



Value added tax fraud, false invoicing and the evolution of associated money-laundering dynamics

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Abstract

Value added tax fraud, false invoicing and money laundering reveal increasingly close connections with the activities of organised crime, presenting complex operational challenges in identifying the intersections between illicit economic-financial phenomena and criminal structures. Within this context, money laundering evolves through progressively sophisticated methodologies, giving rise to new paradigms that disrupt the 'classic' archetype of the three-stage model: placement-layering-integration. Can the traditional model still be considered valid, or does it require reformulation in light of the increasingly innovative practices adopted by criminal organisations?

This study, starting from a contextual analysis of the operations of criminal organisations in the globalised economy, aims to answer this question by developing, with the aid of artificial intelligence tools, a specific mathematical function capable of outlining the main trends in money laundering and exploring the challenges posed by a phenomenon as pervasive as it is protean.

The connection between false invoicing, money laundering and organised crime emerges as a pivotal issue in the fight against criminal organisations. These entities exploit such practices not only to finance their illicit activities but also to infiltrate the legal economy, undermining the foundations of legality and social equity.

Keywords: VAT fraud and false invoicing, placement-layering-integration phases, declining sigmoid curve of money laundering, dissociation phase, three-level analysis.

Introduction

Money laundering constitutes one of the fundamental mechanisms through which criminal organisations perpetuate and amplify their economic and social influence. Recent analyses, including the European Union Agency for Law Enforcement Cooperation (Europol) report *Decoding the EU's Most Threatening Criminal Networks* and the Italian Anti-Mafia Investigative Directorate (DIA) semi-annual report for the second half of 2023 (DIA, 2023), highlight the significant evolution of money-laundering dynamics. These developments reflect the increasing sophistication of criminal networks and their penetration into legal economic and financial circuits.

The traditional assumption that money laundering primarily involves introducing illicit cash into legal financial systems needs to be reconsidered. Modern criminal organisations, now highly structured, generate illicit capital within legal financial systems, making the tracking and the countering of these activities increasingly complex. Consequently, the illicit proceeds requiring laundering are no longer confined to cash but extend also to resources produced directly within legal economic systems and the rapidly expanding domain of crypto-assets.

Europol's analysis underscores the agility, transnational nature and significant control that criminal networks exert over legal economic sectors within the European Union. These networks employ professional facilitators and advanced technologies, such as crypto-assets, to establish illicit financial networks that are exceptionally difficult to decipher.

In particular, Europol's report examines the methods and strategies employed by the EU's most threatening criminal networks to launder illicit capital. The report identifies several key characteristics.

- **Agility:** 96 % of the criminal networks are capable of independently laundering their illicit proceeds, using legal business structures to conceal the origins of funds.
- **Transnationality:** 68 % of these organisations consist of members from diverse nationalities and operate on an international scale.
- **Control:** the networks infiltrate vulnerable sectors such as construction, logistics and hospitality, employing shell companies and other legal structures to disguise illicit activities.

The utilisation of legitimate corporate structures is a cornerstone of money-laundering strategies, consistently involving professional intermediaries. According to Europol, over 86 % of criminal networks rely on such structures to facilitate laundering, while 71 % employ corruption to obstruct investigations and influence judicial proceedings.

At the national level, Europol's findings are closely mirrored by the Italian context. The semi-annual report by the DIA for the second half of 2023 highlights how Italian criminal organisations have adopted an 'entrepreneurial' model. This model replaces overt violence with the silent control of territory through corruption and economic infiltration. This transformation has enabled these organisations to consolidate their presence across various legal sectors, using shell companies, trusts and complex corporate structures to obscure the illicit origins of their funds.

The DIA report, based on investigations conducted by Italian law enforcement, reveals the adoption of increasingly sophisticated strategies, including false invoicing, value added tax (VAT) fraud, trade-based money-laundering schemes and the frequent use of emerging technologies.

These methods allow criminal organisations to exploit seemingly legitimate economic systems, further embedding themselves within the legal economy and strengthening their foothold in key industries.

Methodology and objectives

The context outlined serves as the foundational premise of this study, which aims to propose a more updated and coherent criminological model for money laundering. This model seeks to guide preventive and repressive policy decisions while supporting investigative and criminological efforts more broadly.

The term ‘money laundering’ first appeared in the English language in the 1970s, gaining prominence in journalistic accounts related to financial and political scandals (Oxford English Dictionary, 2026; Madinger and Kinnison, 2011). However, the practice of reintegrating illicitly obtained proceeds into the legal economy predates this period, notably during the American Prohibition era (1920–1933). Criminal organisations, including the Italian American Cosa Nostra, actively sought methods to ‘clean’ cash derived from illegal activities such as the illicit alcohol trade, prostitution, gambling and extortion. These groups often utilised seemingly legitimate businesses, such as laundries, restaurants, bars and other commercial establishments, to justify otherwise inexplicable cash flows. It is plausible that the notion of ‘washing’ money contributed to the subsequent adoption of the term ‘money laundering’ (Madinger and Kinnison, 2011; Unger and van der Linde, 2013).

The criminological model describing illicit capital laundering, based on the paradigm of placement–layering–integration, raises a fundamental question: is it still current and fully descriptive of the phenomenon, or does it require reformulation to account for the more modern operations of criminal organisations?

Other scholars have questioned the continued relevance of this model, approaching the issue from various perspectives but converging on the conclusion that a broader approach is necessary. This is especially true in investigator training (Cassella, 2018) given the increasing prevalence of economic and cybercrime in money laundering dynamics (Sultan and Mohamed, 2024).

The foundational premise of this study asserts that advanced criminal organisations now operate with an entrepreneurial structure, facing no difficulty in laundering cash through the management of legitimate businesses.

Thanks to schemes involving VAT fraud and false invoicing, these organisations demonstrate an increasing capacity to generate illicit revenues directly within legal financial systems, including through the use of crypto-assets. This phenomenon represents a significant shift in the placement phase of illicit capital, traditionally associated with the introduction of criminal proceeds as cash into legal economic channels. Such changes mean that illicit resources are now generated directly within banking systems rather than as cash, rendering techniques like ‘smurfing’, the structuring of transactions to obscure the origins of funds, less relevant. This shift redefines the relationship between

criminal organisations and cash, which no longer necessarily marks the starting point of the 'paper trail' but can instead serve as its end point.

The conventional approach to combating money laundering can no longer be confined to the prevention and suppression of behaviours aimed at introducing illicit cash into legal financial circuits. Instead, it is crucial to identify models that better reflect the trends exhibited by the most insidious and dangerous criminal organisations. These groups have already infiltrated the economic fabric, generating illicit revenues directly within it, compromising the integrity of economic and financial systems, and undermining competition and economic equality.

Using artificial intelligence tools, a model has been developed to mathematically represent the inverse relationship between the level of 'sophistication' of a criminal organisation and the percentage of cash generated relative to total illicit proceeds. This model is essential for the considerations explored in the remainder of this study.

The declining sigmoid curve of money laundering

As previously highlighted, this study builds on empirical evidence outlined in Europol's report, *Decoding the EU's Most Threatening Criminal Networks*, at the European level, and the DIA's semi-annual report for the second half of 2023, which confirms these trends within a national context. An inverse proportionality can be observed between the complexity and sophistication of crimes committed by a criminal organisation and the percentage of cash generated relative to the total illicit proceeds accumulated. For instance, an organisation engaged in predatory crimes (such as theft, robbery and extortion) tends to produce proceeds exclusively in cash, relying on laundering schemes that adhere to the traditional three-stage model of placement–layering–integration. In contrast, more complex and sophisticated criminal organisations, particularly those involved in financial crimes, generate illicit proceeds that are already integrated into the legal financial system and adopt different laundering schemes and phases.

A further evolution is evident in organisations active in cybercrime, which accumulate proceeds exclusively in cryptocurrencies. These have become the preferred instruments for facilitating illicit transactions online and on the Dark Web.

Thus, there is a progressive reduction in the proportion of cash generated as the operational complexity and technological integration of criminal organisations increase.

To analyse this phenomenon, a mathematical function has been developed with the assistance of artificial intelligence tools. This function represents the relationship between the level of criminal sophistication and the percentage of cash generated:

- x = criminal sophistication index;
- y = percentage of cash (the share of illicit proceeds in cash relative to the total illicit revenues generated).

The criminal sophistication index increases incrementally on a scale from 0 to 100. A value of 0 represents an organisation solely engaged in predatory crimes. Progressing along the x-axis, the index rises through the following categories: organisations involved in illicit trafficking (15), basic economic crime (30), more complex economic crimes such as VAT fraud and false invoicing (50), corporate and financial crimes (80), and cybercrime networks (100).

It is important to note that there are criminal groups engaged in activities such as robberies or illicit trafficking that are highly complex, organised and disciplined. Therefore, the criminal sophistication index should be understood as an indicator of the complexity of crimes committed, relative to the organisation's ability to generate illicit proceeds through various systems and methods.

The percentage of cash generated by a criminal organisation relative to the total illicit proceeds is represented on the y-axis, ranging from 0 to 100.

A critical point on the x-axis is located at a value of 50, which corresponds to criminal organisations engaged in more complex economic and financial crimes, such as VAT fraud and false invoicing. Groups that reach this level of sophistication are potentially capable of generating illicit proceeds directly within legal financial circuits and in increasingly significant proportions.

Based on the parameters described above, which characterise the criminal phenomena under investigation, the following function can be implemented:

$$y(x) = \frac{C}{1 + e^{k(x-x_0)}}$$

Where:

y represents the percentage of cash relative to the total illicit proceeds;

x is the criminal sophistication index;

C denotes the maximum percentage of cash (in this case $C = 100$, i.e. 100 %);

e is known as the Euler's number (approximately 2.718);

k is the constant that determines the slope of the curve (approximated in this instance to $k = 0.2$);

x_0 represents the critical point of the function ($x_0 = 50$).

The function described above generates the graph in Figure 10.1.

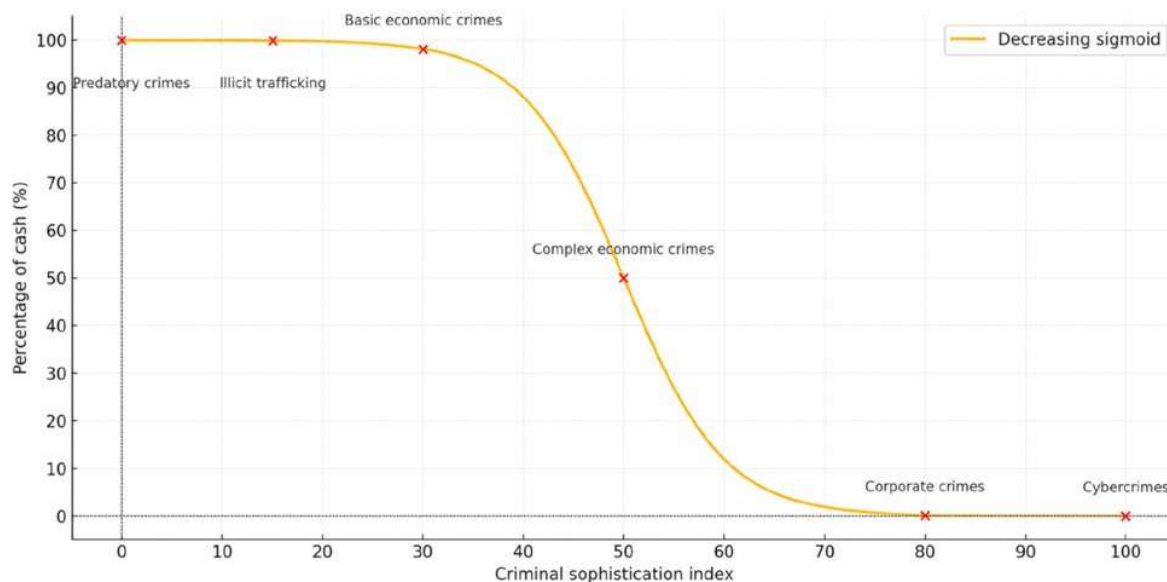


Figure 10.1. Criminal phenomena under investigation

Interpretation of the graph

The graph illustrates a declining sigmoid curve that depicts the relationship between the criminal sophistication index (x) and the percentage of cash generated as a proportion of total illicit proceeds (y).

At the initial values, ($x = 0$), which represents criminal groups engaged in predatory crimes (e.g. theft, robbery, extortion), and $y = 100$, as these groups generate the entirety of their illicit proceeds in cash. To launder these proceeds, such organisations must rely on third parties or adopt schemes rooted in the traditional three stages of placement–layering–integration.

As the sophistication index increases ($x > 0$), the cash percentage (y) remains dominant for groups involved in illicit trafficking (e.g. drug trafficking, smuggling, counterfeiting). However, the utilisation of logistical and legal structures enables these organisations to generate part of their illicit proceeds through other means, such as tax evasion or fraud, which are sometimes employed to facilitate laundering. Although laundering methods still depend on the placement–layering–integration model, the growing operational complexity alters their efficacy and potential.

Moving further along the x-axis, the criminal sophistication index increases to levels corresponding to basic economic crime. This includes groups operating in the informal economy, whose proceeds predominantly come from ‘off-the-books’ revenue. For example, this is observed in the informal economies within immigrant communities, particularly non-EU migrants. In this context, the cash percentage remains prevalent but begins to decrease further as the operation of businesses and other legal structures facilitates additional means of enrichment. These organisations, however, still face the challenge of managing large quantities of accumulated cash, particularly to ensure continuous remittances to their countries of origin.

The criminal sophistication index reaches a critical point ($x = 50$) associated with criminal groups specialising in complex economic and financial crimes, such as VAT fraud and false invoicing. These organisations are capable of generating illicit proceeds directly within legal financial systems. This phenomenon represents an evolution from the past, where fraudulent invoicing was primarily the domain of 'specialists' operating shell companies. Today, however, it has become a strategic sector for many criminal organisations, exploited to generate significant profits while minimising the economic and legal risks associated with other illicit activities.

At this level of sophistication ($x = 50$), a significant increase in synergies between organised crime and white-collar professionals can be observed. Professionals such as accountants, notaries and lawyers provide essential contributions to the planning and execution of complex frauds, expanding the 'grey area' of intersections between the legal sector and criminal activity. This level of complexity necessitates the adoption of laundering methods that go beyond traditional models.

Further along the x-axis ($x = 80$), highly sophisticated criminal organisations emerge, dedicated exclusively to complex economic and financial crimes, corporate offences, stock market manipulation and corruption in public administration. These groups generate illicit proceeds entirely within legal financial systems, which, in theory, are traceable and subject to seizure and confiscation measures. To mitigate this risk, such organisations adopt strategies to monetise their accumulated illicit funds in cash, transferring them outside the legal circuits through the systematic use of cash mules. This method involves withdrawing money from the accounts of companies used to commit illicit acts and delivering it directly to the perpetrators of the fraud, with intermediaries retaining a percentage as a fee for their services.

In cases such as those described, which are becoming increasingly widespread and significant, the traditional placement-layering-integration money-laundering model is no longer a suitable framework. Instead, money laundering occurs through inverse methods (Danese et al., 2022), whereby illicit funds initially accumulate in the bank accounts of shell companies, which play a central role in the criminal economy.

The next stage, required to complete the process, involves the monetisation of illicit proceeds through fractional withdrawals. While these operations resemble the concept of smurfing, they represent its algebraic inverse: rather than depositing small amounts of cash to integrate funds into legal financial circuits, funds are withdrawn from accounts to convert them into cash. This stage finalises the laundering process, making the funds available for further illicit activities, such as loansharking and bribing public officials.

However, even monetisation operations entail significant costs and various risks. This raises an important question: why not source cash from organisations with an excess supply? The demand for monetisation intersects with the supply of cash from less sophisticated criminal groups ($x < 50$), particularly those active in illicit trafficking and the informal economy ($15 < x < 50$). These groups, retaining a commission, supply cash to economic and financial criminals who, in exchange, conduct wire transfers abroad on their behalf. Such transfers often exploit non-cooperative jurisdictions in terms of criminal, tax or anti-money-laundering enforcement and are typically intended to finance drug trafficking, smuggling or cross-border remittances.

This phenomenon also explains the resurgence of underground banking systems in Europe, particularly among non-EU immigrant communities.

Finally, those engaged in cybercrime operate on an entirely different plane, characterised by the absence of cash and the bypassing of traditional financial systems. They generate illicit proceeds in crypto-assets, concealing their origin through unregulated platforms that ensure anonymity. Techniques employed include mixing and tumbling services, which fragment transactions to prevent tracking, and the use of non-custodial wallets for cryptocurrency storage.

In such cases, the traditional three-phase model (placement–layering–integration) proves obsolete and inadequate for describing these new operational methods.

Conclusions

The analysis conducted in this study highlights the radical evolution of money laundering, moving away from the traditional paradigm based on the three stages of placement–layering–integration. Modern criminal organisations have achieved levels of sophistication that render many of the investigative strategies employed to date obsolete. Given this increasingly complex landscape, it is imperative not only to update countermeasures but also to redefine the theoretical categories that guide criminological analyses of the phenomenon.

The classical money-laundering model remains valid in cases where criminal organisations need to launder illicit proceeds generated in cash. As indicated in the graph, this applies to organisations operating at values corresponding to $x < 50$. However, beyond this critical point, the model proves inadequate in describing the operational methods of contemporary criminal groups, particularly those involved in complex economic and financial sectors or in crypto-related activities. In such cases, illicit proceeds are often already integrated into the legal financial system or generated directly in digital environments, eliminating the need for an initial placement phase.

To describe the laundering processes of funds generated directly within legal financial systems or in crypto-assets, the introduction of a new operational phase is proposed: the dissociation phase. This phase addresses the primary need to distance illicit proceeds from the context in which they were generated, preventing them from being traced back to the original criminal activity or subjected to asset seizure.

To better understand the findings of this analysis, it is necessary to consider the methods of generating illicit proceeds within three distinct operational levels:

- cash, relating to physical money and tangible material wealth;
- traditional finance, encompassing centralised and regulated financial circuits, such as banks, credit institutions, payment institutions and electronic money operators;
- digital and decentralised finance (DeFi), relating to the realm of crypto-assets and blockchain-based tools, and characterised by the absence of centralised intermediaries, pseudo-anonymity and high operational autonomy.

The laundering of proceeds generated at the cash level can be analysed and described using the traditional model. The placement phase represents the critical moment when cash is introduced into legal financial circuits or converted into crypto-assets. Indeed, the model remains applicable even in cases where criminal organisations launder cash directly into crypto-assets, using, for instance, crypto ATMs or other channels within the crypto ecosystem.

Thus, it can be asserted that, starting from the cash level, money laundering proceeds according to the traditional model, involving an initial placement phase within both traditional finance and digital, decentralised finance (Gabbiadini et al., 2024).

Different considerations must be made when illicit proceeds are generated at the other two levels. In these contexts, money laundering does not require a placement phase but rather a dissociation phase, aimed at separating the funds from the context in which they were generated to obscure their illicit origin. Unlike the layering phase, which emphasises complexity and concealment through multiple transactions, the purpose of the dissociation phase is to clearly separate illicit proceeds from their original source. The idea is essentially to move to another 'level' to evade traceability.

This necessity is particularly pronounced in traditional finance and can be achieved through the following:

- transfers and transactions involving non-cooperative jurisdictions in terms of criminal, tax and anti-money-laundering compliance (such operations allow for the separation and distancing of illicit proceeds from the domestic jurisdiction where they were generated, obscuring their origin and hindering investigative efforts);
- monetisation, converting illicit proceeds to cash;
- transferring funds to the level of digital and decentralised finance, utilising laundering methods based on crypto-assets.

In DeFi, laundering processes follow specific methods tailored to the unique characteristics of the system. The dissociation phase can occur:

- within the same level, using tools such as mixers and tumblers or fragmenting transactions across different blockchains to disrupt traceability;
- by transferring crypto-assets to other levels, such as traditional financial circuits (e.g. conversion to fiat currency via regulated or unregulated exchanges) or cash (via cash-out and monetisation).

Particular attention must be paid to DeFi, an ecosystem based on blockchain and decentralised protocols such as smart contracts, decentralised exchanges, liquidity pools and non-custodial wallets. Unlike centralised finance, DeFi is characterised by the absence of centralised intermediaries. Criminal organisations with substantial crypto-assets in liquidity pools and non-custodial wallets could engage in transactions with other organisations that require cryptocurrencies, operating as an underground banking system within the crypto world.

The analysis of the three levels demonstrates that the traditional three-phase model remains effective at the cash level. However, the introduction of the dissociation phase is essential for understanding operational mechanisms within legal financial circuits and DeFi. These dynamics underscore the evolution of money laundering and the need to adapt criminological models and, consequently, counterstrategies to the specific characteristics of different contexts.

The proposed analytical model proves fundamental for policymaking and predictive purposes, offering tools to understand and combat the evolution of money laundering. It also provides a solid foundation for specialised investigator training. Simultaneously, it is crucial to strengthen international cooperation, particularly within the EU, and to promote the adoption of new technologies for investigative purposes to effectively address the challenges posed by modern criminal networks.

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