

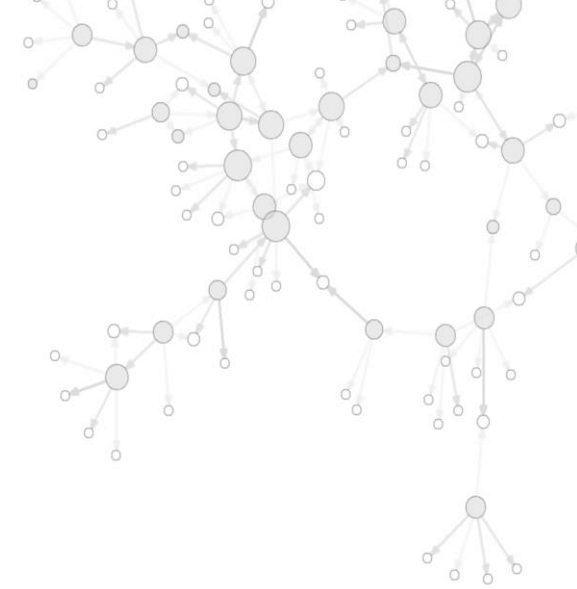
Networks of Online Stolen Data Markets How Vendor Flows Connect Digital Marketplaces

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Vendor migration

Since the launch of Silk Road in 2011 there has been an increase in the number of digital marketplaces (Van Buskirk et al., 2017)

Vendors are increasingly cross-listing their products across multiple platforms (Décary-Hétu & Giommoni 2017; Ladegaard, 2019; 2020; Norbutas et al., 2020)

The flow of 'market refugees' from seized to neighboring markets key to the resilience of the darknet ecosystem (Ladegaard 2020)

Digital displacement

What motivates offenders' decisions to move their illicit activities to a new location - physical or otherwise?

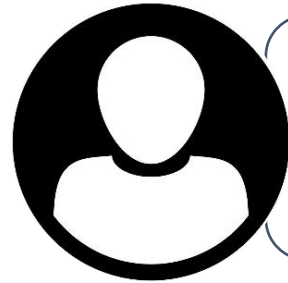
Economic calculus underlie the decision making of illicit actors on digital platforms (Martin et al., 2020; Reuter & Kleiman, 1986)

Social forces *"If Silk Road is down, everyone moves to Agora, if Agora is down everyone moves to Evo ... and so on [...] the DNM's user base is VERY herd like"* (Moeller et al., 2017, p. 1434).

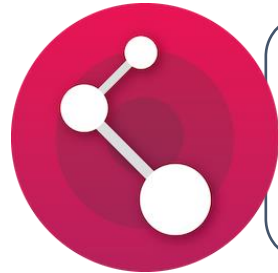
Current study



Compile weekly trend data from online stolen data markets



Track vendors' patterns on stolen data markets



Generate market networks to assess vendor decisions to move to a new market

Digital trace data on the darkweb

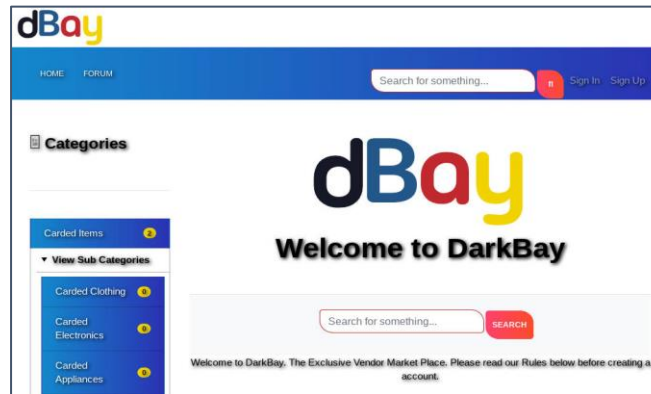
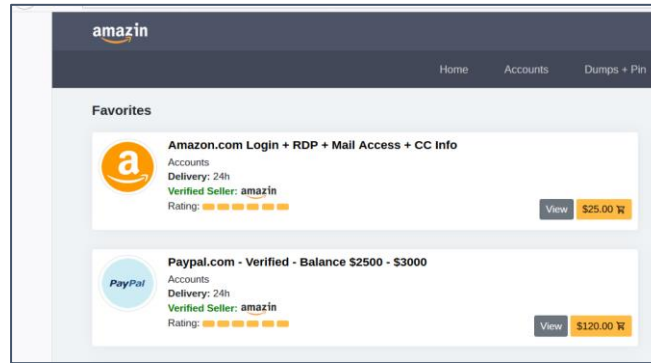
Weekly data across 30 English-language marketplaces that sell stolen data products on the darkweb

Database compiles information on:

- Vendor profiles
- Product ratings
- Vendor ratings
- Product descriptions

Interviews with vendors involved in the sale of stolen data

Digital trace data on the darkweb



The profile card for the vendor "Free Republic" features a circular profile picture with a Statue of Liberty icon. The text reads: "Free Republic", "Undetectable fake Passports, Driver's License, ID cards BIG SALE!!!", "Category: Documents", "Status: Online", "Member since: Jun 2017", "Sales: 5860", "Buyer protection: Yes", and "Rating: ★★★★★". A "View Vendor" button is located at the bottom.

Products



Undetectable fake passports

\$1,779.00 \$899.00

See more



Undetectable fake Driver's License

\$350.00 \$99.00

See more



Undetectable fake ID cards

\$699.00 \$299.00

See more

Vendor Reviews:

Pavanem ★★★★★

Bought product: Undetectable fake passports

6 days to Texas, nice
on 25/03/2020

Ownarrali ★★★★★

Bought product: Undetectable fake ID cards

Just received the documents, thank you
on 08/03/2020

Fayin ★★★★★

Bought product: Undetectable fake Driver's License

Thank you for this opportunity
on 03/03/2020

Uzudeemi ★★★★★

Bought product: Undetectable fake ID cards

Everything went quickly and clean, I got the documents
on 01/03/2020

Teffra ★★★★★

Bought product: Undetectable fake passports

Thanks to this seller, now I'm a new person
on 01/03/2020

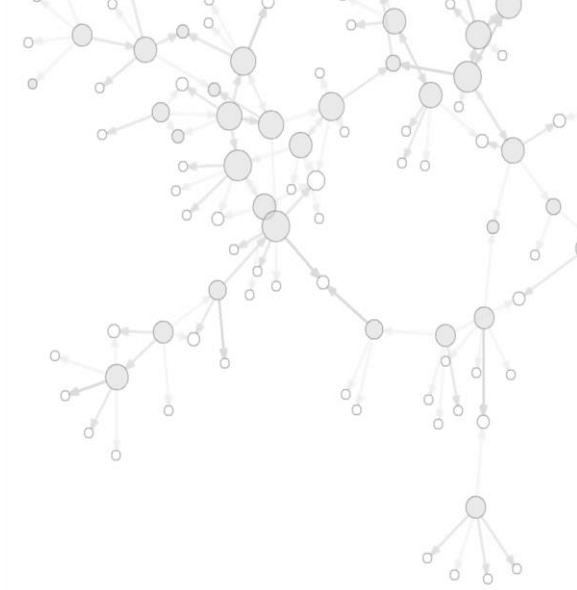
Kiasheshi ★★★★★

Bought product: Undetectable fake passports

everything is cool, my documents came yesterday
on 24/02/2020

GOLD BUYER Ieladdyan ★★★★★

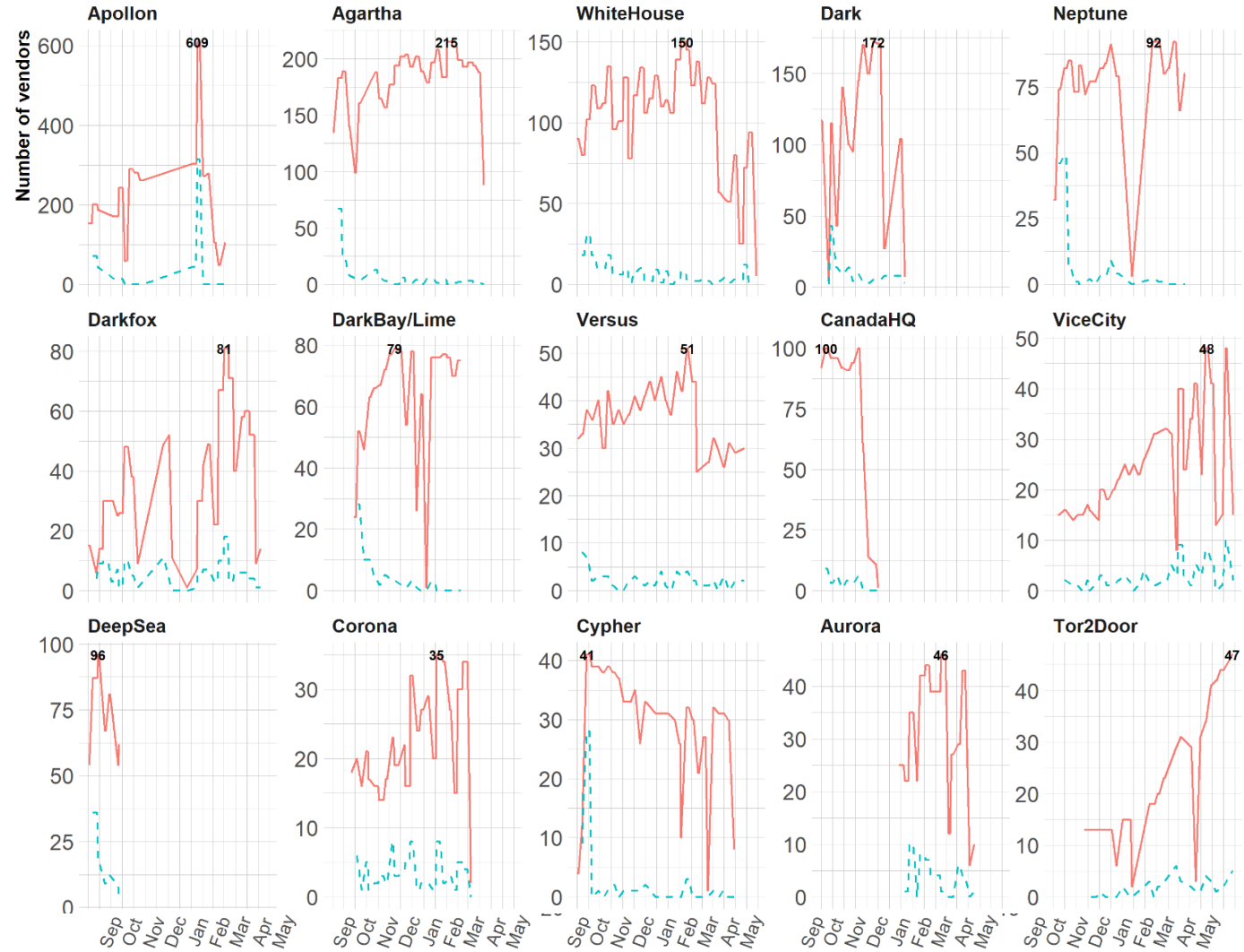
Bought product: Undetectable fake Driver's License



Market and vendor trends on online stolen data marketplaces

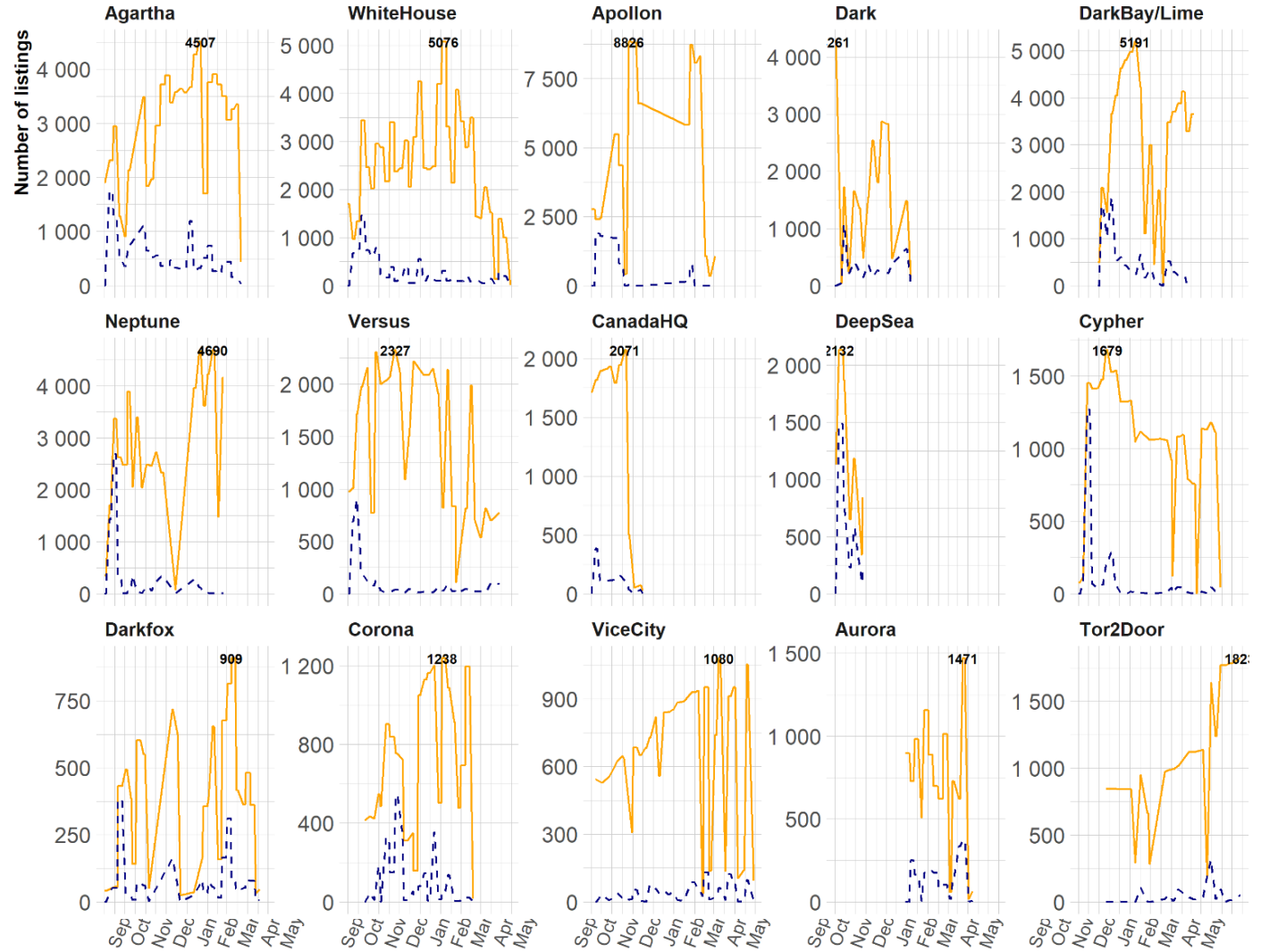
Market-level trends

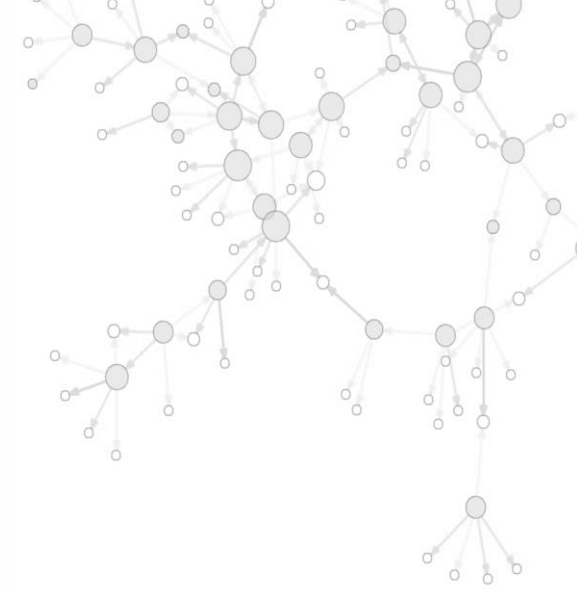
Number of vendors



Market-level trends

Number of listings





Vendor displacement after a disruption

What drives vendors' decisions to migrate to new marketplaces?

Where do vendors migrate after a marketplace seizure?

POLICY / US & WORLD / TECH

Authorities have taken down the dark web's largest illegal marketplace

DarkMarket had almost 500,000 users

By Ian Carlos Campbell | @soupsthename | Jan 12, 2021, 8:57pm EST



<https://www.theverge.com/2021/1/12/22227929/darkmarket-shutdown-europol-worlds-largest-illegal-marketplace>

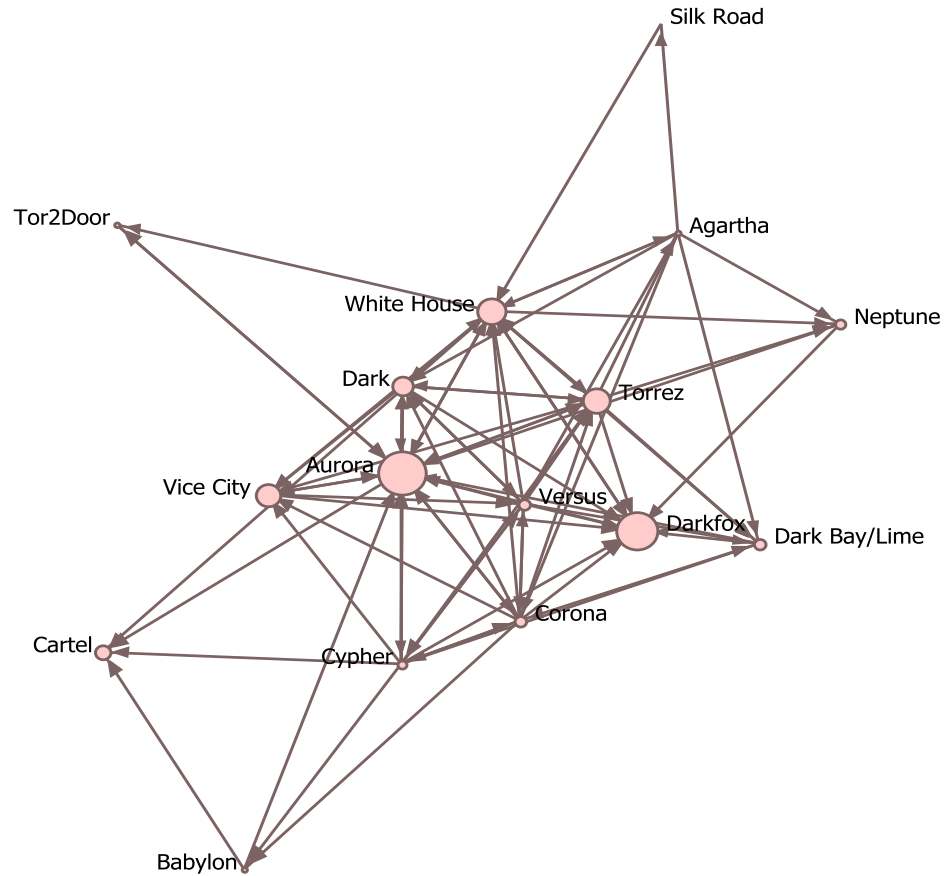
A network approach

Marketplace networks created by vendor flows (nodes = markets, ties = stock of vendors who move between any set of markets)

Outcome variable: **intensity of vendor flows** (vendor out-flows one month before and after the seizure of Dark Market Jan 11, 2021)

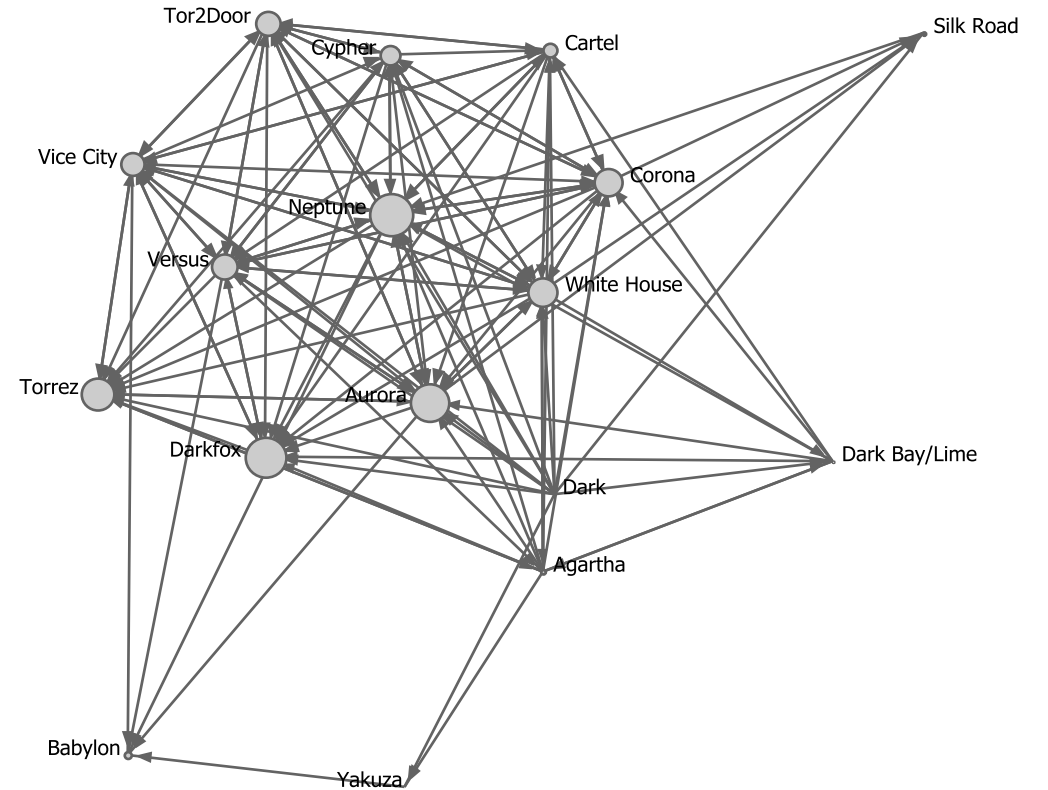
Sample: 17 markets, 979 vendor aliases, and 221,094 product listings

Vendor flows *pre-seizure*



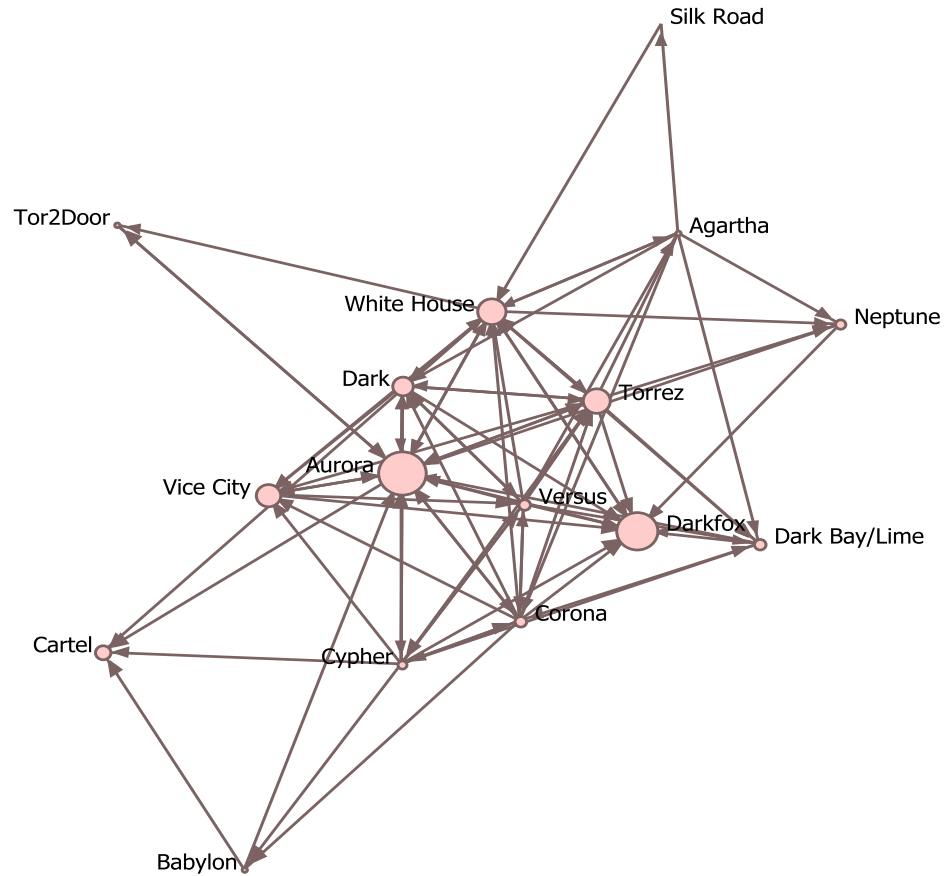
Size: 17 markets

Vendor flows *post-seizure*



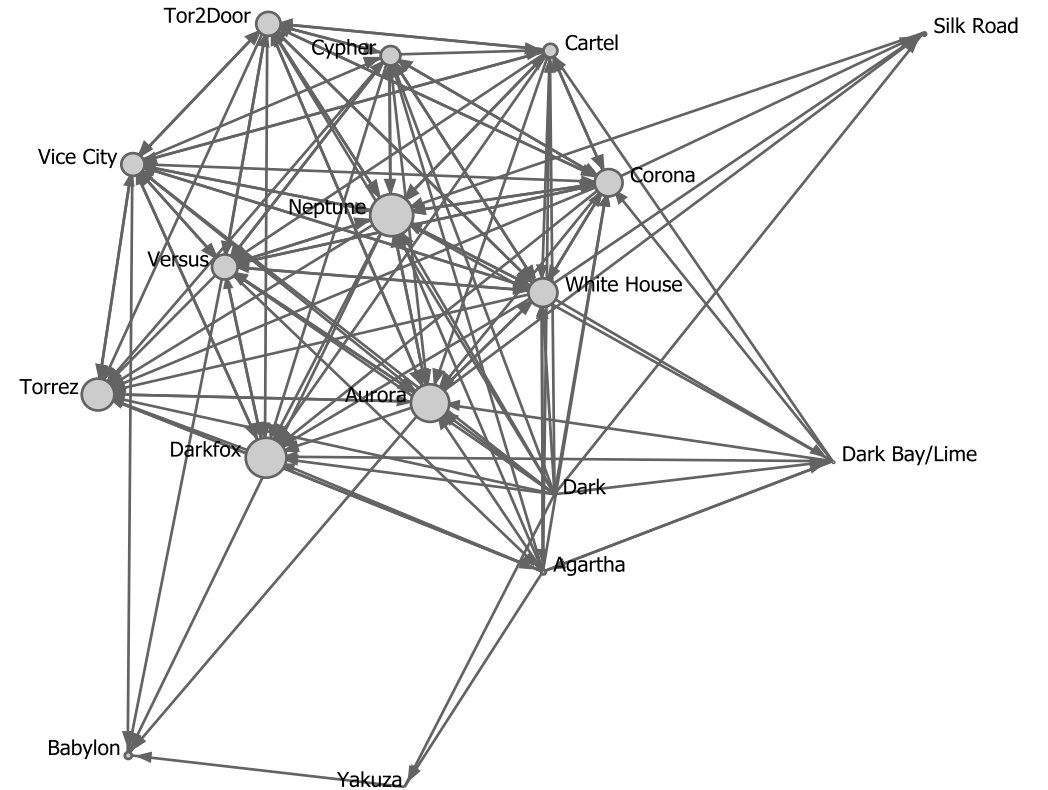
Size: 17 markets

Vendor flows *pre-seizure*



Size: 17 markets
In-degree centralization: .401

Vendor flows *post-seizure*



Size: 17 markets
In-degree centralization: .301

Covariates of vendor flows

Number of vendors on a marketplace. Proxy of supply (or anonymity)

Price changes on a marketplace. Proxy of demand

Reciprocity. Vendor flows Market A \rightarrow B, Market B \rightarrow A

Transitivity. Vendor flows Market A \rightarrow B & Market A \rightarrow C, Market B \rightarrow C

Network lag term. Vendor flows in the prior one-month period

The drivers of vendor flows

Exponential random graph models

Variables	Pre-seizure network
Sum	-.233 (.220)
Market variables	
N vendors - receiving market	-.001 (.001)
N vendors – sending market	-.003* (.001)
Price change – receiving market	-.009 (.024)
Price change – sending market	-.114** (.039)
Network variables	
Reciprocity	-.582* (.240)
Transitivity	.290 (.189)
Prior network structure	.670*** (.139)
AIC	-32.16
BIC	-3.31

Markets with more vendors were less likely to experience out-flows to other marketplaces

Markets that had a drop in listing prices were more likely to experience out-flows of vendors to other markets

Out-flows of vendors to other markets tended not to be reciprocated from the receiving market

Vendor flows between markets were guided by the collective patterns of where individuals had moved in the past

*** $p < .001$, ** $p < .01$, * $p < .05$, † $p < .10$

The drivers of vendor flows

Exponential random graph models

Variables	Pre-seizure network	Post-seizure network
Sum	-.233 (.220)	-.824*** (.232)
Market variables		
N vendors - receiving market	-.001 (.001)	.003 [†] (.001)
N vendors – sending market	-.003* (.001)	.004* (.001)
Price change – receiving market	-.009 (.024)	-.040** (.013)
Price change – sending market	-.114** (.039)	-.034*** (.009)
Network variables		
Reciprocity	-.582* (.240)	-.918*** (.189)
Transitivity	.290 (.189)	.854*** (.220)
Prior network structure	.670*** (.139)	.340*** (.123)
AIC	-32.16	-62.36
BIC	-3.31	-33.51

Markets with more vendors were more likely to experience in- and out-flows of vendors

Vendors were more likely to move to and from markets that had price drops

Out-flows of vendors to other markets tended not to be reciprocated

Vendors were more likely to move to markets that had a shared market in common

Vendors were more likely to move to markets where their peers moved to in the past

*** $p < .001$, ** $p < .01$, * $p < .05$, [†] $p < .10$

Digital marketplaces as an ecosystem

Marketplaces are highly connected by vendors who span multiple platforms, and an intervention increased the connectivity of marketplaces

*"i have plenty of backup storefronts already active and my customers will know how to find me not super difficult."
[vendor azon]*

*"I initially got grandfathered into one of the top markets places also known as white house market, thats where all the real players are. From white house i was able to get vendor bond waived on almost every other market place"
[vendor peachmon]*

**Vendor flows
shaped by both
economic and
social forces**

Changes in market demand shaped vendor decisions to move from a marketplace, and which market they moved to

“If I see something that’s a good deal i will buy it just for the sole intention to resell but always bulk listings obviously, that’s how you make money” (vendor akon)

Vendor flows were more likely to occur between marketplaces where their peers had moved to in the past

Limitations and next steps

- Data from vendors who listed stolen data products on darknet marketplaces
- The impact of a single shock
- Distinguishing between **vendor migration** and **vendor cross-use** of platforms



Thank you! Questions?

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