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Study on Cross-Border Money Laundering via Network Flow Analysis

Money laundering is a set of activities that aims to eliminate the traces of the source of income, and rationalize large amount of illegal income generated by different criminal activities such as organized gangster crimes and drug trafficking. There are multiple types of laundering methods, for example mirror trading, art money laundering, real-estate money laundering, and so on. Nowadays, money laundering becomes a critical global issue because criminal enterprises try to utilize the differences of regulatory mechanisms between countries to facilitate the money laundering process. Therefore, there is an idea to investigate the cross-border money laundering networks based on countries' geography, regulatory systems and economic conditions.

Traditional research on money laundering usually focuses on real-life case studies or reviews on the national regulatory mechanisms. In the previous decades, the money laundering activities were usually identified by considering the frequency and amount of transactions. Yet, if there were many parties engaged and the criminals tried to split the transactions to make it be complicated, it would be hard to detected. Therefore, in recent years, some researchers try to analyse the criminal behaviour trends to develop new methods to spot these suspicious activities. Colladon and Remondi (2017) conducted social network analysis on a case of Italian Factoring company, by taking the economic factors and geographic regions into account like whether it is high-crime Italian region, they constructed 4 networks with the concerns of 3 key metrics, degree centrality, network constraint, and closeness centrality. Using network science seems to be a good way to detect and prevent money laundering.

From 2012 to 2017, there was a team from Morocco helping British drug dealer to legalize their revenue by gold money laundering. It was a long "laundering journey" from England to Dubai, where there were few stops in between, Paris, Belgium, Amsterdam. It is believed that the money laundering networks are not randomly distributed but they varies across different cities, regions and countries. Countries or cities can act as the nodes in the networks. The distance here may be represented by the steps needed for the money to flow between countries. The distance effect may be able to tell the optimization (shortest path) of laundering operations among countries. A higher degree centrality may indicates a country has many direct connections in the laundering networks.

As mentioned, the criminals exploit the divergence of financial regulations of different countries to accelerate money laundering. It is possible that there are some specific hotspots where money laundering is more concentrated, such as Dubai, Hong Kong, Switzerland, and Singapore, since these financial hubs have lower level of regulatory enforcement. Using the concept of betweenness centrality, it is able to find out the "brokers" which countries act as a bridge connecting others in laundering transactions. As a case in point, there can be a country connecting high-risk (strictly regulated) regions with low-risk (leniently regulated) regions. The modularity of the network will be also measured as the countries will be clustered into distinct laundering communities and the brokers will act as intermediates of connections. The network fragmentation can be also demonstrated in the network. If it is expected that the fragmentation is low in the network, it means that the money flows freely across countries or cities with minimal barriers. The nodes are highly connected. And vice versa, the network being highly fragmented proves that there are multiple isolated small-world networks and they need to be reconnected by brokers.

According to the proposal mentioned above, there can be further investigations on the impact of regulatory enforcement levels and the geographical proximity status of countries on network broker, modularity and fragmentation. On the other hand, after the measurement of betweenness, it is also possible to reveal the relationship between money-laundering-concentrated countries and their socio-economic conditions. For instance, whether the countries or cities with better economic status, such as higher GDP and lower unemployment rate, are usually selected as the transit zones for money laundering.

The plots from appendix are the examples of a small try to check the feasibility of visualizing the money laundering networks. The suspicious bank transactions among 18 countries are used. The weights are the frequencies of bank transactions made between countries. Ignoring the limitations of the dataset itself, the result simply manifests the brokers and critical edges in this network. With a better visualization on world map to see the connections between countries, it is easier to see the flows in general and the geographical relationships of the countries.

By applying network science to money laundering research, it is hoped to have a better understanding on how money laundering works across borders and further explore the determinants for being the important hubs or intermediates in the network.

Appendix

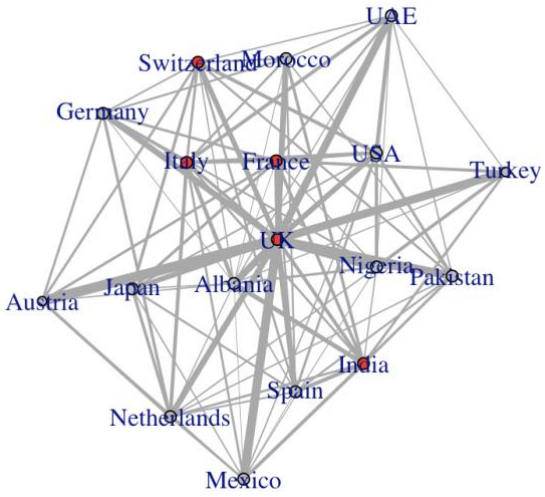

Figure 1. Edge Coreness and Betweenness Centrality for Countries

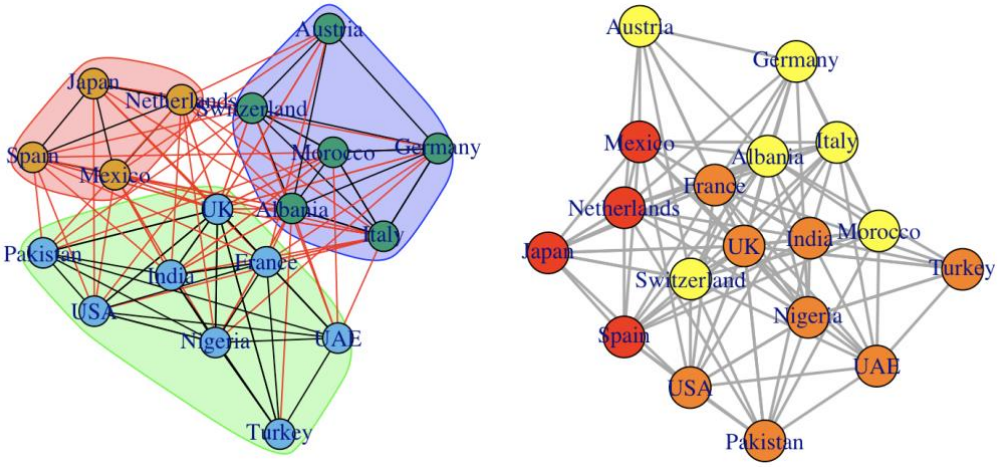

Figure 2s. Network with Community Clusters

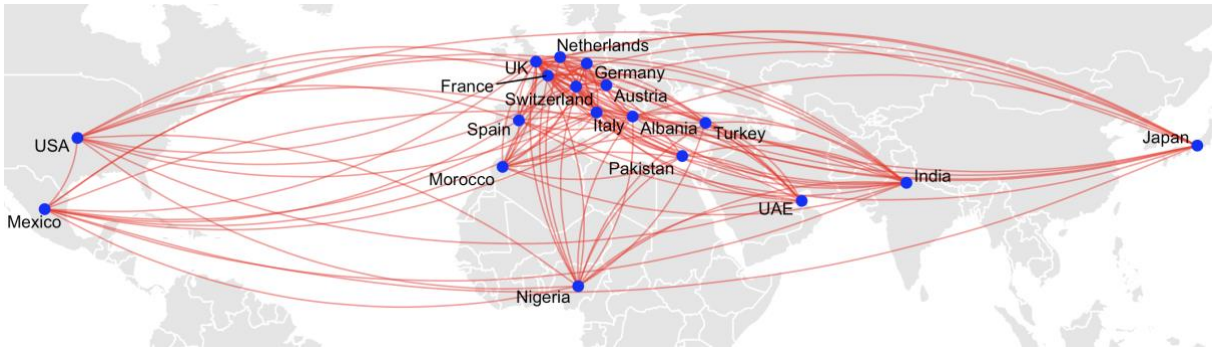

Figure 3. Visualization on World Map

Reference

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