Coordination problems in cryptomarkets:

Changes in cooperation, competition and valuation.

Abstract

The new drug markets emerging on the dark net (TOR) have reduced earlier drug market risk factors such as visibility and violence. This study uses economic sociology and transaction cost economics to broaden the present understanding of cryptomarkets. Results focus on three coordination problems characterising illegal markets and how they are alleviated in cryptomarkets. More information and better visibility increase competition, the feedback system enforces cooperation and border control introduces a new cost influencing valuation. Cryptomarkets are formally structured and regulated by rules of conduct and centralised decisions. We argue that the online context circumvents earlier coordination problems in illegal markets, making dark net markets more structurally efficient compared to conventional drug markets.

Introduction

The Internet has paved the way for a new drug market, referred to as the "dark net drug market" or "cryptomarket". Buyers can now sit at home and safely order illegal drugs via their computers, compare prices and products from different sellers, while also avoiding law enforcement agencies. It is also less risky for the sellers of illicit drugs. Although partially a stereotype, physical strength and shady looks are not important in the online world. In cryptomarkets, the characteristics of a successful seller revolve around customer service, knowledge and other conventional parameters associated with marketing. This visibility of drug selling is no longer a threat to either buyer or seller, something that fundamentally changes the organisation of economic activity in open drug markets.

The cryptomarket known as "Silk Road 2.0" has been at the forefront of this development. In 2014, Silk Road 2.0 was one of the largest markets on the dark net (Broséus et al., 2016; Soska and Christin, 2015). After making an appearance on 6 November 2013, the site only lasted one year before the FBI closed it down on the exact same date a year later in 2014. Despite being a separate market, Silk Road 2.0 was based on the original version of Silk Road – the first and largest dark net market for illegal drugs (Martin, 2013; 2014; Christin, 2013; Barratt, 2012; Van Hout and Bingham, 2013a). The original Silk Road emerged in February 2011, growing at an amazing speed with a turnover that grew from around 15 million USD in 2012 to an estimated 89 million USD in October 2013 (Aldridge and Décary-Hetú, 2014). After two and a half years, the FBI shut down the site after it allegedly caught the chief administrator of Silk Road (FBI, 2014). Exploiting their forerunner's success, Silk Road 2.0 adapted the same general design and seemingly many of the same buyers and vendors.

Cryptomarkets are fundamentally different from traditional drug markets and could potentially change the entire global drug industry (Martin, 2013). In this study, we take a

closer look at the top vendors of Silk Road 2.0. Details from vendor profiles, products sites and given feedback are used to describe vendors and their operations, emphasising characteristics such as shipping, products, profiles and branding. We analyse the cryptomarket using a combination of transaction costs economics (Williamson, 1979; Reuter and Kleiman, 1986) and economic sociology (Beckert and Wehinger, 2012; Thorelli 1986). Our aim is to improve comparative studies of illegal drug markets by applying conventional models of economic activity to a dark net context.

Traditional and new drug markets

Illicit drugs, like any other commodity, may be supplied through various market structures. Extending Yar's (2005) comparison of online and offline crime, cryptomarkets can be compared to drug markets. Traditional economic drug market theory has often characterised drug markets along two axes of differentiation: the degree of visibility and the level of distribution. This classification by visibility focuses on how risk management affects the *modus operandi* of drug distributors (Desroches, 2007; Reuter and Kleiman, 1986). It is important for drug markets to achieve the right balance of security and visibility in order to succeed in selling without entailing too much legal risk. A common distinction is made between open or closed drug markets. Street level retail markets are the typical example of open markets. Here, anonymous sellers and buyers meet for a brief moment to exchange drugs and money at competitive prices. Access to customers and drugs is more important than security. In these open markets, systemic and retaliatory violence is used to sanction malfeasance and prevent opportunism (e.g. Topalli et al., 2002; Jacobs et al., 2000). At the closed end, we find social networks in which peers exchange drugs more concealed from law enforcement agencies. Networks require social relationships but are effective at creating trust and avoiding violence (May and Hough, 2004; Natarajan and Belanger, 1998).

Drug markets are often conceptualised as social networks, or informal organisations with no clear hierarchy that excel at building trust between participants (Moeller and Sandberg, 2015). Typical characteristics of networks are fragmentation, absence of monopoly, entrepreneurship and non-hierarchical organisational structures (e.g. Dorn et al, 1992; Wright et al., 1993; Murji, 1998; Paoli, 2002; Coomber and Turnbull, 2007). Social networks are preferred for drug distribution because it is better to have repeated dealings with a trusted supplier than have to find a new one every time (Jarillo, 1988). This interpersonal trust reduces opportunism, but introduces a competition problem due to the narrow range of participants. Where markets are influenced by the invisible hand of the price mechanism, networks are surrounded by an invisible wall that keeps desired participants in and undesirable participants out (Thompson, 2003). There are also other organisational structures in between markets and networks, such as freelancers and corporations (Natarjan and Belanger, 1998; Natarjan et al., 2015) or semi-open markets in pubs (May and Hough, 2004). In this study, we will examine how these basic understandings fit into the cryptomarket, a market that is structurally very different from conventional drug markets.

Characteristics of economic activity on cryptomarkets

Cryptomarkets alleviate some of the problems associated with marketing, violence and risk of legal sanctions. Encrypted communication offers anonymity in a way that has resulted in professionally-run businesses that are based on information sharing. Vendors are dedicated to quality service, which often includes professional communication, visibility on forum pages, competitive pricing, quality products and avoiding disputes, for example (Van Hout and Bingham, 2014; Aldridge and Décary-Hétu, 2014). In this way, cryptomarkets sustain a level of openness that is impossible to achieve in traditional drug markets. Also, trust is not

enforced by threats of retaliation, another reason why customers prefer cryptomarkets (Martin, 2013; Van Hout and Bingham, 2013a; 2013b; 2014).

There are aspects of cryptomarkets that make them both a closed and an open market at the same time. On a more general level, cryptomarkets are also open in the sense that everyone has access to them (in principle), but they are only open for those who are "in the know" and who have sufficient technological knowledge. This makes them more similar to semi-open markets such as pub or club markets (May and Hough, 2004). However, as opposed to the pub or club, the website acts like an intermediary where buyers and vendors trade money for drugs (Christin, 2013). This enables a wide selection of buyers and sellers to assess each other before making a decision, similar to a market in which prices determine purchases. Data from the original Silk Road shows a large number of transactions involving illegal drugs, estimating a continuously increasing turnover of around 1.2 million USD a month (Christin, 2013; Van Buskirk et al., 2013). Other aspects of cryptomarkets are similar to social networks. The seller reputation is the basis for buyer trust (Hardy and Norgaard, 2015), while buyers earn their trust through repeated dealings. This corresponds to the iterative exchanges that characterise networks, except that on cryptomarkets the reputation system formalises the trustworthiness of participants for all to see.

Tzanetakis and colleagues (2015) note that the combination of openness and secrecy on cryptomarkets makes online trust fundamentally different from the interpersonal trust that characterises traditional illegal drug distribution. Illustratively, some researchers refer to cryptomarkets as "marketplaces" on the TOR "network" (Barratt et al., 2013; Christin, 2013; Van Hout and Bingham, 2013b; Dolliver 2015), while others note the interpersonal trust similar as in network structures (Tzanetakis et al., 2015; Norgaard, unpublished). Regardless of categorisations, semi-open or social network, cryptomarkets do

seem to have achieved a balance of low risk and high level of traffic that appeals to both sellers and buyers (e.g. Van Hout and Bingham, 2013b; 2014).

Transaction cost economics and economic sociology

The market structure is important and general theories on the organisation of economic activities can inform studies of drug markets (Bushway and Reuter, 2008; Dick, 1995). Structure is especially important where the costs of running the economic system are high (Williamson, 1979). Illegality makes drug distribution very inefficient when concerning organisation of production and sales. The fear of law enforcement, absence of enforceable contracts, lack of information on the quality of the drugs and the trustworthiness of transaction partners are constant sources of uncertainty in illicit drug distribution. All participants must be compensated financially for the risks that they run (Reuter and Kleiman, 1986).

These costs are different contingent on the structure of distribution. Eck (1995) argues that this implies that drug markets can only take two forms: social networks, or marketplaces where routine activity is the norm. Street level drug markets face risks from law enforcement agencies because of the visibility of the criminal acts and potential violence from competing groups (Reuter, 1983). Therefore, many buyers and sellers prefer social networks because of the lower legal risks. Networks have lower risks but they still have costs associated with the necessary investments in the interpersonal relationship and reputation (Moeller and Sandberg, 2015). These investments make transactions "idiosyncratic" because they become person-specific, which entails protracted bargaining and therefore inefficient competition due to limited transparency (Williamson, 1979). This reduces the overall effectiveness of drug distribution.

Economic theory and economic sociology deal with three main organisational structures of economic activity: markets, networks and hierarchies (Thompson, 2003; Murji, 2007). Real-life organisational forms are flexible and contain elements of multiple forms, but these three ideal types represent a continuum, with markets and hierarchies at opposite ends and networks in the middle. In markets, there are dispersed agents that act on the information of the product price and there is no centre that makes decisions. Networks are self-enforcing and embedded in interpersonal relationships that provide a mechanism for the transfer of information (Williamson, 1981; Thompson, 2003; Thorelli, 1986; Jarillo, 1988). Hierarchies are based on an unequal distribution of power, formal contracts and a decision-maker who resolves disputes. The essence of the hierarchy, commonly understood as a firm, is organisational coordination. This corresponds to the traditional monopoly model of organised crime that Schelling (1967) proposed in which a kingpin controls an organisation top-down. Reuter (1983) refuted this as incongruent with an empirical reality that bears a greater resemblance to "disorganised crime" (see also Murji, 2007; Dorn et al., 1992; Natarajan and Belanger, 1998; 2015; Paoli, 2002; Coomber and Turnbull, 2007). In practice, there are mainly high-risk marketplaces based on social networks that require access. In this sense, drug markets are failed markets.

Economic sociology has described how the uncertainty encountered in illegal markets can be analytically distinguished as three interrelated coordination problems (Beckert and Wehinger, 2012): The *competition* problem concerns the inefficiency that follows from limited marketing; the *cooperation* problem follows from the absence of contractual obligations and legal recourse; the *valuation* of the product is a problem because there is a sharp information asymmetry between seller and buyer regarding the quality of the product (Beckert and Wehinger, 2012). In transaction cost economics, Williamson (1979) specified that frictions in legal exchanges stem from similar types of problems that he conceptualised as

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bargaining costs, enforcement costs and search costs. The difference between these conceptualisations can be explained from their respective overarching themes. In economic sociology the general theme is coordination (Beckert and Wehinger, 2012), while the economic perspective revolves around information, or rather the lack thereof (Dick, 1995). Clearly, effective coordination hinges on the flow of reliable information, so these conceptualisations are easily reconciled. The difference is that economic sociology prioritises the social component more (Beckert and Wehinger, 2012) than transaction costs economics (Dick, 1995; Reuter, 1983; Williamson, 1979).

We use a combination of transaction cost economics (Williamson, 1979; Reuter and Kleiman, 1986) and economic sociology (Beckert and Wehinger, 2012) to analyse how these emerging cryptomarkets solve the inherent coordination problems that characterise illicit drug distribution. Our aim is to gain a better understanding of dark net markets and how they differ from traditional markets by linking the growing cryptomarket research to broader research into the organisation of illegal drug distribution and economic activities.

Method

The main data in this study comprises the top twenty vendor profiles from Silk Road 2.0 and their related product sites and customer feedback. More precisely, 562 screenshots of with textual data and images made on 15 September 2014. At that time, the second version of the Silk Road market had existed for almost a year since its initialisation on 6 November 2013. The bestselling list was arranged by the website and represented vendors with most sold products. The list differed greatly from one day to another, so the vendors that have been analysed are a randomly selected sample taken at the time. The top twenty vendor profiles had some of the most descriptive profiles, which provided an insight into who the main vendors on Silk Road 2.0 were and how they interacted with other market participants. Additional data

from other markets and forums were collected simultaneously for a larger netnographic (Kozinets, 2010) study to analyse the general market structure of cryptomarkets (Bakken, 2015). These netnographic observations informed the researchers in this study, but is not used as the main data for the following analysis.

Basic details of the sample were collected from the information box submitted as the key information on the vendors. This information included a vendor score based on comments and feedback, the length of vending, last seen, number of listings, and to where and from they were sending the shipment. All of the vendors had been active for a long time and twelve of them had been present from the beginning of Silk Road 2.0 (eleven months). Seven of the other vendors had been on Silk Road 2.0 for ten months while one had been present for eight months. They were active sellers in this cryptomarket, and while eighteen of the vendors had been on Silk Road the same day as the screenshot was taken, the remaining two had been present the day before or two days previously. Many of the vendors also kept an "update" part in their profile, where they left the latest news, requiring frequent visits.

The 20 vendors had a relatively high vendor score, indicating they were successful sellers. The vendor score is the average result of all product scores. Out of a hundred points, the lowest score was 85 and the highest score 97, and the average was 91.9. They also had a high number of listings, meaning the amount of product sites for which the vendor was in charge. The vendor listings ranged from 5 to 137, with the average listing below 50, where they offered a variety of drugs (see Table 1).

[*INSERT TABLE 1*]

Moreover, 65% of the vendors were selling from English-speaking countries: six from the United Kingdom, five from the United States, one from Australia and one from Canada. The last seven vendors listed EU countries as their origin: three from Germany, two from the Netherlands, and two stating only "EU country" on their product sites. All product sites

contained specific information about shipping, including product price, shipping destination and expected time of arrival. Fourteen of the vendors shipped worldwide. Four only sold domestically in the US and Canada and one domestically in Australia, while the last vendor wrote "undeclared".

We analysed vendor profiles and their connected feedback and product sites qualitatively as case studies (Bryman, 2012). Silk Road 2.0 required specific information in assigned information boxes something that resulted in that information such as shipping information and products was present in all twenty profiles. While these spots demanded only a minimum of information, the profiles and product sites were often used by vendors to provide more detailed information about shipping, geographical location and price. This was compared across the sample to see how it differed among the vendors. The more general information was then supplemented with information written by the vendors themselves in the profile text or product sites., The vendor profiles included descriptive information about who they were as vendors, how their business was organised, and what they had as their ethos or strategy for sales. Both profiles and product sites were analysed by examining vendor presentation, production updates, expressed vendor movement to other sites, product presentation and shipping details. We have focused on information about the product, the vendor, and organisation, including presentation form and information.

In this article, we use selected data from Silk Road 2.0 to explore a larger structural theory about illegal markets – and look at differences between cryptomarkets and legal businesses and economies. The main limitation of our approach is the focus on the top twenty vendors.This leads to an uneven balance of successful vendors, maybe exaggerating the functionality of these markets. Comprising less successful vendors might have provided a different picture. While acknowledging this limitation, we note that the successful vendors were very active, had many sales and invested much in the running of the market. Another

limitation is that the comparison to traditional illegal drug markets is based on available literature and theory. This makes our argument about the relative effectiveness of online and offline drug markets a suggestive one that needs further investigation. We still believe this study points to important structural differences in drug markets that can, and should, be explored theoretically.

Results

In cryptomarkets the coordination problems of traditional drug markets – competition, cooperation, and valuation – (Beckert and Wehinger, 2012) are resolved in new ways. Competition is more intense, involving a multitude of exchanges and comparable prices. Cooperation is improved through a formalised trust-building system instead of violence or interpersonal trust. The most important indirect costs influencing the valuation problem is a change from law enforcement to border control. Below we go into details on each of these coordination problems, describing vendor profiles, feedback system, products and risks in cryptomarkets.

Competition

The absence of competitive structures is one of the main coordination problems in illegal markets (Beckert and Wehinger, 2012). Conventional drug markets are structurally inefficient because there is an absence of state-sanctioned rules protecting participants from price cooperation, limits on offering products openly and a lack of information when comparing levels of service, prices or product quality. The fragmented structure and trading in personal networks makes competition in illegal drug markets inefficient (Arlacchi, 1998). Williamson (1979) refers to this as the bargaining costs that are a consequence of idiosyncratic transactional relationships. Cryptomarkets seem to change competition dramatically and be

more efficient. The encrypted dark net makes it possible to advertise products openly and establish websites for sale, thus formalising structures that increase competition.

A visible drug market

An important element of cryptomarkets is profiles offering a presentation of the vendors, their products, and services. As mentioned in the method section, Silk Road 2.0 offered an information box providing basic information on all vendors. It included vendor score, length of vending experience, last seen, and from/to where the vendor ships. Most vendors then used their profiles to clarify their own rules regarding how to order goods, shipping time, refunds, delivery information, etc. Eighteen of the vendors started their profile with a news update, providing information of particular importance. This could be news about the latest batch on sale, problems with the site or shipping, and new shipping rules or banned countries:

> 26.06.2014: New reship/refund policy for customers from Australia. (…) This is due to many "fresh" Australian orders being recently reported as lost. Surprisingly, orders arrive just fine for the old customers, even when sent on the same day (…). Sorry guys, (…) but we have to protect ourselves from scammers somehow, since we already lowered our profit margin to provide affordable prices for our wares.

Being able to provide this information reduced the inventory problem experienced by drug distributors in conventional markets (Moeller and Sandberg, 2015; Aldridge and Askew, 2017). It was crucial for business to be considered trustworthy and provide accurate information (Van Hout and Bingham, 2014). Vendors had to create an image of themselves as responsible vendors selling a quality product with a satisfactory level of customer service.

All of the top profile texts were written in a service-minded mode: polite, formal, and informative:

> *9/13/2014 - All items in stock. Some orders received between 9/2 and 9/8 shipped on 9/13 because of the back to school rush. Huge apologies to anyone who has been delayed and thank you for being patient!*

The profile was not only important in presenting their business; it was also a way to protect themselves from negative feedback, low scores and bad reputations. Despite the generally polite tone, eight vendors also displayed a rough tone in parts of their profile, telling their customers to contact them personallyt in private messages if they experienced problems. Thirteen vendors also instructed buyers to read carefully the profile before placing an order. This was to limit the number of questions or misunderstandings, and related negative feedback.

Increased competition

The numerous suppliers in cryptomarkets increase competition (Van Hout and Bingham, 2013a). Silk Road 2.0 had around 450–550 vendors actively selling illegal goods (Munksgaard et al., 2016). The top vendors offered a great variety of merchandise but had to compete for buyers' attention. One way of standing out was to highlight particular aspects of the business. A popular method was to show closeness to the product by describing a private production process. One of the vendors specialised in liquid mushrooms and provided this detailed description of how to produce a potent drug:

These are regular hallucinogenic mushrooms (Cambodian and Golden

Teacher races) that I've grown myself, dried, pulverized, then used an

ethanol alcohol extraction method with a specialized funnel over multiple

washes, and finally controlled evaporation down to desired potency. It's a

time-consuming process, and takes about a month to do it right.

The same vendor also stated being a user and gave advice on dosage and warnings of what

could go wrong. Another vendor stood out by selling homemade THC-infused sweets. This

was also the only vendor out of twenty vendors who had a nickname that indicated the vendor

was a female, possibly indicating that emphasizing being a woman was a way to stand out in

the crowd. Other vendors used large figure decorations made out of symbols, or images of

drug tests to draw attention to themselves.

Making communication in the profile personal was a widely used strategy

among vendors. Half of the vendors presented themselves as single people, referring to

themselves as "I" throughout the profile. Three of these switched between "I" and "we",

where one mentioned he had a team with him. The remaining half only referred to themselves

in the plural. This might point to a variation among the vendors on Silk Road 2.0, in which

some of them ran their own business, while others worked in teams. It could also be a result

of division of work, where one person could be responsible for communication and

administrative work on the cryptomarket, while others produced, packaged and shipped the

drugs. Eight of the vendors emphasised the high volume of inquiries. According to the

profiles, one way to make the organisation more effective was to divide the operation into

different work tasks.

The Silk Road vendors worked hard to establish their user name as a product

brand. They invested a lot of effort in protecting their user name from negative feedback and

from being misused by others, such as this vendor defending himself from hurtful feedback: *"Remember we are the good guys. Don't go away feeling done over or wronged without having a chat with us. We will do our best to make it right"*. A way of protecting themselves was to prefer returning customers, which also helped reduce the effect of competition. Not only was their user name used frequently throughout their profile and product sites, they also tried to claim a monopoly on the same names in the forum and on other dark net markets. If someone "stole" their name and presented products under the same or similar name, vendors were quick to defend their brand in their own profiles.Such as this vendor clarifying his/her existence on different markets: *"We are only active on Silkroad 2.0 and do not vend on any other markets at this moment. We are no longer active on Agora (…). We have never been a vendor on Evolution or Drug Market."*.

Through vendor profiles, private messages and discussion threads, drug consumers and manufacturers can now communicate directly (Martin, 2013; Christin, 2013; Barratt, 2012). Seven of the twenty vendors stated to produce their own products. A possible direct contact with manufacturers means that consumers can receive purer drugs and more information about the drugs they are using, potentially reducing the harm of drug use (Barratt et al., 2013; Van Hout and Bingham, 2013a). Silk Road is not only a "business-to-customer" market, it is also a "business-to-business" market, indicated by the large quantities that are sometimes sold (Aldridge and Décary-Hétu, 2014:16-17). This willingness to sell larger amounts demonstrates that the cryptomarket structure has proven to be effective at securing transactions, reducing opportunism, while maintaining competition between vendors. The welinforming vendor profiles on Silk Road provide a platform for offering products openly, as well as offer detailed information when customers compare levels of service, prices and product quality. This indicates that cryptomarkets make price cooperation more difficult, possible offering a more competitive structure than other illegal drug markets.

Cooperation

The second coordination problem in illegal markets is cooperation, or the absence of contractual obligations and legal recourse (Beckert and Wehinger, 2012). In legal markets, the state and its institutions seek to create trust between economic actors because this will improve efficiency and growth. Not only do illegal markets operate independently of a centralised-authority state, they also operate against the state - and this generates much uncertainty compared to legal transactions (Becker and Wehinger, 2012). In illegal markets, cooperation is based on networks, interpersonal trust, threats of violence and reputational concerns, which all require investments of various kinds (Moeller and Sandberg, 2016). Williamson (1979) describes this as enforcement costs, which are the expenses associated with securing the transaction. This can be understood as a question of asymmetric information, because only the seller knows if he is trustworthy and will deliver the product agreed upon. Compensating for the risk of cooperation problems leads to market inefficiency and a price increase (Reuter and Kleiman, 1986). With centrally regulated, formalised and effective forms of promoting trust and reducing uncertainty for all participants, the cooperation problem is reduced (Beckert and Wehinger, 2012).

Formalising reputation

The feedback system was an essential function of Silk Road 2.0 when customers confirmed they had received the drugs. It was a formal system introduced by the site administrators to avoid scammers among both vendors and buyers. The vendors were ranked according to stars (1–5) and a short comment, such as: "*Great stealth and the product was good. Just would have liked a faster shipping.*" On cryptomarkets, drug listings are public and communication is encrypted and anonymised. Using reputation scores has made it possible to formalise and

spread reputations publicly (Tzanetakis et al., 2015). By introducing market rules like the feedback system and actively using sanctions such as excluding vendors, the administrator actively regulates market behaviour.

The feedback system is crucial in ensuring a basis for cooperation. For example, when sellers did not live up to the standards of their advertisements or buyer expectations it was easy to file a complaint for all to see: "*Your gear is shit and you sent me crap! I demand a 250% refund or I'll tell the forums!*" By reading feedback, other buyers could easily distinguish between vendors they wanted to do business with and those that would be best avoided (see also Décary-Hétu, Paquet-Clouston and Aldridge, 2016). Feedback was usually directed towards vendor, product, shipping, or communication between the buyer and the vendor. Most buyers had tried the products before leaving feedback, or used different tests to check the quality. Many wrote "*perfect as usual*" or "*never had any problems with this vendor*", suggesting that they were regular customers.

The negative feedback about possible scammers was particularly important. The reasons for complaints were usually that a package had not arrived – or had not been sent at all. The product may also not have lived up to expectations or smelt differently than it should. The vendors in this study had high feedback scores and were seldom described as outright scammers, but were still sometimes accused of occasionally hustling in comments such as: "*Did not receive original order or resend. Selective scammer*". A selective scammer was a vendor who sent packages and carried out normal sales with most clients but then chose not to fulfil certain orders by stating that they had been lost in the post.

Feedback is also an important mechanism for securing trust in legal online markets and has a great impact on sales (Houser and Wooders, 2006). Without traditional trust based on location, inspections and long-standing reputations, online stores have to establish trust by providing more information about seller and products, and public feedback

(Resnick and Zeckhauser, 2002; Resnick et al., 2006). The feedback system creates a more fluent and efficient market and makes rich networks an important factor to succeed (Décary-Hetú and Dupont, 2013). Both the administrator and vendors encourage buyers to leave feedback, in statements such as: "*Can everyone who orders please leave feedback! We need it to make this community work, currently only about 10% of customers are actually leaving any feedback.*" Without the buyers' involvement in these reputation standards, such formalised systems of trust in cryptomarkets would not work. Equally, the feedback systems make it harder for new vendors to become established and, as in legal markets, they should expect to invest a lot of time and effort in establishing a reputation when entering the market (Fan et al, 2013).

The feedback system in cryptomarkets is a formalised way of building trust (Tzanetakis et al, 2015) that shares many similarities with contractual arrangements found in legal markets (Houser and Wooders, 2006). Site administrators sanction vendors who repeatedly infringe on the rules and the feedback system motivate vendors to provide high-quality products and good customer service to optimise outputs and market flow (Van Hout and Bingham, 2014). Negative feedback can potentially ruin a business and force vendors to be service-minded and communicate in a friendly and open way with buyers. In conventional drug markets, drug sellers also gain a reputation for how they conduct their business and sellers with a good reputation attract more customers (Moeller and Sandberg, 2016). Cryptomarkets can sanction malicious peers at a very low cost because they only lose their business, as opposed to also risking violent retaliation or snitching, as in the traditional drug markets. In the cryptomarket under study, the drug seller reputation is formalised through the feedback system in a way that ensures trust and makes cooperation easier. This hierarchical characteristic suggests that they are more structurally effective than traditional drug markets.

Valuation

The third coordination problem in illegal markets concerns the process of classification and comparisons, influencing product valuation (Beckert and Wehinger, 2012). Akerlof's (1970) classic lemon problem is particularly relevant to illegal drugs and highlights how uncertainty about product quality influences valuation. Lack of market visibility makes it difficult to assign value to certain categories of goods and to see the different value of heterogeneous products within the same market. The valuation problem can also be understood in terms of search costs (Williamson, 1979). Many transactions in illegal markets take place because the customer is desperate for the product and lacks alternative dealers. The network structure that typically characterises illegal drug distribution is a response to these problems. The transparency of cryptomarkets (Tzanetakis et al., 2015) attenuates the coordination problem associated with valuation. It also introduces new uncertainties, because sometimes shipments do not arrive as agreed.

Product presentation and shipping

Online anonymity in cryptomarkets has made it possible for vendors of illegal drugs to present their products openly, making product valuation easier for customers. Information and the use of commercial tricks such as jargon, appealing pictures and weekly deals or discounts is common. This is one example of how vendors advertised their products:

> *Listing is for 1 gram of [vendor name] 95–99% MDMA. The connoisseur's first choice, the best quality, the strongest potency, the ultimate seduction. (…) Flawless delivery rate – Buy with confidence!*

When entering the profiles, the headline and product picture is the first thing that catches the customers' attention. Most headlines include type of drug, quantity, brand name and a descriptive factor such as "*pure*", "*raw*" or "*amazing*". All vendors had product pictures, often including a sign featuring their vendor name, or common objects such as coins to prove the product size.

The business strategies of the vendors in this study differed. Most sold multiple drugs, the average was 2–4 items, but a few listed up to eight different types of drugs (see table 1). Pure MDMA and cocaine were the most sold drugs; both were sold by half of the vendors. Seven vendors sold one drug exclusively. This might have been the only drug they had access to although some described this as a desire to specialise in certain drugs in order to offer a particular kind of expertise. Others expressed an empathy with their specific product, such as this vendor selling homegrown cannabis:

> *I'm a small farmer who grows his herb with care and has the medical user*
> *in mind. So clean, healthy and potent cannabis. Supplied also to local*
> *clinics. This is a passion of mine and I enjoy providing this wonderful plant*
> *to others to enjoy and utilize in whatever way they choose whether*
> *recreationally or medically.*

All vendors offered different quantities, either in grams or numbers of pills, showing that Silk Road 2.0 was used for different purposes such as personal use, social dealing and resale. The usual amount of cocaine, marihuana, MDMA crystals etc., was 1-gram packages, while multiple vendors also sold 5g and 10g on their top 5 list. Vendors selling pills or capsules usually sold one or two, but also sold up to 25 or 50 pieces. The biggest shipment offered was

100g of amphetamine paste, which indicates there were buyers aiming for reselling the products they bought. Larger amounts made the price lower per gram or number of pills, while drug strength and destination additionally affected the price. Buyers could therefore choose to spend more money for quality, or less for quantity. As Table 2 shows, the prices of 1g MDMA varied from 22€ to 211€, where a domestic Australian vendor had the highest price. When selling larger quantities, about 0.5-1g was given freely when buying 5g, and even more at 10g.

<center>*<INSERT TABLE 2>*</center>

The product sites included a detailed description of shipping, split into destinations and prices. The shipping categories were usually "Europe/EU countries", "USA/Canada", "Australia" and "Other parts of the world". Six only distinguished between international and domestic shipments. The expected time of arrival depended on the country of origin. A shipment to Australia and New Zealand took the longest while Scandinavia expanded the shipment duration compared to mainland Europe. European vendors often guaranteed a next day delivery by domestic post, combined with a detailed shipping schedule and fixed deadlines for incoming orders, like this UK vendor:

> *UK CUSTOMERS – all items will be sent by Royal Mail First class. Items ordered before 1pm will be sent out on the same day, order made after will be sent out the following working day. 60% of the time it will arrive the next working day, but if not then usually the working day after.*

In USA/Canada, the expected delivery time for a domestic shipment was longer and most vendors expected it to be around 3–4 days. Some vendors operated with very long time

frames. One vendor stated that it took about 40 days to send to Ukraine, another that packages to Australia, New Zealand and Russia might take up to eight weeks.

The new risks of cryptomarkets

The FBI and other law enforcement agencies have closed down a few cryptomarkets but it is the daily risk of hacker attacks and scams that represent the bigger threat (Van Hout and Bingham, 2013a). Some cryptomarkets have experienced large scams such as the administrator running off with the money held in Escrow (Woolf, 2015; Greenberg, 2013), while others have had external hacker attacks (Hajdarbegovic, 2014). In the vendor profiles and product presentations we studied, sellers were concerned about national customs. Risk-reducing strategies differed significantly when drugs were distributed domestically and internationally. One vendor, for example, changed MDMA from crystal form to powder when shipping internationally. Another reduced the risk by varying the countries they shipped from:

> *Any order to a country outside the Netherlands is now shipped from*
> *Germany for your safety. (…) For security reasons we cannot tell you what*
> *days we ship, but we change it every week.*

The price of shipment varied depending on where it was being sent. It cost more to ship internationally but risk assessment was also important (see also Décary-Hétu, Paquet-Clouston and Aldridge, 2016). Shipping across borders heightened the risk of the package being seized and the recipient being visited by the police. Longer distances also demanded more extensive securing of the packages and many vendors alternated their stealth (method of securing shipment) when shipping overseas. One vendor explained:

The high price of postage for international orders reflects the time, effort and skill, which goes into preparing an international letter. (…) I must stress that international shipping times have always been random (…).

Vendors did not just raise prices depending on these risks but also narrowed down rights of reshipments or refunds in cases where customers did not receive the drugs. A basic refund or reshipment amounted to between 30–100% of the ordered products, but the rights usually required a customer to be a returning customer. Some vendors demanded a total of 8–10 purchases or a minimum spend of 500–600 USD to refund drugs that had been lost in transit.

The risks of scams or rigorous border controls led vendors to restrict their shipping destinations. Nine vendors mentioned high-risk countries where buyers were forfeited their right to ask for their money back or receive a new shipment. Australia and New Zealand were among the top countries not worth the risk because of their tight border controls. One vendor stated: *"We lose about 1 in 20 packages to Australia. This is a considerably higher rate of loss than other areas"*. The Nordic countries were also considered risky destinations and some vendors would not ship to European countries such as Italy, the Netherlands and the Czech Republic. Moreover, the risk of scammers led many vendors to ban countries like Russia and continents/areas such as South America, Africa and the Middle East. Examples of scams could be buyers wrongfully claiming not to have received the goods or complaining about the quality or amount of drugs received, and asking for compensation.

Data from top twenty vendor profiles on Silk Road indicates that cryptomarkets offer many new opportunities that stem from the structural organisation of their transactions, most importantly, making the processes of classifying and comparing products and suppliers more effective than in traditional drug markets. This can reduce the valuation problem in illegal markets as described by Beckert and Wehinger (2012). As opposed to most traditional

illegal drug markets, buyers can choose from a variety of sellers and receive detailed information about products, prices and quality (Bancroft and Reid, 2015). The large variety of drugs offered (Christin, 2013) also provides an opportunity to explore and assign different values to certain categories of goods. The time it takes to order a drug also makes drugs bought in "desperation" less common and customers will typically make a more balanced decision regarding drug purchases than in, for example, an open street drug market. This opens up for more effective solutions to the problem of valuation than what is typically the case in illegal drug markets.

Discussion

The anonymity of cryptomarkets enables direct contact between a multitude of sellers and buyers of illegal goods. Vendors can advertise their products in personal profiles and buyers can provide public feedback and participate in discussion forums. The technological innovation of the dark net has enabled a reduction in the problems of visibility and security that plague regular drug markets. Creating a market with less traditional drug trading problems might lead to a change in the vendor and buyer population, as well as an increase of international drug trade. This innovation has also changed the organisation of illegal drug markets dramatically, enabling more formalised structures with rules and centralised regulation.

Tzanetakis and colleagues (2015) describe the transparency paradox of conventional and online drug markets and reveal how they differ in terms of formalised trust building, conflict resolution and logistics. These three elements are similar to the coordination problems identified by Beckert and Wehinger (2013). For example, conflict resolution can be seen as an aspect of a broader issue of competition. Traditional illegal markets must restrict access to information but cryptomarkets introduce a system of third-party-conflict resolution

that ensures sellers compete for customers on price and service (Tzanetakis et al., 2015). This also reduces bargaining costs (Williamson, 1979) by removing the incentive for either party to act opportunistically. A central authority with sanctioning capacity oversees the transaction. This market structure promotes reliable quality information and fair competition, arguably making cryptomarkets more effective than traditional drug markets.

Building trust is a transaction cost in any kind of economic transfer and it is the essential part of the cooperation problem in illegal drug markets (Beckert and Wehinger, 2012). How this trust and cooperation is established is different for the various forms of economic organisation. Administrators and participants are proactively promoting trust through the market structure in cryptomarkets, because the centralised review system encourages good conduct (Décary-Hetú and Dupont. 2013). The feedback system is an important base for a more formalised way of building trust (Tzantakis et al., 2015), which reduces the enforcement costs as compared to markets (Williamson, 1979) and networks (Moeller and Sandberg, 2015).

Finally, the question of valuation (Beckert and Wehinger, 2012) is also a problem of logistics in cryptomarkets (Tzanetakis et al., 2015) or interpreted as additional costs (Williamson, 1979). Trafficking drugs across borders is the riskiest aspect of the distribution process and therefore the biggest cost component in the price of illicit drugs. In cryptomarkets, national customs and the cost of circumventing them have become the most important indirect costs that add price to the product. Cryptomarkets still remain illegal markets with important risks that increase the cost of the product (Caulkins and Reuter, 1998). The transparency of information on price differences between shipping points and destinations reduces the valuation problem, but the essential uncertainty persists. We note, however, that this is primarily a problem for international shipping and specific high-risk destinations.

In traditional drug markets, hierarchies are unfeasible in the longer run because they are visible and draw attention from law enforcement agencies (Reuter, 1983). Cryptomarkets circumvent the problem of visibility by using encrypted communication and anonymous payments. The cryptomarket structure improves information flows, attenuates opportunism and creates trust between participants at comparably costs (Aldridge and Askew, 2017). While cryptomarket participants sometimes scam each other, they also act together in a concerted way. Transaction costs seem to be embedded in a deeply rooted demand for justice (Ouchi, 1980), where most participants attempt to make the market efficient and well-functioning. Furthermore, administrators of dark net sites can monitor the progress of exchanges and evaluate vendors and buyers according to review scores – and punish infractions by banning users. Cryptomarkets therefore share some characteristics with a hierarchical structure based on an unequal distribution of power where a decision-maker resolves disputes and introduces formal contracts.

Conclusion

This study of top vendor profiles in Silk Road 2.0 and their connected feedback and product sites suggests that online and dark net context has made it possible to run a drug market as a more formalised and centrally-regulated structure than conventional drug markets. Until they are legalized, drug markets can never become fully formalised, but in cryptomarkets, drug sellers can create a more effective system of drug distribution. We have analysed illegal drug market transactions from the same perspective as financially legal transactions. Our argument is that cryptomarkets are formally organised, meaning hierarchically run with rules and limitations. This makes them better at reducing the coordination problems found in traditional drug markets. Cryptomarkets reduce costs because the investments in trust that characterise distribution in social networks can be transferred to other suppliers through the review

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system. The importance of feedback (positive) and the centrally-regulated review system greatly reduces the uncertainty usually associated with illicit transactions. Visibility is no longer a major security threat and sellers and buyers can communicate directly through messaging systems, discussion forums, vendor profiles and feedback systems. Cryptomarkets thus represent a fundamentally new type of drug market.

Data in this study are from a sample of successful vendors in one particular market, and findings cannot be generalised to vendors and cryptomarkets in general. We still believe that insights generated from our study can contribute to a better theoretical understanding of cryptomarkets. To comprehend and conceptualise these new markets, netnographic studies and insights from transaction cost economics and economic sociology are crucial. Combined, they suggest how the problems of competition, cooperation and valuation in traditional drug markets are solved better in cryptomarkets. The cryptomarket structure provides advantages for both vendors and buyers, increasing potential sales and safer buys. If this holds true, we should expect a further rise of dark net drug markets in the future.

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TABLE 1 – An overview of vendors, product sites and the main products offered

Vendor	Listings[1]	Products
1	25	MDMA, cocaine

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[1] "Listings" represents the number of product sites of each vendor. These might represent different drugs, but also the same drugs but vary in amount. The numbers were usually higher than the actual visible amount because inactive product sites were also counted for.

2	10	Cocaine, amphetamine, MDMA
3	30	Cocaine, MDMA, amphetamine, ecstasy
4	52	MDMA, cocaine, mephedrone, 2ci, LSD
5	18	Ketamine, MDMA, mephedrone, ketamine
6	3	Liquid mushrooms
7	51	MDMA, amphetamine, cocaine, ecstasy, cannabis, LSD
8	108	Ecstasy, MDMA, mephedrone, cocaine, hashish, DOM/STP, DOB, Viagra
9	23	THC infused suckers (cannabis)
10	15	Cocaine, MDMA
11	137	Marihuana, hashish
12	6	Heroin
13	25	Ketamine, MDMA
14	9	Cocaine
15	13	Cocaine, hashish
16	13	LSD
17	6	Marihuana
18	27	Mescaline HCL, DOM/STP, LSD
19	28	Amphetamine, MDMA, cocaine
20	5	LSD

TABLE 2 – Examples of prices offered on Silk Road 2.0 from vendors in the sample

From	To	Consistency	Strength	Price for 1 gram	Price for 5/10/25 gram
US	US	Crystals	95-99%	53,2 €	5g: 221,7 €
Germany	Worldwide	Powder	80%	22,2 €	5g: 95,9 €
Germany	Worldwide	Crystals	80%	---	5g: 78,4 €
UK	Worldwide	Crystals and powder	---	28,4 €	5g: 129,2 €
UK	Worldwide	---	---	29,4 €	10g: 225,6 €
Netherlands	Worldwide	Crystals	84%	22,9 €	10g: 138,7 €
UK	Worldwide	---	---	26,2 €	---
Germany	Worldwide	---	---	48,3 €	10g: 165,1 €
UK	Worldwide	---	---	---	25g: 614,9 €
Australia	Australia	Crystals	---	211,3 €	---