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Social order of anonymous digital markets: Towards an economic sociology of cryptomarkets

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Sophisticated networked technologies have contributed to the proliferation of digital drug markets. To enable the exchange of illegal goods, platforms on the Internet take advantage of technological innovations that conceal the identity and physical location of their users. This chapter introduces economic sociology as a conceptual framework for better understanding cryptomarkets. It explores how economic actors promote coordination on cryptomarkets when they are uncertain about the value of the drugs being traded (the ‘valuation problem’), their profit opportunities (the ‘competition problem’), and social uncertainties entailed in transactions (‘the cooperation problem’). Based on a digital ethnographic study, the analysis shows with which socio-technical practises social order is established on cryptomarkets. The investigation suggests that (a) informal institutional standardisations help overcome the valuation problem; (b) allowing for national and international competition between vendors and among platforms solves the competition problem; and (c) implementing an institution-based rating system promoting trust between exchange partners not meeting face-to-face reduces the cooperation problem. By applying this conceptual framework of fundamental coordination problems to anonymous marketplaces, this study contributes to a sociological analysis of structural factors underlying the resilience and growth of online drug markets.

Keywords: cryptomarkets, economic sociology, online drug markets, darknet, coordination problems, informality, institutionalisation, valuation, competition, cooperation

1. Introducing anonymous online markets

Though buying and selling illicit drugs on the Internet has a long history, a set of technological developments has enabled systematic drug trading online (Buxton & Bingham, 2015; Martin, 2014). The first cryptomarket, *Silk Road*, started in February 2011, implementing a combination of anonymising software (e.g., TOR) and cryptocurrencies (e.g., Bitcoin) for the first time (Martin, 2014). Together these technological innovations conceal the identity and physical location of actors often infringing criminal law, simultaneously complicating police investigations. On *Silk Road* (closed in October 2013), various psychoactive substances, pornography, hacking services and forged documents were offered by vendors (Van Buskirk, Roxburgh, Farrell & Burns, 2014). Weapons and ammunition were also traded until later moved to their own marketplace (Christin, 2013).

The opening and closure of *Silk Road* was accompanied by media attention, disapproval by government authorities and law enforcement, and increasing academic interest. Only after *Silk Road* was taken down did other marketplaces emerge in significant number, competing for market share (Soska & Christin, 2015). By mid-2018, customers could choose from almost two dozen online platforms of varying sizes and feature sets (DarkNet Stats, 2018). The proliferation of digital drug markets exemplifies how digitalisation affects more and more areas of life, resulting in fundamental social and economic structural change.

Although research on darknet¹ drug markets is nascent, previous studies have explored three streams of research that could form a basis for an economic-sociological approach to understanding social order on drug cryptomarkets. First, scholars have studied the size of online drug markets in terms of value of drugs traded. For example, Soska and Christin (2015) report an increase in annual sales on *Silk Road* from \$15 million in mid-2012 (Christin, 2013) to over \$100 million for 2013. A long-term analysis of the popular platform *AlphaBay*, estimated total drug sales at approximately \$94 million over 12 months from 2015 to 2016 (Tzanetakis, 2018). With the EU retail drug market, for example, worth approximately €24 billion in 2013 (EMCDDA, 2016, p. 27), these studies show that cryptomarkets have only a small overall market share, although this is growing.

A second branch of literature concerns users of anonymous drug markets and drugs purchased. The majority of cryptomarket users are male (>80%), aged early- to mid-20s, in professional employment or tertiary education, and characterisable as occasional or recreational drug users (Bancroft & Reid, 2016; Barratt, Ferris & Winstock, 2016; Buxton & Bingham, 2015; Kruithof et al., 2016;

¹ The darknet is a hidden part of the Internet accessible only with anonymising software like TOR (The Onion Router) or I2P (Invisible Internet Project).

Van Hout & Bingham, 2013). The three most popular drugs on cryptomarkets are cannabis, ecstasy and cocaine (Barratt et al., 2016; Tzanetakis, 2018; Van Hout & Bingham, 2013).

A third body of literature considers how anonymous Internet platforms may facilitate harm reduction due to the availability of high-quality drugs with a lower risk of contamination, the reduction of uncertainties associated with open drug markets (e.g., violent encounters), and the fact that cryptomarkets allow users to exchange information about the qualities of substances and experiences with vendors (Aldridge & Décary-Héту, 2014; Bancroft & Reid, 2016; Barrett et al. 2016a, 2016b; Buxton & Bingham, 2015; Caudevilla et al., 2016; Van Hout & Bingham, 2013).

This chapter contributes to emerging research into the economic sociology of cryptomarkets. Bakken, Møller and Sandberg (2017) combined transaction cost economics and economic sociology to analyse how successful vendors on *Silk Road 2* solve coordination problems inherent in illicit drug distribution, concluding that cryptomarkets are more structurally efficient than traditional markets. Przepiorka, Norbutas and Corten (2017) used a data set of illegal drug items on the original *Silk Road* to show that buyers' ratings affect seller's business success.

Building on these earlier studies, this chapter expands on Beckert's (2009) social order of markets approach by exploring how coordination is enabled in anonymous Internet marketplaces. Although Beckert developed his framework of coordination problems for legal material markets (i.e., 'traditional' offline markets), this study applies Beckert's framework to digital illegal markets. The chapter seeks to improve our understanding of cryptomarkets by asking how the fundamental coordination problems of valuation, competition and cooperation are resolved in cryptomarkets to stabilise expectations. This question is relevant because unlike in material markets, economic actors on anonymous marketplaces do not meet. Instead, encryption technology is used to advertise, order and pay for drugs which are delivered by regular postal services. While all coordination problems are potential sources of uncertainty as they complicate successful transactions, in an anonymous environment like the darknet, the degree of uncertainty appears even higher.

The following section introduces basic elements of social order in illegal markets by drawing on approaches from economic sociology and political economy. This lays the ground for the analysis of socio-technical practises enabling coordination on cryptomarkets in section three. The concluding section discusses resilience and structural growth conditions of darknet drug markets.

2. Social order in illicit markets

Sociological approaches to markets do not assume that decisions of actors are individual rational acts but are rather understood as arenas of social interaction (Aspers, 2011; Beckert, 2009; Bourdieu, 2005; Swedberg, 2003). Thus, the economic organisation of goods and services is based on the social organisation of voluntary exchange among competing parties. Economic action in markets is understood in relation to social structure and interpersonal relationships contextualised by social rules, norms, conventions, values, cultural beliefs, power relations and institutional arrangements. However, economic sociology has largely presumed that market transactions are legal and therefore left illegal exchanges aside (Aspers, 2011). Following an emerging perspective within this tradition (Beckert & Wehinger, 2013; Beckert & Dewey, 2017; Møller & Sandberg, 2017; Sandberg, 2012), this chapter applies an economic-sociological approach to darknet drug markets. Hereby, economic action in anonymous drug markets is considered as being enacted through socio-technical practices.

Explaining social order of markets is the core problem of market sociology. Granovetter's (1985) seminal article popularised the notion of embeddedness as a central concept of modern economic sociology indicating that economic action is always embedded in some form of social structure. Zukin and DiMaggio (1990) differentiate Granovetter's concept by distinguishing between structural, institutional and cultural embeddedness. In legal markets, actors are confronted with a high degree of uncertainty about exchange outcomes, which must be reduced for markets to operate (Beckert, 2009). Biggart and Beamish (2003, p. 456) define uncertainty as 'a situation in which actors cannot assign a probability to the consequences of their acts'. Only when uncertainty is reduced can 'stable worlds' (Fligstein, 2001) emerge.

Illegal markets differ from legal ones in various ways. In contemporary legal markets exchange is regulated by formal institutions (e.g., property rights are protected by law) (Beckert & Wehinger, 2013). However, when a market is illegal, actors cannot sue each other for contractual infringement nor for violating standards of product quality. However, actors can be prosecuted for the exchange of illegal drugs. The risk of law enforcement intervention and lack of legal protection have implications for the social organisation of market transactions. The governance of illegal markets has, according to political economic research, an internal and external dimension (Andreas & Nadelmann, 2006; Jakobi, 2018). The external dimension focuses on how to limit criminal activities, including policing and sanctioning. The internal dimension refers to how actors establish shared norms and understandings that facilitate coordination of transactions. Further, what constitutes an illegal market differs between jurisdictions and over time.

Next, the social embeddedness of the internal governance of illegal markets is looked at by applying an economic sociological approach. Despite the absence of formal regulation, actors involved in illegal drug markets build social order via the establishment and maintenance of relationships and production of shared cultural understandings (Dwyer & Moore, 2010). Social actors must balance the uncertainty of enforcement activity and the lack of legal protection of their trading activities against the degree of visibility (Aldridge & Askew, 2017; Bakken et al., 2017; Tzanetakis, 2018). This trade-off varies between open, semi-open and closed retail drug markets (Dorn, Murji & South, 1992; Hough & Natarajan, 2000; Sandberg, 2012). In open drug markets, dealers and buyers expose themselves to law enforcement as drugs are advertised publicly and transactions take place in public spaces. Due to a higher degree of visibility, risk of law enforcement interventions increases compared to closed markets. Closed markets are accessible to those having previously established trust or by introduction by a trusted acquaintance. Hence, the risk of law enforcement is lower due to limited visibility when exchanging prohibited substances at relatively secure locations outdoors or in private residences. By contrast, the exchange of drugs in semi-open markets takes place in private locations like clubs, cafes or bars but do not require previous personal contacts. Cryptomarkets are similar to semi-open markets with drugs accessible to anyone having the technical skills and equipment to visit the platforms without prior social relationships (Tzanetakis, Kamphausen, Werse & von Laufenberg, 2016).

3. Solving coordination problems on cryptomarkets

This analysis of socio-technical practices enabling internal governance in cryptomarkets addresses the following questions: How is systematic trading of illicit substances enabled within anonymous environments? And, how do digital technologies help users cope with uncertainty? This analysis applies Beckert's social order of markets approach, developed for legal, material markets, to the framework of illegal darknet markets. Beckert's conceptual framework is based on the need to resolve the fundamental coordination problems of valuation, competition and cooperation to reduce unpredictable outcomes and stabilise market expectations (Beckert, 2009; Beckert & Wehinger, 2013).

The analysis draws on a digital ethnography conducted between 2014 and 2018. Digital ethnography seeks to describe social practices, meanings, beliefs and activities of actors by considering the digital environments of the everyday practices of people (Coleman, 2010; Pink et al., 2016; Varis, 2016). In contrast to other empirical inquiries (e.g., Bakken et al., 2017; Przepiorka et al., 2017),

the data for this study comes from multiple platforms on the darknet as well as cryptomarket discussion forums.

The digital ethnography included eleven semi-structured face-to-face and four encrypted online interviews with cryptomarket users, digital monitoring of cryptomarkets including *AlphaBay*, *Agora*, *Dream Market*, *Nucleus* and *Outlaw*, associated discussion forums (e.g., official market forums, Subreddit DarkNet-Markets) and scraping of market data on *AlphaBay* from September 2015 to August 2016 (described in Tzanetakis, 2018).

Quantitative accounts in illegal drug research are usually limited by the constrained ability to accurately measure activities (e.g., how many drugs were sold) where research subjects may face increased risk of law enforcement activity if such data is reported. By contrast, the use of encryption technology in cryptomarkets offers unprecedented opportunities to collect market data for research purposes as their users can communicate without necessarily revealing identifying information. Hence, access to market data and (anonymous) contact information are a by-product as vendors make detailed information on previous transactions visible to customers to encourage them to buy from vendors they do not know personally.

The data analysed for this chapter includes transcripts and chat logs of anonymous online interviews, online observations (e.g., screenshots) and user postings. During the coding process, the data was categorised according to deductively generated themes from the different datasets (Schreier, 2012). Deductions from the results are presented in the following section.

3.1 The social value order of cryptomarkets

The first coordination problem is valuation (Aspers, 2009; Beckert, 2009; Beckert & Wehinger, 2013). Buyers are confronted with difficulties assigning value to commodities within a market. The uncertainty of attaching value refers to the social processes of establishing standards to distinguish between qualities, conventions, or social status. In legal markets, product qualities may be distinguished by, for example, technically defined classification; conventions are established in political and social processes (e.g., by taken-for-granted beliefs about why certain wage structures are normal), which are subject to dispute and change over time and jurisdiction; social status is signalled by trappings (e.g., owning a Lamborghini compared to a Dacia), which depends on socially constructed symbolic assignments of value. If institutionalised standards or social status are established, goods can be compared on criteria such as price and preferences can be formed.

Uncertainties can be reduced when value is credibly attached to a product by suppliers and when potential buyers are in the position to distinguish between the values of goods. What is regarded as valuable cannot be controlled via rational calculation nor is it static but rather a dynamic process of change, driven through technological or cultural innovations. Thus, the question arises: with which socio-technical practices do actors on the networked environments of cryptomarkets solve the problem of assigning value?

While actors on illegal drug markets cannot rely on formal institutionalised standards and product qualities cannot be objectively determined, the community of cryptomarket users have agreed on informal institutionalised standards which need to be constantly negotiated in order to fulfil their basic requirements. Firstly, drugs are categorised according to a classification system, which is predefined by the marketplace operator. These categories are comparable across different cryptomarkets, which facilitates the navigation of individual platforms without acquiring new knowledge. The classification system includes different drug categories such as barbiturates, benzos, cannabis, ecstasy, dissociatives, opioids, prescription, psychedelics, research chemicals, steroids, stimulants, weight loss, and other. Vendors place their drug offers according to the predefined system as they have an interest in customers easily finding their offers. The drug listings are displayed to customers depending on the selection of a particular drug category, which can be further filtered by using a selection box (e.g., country of delivery, trust level) and ordered according to sophisticated algorithms.

The convention of implementing a classification system is particularly useful in regard to individual cryptomarkets closing (either voluntarily or by LE) and therefore sellers and buyers moving to other marketplaces. A buyer explains how he moved on to another cryptomarket when the platform that he previously ordered drugs from closed:

A friend of mine also ordering stuff recommended that other market. She told me it's similarly structured to AlphaBay. Then I spent some time there, just to have a look how everything goes. Well, I liked it and at some point I ordered something.

As the quote illustrates, the standardised classification system eases the shifting process. Simultaneously, it signals a familiar setting. This reduces uncertainty by allowing actors to differentiate between distinct drug categories across platforms and by socio-technically constructing a high recognition value supporting the resilience of the cryptomarket ecosystem.

Another socio-technical practice enabling buyers to distinguish between the values of drugs and sellers to assure the value of their products is market-

ing activities. Marketing is impeded on material drug markets as the increased visibility corresponds with an increased risk of law enforcement activity (Reuter, 1983). Accordingly, being able to actively market products is novel for drug markets. Marketing practices include indirect activities such as professional communication and visibility on platforms and associated forums, product branding, providing comprehensive information on the drug item (e.g., purity), speedy dispatch of slightly overweight drugs, and activities such as dispatching free sample items, free shipping, special discounts and promotion offers. Similar to how material drug markets adapt business practices from legitimate businesses (Adler, 1993), cryptomarkets adapt marketing activities used by e-commerce platforms.

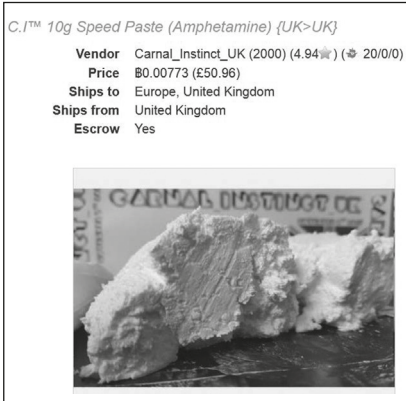


Figure 1: Screenshot of product branding by a British vendor on Dream Market

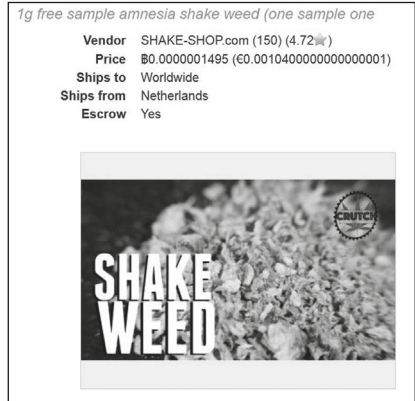


Figure 2: Screenshot of a free sample offered by a Dutch vendor on Dream Market

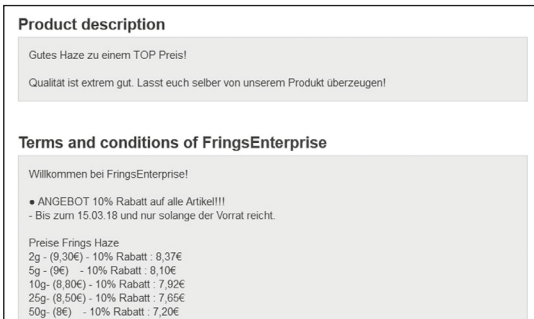


Figure 3: Screenshot of promotion offers ('Rabatt'=discount) by a German vendor on Dream Market

An illustration of marketing practices utilised on *Dream Market* are provided in Figures 1 to 3. Figure 1 shows how product branding is visualised by including the pseudonym of the vendor in the picture attached to an item for sale. Product branding was introduced on the *Silk Road* as a solution to vendors passing off product pictures from other vendors as their own. Nowadays product branding is widely used, although not by every vendor. Figures 2 and 3 illustrate the offer of free samples and special discounts. Both practices are used to attract new customers or to make a new drug offer appealing.

The practice of giving away free samples is usually introduced by new vendors with a low number of completed transactions and less by established ones (e.g., the vendor in Figure 2 has completed 150 transactions; the vendor in Figure 1 has finished 2000). In this way, by socio-technical marketing practices vendors manage to signal product value and hence help reduce the customer's uncertainty about the assignment of symbolic value. This echoes previous research findings. Bancroft & Reid (2016) demonstrated that users confer different meanings to product qualities including purity, embodied experience and scientific knowledge. Caudevilla et al. (2016) tested 219 drug samples and found that 91.3% of the test results matched the advertised substance online and most samples were of high purity. To summarise, the socio-technical practices of implementing a similar classification system regardless of the individual platform and employing marketing activities allow cryptomarket users to compare drugs.

3.2 Competition in cryptomarkets

The second problem refers to competition, a prerequisite for efficient market structures as competition between suppliers is perceived as an important foundation of markets (Beckert, 2009). However, if competition is too efficient it may reduce the profit opportunities of suppliers. Thus, competition comes with a conflict of interest between suppliers, the state and intermediaries, who are struggling to shape, regulate or expand competition. This was called the 'market struggle' by Max Weber (1978). While institutional regulation through state legislation, subsidies and consumer protection measures are the most important way of organising competition in legal markets, illegal markets are governed by legal regulations only externally. Internally, regulation can be achieved by voluntary agreements and personalised networks. Moreover, suppliers may create competition by 'product differentiation, first-mover advantages, reciprocal agreements, corruption, collusion, cartels, or by achieving a monopoly position to stabilise their profit opportunities' (Beckert, 2009: 258).

The dynamic process of competition is also shaped by the structuration of competition. While large firms increase profits through economies of scale,

small firms can increase profits by evading competition with large firms and specialising in a limited market segment or product differentiations. The structuration of competition creates predictability for market actors and thus contributes to capitalist growth based on unequal power relations. However, the position of actors must continually remain threatened by competition in order for market dynamics to unfold.

To solve the competition problem in cryptomarkets, competition is organised among platforms and between vendors both nationally and internationally. While material drug markets rely mainly on interpersonal networks being of limited geographical scope (Reuter, 1983), cryptomarkets allow for national and cross-border exchange of psychoactive substances and easy market entry, and substitute face-to-face transactions with technologically enabled anonymous exchange practices (Tzanetakis, 2018). However, the state is absent as an immediate regulator of competition in all types of illegal markets.

Contrary to material drug markets and similarly to (legal) e-commerce platforms, cryptomarkets allow for a high degree of competition at national and international level among platforms and between vendors. Competition emerges between vendors as cryptomarkets allow them to offer their drugs for a fee, which is usually 2-4% of a transaction depending on the market power of a platform. In return, the operator(s) of a cryptomarket organise the infrastructure allowing for market transactions to take place. Moreover, on illegal markets actors do not have full information about the products they are trading or the circumstances of the trade (Beckert & Wehinger, 2013). These implications are reversed in cryptomarkets. With a set of institutional innovations and socio-technical practices a high degree of transparency on quantity, price, product quality, purity, escrow services, shipping information and the trustworthiness of vendors (see Figure 4) contributes to how competition is structured on cryptomarkets. The accuracy of vendors' self-descriptions are subsequently reviewed by customers via a rating system. Consequently, customers can choose from a huge variety of different products, quantities, and qualities.

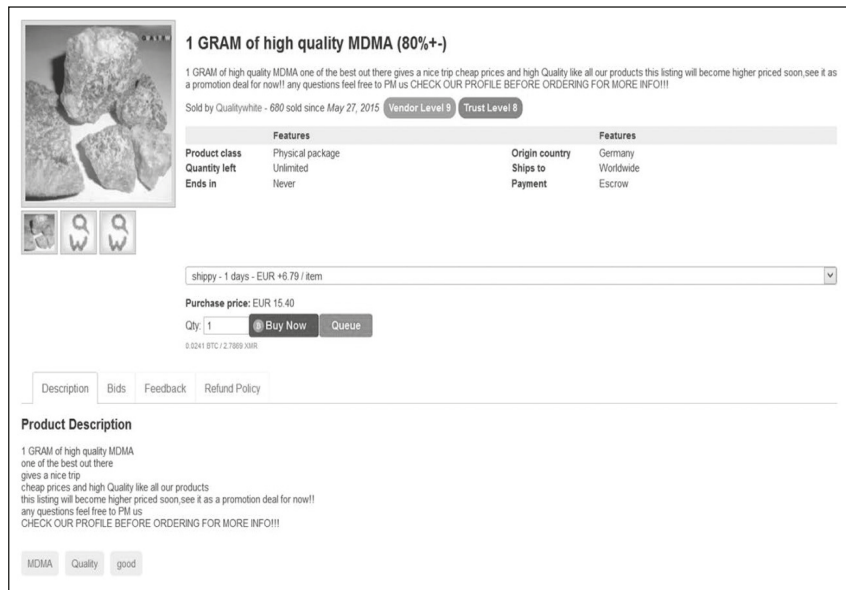
Usually many vendors compete with each other on individual platforms. This is illustrated by a longitudinal web-scraping analysis of *AlphaBay*, recognised as the most popular active market at the time of data collection. Over 12 months approximately 2,200 unique vendors offered about 12,000 drug items for sale. However, competition between vendors led to an unequal structure of power relations as revenues were not distributed equally. About 58% of vendors sold drug items totalling less than \$10,000 within a one-year period, together responsible for roughly 3.5% of total revenues. By contrast, about 5% of vendors made over \$200,000, generating about 53% of the total revenues on *AlphaBay* (Tzanetakis, 2018). The data suggest that a large number of small-scale dealers generate modest revenues (presumably making little profit) while a small num-

ber of large-scale dealers generate large sales volumes. Hence, competition between many vendors results in high levels of market concentration.

What enables some vendors to make more revenue than others? Vendors invest in their reputation to reduce customer uncertainty and increase sales. A seller's reputation is promoted by completing many transactions and receiving a lot of positive feedback or ratings. The latter is illustrated in Figure 4 with the indication 'Trust Level 8' and the former with 'Vendor Level 9'. This vendor on *AlphaBay* established a good reputation with high scores in both categories (10 being the top evaluation). While the numbers are created by an automated program, practices to increase the trustworthiness of vendors are established via social interactions.

A seller's reputation is promoted in a similar way on each individual cryptomarket although the visual tools to indicate both aspects vary across platforms. Vendors actively take action to increase their reputation. This includes providing an accurate description of the drugs for sale (see Figure 4), actively engaging with customers on forums, providing good customer service and being accessible at all times for requests. Moreover, some vendors state their refund policy in case a delivery does not arrive. However, although reputation is actively promoted, cases of fraud occur (e.g., fake customer reviews, not delivering drugs) (Møller & Sandberg, 2017; Tzanetakis, 2015). In other words, all the actions taken by vendors provide predictable information on the sales procedure, price and product quality, therefore reducing uncertainty while increasing trustworthiness. However, although the degree of available information has increased on cryptomarkets, market actors still face some uncertainties. For example, vendors operating on darknet markets might be collaborating with each other to control a particular market niche, which would not be known by the customers and might restrict their choices. This supports Hardy and Nordgaard (2015) who conclude that investment in reputation provides a premium to sellers as it incentivises them to provide good service to buyers.

Competition emerges among cryptomarkets at national and international levels as there are no personal or geographical restrictions to setting up a platform. Nevertheless, setting up the technological infrastructure for a marketplace requires a high level of programming skills and cultural capital. Running a platform in English will most likely attract the biggest possible target audience. About two dozen cryptomarkets varying greatly in size are operating where vendors offer drugs for sale. Anonymous platforms also differ, among other factors, according to language, referral link in order to register, commission fee for vendors, payment system, and cryptocurrency. Cryptomarkets also vary according to their moral code, such as what can or cannot be transacted. While most platforms strictly reject the exchange of child pornographic content (Martin, 2014), the trade of weapons is allowed by some cryptomarkets but not others.



1 GRAM of high quality MDMA (80%+)

1 GRAM of high quality MDMA one of the best out there gives a nice trip cheap prices and high Quality like all our products this listing will become higher priced soon,see it as a promotion deal for now!! any questions feel free to PM us CHECK OUR PROFILE BEFORE ORDERING FOR MORE INFO!!!

Sold by Qualitywhite - 690 sold since May 27, 2015 Vendor Level 9 Trust Level 8

	Features	Features
Product class	Physical package	Origin country
Quantity left	Unlimited	Ships to
Ends in	Never	Payment
		Escrow

shippy - 1 days - EUR +6.79 / item

Purchase price: EUR 15.40

Qty:

0.0241 BTC / 2.7069 XMR

Description Bids Feedback Refund Policy

Product Description

1 GRAM of high quality MDMA
one of the best out there
gives a nice trip
cheap prices and high Quality like all our products
this listing will become higher priced soon,see it as a promotion deal for now!!
any questions feel free to PM us
CHECK OUR PROFILE BEFORE ORDERING FOR MORE INFO!!!

MDMA Quality good

Figure 4: Screenshot of product information page by a German vendor on AlphaBay

On the customer side, access to computer hardware and the Internet implies a minimum socioeconomic status. This echoes earlier research indicating that most users of cryptomarkets are well-educated, well-off young men (Barratt et al., 2016; Kruithof et al., 2016; Van Hout & Bingham, 2013). Nevertheless, three or four platforms seem to be quite popular while the others attract a modest number of vendors and buyers. Except for Soska and Christin (2015), research into the relationship between various marketplaces is lacking. However, it can be assumed that competition between individual platforms results in a similar oligopoly as competition between vendors.

Moreover, competition on anonymous platforms is shaped by attracting more users. Hence, the market power of a platform is dependent on the number of vendors and buyers exchanging goods and services while both user types are free to transact on any preferred individual platform. Some vendors choose to offer drugs on several marketplaces. Likewise, customers may order drugs from different platforms. The number of vendors broadly corresponds to the number of users on an individual marketplace as a higher number of vendors attracts more customers and vice versa. However, once sellers have achieved a better reputation, they can attain higher prices for their goods and are able to

sell more (Przepiorka et al., 2017). Conversely, sellers with poorer reputations or lower number of sales decrease their prices to attract buyers, which might allow them to position themselves in a niche.

3.3 Cooperation – building trust in cryptomarkets

The third coordination problem, cooperation, arises from social risks and uncertainties of exchange as actors have incomplete knowledge of the intentions of their exchange partners and of product quality (Beckert, 2009; Beckert & Wehinger, 2013). In addition, transactions are uncertain when actors cannot be sure if contracts or voluntary agreements are fulfilled, such as when making a payment in advance. Further uncertainties occur in illegal markets as actors cannot rely upon state-guaranteed legal protection and risk law enforcement activity. Hence, a set of socio-technical practices help reduce uncertainties including the development of trust between exchange partners, social norms, power relations, personal networks, traditions and emotions. Resolving this cooperation problem is another precondition for stable market relations.

Thus, the problem arises of how trust can be established when actors violate legal regulations while exchanging goods. Empirical studies of illegal markets have demonstrated that social practices for building trust are embedded in interpersonal network relations (Adler, 1993; Coomber, Moyle & South, 2015; Sandberg, 2012; Taylor & Potter, 2013; Werse & Bernard, 2016). By contrast, illegal drug markets on the darknet are faced with a dilemma: technological innovations enable exchange partners to conceal their identities while anonymity leads to a fundamental lack of interpersonal trust and provides a potential breeding ground for fraud (Aldridge & Askew, 2017; Martin, 2014; Tzanetakos, 2015). However, building trust is still an intrinsic social practice for reducing uncertainty in order to make exchange possible. Nevertheless, as personal relationships are not common when trading on the darknet, trust has to be established differently online in order to stabilise market expectations.

Establishing trust is a complex and multifaceted social practice. Building on classical sociologist Georg Simmel, Möllering (2006) offers a definition of trust in economic relationships including a rational, more calculable aspect and a non-rational aspect requiring a leap of faith. From the angle of sociological neoinstitutionalism, trust is 'a reflexive process of building on reason, routine and reflexivity, suspending irreducible social vulnerability and uncertainty as if they were favourably resolved, and maintaining a state of favourable expectation towards the actions and intentions of more or less specific others' (Möllering, 2006, p. 356). It is argued that cryptomarkets allow both these aspects of trust to develop, despite face-to-face interactions being common. Central to

this is the rating or feedback system. This can be characterised as an institution-based trust building practice (Zucker, 1986) due to the impersonal nature of online transactions and the embeddedness of exchange partners in the institutional environment (i.e., the infrastructure of a marketplace).

4d	★★★★★	Perfect"! everything is well. Guter und vertrauensvoller vendor. Qualität gut, sehr guter Preis. I will come back! 10*****	a . . . 0	~ B0.05
10d	★★★★★	Jamais déçu avec Duck. J+1, c'est pas souvent que ça m'arrive, merci ;). Sinon pour le reste c'est comme d'habitude. Super communication, rapidité et la qualité est là. Encore merci ;)	a . . . u	~ B0.004
8d	★★★★★	Au top comme d'habitude, reçu j + 2 (jour ouvré) ;)	p . . . e	~ B0.01
1d 17h	★★★★★	Après plusieurs vendeurs pour tester. La meilleure qualité c'est ici et de large .	s . . . 4	~ B0.01
10d	★★★★★		h . . . h	~ B0.007
7d	★★★★★	Bien reçu en J+2. Bon hash, clean au goût, high subtil, me rappelle l'avocado en un peu moins prononcé. Merci!	k . . . n	~ B0.002
5d	★★★★★	Trés bien	p . . . y	~ B0.002
6d	★★★★★	Fast delivery with very good stealth. Right quantity and quality is ok. Thanks mate !	d . . . d	~ B0.02
8d	★★★★★	tout parfait	l . . . r	~ B0.007
10d	★★★★★	tres bon hash et tres bien emballer je recommande ce vendeur tres professionnel et expedier rapidement merci a toi.	f . . . l	~ B0.002
7d	★★★★★	Bon packaging discret et bonne qualité !	r . . . t	~ B0.007
4d	★★★★★	Wow Wow Wow The Best!!!! Super, kann ich jedem empfehlen !!!	T . . . x	~ B0.02
2d 1h	★★★★★	Enter your comments here	A . . . e	~ B0.005
10d	★★★★★	ça manquait une valeur aussi sûre que le Hug. Je me Demande si la qualité n'est pas encore meilleure qu'avant. Chapeau l'artiste!	z . . . r	~ B0.007
10d	★★★★★	Ah, ça fait plaisir de retrouver un vrai pro: j+1, super emballage, qualité et quantité au rdv. Bravo.	z . . . r	~ B0.02
10d	★★★★★	Enter your comments here	i . . . 7	~ B0.007
7d	★★★★★	Enter your comments here	t . . . s	~ B0.05
4d	★★★★★	Enter your comments here	v . . . 4	~ B0.003
10d	★★★★★	Perfect !	p . . . 2	~ B0.005
8d	★★★★★	Top	e . . . o	~ B0.013
8d	★★★★★	Parfait + envoi rapide comme d'habitude. MERCI	o . . . e	~ B0.004

Figure 5: Screenshot of customer feedback on a French vendor on Dream Market

A more rational aspect of trust is established on cryptomarkets by customers submitting ratings of vendors and drugs ordered. Importantly, rating is enabled via the institutional infrastructure of the platform. Regardless of the individual marketplace, feedback includes both a numerical rating and a short written statement (see Figure 5). Giving feedback is not usually mandatory, but is strongly encouraged, and a large majority of customers do so. In individual marketplaces, the rational aspect of trust is often expressed numerically (see Figure 4), making trust calculable.

On the other hand, the rating system includes a non-rational aspect of building trust based, inter alia, on the past history of exchange. The rating history of a vendor arguably serves as a substitute for personally meeting a dealer. It is made visible through the rating system where individual ratings are gathered and displayed to users (see Figure 5). Numbers of ratings vary according to the policy of individual cryptomarkets and range from displaying the feedback of all past transactions of a vendor to showing ratings from, for example, the past ninety days. Making the past behaviour of a vendor visible signals the degree of trustworthiness to potential customers, helping to fill a gap left by the impersonal nature of cryptomarkets. Once a customer has made some successful transactions with a vendor, purchasing decisions can be based on personal experiences. However, the system is useful to all users as sudden negative feedback may indicate something wrong with a vendor.

Nevertheless, negative feedback is rare and vendors are often willing to provide good customer service in exchange for positive feedback. Negative ratings seem to affect sellers with fewer transactions more than those with a good rating reputation and customer base. However, feedback can be faked to support a vendor in developing or maintaining a good reputation, or to undermine a competitor's reputation. In this context, the balance of positive and negative customer feedback is important to customers. A customer summarises what is relevant for him before making a transaction:

Sure, I believe I buy like most people do it, similarly to Amazon. There is a rating system. Based on the previous ratings I pick the one with the best feedbacks. And most of them were Dutch. This is how I went.

In this way, rational and non-rational institution-based trust practices are applied on cryptomarkets similarly to other e-commerce platforms to reduce uncertainty and facilitate the trust required for the exchange of illegal goods. This is consistent with previous research highlighting the role of trust in drug exchanges on cryptomarkets (Duxbury & Haynie, 2018; Tzanetakakis et al., 2016). Duxbury and Haynie (2018) found that increasing trustworthiness attracts more customers and buyers may be willing to pay a premium to trustworthy vendors.

4. Conclusion and discussion

This chapter has explored how socio-technical practices help resolve the coordination problems of valuation, competition and cooperation on cryptomarkets. The main research question was how market actors mitigate these problems in a highly uncertain environment characterised by technologically enabled anonymity and in absence of state governance. As this study shows, informal institutional standardisations, as well as marketing and advertising activities, help overcome the difficulties of assigning value attributions to commodities. Moreover, cryptomarkets allow competition to emerge between vendors and among platforms. In order to increase sales, vendors carefully build reputations beyond national borders and socio-technical institutions provide users with information regarding price, product quality, shipping destinations and the offer of escrow services.

This chapter also shows that the institution-based rating system promotes trust between exchange partners not knowing each other personally. This contributes to solving the social uncertainties of market exchange and enhances cooperation. The analysis demonstrates how the process of digitalisation contributes to the emergence of a new social order on digital drug markets. Digitalisation enables geographical expansion of markets and overcomes local limitations regarding accessibility of illegal drugs, sellers and customers. Consistent with prior research, this study concludes that cryptomarkets enable more efficient market structures compared to traditional drug markets (Bakken et al., 2017; Duxbury & Haynie, 2018).

This research contributes to the literature on cryptomarkets by expanding our understanding of the role of socio-technical practises in coping with the uncertainties inherent in darknet drug markets. It also adds to recent scholarly effort to include illegal markets within the economic sociology of markets by introducing informal institutional practices to solve the three coordination problems (Bakken et al., 2017; Beckert & Wehinger, 2013; Møller & Sandberg, 2017; Przepiorka et al., 2017).

By reducing the uncertainty of the coordination problems, 'stable worlds' (Fligstein, 2001) are being created which are a precondition for market transactions. However, simultaneously market based economies inherently need an element of uncertainty in order to expand and renew (Beckert, 2009). Value attributions change as new drugs emerge, profitable market positions are threatened by new platforms, new actors or modified regulations (e.g., legalisation, decriminalisation), and the risk of incarceration persists despite institutional practices, technological innovations, online cultures, conventions, and social norms. Uncertainties arise out of exogenous factors like disruptions caused by

the sudden closure of particular marketplaces or by the innovative dynamics of capitalism.

In cryptomarkets, capitalist dynamics are based on technological innovations allowing the actors to adapt to risks and uncertainties involved in operating in an anonymous environment and while committing legal offences. One such innovation is decentralised markets, which enable buyers and sellers to make transactions without an intermediary. In this way, the process of digitalisation becomes a driver of growth within market economies. Capitalist economic markets require a reduction of uncertainty and simultaneously an ongoing renewal of uncertainty to thrive. As demonstrated here, all of these prerequisites are implemented in cryptomarkets and may enable anonymous drug markets to grow systematically in future.

By theorising ‘transformative criminal innovation’ (Aldridge & Décary-Héту, 2014) on the darknet from the vantage point of social order of capitalist markets, its potential to explain the resilience of cryptomarkets is also revealed. Accordingly, disruptions by law enforcement or voluntary closure may contribute to a renewal of uncertainty, which is necessary for the development of capitalist dynamics of growth. Moreover, anonymity of market actors results in a paradox: in contrast to material drug markets, anonymity facilitates the distribution of high quality drugs while reducing the risk of interventions by LE. While the latter is related to police investigations being complicated due to difficulties in identifying parties involved, the former is a side effect of competition among vendors, seeking positive ratings to increase revenues. Finally, the emergence of digitally mediated cryptomarkets have challenged prohibition-oriented drug control policies. Therefore, policy responses at national and international level must take into account both the structural growth conditions of anonymous drug markets and opportunities (e.g., harm reduction) and risks (e.g., availability and accessibility) associated with this emergent phenomenon. Accordingly, this chapter provides an opportunity to articulate how drug cryptomarkets can make us rethink issues of valuation, competition, cooperation and anonymity.

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