customer conversion contribution, or time-to-market advantage. It may also refuse deductions for criminal costs such as bribes, hacking expenses, or payments to insiders because those costs are part of the unlawful scheme rather than legitimate production costs.

The three layers also allocate evidential burdens. The prosecution or claimant should establish the misappropriation, the existence of gain, and a plausible causal connection. Once a prima facie connection is shown, the defendant is often best placed to identify lawful cost items, independent technologies, alternative sources, and non-secret contributions. A carefully limited evidential shift can therefore be justified, provided the ultimate criminal standard remains respected. The defendant should not be convicted through accounting uncertainty alone, but neither should it profit from opacity created by its own wrongful conduct.

This framework transforms illicit gain from a raw accounting figure into a structured legal conclusion. It begins with causation, grounds quantification in market evidence, and ends with proportionality. It can accommodate technical secrets, commercial secrets, direct disclosure, internal use, and hybrid structures. Most importantly, it makes visible the normative choices that otherwise remain hidden inside a single number. Section 5 translates these normative principles into operational estimation techniques.

5. Models for Quantifying Illicit Gains in Trade Secret Misappropriation

The preceding section established the normative filters that determine whether a profit can be attributed to misappropriation. The following subsections translate those filters into operational

estimation models for stable baseline, acceleration, and multi-factor causation settings.

5.1. Role of Operational Models in Attribution

The models discussed below translate legal attribution principles into structured estimation techniques without replacing judicial judgment.

The attribution framework requires operational models. These models are interpretive legal tools designed to structure judicial reasoning rather than to produce mechanical economic outputs. Three models are especially useful: the incremental profit model, the counterfactual profit reconstruction model, and the contribution apportionment model. These models are not alternative options but complementary tools depending on factual structure. They should not be treated as rigid formulas. Each depends on assumptions about markets, costs, substitutes, and causation. Their value lies in making those assumptions explicit.

5.2. Incremental Profit Model and Baseline Comparison

Among the available quantification approaches, incremental profit analysis provides the most direct method where stable commercial baselines exist.

The incremental profit model measures the increase in profit attributable to the misappropriation. In simplified form, illicit gain equals actual profit during the relevant period minus the profit the defendant would have earned without the secret. This model is suitable where the defendant has a stable pre-misappropriation baseline or where the effect of the secret appears in measurable changes such as lower costs, higher yields, faster production, or higher sales conversion. Its assumptions are that the business before and after misappropriation is sufficiently comparable, that external market changes can be isolated, and that accounting data are reliable.

The model's limitations are significant. It may overstate gain in fast-growing markets because profits would have increased even without wrongdoing. It may understate gain where the defendant used the secret to enter a new market and therefore has no historical baseline. It may be distorted by cost manipulation, transfer pricing, or changes in product mix. For that reason, incremental profit analysis should be accompanied by sensitivity testing. The decision-maker should ask how the result changes if demand growth, input costs, or product mix are adjusted. A robust attribution figure should remain plausible across reasonable scenarios.

5.3. Counterfactual Profit Reconstruction and Lawful Alternatives

Counterfactual reconstruction is most useful where the secret altered the defendant's development path, market-entry timing, or lawful substitute options.

The counterfactual profit reconstruction model builds a lawful alternative scenario. It asks what would have happened if the defendant had used public domain technology, independently developed a

substitute, obtained a licence, or continued without the customer information. The difference between actual profit and reconstructed lawful profit is the illicit gain. This model is especially useful where the misappropriation shortened development time or avoided research costs. If the defendant entered the market two years earlier because of a stolen process, the gain may include profits earned during the acceleration period and any durable first-mover advantage causally linked to that acceleration.

The assumptions of counterfactual reconstruction must be stated carefully. The model assumes that a lawful alternative existed or can be reasonably simulated. It also assumes that the timing, cost, and performance of that alternative can be estimated from evidence. Expert testimony may be necessary to compare technical substitutes, development timelines, and market adoption. Counterfactual estimation must remain evidence-based and conservative to avoid speculative reconstruction. Courts should prefer scenarios supported by industry practice, documented development history, and comparable firms. Where uncertainty remains, the equity adjustment rule should prevent the counterfactual from becoming a vehicle for punitive estimation.

5.4. Contribution Apportionment in Multi-Factor Causation

Contribution apportionment addresses cases in which the secret is only one element within a broader profit-generating system.

The contribution apportionment model is used when the secret is one factor among many. It first identifies the total profit pool connected to the relevant product, service, customer segment, or transaction. It then estimates the percentage contribution of the secret to that pool. Contribution may be technical, commercial, temporal, or transactional. A technical contribution might be measured by cost saving, performance improvement, or share of product value. A commercial contribution might be measured by customer conversion, repeat purchase probability, or avoided acquisition cost. A temporal contribution might be measured by the profits earned during the period by which misappropriation accelerated market entry.

This model's central assumption is divisibility. It assumes that the profit pool can be divided into causal contributions. Sometimes this is realistic. A secret process may reduce unit cost by a measurable amount. A confidential list may account for a portion of customer acquisition. A software module may supply one function in a larger product. In other cases, divisibility is more difficult because the secret is integrated into a system. Even then, apportionment may still be preferable to all-or-nothing attribution. Courts can use ranges, expert estimates, and reasoned proxies, provided they explain why the selected contribution rate is tied to evidence.

The model also has limitations. Contribution rates can create an illusion of precision. A figure such as 38 percent may look scientific even if it rests on contestable assumptions. The model should therefore disclose the basis of the rate: engineering analysis, cost saving, licence comparables, survey

evidence, or historical comparison. It should also distinguish the contribution of the secret from the contribution of the defendant's lawful assets. Machinery, labour, distribution, brand, management, and capital should not be silently absorbed into the secret's contribution.

5.5. Model Selection and Integrated Application

Model selection connects the factual structure of the case to the appropriate estimation method.

A model selection rule follows from these differences. The incremental profit model should be used primarily in stable baseline cases, where pre- and post-misappropriation performance can be compared without excessive market noise. Counterfactual reconstruction should be used primarily in time-to-market and acceleration cases, where the secret changed the defendant's development path, launch date, or substitute technology trajectory. Contribution apportionment should be used primarily in multi-factor causation systems, where the secret is embedded in a product, customer relationship, production process, or corporate structure alongside lawful inputs. A sophisticated case may require all three: counterfactual reconstruction to define the relevant profit pool, incremental profit to estimate the advantage, and contribution apportionment to separate secret-derived profit from lawful business performance.

6. Hybrid Misappropriation and the Decomposition of Illicit Gains

This section applies the attribution framework to hybrid misappropriation. Hybrid cases require separate attention because the same trade secret may generate overlapping profit streams through disclosure, use, and affiliated transfers. The analysis below therefore focuses on decomposition rather than mechanical aggregation.

Hybrid misappropriation deserves separate treatment because it presents the highest risk of both under-enforcement and over-attribution. It refers only to cases involving overlapping causal realisation pathways of the same trade secret, not merely multiple acts in the history of a dispute. In a hybrid system, the same secret can travel through several forms: acquisition, disclosure, internal use, third-party use, affiliate transfer, equity participation, and disguised profit distribution. Each stage may generate an apparent gain. The legal question is whether those apparent gains are distinct, cumulative, overlapping, or merely different accounting expressions of the same underlying advantage.

The profit stacking problem arises when multiple gains are layered on the same causal base. Suppose an engineer transfers a confidential production process to a new company in exchange for shares. The company then uses the process to manufacture products and pays the engineer consulting fees from the resulting profits. If the law counts the full value of the shares, the full operating profit, and the full consulting payments, it may count the same informational contribution three times. The shares may represent anticipated operating profit; the consulting fees may be a distribution of that

profit; and the operating profit may already capture the value of the process. Mechanical addition would inflate criminal gain.

The opposite error is also possible. If the law counts only the initial disclosure fee, it may ignore the fact that the disclosure was designed to enable downstream exploitation. A low upfront payment may be artificially selected to conceal the real profit in an affiliate. Hybrid cases therefore require decomposition of overlapping causal contributions. The decision-maker must map the causal chain, identify the profit pools, and determine whether each pool reflects a new exploitation of the secret or a redistribution of a previously counted gain.

Layered causation chains should be analysed in sequence. The first question is whether the acquisition itself produced gain. Often it does not; acquisition creates capacity. The second question is whether disclosure produced consideration. If so, that consideration should be valued at arm's length and separated from lawful consideration. The third question is whether use produced operating profit. If so, the profit must be reconstructed and apportioned. The fourth question is whether later transfers, consulting fees, dividends, or affiliate payments are independent gains or distributions of the disclosure or use gain. This sequence prevents both omission and duplication.

Hybrid cases also require attention to principal and accessory conduct. Where disclosure is merely instrumental to downstream use by the same economic enterprise, the use-based profit may absorb the disclosure value. Where disclosure to an independent third party produces a separate payment and the third party later earns independent profit without a shared criminal plan, the discloser's gain should normally be limited to the payment or benefit received. Where the discloser and user form a joint scheme with profit sharing, the attribution boundary may extend further, but only to the portion of downstream profit within the shared plan and causally connected to the secret.

Affiliate transactions require substance-over-form review. A company may license the secret to a related entity at a nominal price, shift profit through transfer pricing, or pay excessive service fees to individuals who supplied the information. These arrangements should not defeat attribution. The market benchmarking layer can replace non-arm's-length prices with fair values, while the equity adjustment layer can ensure that the same profit is not counted both at the affiliate and parent level. The objective is not to disregard corporate form automatically, but to prevent artificial fragmentation of criminal gain.

Profit decomposition can be expressed as a set of practical questions. What is the underlying secret-derived advantage? Through which transactions or operations was it realised? Which payments are consideration for the secret itself? Which profits are generated by using the secret? Which later transfers merely distribute those profits? Which portions are attributable to lawful assets? Which portions overlap? The answer should produce a consolidated gain figure that captures the total unlawful advantage without stacking the same causal contribution more than once.

Hybrid misappropriation therefore confirms the need for a typological approach. Disclosure, use, and hybrid systems are not labels for convenience; they are different causal architectures. Hybrid cases require the most explicit economic reconstruction because the causal chain is layered, the accounting record may be strategic, and the risk of double counting is acute. A criminal court that fails to decompose overlapping contributions may either trivialise sophisticated wrongdoing or impose a gain figure detached from responsibility.

7. Comparative Perspectives on Trade Secret Enforcement and Gain Attribution

This section tests the functional reach of the proposed framework through comparative analysis. The United States, the European Union, and China use different doctrinal routes, but all face the problem of linking economic advantage to misappropriated information. The comparison demonstrates why attribution accuracy and proportionality are general concerns in trade secret enforcement.

The proposed framework is not tied to one jurisdiction. It is functional because the attribution problem appears wherever trade secret enforcement uses monetary measures to express seriousness, remedy, confiscation, or punishment. A brief comparison of the United States, the European Union, and China shows both diversity in legal form and convergence in underlying need.

United States trade secret law provides the clearest remedial vocabulary. The Uniform Trade Secrets Act permits damages for actual loss and unjust enrichment not taken into account in computing actual loss, and allows a reasonable royalty where other measures are inadequate.[16] The Defend Trade Secrets Act carries similar concepts into federal civil enforcement.[17] Criminal enforcement under the Economic Espionage Act and related provisions adds the public dimension of punishment and deterrence. US doctrine therefore recognises the difference between loss, gain, and reasonable royalty. It has also developed against a broader debate over the proprietary treatment of information and the relationship between control, misuse, and market advantage.[18] Even in civil cases, unjust enrichment requires attribution: the plaintiff must connect the defendant's benefit to the misappropriation rather than to lawful business factors. Large trade secret disputes also demonstrate the difficulty of separating compensatory, punitive, and unjust enrichment logics.

The US approach supports the article's market benchmarking layer. Reasonable royalty analysis encourages attention to hypothetical bargaining, comparable licences, and the value of the information at the time of misappropriation. Unjust enrichment encourages attention to the defendant's actual advantage. But US law also illustrates the need for criminal proportionality. Civil disgorgement may tolerate broader remedial flexibility than criminal punishment. When illicit gain defines criminal seriousness, the calculation must be more closely tied to causation and responsibility.

The European Union contributes a proportionality-oriented framework.[19] The Trade Secrets

Directive requires Member States to provide measures, procedures, and remedies that are fair, equitable, effective, and dissuasive, but not unnecessarily complicated or costly, and subject to proportionality safeguards. Its remedial provisions include damages reflecting negative economic consequences, unfair profits, and moral prejudice, as well as the possibility of royalties in appropriate cases. This language does not solve criminal gain attribution directly, but it reinforces the idea that enforcement must balance effectiveness with proportionality.

The EU perspective is important because trade secret enforcement can easily chill labour mobility, reverse engineering, and legitimate competition. A gain figure that attributes all market success to a secret risks converting trade secret law into excessive control over information. Proportionality therefore functions as a structural safeguard. It supports the equity adjustment rule developed here: even where causation and benchmarks indicate a substantial gain, the final figure should exclude lawful contributions and prevent double counting.

China supplies a useful supporting case because its criminal enforcement structure has increasingly recognised monetary seriousness through quantitative thresholds and doctrinal limits on criminal responsibility.[20][21] Chinese scholarship and judicial practice have grappled with whether illegal gains can reflect harm to market competition,[22] how non-monetary and indirect benefits should be evaluated,[23] and how loss or profit should be reconstructed across different modes of trade secret exploitation.[24][25] The Chinese materials are valuable not because they should dominate the theory, but because they expose the same problem in a criminal threshold setting: how to translate market advantage into a legally responsible amount.

A functional comparison therefore confirms the generalisability of the framework. The United States highlights unjust enrichment and reasonable royalty. The European Union highlights proportionality and balanced enforcement. China highlights criminal threshold design and the practical need to distinguish disclosure, use, and hybrid cases. Across these systems, the common problem is not whether trade secrets should be protected. It is how to attribute economic advantage when misappropriation interacts with lawful business factors. The three-layer framework offers a portable method for that problem.

8. Conclusion

The conclusion draws together the article's typological and attribution-based claims. It does not restate a domestic doctrinal solution, but identifies the broader methodological contribution of the framework. The final point concerns the boundary between lawful competitive success and unlawfully acquired informational rents.

Trade secret misappropriation cases involving profit-based criminal thresholds challenge criminal law because the relevant wrong is often realised as economic advantage rather than immediately

provable loss. Illicit gains can serve as a meaningful proxy for market distortion, but only if they are attributed with care. The central danger is confusing the defendant's total profit with the portion of profit caused by the unlawful informational advantage.

The framework develops a typological and economic attribution model for trade secret misappropriation cases involving profit-based criminal thresholds where multiple causal factors interact. Disclosure-based misappropriation requires valuation of consideration received for transferring secrecy. Use-based misappropriation requires reconstruction of incremental or apportioned operating profit. Hybrid misappropriation requires decomposition of overlapping causal contributions to avoid both omission and double counting. These types identify the path from secret to gain.

The three-layer method links causal attribution through but-for reasoning and a decisive contribution test, market benchmarking through comparable licensing, industry baselines, historical comparisons, and counterfactual reconstruction, and equity adjustment through proportionality and over-attribution control. The quantification models that follow from this method do not promise mathematical certainty. They provide disciplined approximations that make assumptions visible and legally contestable.

The broader conclusion is theoretical. Criminal gain quantification in trade secret misappropriation should be treated as a hybrid legal-economic exercise when profit-based criminal thresholds are used. The framework ensures that criminal gain reflects causal informational advantage rather than accounting profit. A structured attribution framework improves proportionality by ensuring that punishment and confiscation track the unlawful advantage actually produced by the wrong. This framework not only improves attribution accuracy but also delineates the normative boundary between lawful competitive advantage and unlawfully acquired informational rents. In trade secret cases, that framework protects innovation incentives without converting every downstream profit into a criminal gain.

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