# It's all about data: using advanced analytics as an investigative tool

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Data provided by the SWIFT Institute





# 3.1+ billion

Payment messages exchanged between institutions from 2003 to 2018, aggregated by month and by country





Countries and territories



#### What insights could be drawn from the "Big Data" of the network?

What are useful learnings for the community?

### What is a network?

#### **Networks and Network Analytics**

- Networks consist of nodes and links
- Network Visualization is important (but hard)
- Network analytics
  - Analyse links and their properties
  - Detect clusters and communities
  - Identify important nodes and choke points
- How do we model the SWIFT payments as a network?
  - Country level
  - Bank level
  - Payment level



## 1. The global network of payment flows

#### Monthly total message volume



Millions

#### Monthly message volume - Seasonal variation



#### Monthly message volume - Trend



Millions

#### **Anomaly: Anomalies in time series**

We need a model to predict next observation in a time series. If prediction is incorrect, it is an anomaly.



#### Link level analysis: Volume of payments



#### **Network structure**

#### How do countries interact with each other?



United Kingdom 390 links

Estonia 101 links Eswatini 56 links



#### **Theoretical network connectivity**



#### **Evolution of the payments network structure**



#### April 2018 network, maximum spanning tree



Maximum spanning tree is a filtering technique that identifies the strongest links and the community structure.

#### April 2018, 50% network traffic, maximum spanning tree

At Sibos 2014 Gottfried Leibbrandt presented FNA research and showed the backbone network of SWIFT.



The same structure still applies today, but most traffic from Austria, Sweden and Belgium have moved from Germany to the UK. USA increased traffic with The Netherlands, South Korea and Singapore



#### **Anomaly: changing network structure**

What happens when a node is removed from the network?



#### Link level analysis: number of counterparties





Compensation of traffic to its largest remaining link



#### Link level analysis: number of counterparties



Compensation of traffic to its largest remaining link

#### **Communities**



Using an unsupervised machine learning algorithm, we identify communities of countries that deal more with each other, than across the communities.



#### **Communities restructure themselves on the network**

2013





#### **SWIFT - Most important Countries**

SinkRank, Top Countries



#### **SWIFT - Most Volatile Flows**



Relative Importance by SinkRank, Most Volatile Countries



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