

Investigating High-Risk Firms through the Application of a Machine Learning-based Approach to Cross-Border Ownership Data

CEPOL European Research & Science Conference

Mykolas Romeris University, Vilnius, Lithuania - 09/06/2022

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Università Cattolica del Sacro Cuore
Transcrime – Joint Research Centre on Transnational Crime

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Transcrime – who we are



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- Joint Research Centre on Transnational Crime (www.transcrime.it) of Università Cattolica in Milan
- Established in 1994
- 150+ research projects funded nationally and internationally
- Focus: organised crime, money laundering, financial crime
- Established network among Law enforcement, FIUs, Anti-corruption authorities
- Approach: sociology, statistics, economics, forensic accounting, law, IT
- spin-off company Crime&tech (www.crimetech.it) founded in 2015 to transfer Transcrime research into tools and models for the public/private market

The Ownership monitor



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THE OWNERSHIP MONITOR

- Joint initiative of Transcrime – Università Cattolica and its spin-off Crime&tech
- [R&D hub](#) for the study of firm ownership and its relationship with illicit behaviour
- **Focus on *who controls* but especially on *how control is carried out***
- Collection of research, projects, tools, partnerships, training materials

Scope of the session

How to prepare Law Enforcement for fighting financial crime in the digital age?

› Focus on the analysis of ownership data

- Takeaways from project DATACROS I and II
- Focus on ownership risk indicators
- DEMO of DATACROS tool
- Other applications
 - Mapping of Russian sanctions: ‘Inside the Matrioska’
 - Network analysis for financial crime assessment

Background: the trends in financial crime

- › Increasing use of **firms and legal arrangements** for facilitating (and concealing) crime
- › **Cross-links** between organised crime, money laundering, corruption, collusion and tax fraud
- › **Complex and cross-border nature** of illicit schemes
- › Increasing employment of **opaque** corporate vehicles

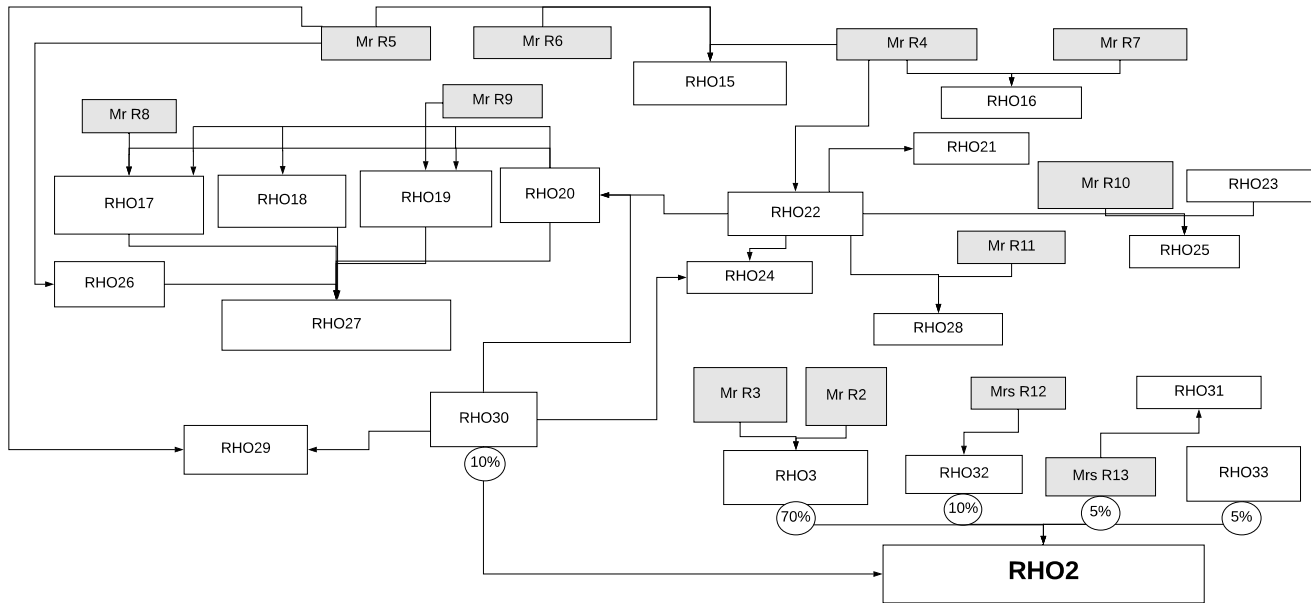


- › Focus shift on **legal persons**
- › From ***who*** to ***how***

Some examples

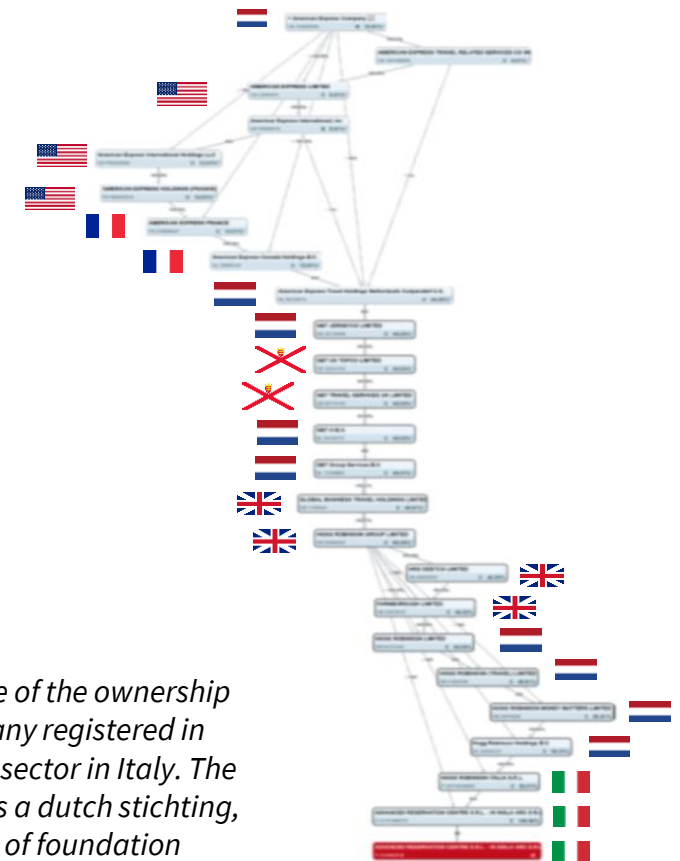
Criminals can exploit complex and opaque business ownership structures for illicit scopes, e.g.:

i. 'Chinese boxes': several consecutive layers of interlocking shareholding links



The 2016-17 investigation Security, conducted by the Italian Antimafia District Directorate, unveiled a complex network of figureheads and shell companies exploited by an organised criminal group connected to a Cosa Nostra family. The companies were interlocked by several ownership (and circular ownership) links

ii. Presence of trust and other opaque legal arrangements: often used in the last layer of complex ownership structures involving foreign jurisdictions



Real-life example of the ownership chain of a company registered in the photovoltaic sector in Italy. The ultimate owner is a dutch stichting, a particular type of foundation

The gaps

- › **Challenges in communication, coordination and exchange of best practices** among public authorities dealing with corruption and financial crime
- › **Difficult access to good quality data on companies**
- › **Lack of risk assessment tools** specifically designed for public authorities

DATACROS project (2020)- Survey across 40 European enforcement and supervisory agencies:



60% of respondents currently do not use any software for conducting financial investigations



70% of respondents would be interested in software for firms' risk assessment and tracing



78% of respondents still rely on data provided by companies themselves or local registers, while they do not use cross-border data

How to address these gaps in the digital age?

Preparing LEAs for the digital Age: Focus on Project DATACROS

How to address these gaps? Project DATACROS & Project DATACROS II

- › **Project DATACROS:** «Developing A Tool to Assess Corruption Risk factors in firms' Ownership Structure»
- › **Co-funding:** EU Commission, DG Home Affairs - Internal Security Fund-Police
- › **Partners:** 4 partners (LEAs, Anti-corruption agencies)
- › **Duration:** March 2019-February 2021



Funded by the European Union
Internal Security Fund – Police

www.transcrime.it/datacros

- › **Project DATACROS II:** «Empowering the Tool to Assess Corruption Risk factors in firms' Ownership Structure»
- › **Co-funding:** EU Commission, DG Home Affairs - Internal Security Fund-Police
- › **Partners:** 18 partners (LEAs, AROs, Anti-corruption agencies, Competition agencies)
- › **Duration:** February 2022-February 2024



Funded by the European Union
Internal Security Fund – Police

How DATACROS has started addressing these gaps?

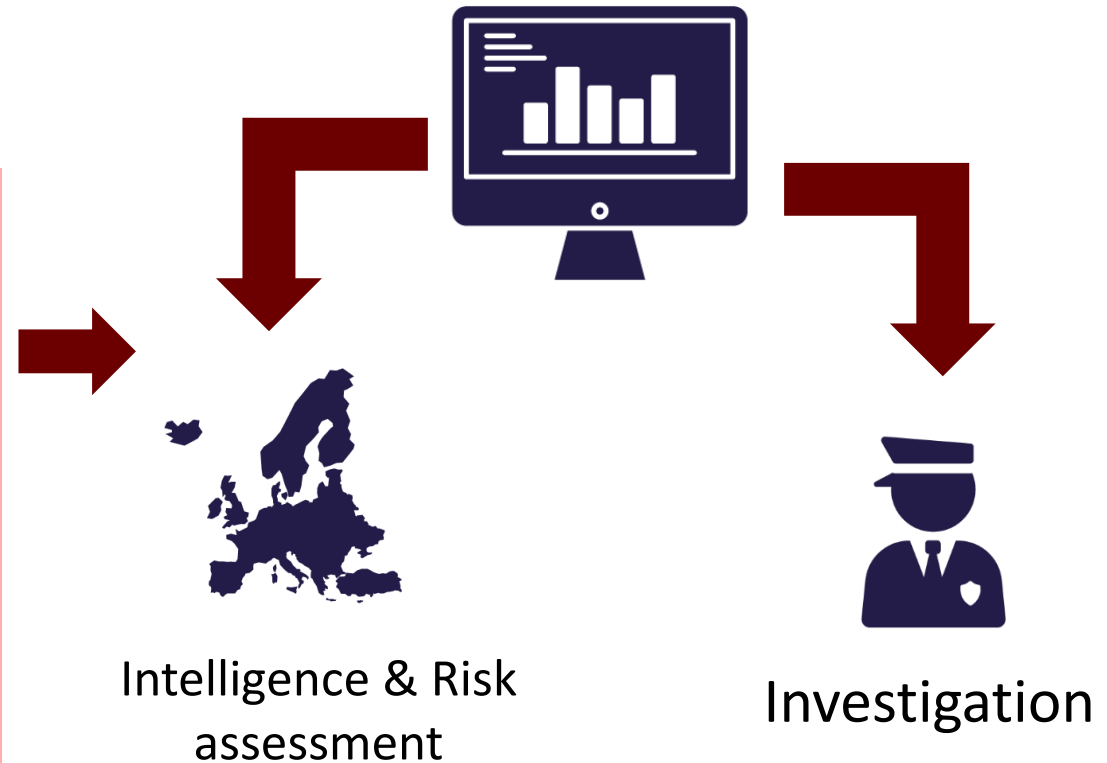
1. Analysis of ownership anomalies across EU regions and sectors



13.4M limited companies, 27M owners

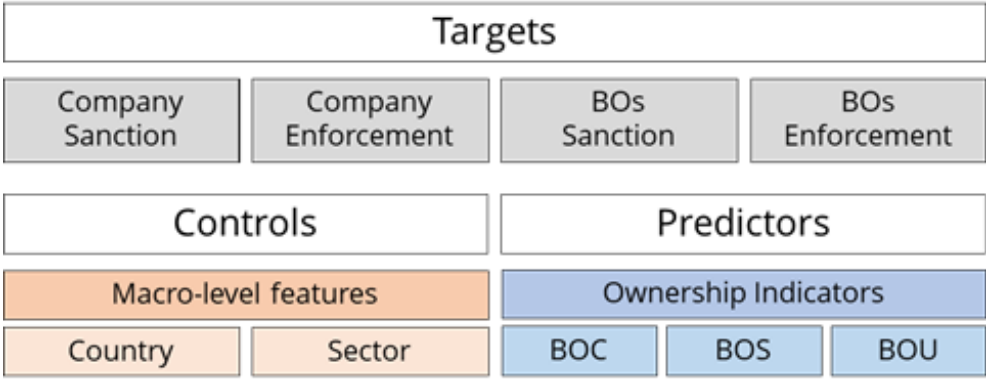
- › Ownership links with **blacklisted countries**
- › Use of **trusts, fiduciaries, foundations** as owners
- › **Unjustified complexity** of ownership structure
- › Ownership links with **PEPs and local administrators**
- › Ownership links with **sanctions/enforcement cases**
- › Anomalies in **companies' characteristics** (e.g. frequent change of name, address)
- › Anomalies in **owners' characteristics** (e.g. age, gender, address, etc.)
- › Anomalies in **financials** (e.g. shell companies)

2. Risk assessment prototype tool



Focus: DATACROS ownership indicators

Empirical validation of DATACROS indicators



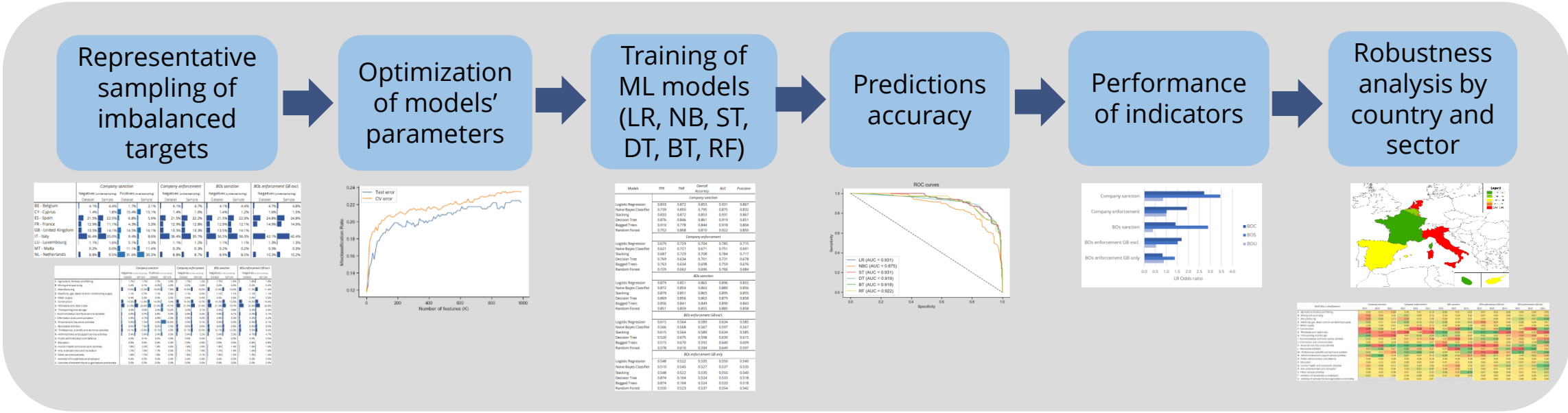
World Compliance Sanctions & Enforcements



Ownership data
Sample of 3M firms (BE, CY, ES, FR, GB, IT, LU, MT, NL)

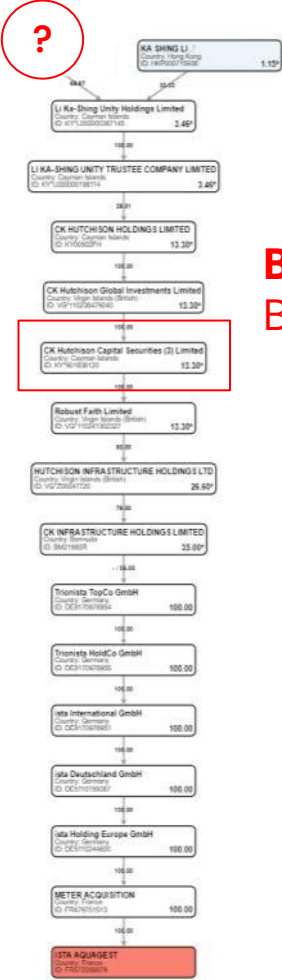


Machine Learning Approach



DATAACROS ownership risk indicators

BOU: Unavailability of BO information



BOS: Links to Blacklisted countries

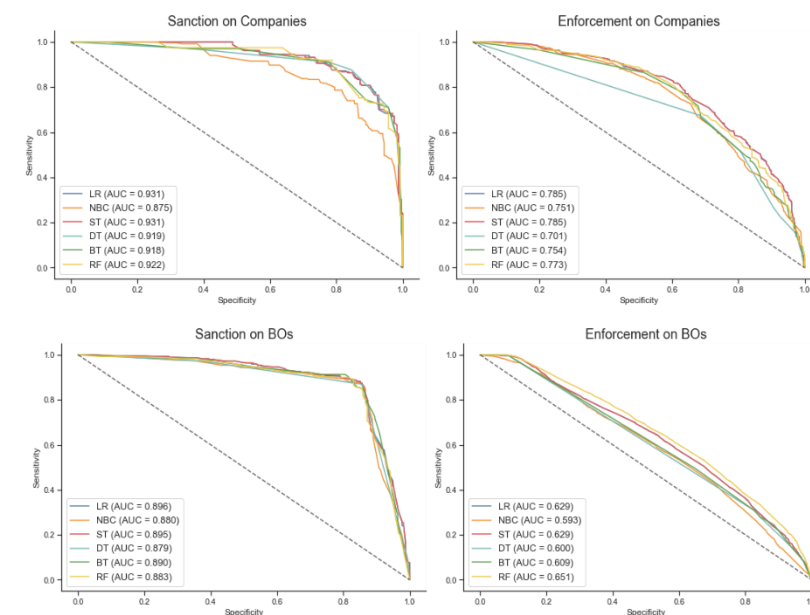
BOC: Anomalous complexity

Anomaly Type	Description	Risk Indicator
Complexity of ownership structure	A company presents a complex ownership structure not justified by its size and business sector	BOC (scale 1-5)
Links to high-risk jurisdictions	A company presents ownership to with high-risk or blacklisted jurisdictions	BOS (scale 1-5)
Links to opaque corporate vehicles	A company presents ownership links to opaque corporate vehicles (trusts, fiduciaries, investment funds)	BOU (scale 1-5)

Empirical validation of DATACROS indicators

- › Machine learning for risk assessment and validation of risk indicators
- › Good **predictive performance** of all indicators and methods, in particular for sanction cases

	True Positive Rate	True Negative Rate	Overall Accuracy	AUC	Precision
SANCTIONS ON COMPANIES	83.3%	87.2%	85.3%	0.901	0.828
ENFORCEMENT ON COMPANIES	67.9%	72.9%	70.4%	0.792	0.732
SANCTIONS ON OWNERS	87.9%	85.1%	86.5%	0.892	0.842
ENFORCEMENT ON OWNERS	61.5%	56.4%	58.9%	0.639	0.586



Analysis based on a sample of 3 million companies. See: Jofre M., Bosisio A., Guastamacchia S., Riccardi M., 2021, "Money laundering and the detection of bad entities: a machine learning approach for the risk assessment of anomalous ownership structures", AML Empirical research conference, Central Bank of Bahamas, January 2021

Empirical validation of DATACROS indicators

Robustness analysis by country

Country	Company sanction			Company enforcement			BOs sanction			BOs enforcement		
	BOC	BOS	BOU	BOC	BOS	BOU	BOC	BOS	BOU	BOC	BOS	BOU
BE - Belgium	0.00	0.02	-0.12	0.00	0.10	1.07	0.01	-0.02	0.03	-0.04	-0.59	0.02
CY - Cyprus	0.03	0.13	0.36	-0.09	-3.71	-2.28	0.58	-0.36	0.15	0.00	0.08	-0.01
ES - Spain	0.02	0.13	-0.33	0.03	0.17	1.68	0.45	0.10	-0.03	0.16	0.59	-0.06
FR - France	-0.16	0.10	-0.04	-0.01	-0.41	-0.26	-0.10	0.02	-0.13	-0.19	-0.35	-0.05
GB - United Kingdom	0.02	-2.09	-1.96	0.04	12.58	2.37	-0.55	2.50	-0.87	-	-	-
IT - Italy	0.18	0.08	-0.72	0.14	0.30	1.84	0.38	0.19	-0.18	-0.03	-1.82	0.04
LU - Luxembourg	-0.01	0.04	-0.03	-0.03	-0.05	0.33	0.00	-0.03	0.08	0.01	-0.22	-0.01
MT - Malta	-0.11	0.34	1.41	0.01	-0.71	-0.66	-0.04	-0.03	0.01	-0.01	-0.19	0.00
NL - Netherlands	0.12	0.00	-1.68	-0.06	-0.81	-5.33	0.03	0.08	0.33	0.05	3.19	0.30

Robustness analysis by sector

NACE (Rev.2 classification)	Company sanction			Company enforcement			BOs sanction			BOs enforcement GB excl.			BOs enforcement GB only		
	BOC	BOS	BOU	BOC	BOS	BOU	BOC	BOS	BOU	BOC	BOS	BOU	BOC	BOS	BOU
A - Agriculture, forestry and fishing	0.00	-0.01	0.29	0.00	0.01	-0.10	-0.05	0.01	-0.01	-0.01	0.02	0.00	0.00	0.00	0.02
B - Mining and quarrying	0.02	0.05	0.02	-0.01	-0.09	0.15	0.00	0.00	0.01	0.01	0.00	0.00	0.01	-0.01	0.02
C - Manufacturing	0.03	-0.08	0.13	0.04	-0.03	0.08	0.06	0.00	-0.01	0.00	-0.04	0.00	-0.04	-0.01	-0.08
D - Electricity, gas, steam and air conditioning supply	-0.02	0.01	-0.05	-0.02	-0.13	-0.22	-0.08	0.00	-0.02	0.03	0.07	0.00	-0.02	0.00	0.01
E - Water supply	0.00	0.00	-0.01	0.00	0.14	0.12	-0.02	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.00
F - Construction	0.04	-0.08	-0.41	0.00	1.19	0.78	0.01	0.05	-0.11	-0.02	0.05	-0.03	0.00	0.09	-0.07
G - Wholesale and retail trade	0.04	0.20	0.78	0.08	0.08	1.33	-0.24	-0.05	0.02	-0.12	-0.46	0.03	0.05	-0.01	0.20
H - Transporting and storage	-0.06	0.20	1.15	0.01	-0.26	-0.34	-0.12	-0.04	-0.01	-0.02	-0.02	0.01	-0.04	0.04	0.01
I - Accommodation and food service activities	-0.02	0.03	-0.08	0.01	0.19	0.46	0.01	0.05	0.05	-0.05	-0.28	0.00	0.02	0.01	0.13
J - Information and communication	0.00	0.02	0.04	0.01	-0.02	-0.01	0.21	-0.01	0.00	0.02	0.05	0.00	0.02	0.00	-0.09
K - Financial and insurance activities	-0.07	0.29	-12.71	-0.04	-0.86	-1.90	0.47	-0.15	0.24	0.06	0.27	0.01	-0.07	-0.04	0.05
L - Real estate activities	0.01	-0.26	0.21	-0.02	0.34	0.21	-0.01	0.06	-0.08	0.01	0.08	-0.01	0.10	-0.07	0.02
M - Professional, scientific and technical activities	-0.02	0.01	0.54	-0.02	-0.68	-0.53	-0.04	-0.01	-0.07	0.05	0.28	0.01	-0.12	0.02	-0.08
N - Administrative and support service activities	0.02	-0.40	0.14	-0.01	0.07	0.13	-0.09	-0.02	0.11	0.03	-0.11	0.01	0.00	-0.02	0.06
O - Public administration and defence	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P - Education	0.00	0.01	-0.02	0.00	0.05	0.04	-0.01	0.01	0.00	0.00	0.00	0.00	-0.01	0.01	-0.03
Q - Human health and social work activities	0.01	-0.04	-0.12	-0.01	0.04	0.06	0.00	0.03	0.00	-0.01	0.04	-0.01	-0.01	-0.02	-0.10
R - Arts, entertainment and recreation	0.00	0.02	-0.06	0.00	-0.21	-0.37	0.06	0.02	0.00	0.00	-0.01	0.00	0.01	0.01	-0.04
S - Other services activities	0.00	0.00	-0.08	0.01	-0.03	-0.03	-0.06	0.01	-0.10	-0.01	-0.04	0.00	0.01	0.00	-0.02
T - Activities of households as employers	-0.01	0.02	0.00	0.00	-0.08	-0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	-0.01
U - Activities of extraterritorial organisations and bodies	-	-	-	0.00	-0.01	-0.01	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00


DATAACROS tool demo


The **DATA**CROS tool can be used for various purposes


- › **Monitoring** corruption high-risk areas/sectors
- › Tracing and **investigating businesses**
- › Supporting **journalistic investigations**
- › Detecting **cartels and collusion**
- › Investigating **sanctioned individuals/entities**
- › Computing **risk indicators** in real-time






DATAACROS tool -demo


Risk assessment tool 


 Search


 Advanced search



 Load data


 **2. Data analysis** 


 2.1 Risk scores


 2.2 Maps


 2.3 Network analysis


 **3. Data sources and lists** 

 3.1 Lexis Nexis

 3.2 Custom lists



 3.3 Reports

 Filters

 Guide and References

Search by

- Company name
- Company national ID
- Owner/Director name

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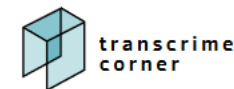
Sanctions mapping: 'Inside the Matrioska'

- At the beginning of March, Transcrime and Crime&tech carried out an **initial mapping** of European firms directly or indirectly linked to a first group of sanctioned 'oligarchs'
- The analysis refers to firms linked to a **group of 33 subjects** sanctioned in the 'first EU package' of sanctions issued at the end of February
- The analysis has identified approximately **1400 European companies** linked to these subjects
- The analysis has also been **extended to companies directly or indirectly controlled by natural and legal persons of Russian nationality**

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March 2022

Inside the matrioska: the firms controlled by sanctioned 'oligarchs' across European regions and sectors

This analysis is part of [TOM - The Ownership Monitor](#), a joint-initiative by Transcrime and its spin-off Crime&tech



There are almost 31 thousand firms in Europe with Russian beneficial owners. 1400 of them are controlled by 33 individuals subject to recent sanctions - the so-called 'oligarchs'. Real estate, construction, hotels, the financial and energy sector prevail. In terms of countries, Germany, United Kingdom, Cyprus, the Netherlands, Luxembourg and Austria host most of oligarchs' firms. The value of these firms is higher than 440 billion US dollars (total assets, book value).

The conflict between Russia and Ukraine - and the sanctions issued by Europe and several countries worldwide against Russia - raise the question of how much exposed is the European economy towards Russian firms and investors.

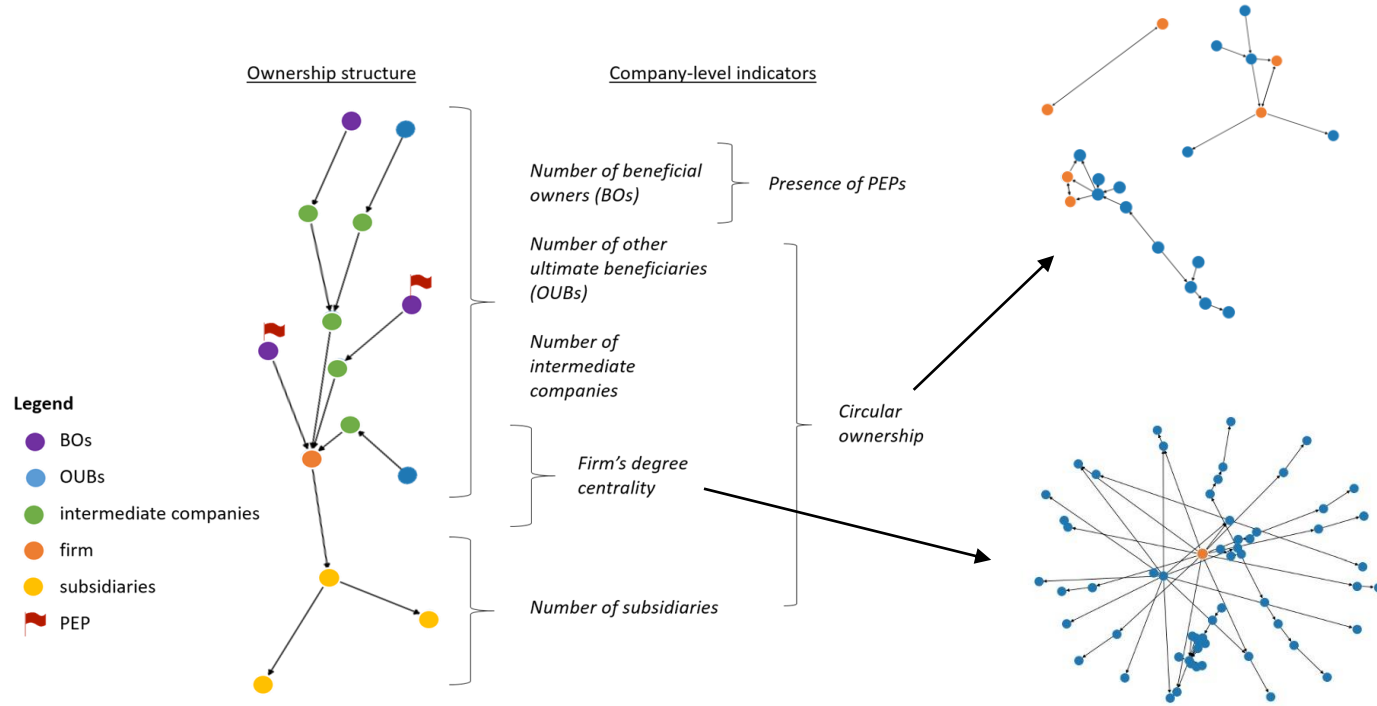
Answering this question requires combining a set of statistics in the trade domain (e.g. in terms of import from or export to Russia) and in the financial domain (for example looking at inward/outward foreign direct investments). A study, published few years ago by CSD and CSIS, already provided a first answer, and also tried to identify the 'enablers' - intermediaries bridging between the Russian and the European economy.

But other key statistics are those related to the amount of European firms owned by Russian entities. This information has become even more important with the widening of the sanctions issued against the so-called 'oligarchs', which have brought to the freezing of many Russian-owned assets - real estate properties, yachts, vessels, and, in fact, company shares.

Transcrime, the joint research centre of the Università Cattolica, and its spin-off Crime&tech, have launched since 2021 a research hub on corporate ownership. It is called [TOM - The Ownership Monitor](#), and it collects a variety of studies and research projects through which we have been monitoring the opacity of firms in Europe and beyond,

Network analysis for financial crime risk assessment

- Ownership structure as a network, where nodes are different entities and edges the ownership relation between them



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Research Article
Network analysis for financial crime risk assessment: the case study of the gambling division in Malta
Maria Jofre
Published online: 23 May 2022

Download citation <https://doi.org/10.1080/17440572.2022.2077330> Check for updates

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ABSTRACT

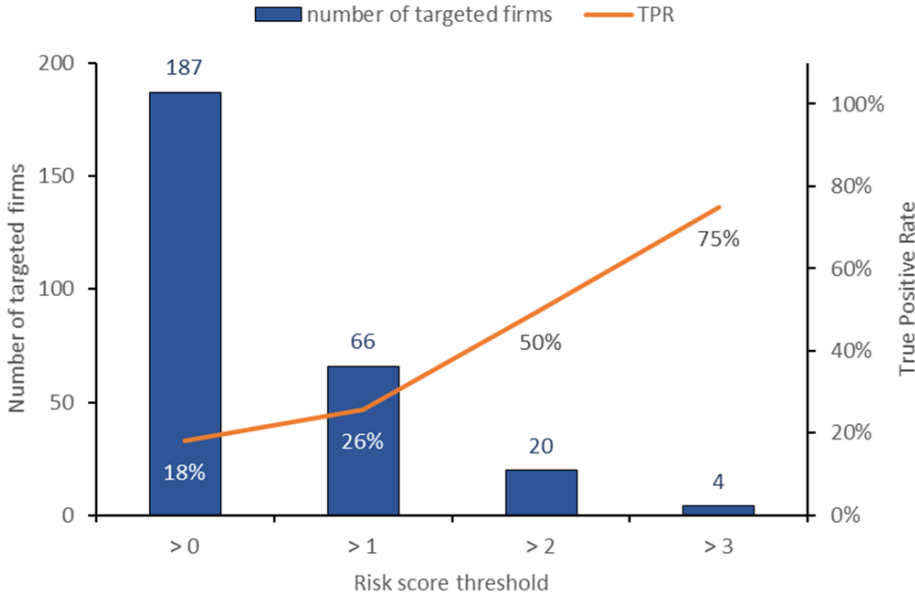
The present study aims to support existing risk assessment tools by proposing an innovative network-oriented methodology based on ownership information. The approach involves calculating company-level indicators that are then transformed into red flags and used to rate risk. To this end, we collect data on companies active in the division of gambling and betting activities in Malta, and further combine them with information on enforcement actions imposed on Maltese companies, their beneficial owners, intermediate shareholders and subsidiaries. Correlation analysis and statistical testing were performed to assess the individual relevance of company-level indicators, while machine learning methods were employed to validate the usefulness of the indicators when used collectively. We conclude that the intelligent use of ownership information and proper analysis of ownership networks greatly supports the detection of firms involved in financial crime, hence the recommendation to adopt akin approaches to improve risk assessment strategies.

KEYWORDS: ownership structure network analysis machine learning red flags risk assessment financial crime

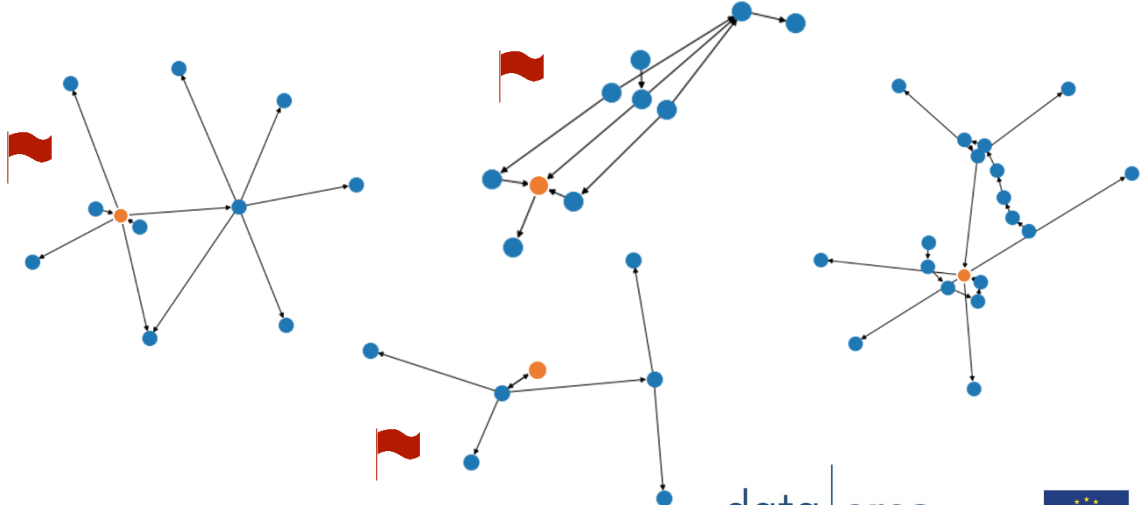
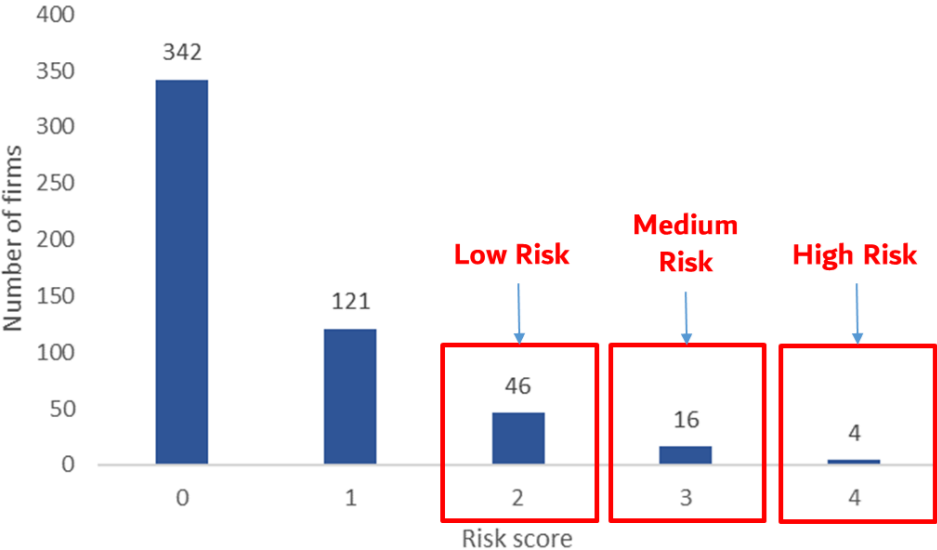
- Assessment and risk profiling of companies active in the **Malta gambling division**

Network analysis for financial crime risk assessment

- Risk score analysis for targeting investigations



- Risky categories for profiling suspicious companies



Conclusions

- › **Increasing use of legitimate companies** in illicit schemes
- › **Schemes are getting more complex** (cross-border, use of opaque vehicles and complex ownership schemes), **but information is getting richer**
- › **How to prepare Law Enforcement for fighting financial crime in the digital age?**
- › It is fundamental to develop **knowledge and skills** for:
 - › Gathering information on companies and related entities/individuals
 - › Developing ML-based indicators and models to identify high-risk companies
 - › Developing and customizing tools for investigation/risk assessment of companies

THANK YOU

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