

Traveling the Silk Road:

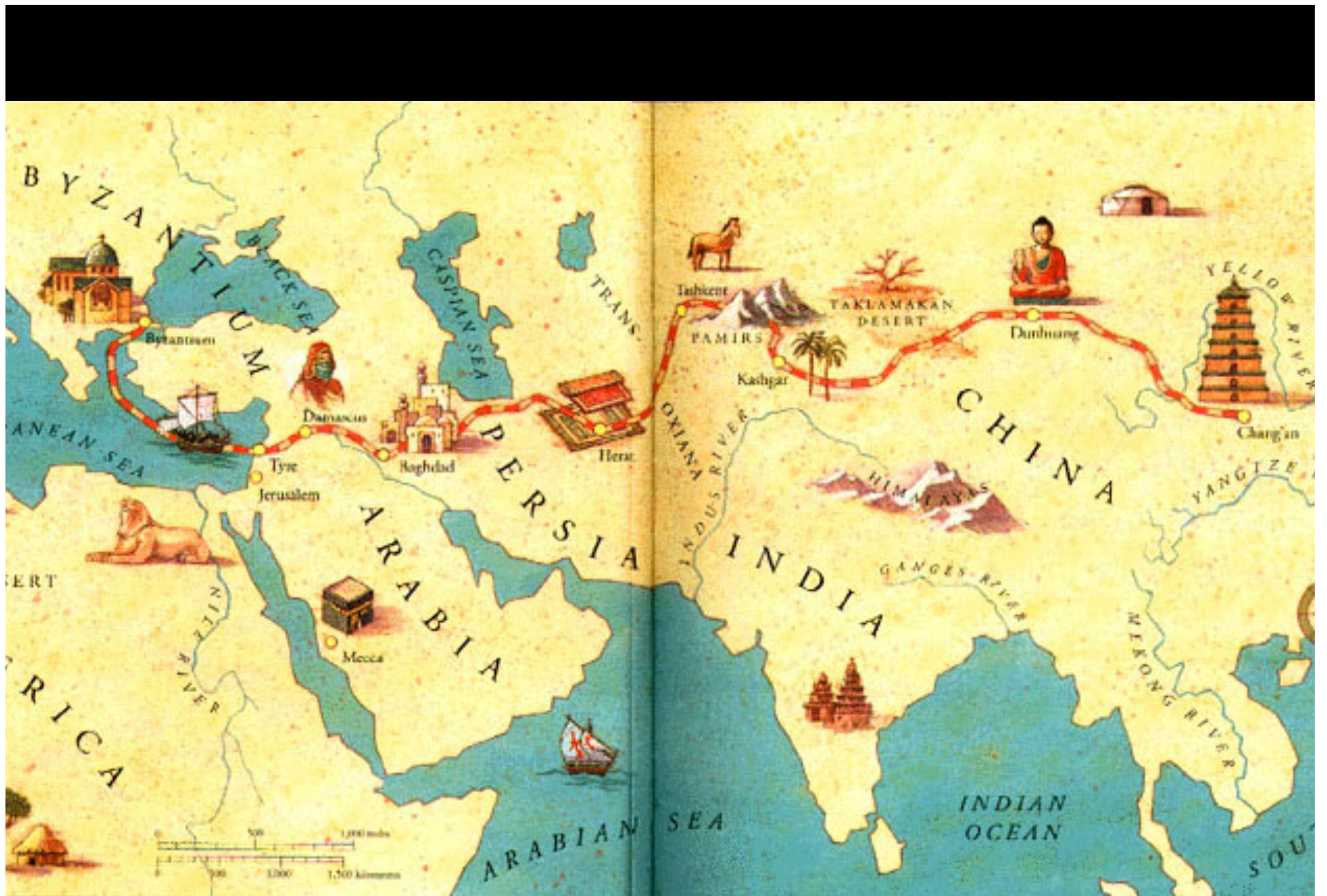
A measurement analysis of a large online
anonymous marketplace

Nicolas Christin

Carnegie Mellon University

INI/CyLab/ECE

nicolasc@cmu.edu



Shop by Category

- Drugs 11,247
 - Cannabis 2,664
 - Dissociatives 269
 - Ecstasy 1,262
 - Opioids 667
 - Other 551
 - Precursors 102
 - Prescription 2,447
 - Psychedelics 1,213
 - Stimulants 1,551
- Apparel 341
- Art 3
- Biotic materials 2
- Books 912
- Collectibles 14
- Computer equipment 74
- Custom Orders 89
- Digital goods 630
- Drug paraphernalia 330
- Electronics 103
- Erotica 626
- Fireworks 15
- Food 9
- Forgeries 158
- Hardware 27
- Herbs & Supplements 11
- Home & Garden 11
- Jewelry 90
- Lab Supplies 53
- Lotteries & games 53
- Medical 44



Royal Customers 10G
₪1.66



Decanoate250, (1 x 10ml = 2.500mg)
₪0.39



XTC Pills MDMA 175mg x500
₪19.28



100g Dimethoxbenzaldehyde
₪1.45



LECKERMANN WEEKLY SKUNK IS BACK STRONG
₪0.52



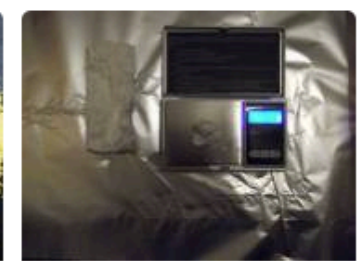
Good Quality Soap Bar | 126g(4.5oz) | UK Vendor
₪2.78



Modafinil 200mg - 300 Pills
₪2.65



0.2g DMT Freebase
₪0.48



1g cocaine high premium quality FLEX - high grade
₪1.32



QUESTION MORE.

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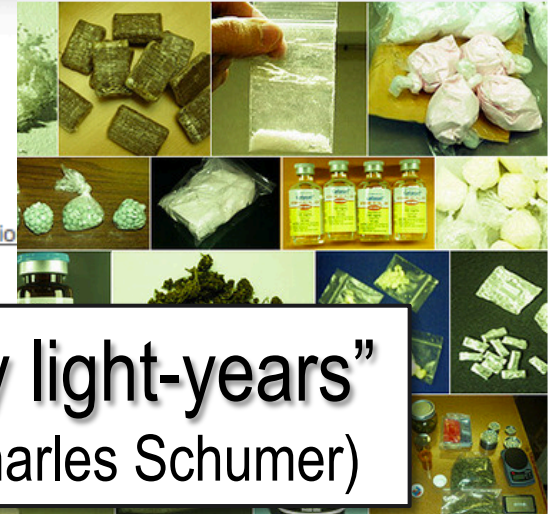
USA → News → Megaupload is illegal, but buying drugs and guns online is okay? ▾

Megaupload is illegal, but buying drugs and guns online is okay?

Published: 31 January, 2012, 00:28

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TOP STORIES



“More brazen than anything else by light-years”
(U.S. Sen. Charles Schumer)



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ALERTS Alert: 14-year-old girl missing

'Silk Road' website called the Amazon, eBay of heroin, cocaine, drug trafficking

...d
You Can
...aginable
...ot dealer sucks.
...ot. What if you

BY ADRIAN CHEN JUN 1, 2011 1:14 PM

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It's Amazon— if Amazon sold mind-altering chemicals.

How can Silk Road survive?

- Tor “hidden service”

- Tor = peer-to-peer network that conceals IP addresses of traffic sources by bouncing traffic around peers
- Website uses Tor to connect to the Internet
- **Only** accessible through Tor
 - .onion address as opposed to .com, .org, .net
- Server is very hard to locate for an attacker



- Bitcoin for payments

- Peer-to-peer, decentralized currency
- Some anonymity (no identity bound to wallets)
 - However the entire chain of transactions is public

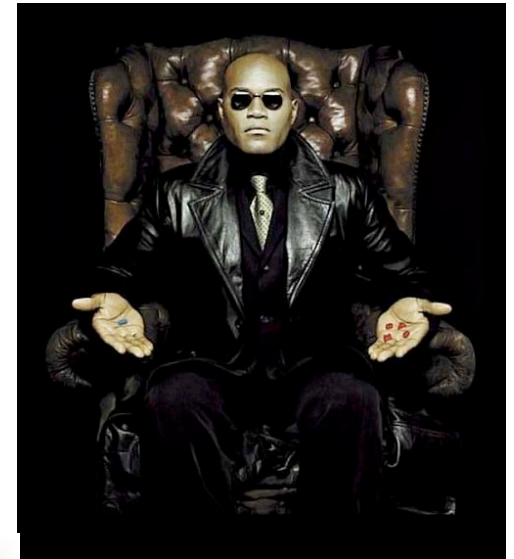
- Marketplace provides escrow mechanism to guarantee transaction completion

- For buyers: Registration free, open to anyone
- For sellers: Relatively modest account fee (refunded after a number of successful transactions)

Silk Road transactions



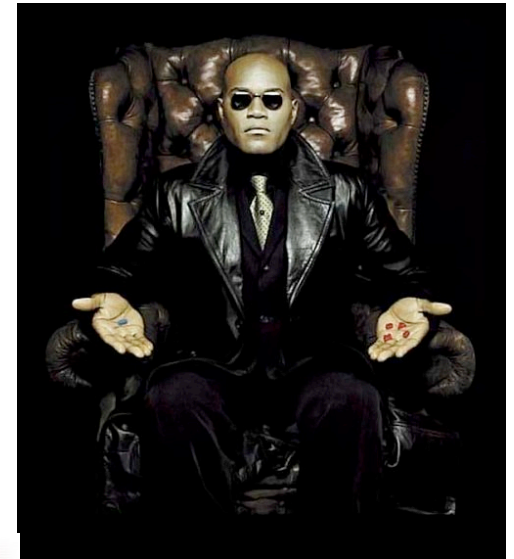
"I'll take the red pill"



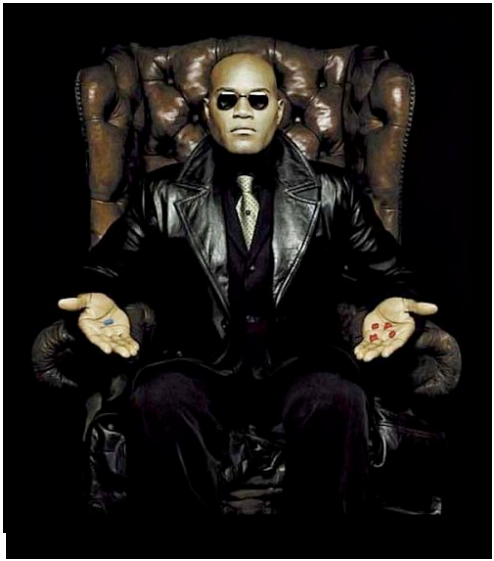
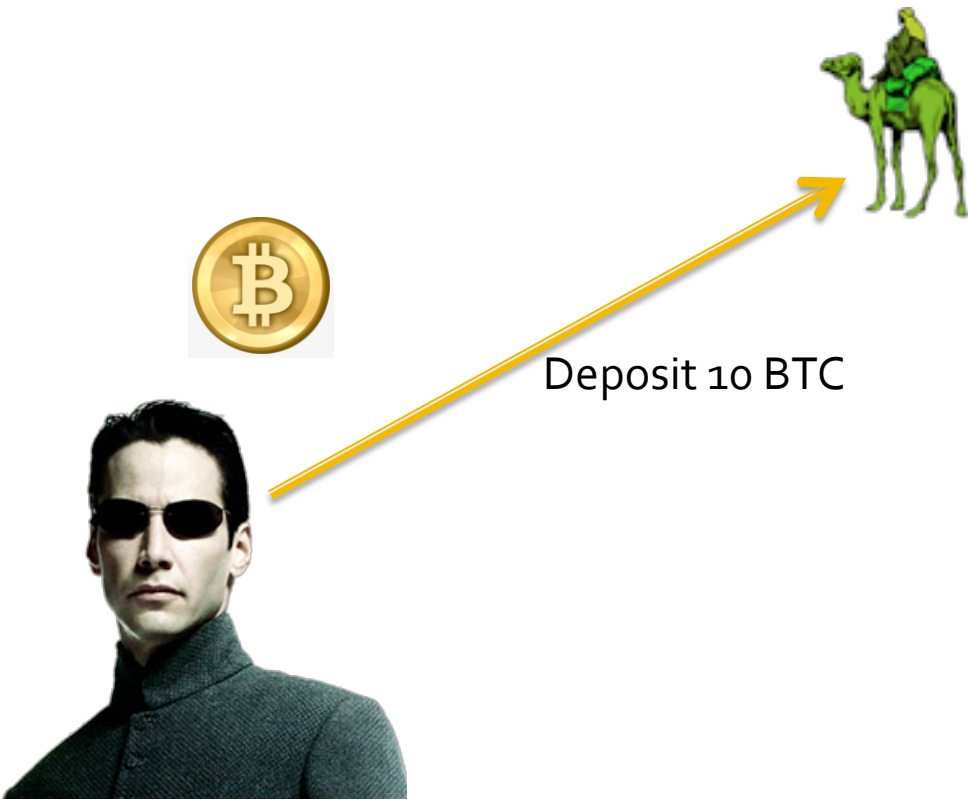
Silk Road transactions



"10 BTC please"



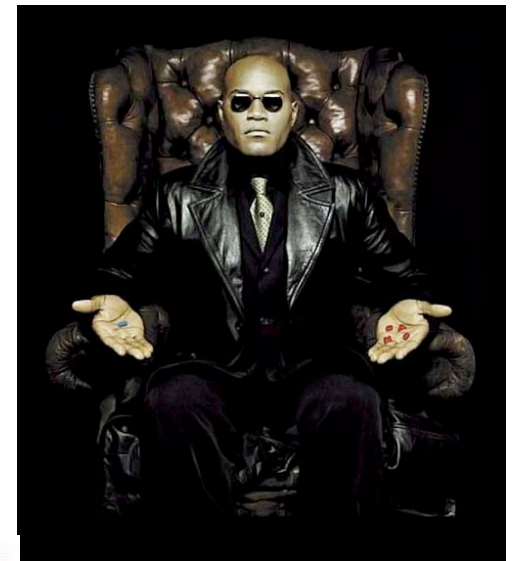
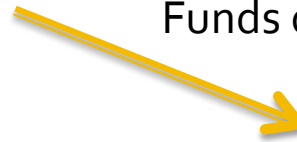
Silk Road transactions



Silk Road transactions



Funds ok



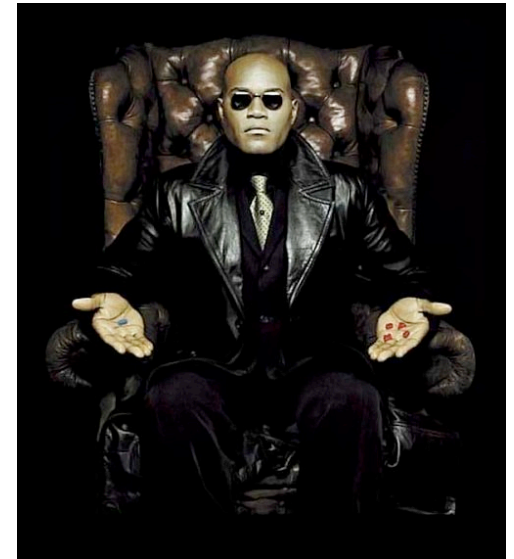
Silk Road transactions



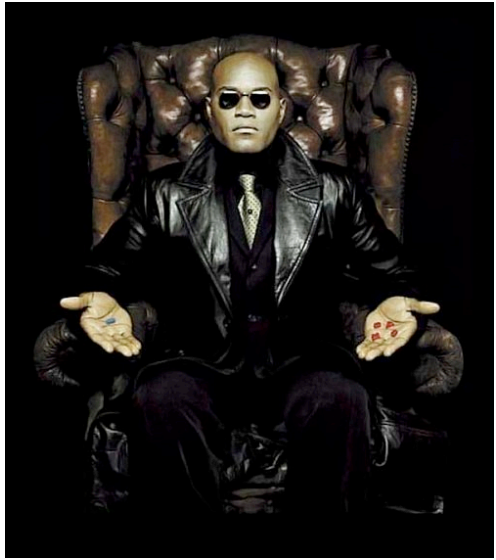
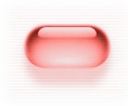
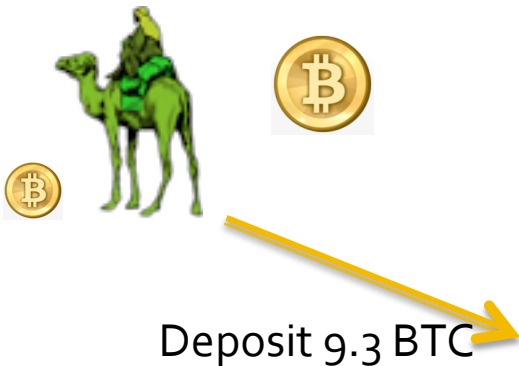
Silk Road transactions



Received
"Excellent seller, would do business
with again. A++++"



Silk Road transactions



Research questions

- **How can we measure activity on this site?**
- **What is being sold?**
 - Exhaustively list items present on the website
- **Who is selling?**
 - Figure out seller information
- **How much are they selling?**
 - Get an idea of transaction volumes
- **What can we do about it?**
 - Explore various intervention policies

Collection methodology

- Test run in November 2011
 - Entire crawl of the site: Did not get noticed
- Daily data collection
 - 6 months (February 3, 2012 – July 24, 2012)
 - Crawl the entire web site using HTTrack (website mirroring tool)
 - Use an assortment of techniques to conceal our activity
 - Random start-up delays, frequent change of Tor circuits...
 - Each crawl took between 3 and 30 hours (average = 14 hours)
 - Between 250MB and 1GB of data
- Parse each page and build database

Collected data

Hacking for beginners

Seller:

hackingtech (98)

Price:

฿0.12

Ships from: undeclared

Ships to: Worldwide

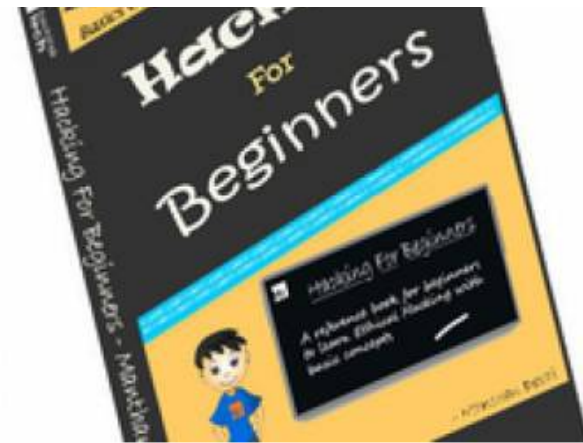
Description:

Hacking For Beginners is a reference book for beginners to learn ethical hacking for free and from basic level to clear all the fundamental concepts of ethical hacking.the book has been prepared by Hacking Tech (www.hackingtech.co.tv) website for the users benefit.so enjoy the book and site...

add to cart

Recent feedback

| rating | feedback | freshness |
|--------|---------------------|-----------|
| 5 of 5 | Fast delivery | 3 days |
| 5 of 5 | Thanks! | 4 days |
| 5 of 5 | Leave feedback here | 9 days |
| 5 of 5 | Leave feedback here | 9 days |



Feedback is mandatory!

➔ Acceptable proxy for sales volume

Collected data

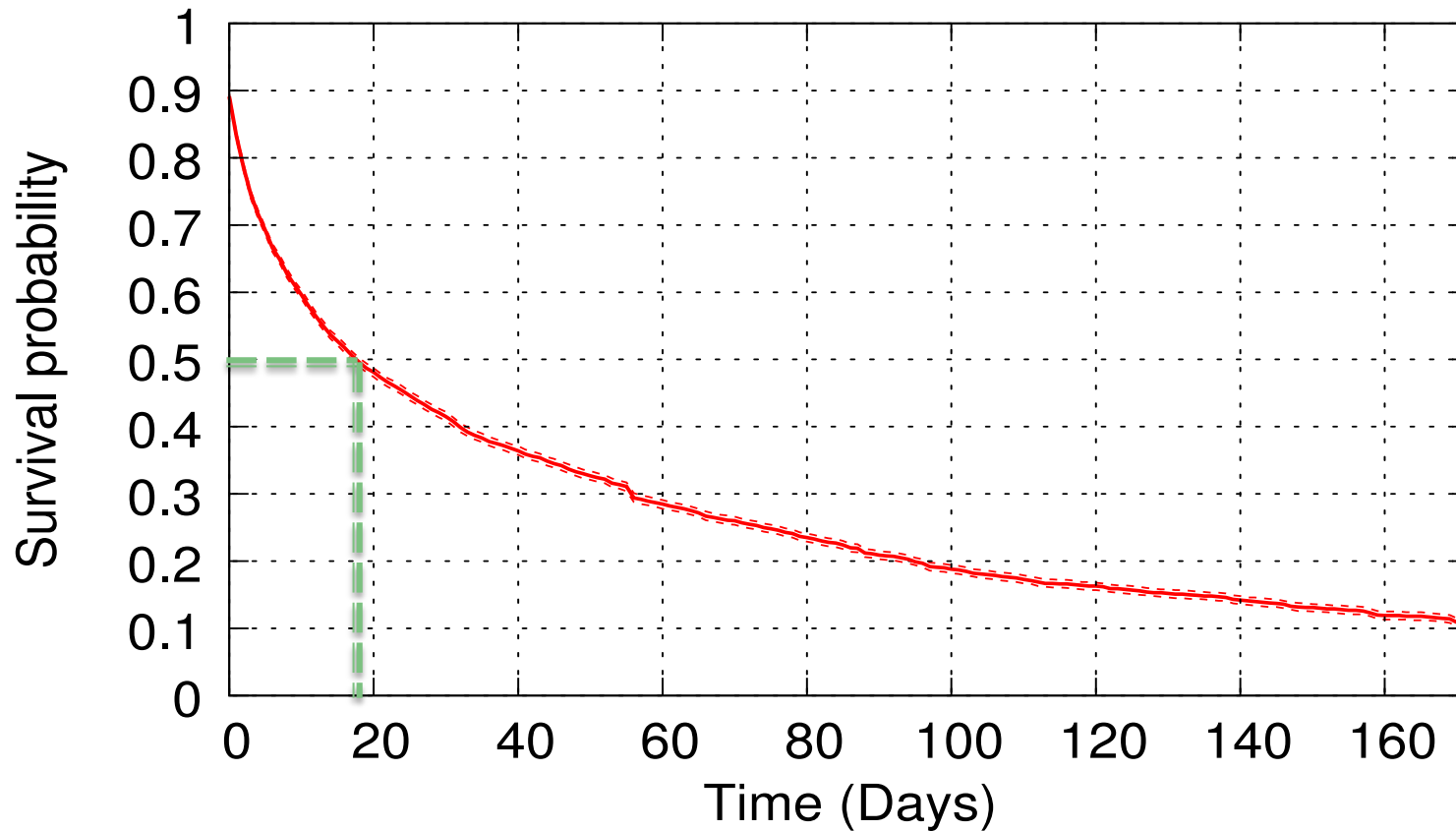
- 6 months (February 3, 2012 – July 24, 2012)
- 24,385 unique items observed
- 1,239 unique seller accounts observed
 - Although far less are active at a given point in time
- 184,804 pieces of feedback (\approx transactions) collected

What is being sold?

| Category (listed by seller) | Number of items | Percentage of all items |
|-----------------------------|-----------------|-------------------------|
| Weed | 3,338 | 13.7% |
| Drugs | 2,194 | 9.0% |
| Prescriptions | 1,784 | 7.3% |
| Benzos | 1,193 | 4.9% |
| Books | 955 | 3.9% |
| Cannabis | 877 | 3.6% |
| Hash | 820 | 3.4% |
| Cocaine | 630 | 2.6% |
| Pills | 473 | 1.9% |
| Blotter (LSD) | 440 | 1.8% |

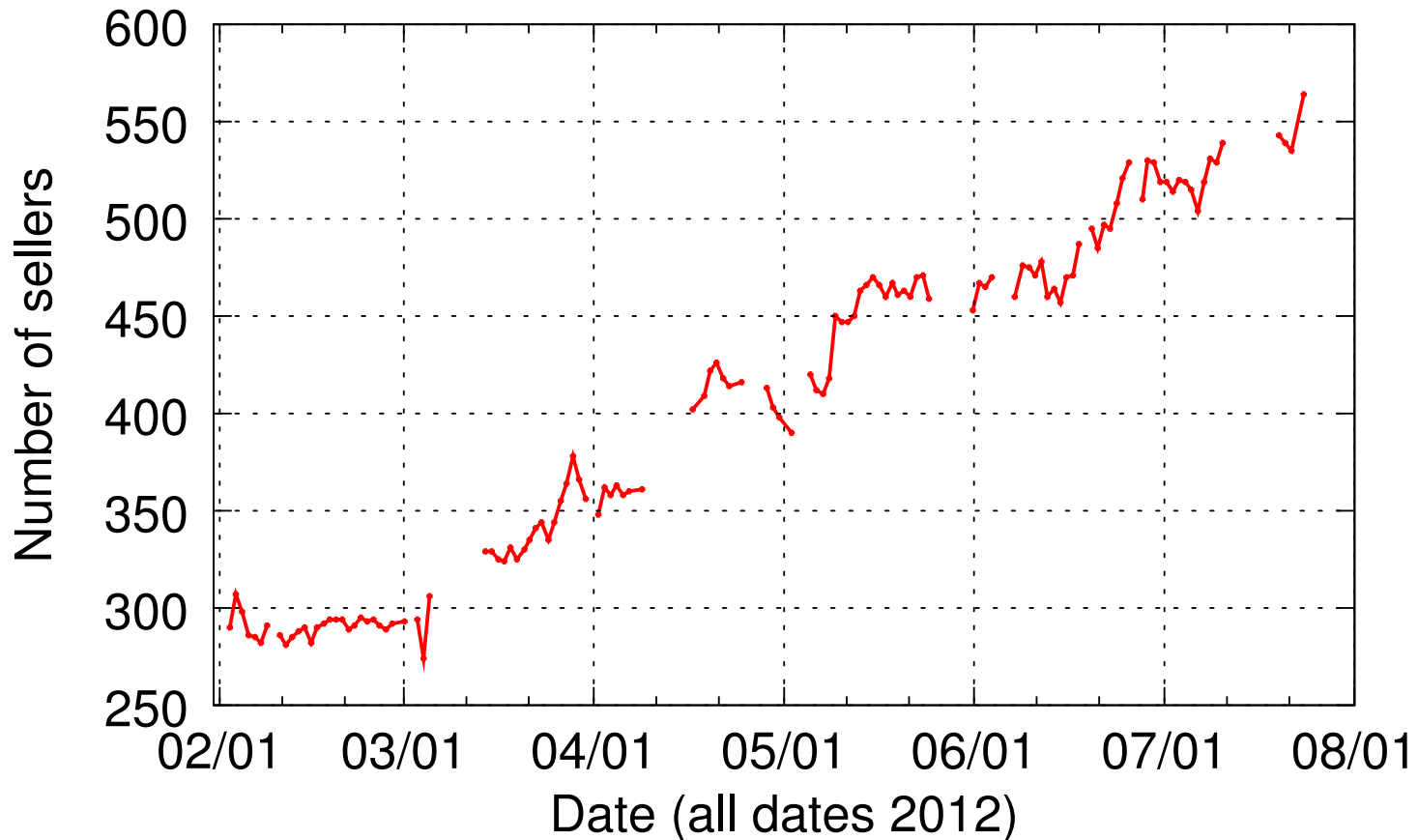
Surprise (not): Silk Road is mostly about drugs, as advertised

Item availability



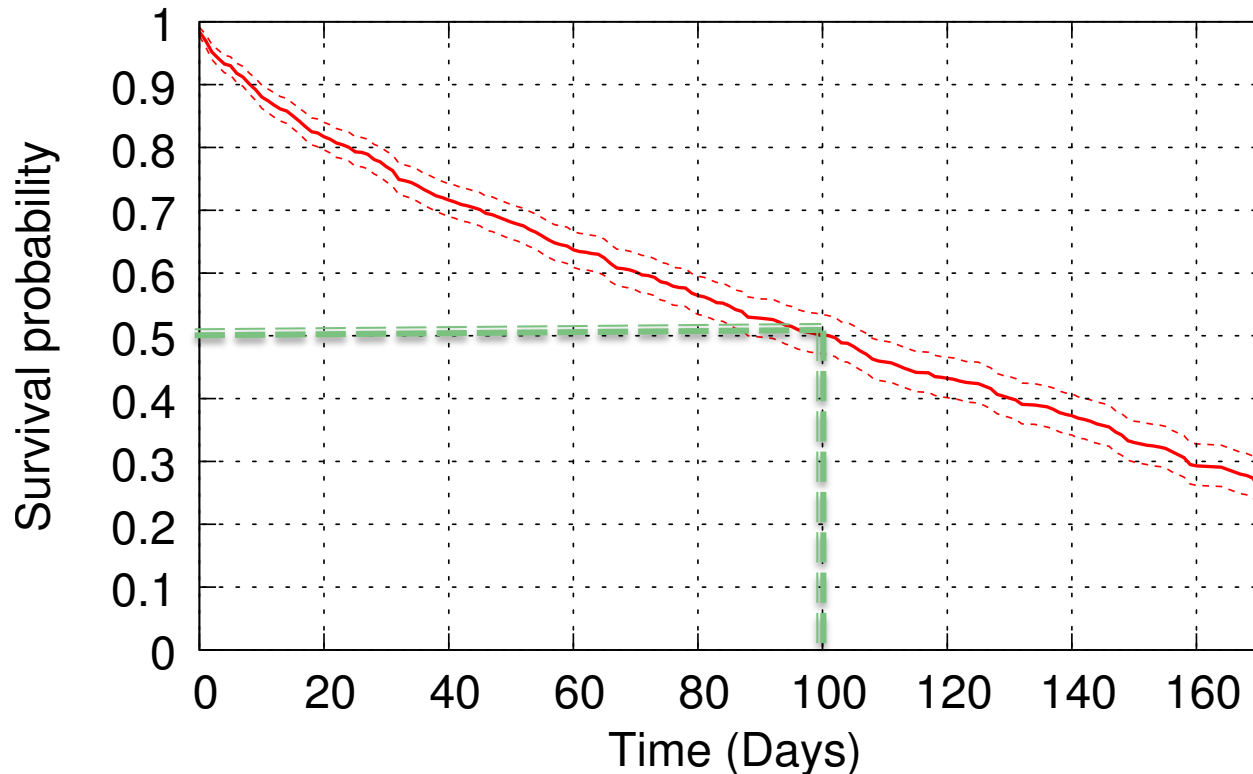
- Fairly rapid turnover
- A lot of items only listed for a couple of days

Who is selling?



- Number of active sellers steadily increasing over time
- Almost doubled during our collection interval

Seller turnover



- 1,397 different seller accounts total
 - But only between 250 and 600 active at a given time
- Relative stability
 - Average "lifespan" is a little bit over three months
 - About 60 "long timers" present over the whole interval

Origins and destinations

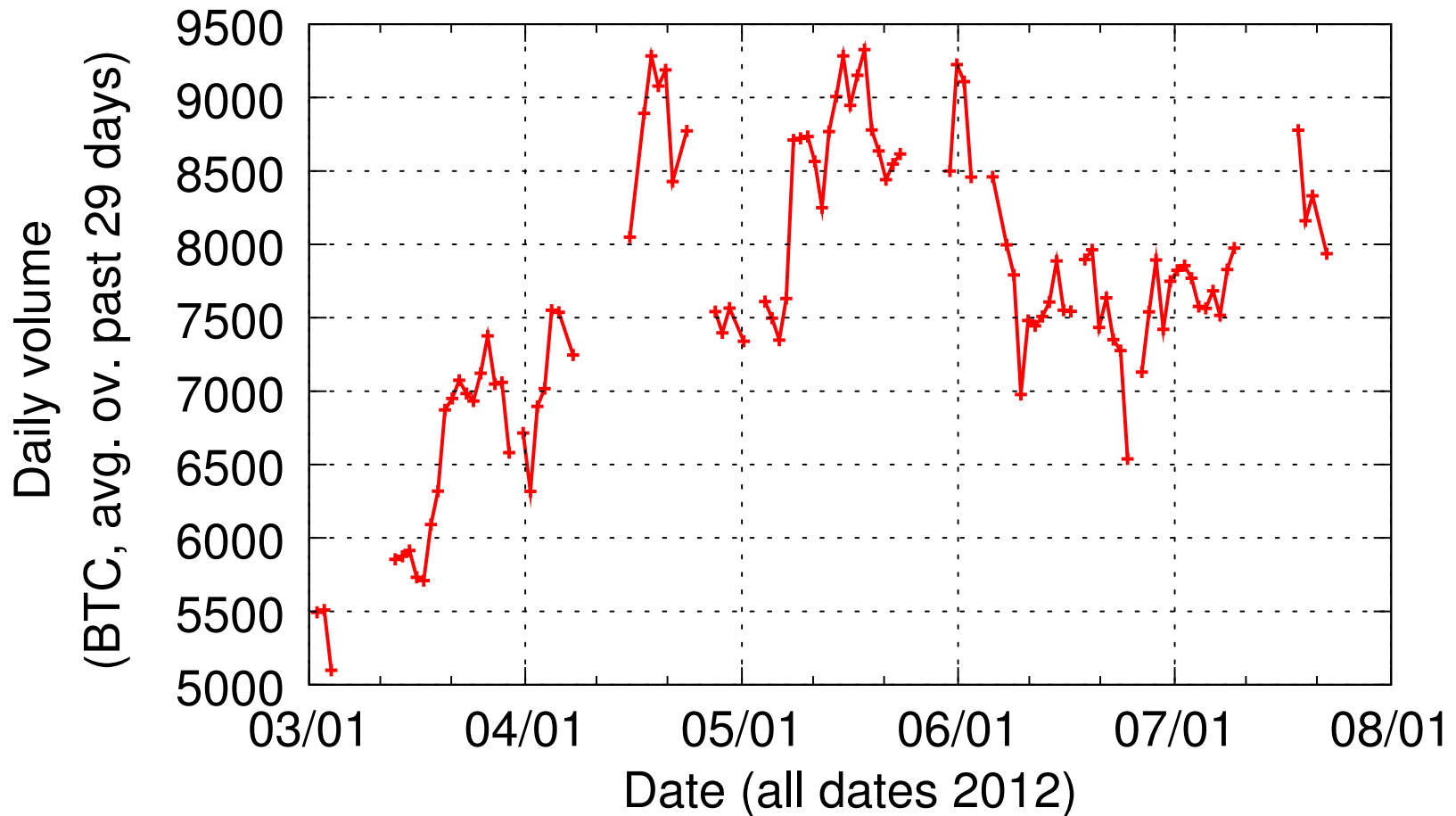
| Country | Percentage |
|-------------|------------|
| USA | 43.83% |
| Undeclared | 16.29% |
| UK | 10.15% |
| Netherlands | 6.52% |
| Canada | 5.89% |
| Germany | 4.51% |
| Australia | 3.19% |
| India | 1.23% |
| Italy | 1.03% |
| China | 0.98% |
| Spain | 0.94% |
| France | 0.82% |

| Country/Region | Percentage |
|-------------------|------------|
| Worldwide | 49.67% |
| USA | 35.15% |
| European Union | 6.19% |
| Canada | 6.05% |
| UK | 3.66% |
| Australia | 2.87% |
| Worldwide, no USA | 1.39% |
| Germany | 1.03% |
| Norway | 0.70% |
| Switzerland | 0.62% |
| New Zealand | 0.56% |
| Undeclared | 0.26% |

How much do they sell?

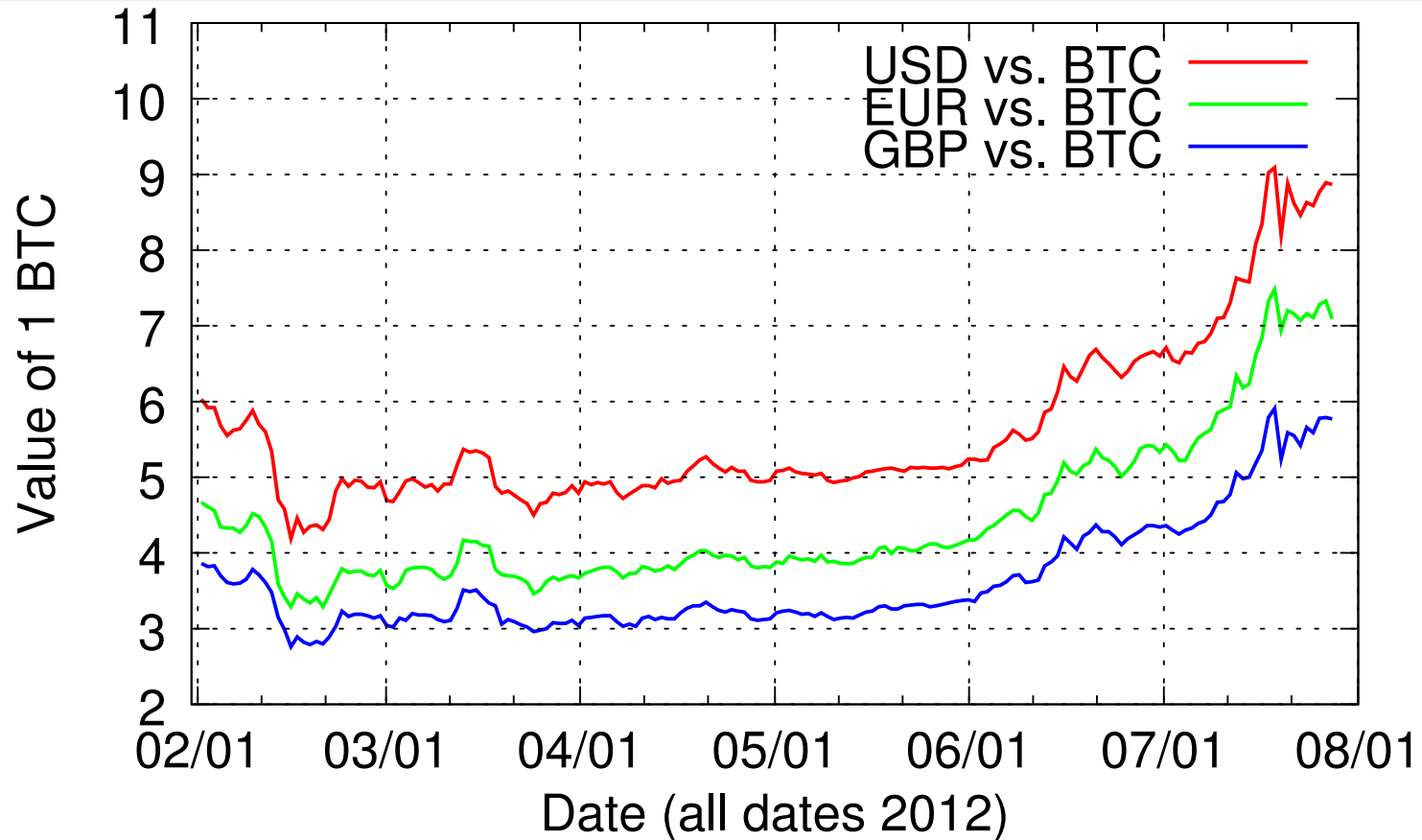
- Sales volume can be estimated from feedback data
- **Assumption 1: 1 piece of feedback = 1 sale**
 - Dishonest sellers may be inserting fake feedback
 - Noticeable behavior, reported in forums → marginal
 - 1 piece of feedback may be equal to x quantities
- **Assumption 2: feedback timestamp accurate**
 - True in the first 24 hours ($ts = n$ hours)
 - Somewhat true in the first 29 days ($ts = n$ days)
 - Completely approximate afterwards ($ts = n$ months)
- **Assumption 3: Feedback isn't counted twice**
 - Very often, buyer leaves feedback at order time, then updates it after reception of parcel; **no way of telling!**
 - Use moving averages over last 29 days

How much do they sell?



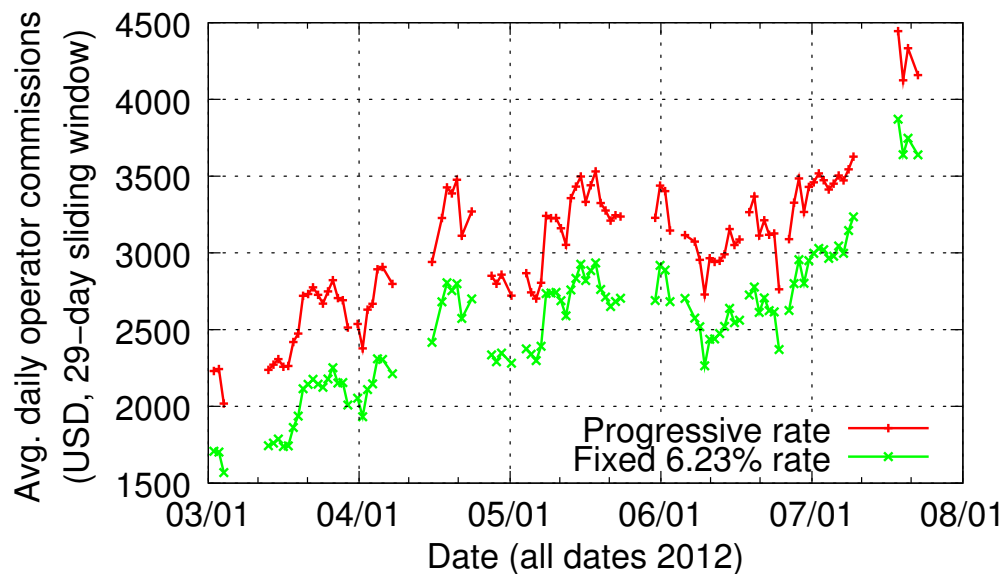
Apparently steady, but...

Bitcoin: A volatile currency



(Side note: went up to \$270 in April 2013, then down to \$70, then back to \$110)

Operator commission



| Item price | Commission |
|------------------|------------|
| first \$50 | 10% |
| \$50.01 - \$150 | 8.5% |
| \$150.01-\$300 | 6% |
| \$300.01-\$500 | 3% |
| \$500.01-\$1,000 | 2% |
| \$1,000.01 + | 1.5% |

- Quite profitable for the marketplace operator
- Expressing amounts in USD (using daily exchange rates) shows **steady increase of sales and commissions**

How much do they sell (redux)?

- Using daily exchange values for BTC and figures reported in previous slides...
 - **Total revenue of the marketplace (1st ½ of 2012) ≈ USD 15M/yr**
 - I.e., combining revenue of all sellers
 - **Total revenue of the operator (1st ½ of 2012) ≈ USD 1.1M/yr**
- **Revenue ≠ profit**
 - Can't estimate expenses
 - Operator: Server(s) maintenance, lawyers(?)
 - Sellers: Bulk prices, packaging costs, ...
 - **No information about profit**
- **It is an estimate!**



What can we do about it?

■ Attack Tor

- Locating hidden services hard...
 - Traffic analysis
- ... time-consuming, lacks precision
 - Unclear you could actually even get a warrant if you managed to get a good idea of where the hidden service is...
 - ... and it could even be a mere proxy to the server
- Denial of Service attacks **a lot** easier – but illegal and easy to recover from

What can we do about it?

■ Attack Bitcoin

- Entire chain of transactions (ledger) available publicly *by design*
 - However identities are zero-cost
 - Mixing makes traceability difficult
- More plausible: adversarial manipulation of currency
 - Bitcoin has high volatility
 - Drops of 50% in value in one day have been seen
 - Very bad for commerce
 - Collateral damage: increasing number of legitimate businesses now accept Bitcoin as well
- Alternative possibility: control exchanges
 - Places where Bitcoins are exchanged to and from currencies
 - Recent FinCEN initiatives

What can we do about it?

- **Strengthen existing police procedures**

- Silk Road = novel retail channel, replaces “weed guy”
 - Only a few sellers sell in bulk
 - Most quantities small



- Supply side presumably still relies on “traditional” channels
- Physical side seemingly more vulnerable
 - Drugs have to be shipped, received
 - Money has to enter/leave the BTC network

- **Strengthen inspection at customs, post-office**

- Not necessarily easy (high volume, stealthy packages)

What can we do about it?

- **Focus on prevention instead?**
 - Reducing demand vs. reducing supply
 - Prevention shown to be more efficient than interdiction (Caulkins et al.)
 - Interdiction costs high here, resilient market
 - Anonymous transactions may reduce violence on the retail side
 - Not the whole story – supply side largely unchanged
 - High user satisfaction shows escrow system works
 - 97% user feedback positive, similar to regular markets (eBay)
- Politically untenable?

Where is this going?



message

1 day 00 hrs 00 mins 00 s

Shop by category:

- Drugs(2788)
- Cannabis(796)
- Dissociatives(48)
- Ecstasy(307)
- Opioids(211)
- Other(98)
- Prescription(541)
- Psychedelics(366)
- Stimulants(235)
- Apparel(28)
- Books(286)
- Computer equipment(13)
- Digital goods(219)
- Drug paraphernalia(74)
- Electronics(17)
- Fireworks(1)



170\$ pecunix

\$39.23



1 OZ of Jamaican Oil

\$73.91



20 Grams of MDMA crystals

\$124.60



HYDRO 10/325 NORCO/LORATAB

\$1.79...

April 19, 2012



Silk Road
anonymous market

messages 0 | orders 0 | accou

Search

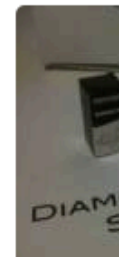
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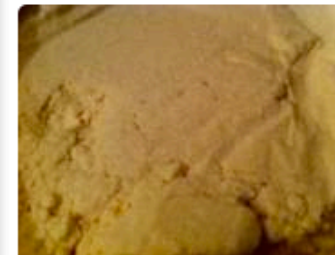
Royal Customers 10G

\$1.66



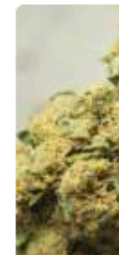
Decanoate 2.500mg)

\$0.39



100g Dimethoxybenzaldehyde

\$1.45



LECKER SKUNK I

\$0.52

May 16, 2013

Where is this going?



Sheep
Marketplace

Forum Help and example

What are you?

illegal a

Atlantis

Users

BlackMarket Reloaded

<http://5onwnspjvuk7cwwk.onion>

Welcome to the BlackMarket Reloaded

Make sure your browser displays the following address in your

If you're unsure, you may use our redirect URL: <http://www.>

In order to enter this site you need either to login or register

Welcome to Atlantis

The new and improved virtual black market. *Cheaper rates, advanced features, ease-of-use, Litecoin and Bitcoin support.* Atlantis has been designed from the ground up to improve on all aspects of competitor markets. We use [Litecoins](#) as

Register

Sign in

Why we're better than the competition:

Cheaper Rates

We undercut all competitor markets to present you with the cheapest rates available online. All

Better Security

We use advanced encryption services to ensure your purchases and sales are safe and

Fan M

Our fan mana with your fav

Summary

- Silk Road: Large, online anonymous market
- Significant revenue, increasing
- Emerging technology (w/ otherwise very desirable uses) enables anonymous transactions
 - Bitcoin, Tor
- Stable, solid, “normal” market
 - ... except for the items being sold, obviously
- Interdiction difficult
 - Traditional policing and increased prevention likely most effective

Web: <http://www.andrew.cmu.edu/user/nicolasc>
Email: nicolasc@cmu.edu
Twitter: [@nc2y](https://twitter.com/nc2y)