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Abstract

Criminal capital theory suggests more experienced offenders receive higher returns from crime. Offenders who accrue skills over their criminal career are better able to minimize detection, increase profits, and navigate illegal markets. Yet shifts in the offending landscape to technologically-dependent crimes have led some to suggest that the skills necessary to be successful in conventional crimes no longer apply, meaning 'traditional' criminals may be left behind. The recent turn of drug vendors to online markets provides an opportunity to investigate whether 'street smarts' translate to success in technologically-dependent crimes. This study surveys 51 drug vendors on online drug markets to compare individuals who began their drug-selling career in physical drug markets with vendors whose onset began on digital platforms. The focus is on their criminal earnings while comparing the scope and management of their networks. The results inform potential spillover effects from offline drug-selling into online marketplaces.

Keywords

cryptomarkets, criminal capital, drug markets, returns to crime

Introduction

The unequal distribution of criminal earnings defines illicit marketplaces. While a minority of offenders make substantial incomes from their crimes, the majority compete to earn anything beyond a minimum wage. Much of the theoretical and empirical work examining variation in criminal earnings has focused on an offender's skill set and expertise at committing crimes – otherwise known as their criminal capital (McCarthy & Hagan, 1995). The role of criminal capital in explaining offender success has been empirically demonstrated multiple times. Offenders with more experience accrue higher earnings (Loughran et al., 2013; McCarthy & Hagan, 1995; 2001; Morselli, Tremblay & McCarthy, 2006; Nguyen & Bouchard, 2013) and are better equipped to evade detection (Bouchard & Nguyen, 2010), as compared to their less proficient counterparts.

Much of the research on criminal capital has modeled the returns to crime using traditional offender populations. However, technological shifts have opened pathways for offenders to commit crimes in the digital realm. Crimes enabled by an internet connection break down physical barriers, reduce the need for face-to-face interaction, and shift the skill sets needed to be successful in crime. As crime relocates to illicit online markets, it raises questions about whether expertise acquired in physical settings carries over to digital contexts. Indeed, shifts to digital platforms provide new opportunities to investigate the determinants of success for online offenders. Whether findings on criminal capital extend to online environments may help us better understand the pathways through which offenders divert into and remain on online markets and strategies to curb online offending.

Prompted by past work investigating criminal achievement in traditional offender populations, this paper explores whether offenders who accrue experience in physical drug markets receive higher criminal earnings in online drug markets. To do so, we survey online drug vendors

about their entry into drug selling, illicit earnings, and criminal collaborators, among other factors. We then analyze vendors' criminal earnings across individuals who began selling drugs in offline markets versus online markets while also comparing their demographics and the management of their distribution networks. We conclude by discussing the potential spillover effects from offline drug markets into online marketplaces.

The Returns to Crime

Early characterizations of illicit drug markets portrayed them as lucrative enterprises, with drug traffickers earning universally high profits. In one of the first tests of these anecdotal claims, Robert MacCoun and Peter Reuter (1992) showed illicit income from drug selling was highly variable. Interviewing 186 probationers who had recently earned income from drug sales, they observed that the net income of the "typical small earner" was 25 USD monthly. In contrast, the "typical large earner" made upwards of 2,500 USD monthly (p. 485). The authors concluded that while a minority of drug sellers received high incomes from their sales, the majority received much smaller sums (also see Fagan, 1992; Levitt & Venkatesh, 2000; Morselli & Tremblay, 2004; Nguyen & Loughran, 2017; Reuter et al., 1990). Recent examinations of drug sellers' transaction histories in online drug markets have led to similar conclusions. For instance, examining drug sellers' online revenues, Décary-Hétu, Paquet-Clouston, and Aldridge (2016) found that the equivalent "small earner" made gross earnings of 63 USD per month, and the "large earner" approximately 2,808 USD per month (also see Duxbury & Haynie, 2021). Illicit earnings are highly skewed across online and offline drug markets, while some offenders earn substantial incomes, others occupy peripheral roles in the illicit economy.

Substantial research has explored the determinants of criminal earnings in offline markets; however, relatively scarce attention has been paid to the success of offenders in online settings.

Often referred to as cybercrime, offences enabled by access to a network connection have led to a host of illicit behaviors not previously within the purview of criminological studies. Whether these offence-types represent 'new crimes' or simply variations of traditional crimes, scholars increasingly concern themselves with these phenomena (Maimon & Louderback, 2019). Studies of online offenders suggest that they may comprise a distinct population, but it is unclear whether that influences variation in their earnings. Here we review what we know about the returns to crime in physical markets and whether experience accrued in offline markets can translate into higher earnings in the digital realm.

The Returns to Crime in Offline Markets

More than 25 years ago, McCarthy and Hagan (1995) termed the phenomena of 'criminal capital' to explain the differential success of offenders. Defined as the "knowledge and technical skills that can facilitate successful criminal activity" (p. 66), criminal capital has since become a staple of studies aiming to uncover the determinants of illicit earnings (Loughran et al., 2013; Matsueda et al., 1992; McCarthy & Hagan, 1995; 2001; Morselli et al., 2006; Morselli & Tremblay, 2004; Nguyen, Parker & Simpson, 2021; Nguyen et al., 2017; Rowen, McGloin & Nguyen, 2018; Uggen & Thompson, 2003). Work examining criminal capital has focused on both an offender's criminal *social* capital, which "arises from associations with skilled offenders" and their criminal *human* capital, the "specialized skills and knowledge about offending" (McCarthy & Hagan, 2001, p. 1038) to explain variation in success.

Much of the work focusing on criminal *social* capital has shown that connections with other offenders lead to important benefits for an individual's illicit earnings. Connections with other criminals increase the likelihood of earnings (Loughran et al., 2013; McCarthy & Hagan, 1995; 2001; Morselli & Tremblay, 2004; Morselli et al., 2006; Morselli et al., 2017; Rowan et al.,

2018). Morselli and Tremblay (2004) introduced the idea that it wasn't simply the number of criminal contacts an offender had that predicted their success but rather how these contacts were connected. Individuals embedded in non-redundant networks - brokering connections between their criminal contacts - were better positioned to profit from their crimes (see Morselli, 2001; Morselli et al., 2006; Morselli & Roy, 2008). More recently, Morselli, Paquet-Clouston and Provost (2017) again demonstrated that an individual's network position was a better predictor of success, here defined as the volume of drugs a participant handled than even their status within the organization. Together, these works highlight the salient nature of an individual's position within their criminal network as a determinant of their success in illicit markets.

Work on criminal human capital shows prior experience also plays an important role for criminal earnings. Numerous proxies have been used to measure experience, including age at first crime, criminal justice contact, and specialization (Loughran et al., 2013; Matsueda et al., 1992; McCarthy & Hagan, 2001; Nguyen & Bouchard, 2013; Nguyen et al., 2017; 2021; Tremblay & Morselli, 2001; Uggen & Thompson, 2003). In one of the most compelling demonstrations of the link between an offender's criminal experience and their returns to crime, Loughran et al. (2013) demonstrated that the cumulative frequency in which an individual engaged in income-generating crimes in the past six months played an important role in explaining an offender's illegal wage rate.[1] The finding that individuals with more criminal experience report higher earnings has been observed across offending populations (e.g., Morselli & Tremblay, 2004; Nguyen & Bouchard, 2013). Together, these results suggest that offenders learn from prior crimes, honing their skill sets to increase future profits.

[1] Measured as individuals' total reported illicit earnings as a function of the number of weeks they worked an illicit job.

Criminal social capital and criminal human capital intersect in ways that allow offenders to learn from their own crimes and those of others to earn higher incomes. Indeed, Nguyen (2020) empirically demonstrates that, in a prison context, criminal capital is unidimensional - individuals highest in criminal social capital were also those highest in criminal human capital. In other words, both an individual's connections with other criminals and their own crime-specific expertise lead to important benefits for their illicit earnings (also see McCarthy & Hagan, 2001). However, much of what we know about variation in criminal earnings comes from studies of offenders engaged in crimes in the physical realm and has yet to foray into how criminal capital influences earnings in cyber-dependent crimes. This represents an important gap, as research on criminal capital suggests that the dimensions critical to success may be distinct for online offences compared to those perpetrated offline (Nguyen, 2020, p. 209). Likewise, the cybercrime literature raises questions about whether the skills and expertise to be a successful drug seller in physical markets carry over to online markets.

The Returns to Crime in Online Markets

Although prior work has primarily explored variation in criminal earnings in offline settings, it has not been completely ignored in online crimes. A growing body of research has begun to assess the features that distinguish more successful offenders in online markets. This work highlights similarities and differences between online and offline markets in terms of the role of criminal contacts and the skills and expertise to be successful.

Some scholars question the benefits of offline criminal contacts for drug sellers' online success, which may not carry the same perks in digital marketplaces. One of the key innovations of online marketplaces is that they supply vendors with access to a centralized pool of potential buyers and rating systems, allowing vendors to build online reputations to attract clients,

independent of ‘who they know’ in the physical world (Diekmann et al., 2014; Jiao, Przeopiorka & Buskens, 2021; Przeopiorka et al., 2017). Past work shows online reputations are one of the main ways customers select sellers on online marketplaces (Duxbury & Haynie, 2018), and vendors with established online reputations who expand their operations to a new market are more likely to be successful than new market entrants (Norbutas, Ruiter & Corten, 2020b). However, once vendors establish trusted exchange relationships with customers, they are more likely to continue their patronage, even if vendors receive negative reviews from other third parties (Norbutas, Ruiter & Corten, 2020a). Indeed, vendors who develop established customer bases and are embedded in transaction networks where buyers indirectly refer other customers have higher monthly revenues on illicit marketplaces (Duxbury & Haynie, 2021). In these contexts, online drug sellers may not be as reliant on ‘brokers’ who have the necessary contacts to procure bulk orders of drugs and distribute them to local sellers as their offline counterparts. Rather online drug sellers establish their own digital identities to secure customer bases on online marketplaces, as compared to offline drug sellers who may rely on personal ties for referrals.

Indeed, the shift from physical to virtual platforms means that face-to-face interactions have in many ways been replaced by online channels of communication (van Hout & Bingham, 2013). Online forums also provide vendors with access to other drug sellers from whom they can learn more about online drug sales. Ladegaard (2020) showed how online drug sellers consulted discussion forums to decide which online marketplaces to sell their shops. Norbutas (2020) found that online drug sellers who engaged in social interactions in online discussion forums had higher sales and established more exchange relationships with customers, even after controlling for their reputation. Indeed, forums provide milieus for individuals to exchange information to learn the skills and expertise to successfully carry out crimes (Holt & Copes, 2010) and techniques to elude

detection (Aldridge & Askew, 2017).

Yet, other researchers find evidence that offline criminal contacts play an important role in online crimes, including curbing distrust (Bulanova-Hristova et al., 2016; Leukfeldt et al., 2017; 2019; Lusthaus, 2019). For instance, Leukfeldt, Kleemans and Stol (2017) show that many of the individuals engaged in online crimes forged relationships offline, counting among their accomplices' individuals from their neighborhood, with whom they had family ties, or belonged to the same school or sports team. Although offline ties played a prominent role in many groups, the individuals who consulted online forums were better equipped to increase their criminal skills. Indeed, Leukfeldt, Kleemans, Kruisbuergen and Roks (2019) found that individuals involved in more 'high-tech cybercrimes' were more likely to rely on online contacts than individuals in 'low-tech cybercrimes' who drew more heavily from offline social relationships. Thus, individuals with offline drug selling experience may continue to rely on offline contacts, having better access to established suppliers that can procure a higher quality product and maintain reliable supply chains than online sellers.

Of particular relevance to our research is the suggestion that online markets also require new and different skillsets than those required in offline markets. For instance, sales on cryptomarkets often necessitate that transactions be done using anonymizing cryptocurrencies, such as Bitcoin. Setting up a wallet, making sales, and converting these cryptocurrencies into usable currency all require a degree of technical proficiency. In addition, vendors must market their illicit wares, attracting clientele through appealing photos and descriptions of their products. Creating and managing online storefronts thus requires that offenders have a degree of technical expertise, in contrast to offline markets, traditionally characterized by quick buys and cash payments.

Lastly, there is also reason to believe that online drug sellers are motivated more by longer-term profits than offline drug sellers. For instance, Jacques and Wright (2015) observed quick fixes and fast money characterize physical drug markets, where drug vendors make quick sales that lead to immediate returns. In contrast, online drug sales require multiple steps before a transaction is completed. Vendors are required to set up an online storefront on a site (i.e., vendor account), which may include a 'deposit' to secure a spot on the market, build their reputation (i.e., feedback), and then after a transaction has been completed, convert cryptocurrency into usable currencies. In this sense, online drug sellers may more closely mirror vendors active on licit online markets, such as eBay or Amazon platforms, where they invest time in building their online brand in order to make returns later on (see Barratt, 2012). This is especially true since there is a significant barrier to sales in online markets. Anyone can set up a seller profile and advertise drugs, but only 1% of them make significant sales. Drug markets have been described as tournament settings where a rotating set of actors compete to reach the top spots that alone come with significant revenues (Décary-Hétu, Paquet-Clouston & Aldridge, 2016). As such, online sellers must bide their time until a spot opens, given that users are most likely to purchase only from established and already popular sellers (Norbutas, 2020), which may not be related to their offline credentials.

Current Study

Market crimes have been undergoing a silent transformation over the past two, if not three decades. This transformation began with the rapid technological innovations in the 1990s, followed by the democratization of communication tools in the 2000s. These realities, although heavily studied in most social science fields, were barely investigated in criminology. This is easily explained by the reliance of researchers on official data that has struggled to keep track of cybercrimes. Cybercrimes can be international, meaning that offenders are located in foreign jurisdictions, and that law

enforcement is not motivated to file reports and statistics on crimes they cannot police. Cybercrimes are harder to track in official statistics as well as harder to research. This explains why few studies have examined the cybercrime offenders, even though cybercrime is suggested to have overtaken property crime at least in frequency, if not in importance.

The transformation of market crimes begs a significant question: is this transformation the product of a shift of current offenders or the result of a new breed of offenders who were not active in crime before? The former would represent a safer answer for criminologists as much of the theories, approaches, and methods used in the past could still apply to today's shifting crime. However, the latter represents an unsettling new reality where much of what has been learned about crime may simply not be true anymore. With new entrants, a new environment, and possibly new forms of crime, it is possible that theories vetted time and time again may not hold much water anymore.

Research opportunities abound in this context, especially to understand if what we believe to be true about crime still resonates in the digital realm. Suppose criminal experience acquired in 'street' or physical markets is positively associated with higher earnings in online drug markets. In that case, this will shed insight into the pathways of offenders into drug markets. Moreover, if experience in physical drug markets doesn't translate into success online, it would suggest a new type of crime or offender is at hand. Conversely, suppose the individuals transitioning from physical realms into virtual ones are not able to reap high criminal earnings. In that case, they may be getting left behind while new cohorts of offenders with technological skills fill the void.

This study builds on past research on traditional drug markets to examine the new digital realm of drug dealing. While relatively small, with 700 million USD in yearly sales compared to offline drug markets, online drug markets have multiplied by more than seven since 2013

(Chainanalysis, 2021). Their anonymity, ease of use, and increasing democratization make them an ideal new testing ground for many other types of crimes that could shift online. Offenders have much to lose by leaving a physical market they know to join a digital market where risks and potential earnings are difficult to assess (Aldridge & Décary-Hétu, 2016). This makes online drug dealing an especially relevant field of research to model the transformation of crime and to understand how different career paths structure criminal earnings.

Data

Data for this study come from an online survey of drug sellers on the darknet. The use of surveys to study drug seller populations has a long history in the study of drug markets (Barratt et al., 2012; Daniulaityte et al., 2018). A digital approach to surveys has recently caught the attention of drug scholars as a means to survey hidden populations, including cannabis cultivators (Barratt et al., 2012), cryptomarket vendors (Martin et al., 2020), and drug users (Daniulaityte et al., 2018; Miller & Sønderlund, 2010). Online surveys provide a novel means to access elusive populations that are not well understood, as is the case here.

The online survey asked cryptomarket drug vendors about their online and offline drug selling experiences, drug-related conflicts, vendor networks, and demographics. Important for our purposes, vendors were asked whether they had sold drugs in physical drug markets, the year they started selling drugs in physical markets (if applicable), and the year they started selling drugs in cryptomarkets, allowing us to identify whether a vendors' onset into drug selling began in an offline or online milieu. In order to respond to the survey, vendors had to report being at least 18-years of age and had made at least one drug sale on a cryptomarket in the past year. All responses to the survey were automatically saved into a text file.

Survey recruitment occurred from September 18, 2017, to December 1, 2017. We recruited cryptomarket drug vendors through three approaches. First, a public advertisement was posted on the DeepDotWeb, a website dedicated to providing news about the dark web. Importantly, DeepDotWeb, at the time, provided real-time links to access cryptomarkets, and thus were frequented by both vendors and buyers. Second, we advertised our survey on Reddit forums on the clearnet for ten cryptomarkets, which were active at the time.[2] Third, vendors with listings on these ten large cryptomarkets were directly invited to participate in the survey through the markets' internal messaging systems. In total, 1,091 vendor accounts were invited to participate in the online survey. A reminder message was sent to sellers previously contacted who still had active accounts between October 24 and December 1, 2017. In all, 745 individuals opened the survey link that was sent to them. Of these 745, a total of 133 individuals provided complete or partial responses to the survey. Here, we focus on 51 vendors who provided information on their year of onset into physical and online drug markets.

Sample Characteristics

Table 1 presents the demographics of our sample. The vast majority of respondents who reported their sex were male, with only one female responding to the survey. Respondents who reported their racial/ethnic background identified primarily as White (79%), with some respondents identifying as East Asian (8%), Other (8%), or Black (4%). The average respondent was 35 years old (SD = 10), with vendors' ages ranging from 23 to 56. Most respondents reported a minimum education level of a high school diploma (93%), with many continuing on to obtain a college or vocational certificate (22%), a university degree (33%), or a Master's or Ph.D. (19%). Respondents came from across the globe, with the majority located in North America (56%), followed by

[2] The ten cryptomarkets comprise Aero, Berlusconi, CGMC, Dream Market, Libertas, RSClub Market, Sourcery Market, Tochka, the Trade Route, and Zion.

Western Europe (34%), Eastern Europe (6%), and Oceania (3%). However, few respondents reported their demographics in the survey. Thus any interpretation of these sample characteristics should keep in mind low response rates across our sample of 51 vendors for all demographic questions.

TABLE 1

Vendors also reported their activities selling drugs online, including the year they first started selling drugs online, the number of vendor accounts they managed, whether they collaborated with others, and the number of hours they dedicated to selling drugs online. On average, vendors had sold drugs online for 2.8 years (*SD* = 1.9), with some having only just started and others having sold drugs for up to six years, back when cryptomarkets had only first emerged. On average, vendors reported creating 2.1 vendor accounts (*SD* = 2.1), with a median of one vendor account, a finding consistent with prior research (Martin et al., 2020). Vendors tended to range in working with other accomplices, reporting that they worked with an average of 2.6 others to sell drugs on cryptomarkets (*SD* = 2.8), ranging from 0 to 10 accomplices. Vendors also reported the number of hours they spent selling drugs online each week. On average, vendors spent a substantial portion of their weeks involved in drug selling, 25.6 hours weekly (*SD* = 23.7), almost a part-time job, ranging from 1 to 100 hours per week.

Essential to the current study, respondents reported their total earnings selling drugs on a cryptomarket in the prior year. All respondents reported receiving some income from selling drugs. Consistent with earlier studies of drug vendors, there was a high degree of variation in criminal earnings. Vendors reported earning a median of 10,000 USD selling drugs on cryptomarkets (*M* = 83,404; *SD* = 243,021), ranging from low earners who made 2,500 USD to high earners who made over 1 million USD in the prior year. We calculate the hourly wage of cryptomarket drug vendors

by dividing a vendor's total reported criminal earnings in a year by the number of weeks and then dividing this by the average number of hours a vendor worked each week. This measure more accurately calculates the proficiency of a vendor at earning returns for the amount of time spent selling drugs. The median hourly wage for a cryptomarket vendor was 15 USD ranging from a low of two dollars per hour to a high of 344 dollars per hour (M = 48 USD; SD = 85 USD).

Lastly, respondents also reported if and when they had sold drugs in offline markets. Our sample was nearly evenly split into vendors whose onset into drug selling began in physical versus digital realms. Out of the 51 cryptomarket drug vendors, 41 percent reported selling drugs offline prior to entering online drug markets. We refer to these vendors as "Offline-first," as they began their selling careers in physical drug markets before transitioning to online ones. Similarly, "Online-first" vendors comprise individuals who did not report selling drugs offline or engaged in offline sales the same year they entered online drug markets or within the next few years. The variation in vendors who began in offline markets compared to those who started online is consistent with other samples (Martin et al., 2020) and allows us to examine our main question of interest - whether prior experience in physical drug markets leads to higher earnings online.

Results

Table 2 compares cryptomarket drug vendors whose onset into selling drugs began in online markets versus those whose onset began in physical markets. We find that vendors whose onset began in online drug markets had a slightly higher number of years of experience selling drugs online. On average, vendors who first sold drugs in online markets had 3.0 years of experience (SD = 2.0). In contrast, vendors who first sold drugs in physical markets had slightly fewer years of experience, with an average of 2.4 years (SD = 1.8). We also find that vendors who began in online drug markets tended to set up a slightly higher number of vendor accounts (M = 2.3; SD =

2.5) than vendors who began in offline markets (M = 1.8; SD = 1.0). Despite having fewer vendor accounts, vendors who started selling drugs in offline markets had a higher number of accomplices assisting them with their online sales. On average, vendors who began selling drugs offline had 3.6 co-accomplices (SD = 3.0), whereas vendors who began selling drugs in online markets reported an average of 2.3 co-accomplices (SD = 2.7). As shown in Table 3, none of the differences are statistically significant.

TABLE 2

Cryptomarket drug vendors who began selling drugs in offline, face-to-face markets also reported lower total income from their online drug sales. Vendors who began in offline markets reported an annual median income of 10,000 USD. In contrast, vendors who began in online markets reported an annual median income of 11,000 USD. Similar to this, we find that vendors who began in online markets spend similar amounts of time selling drugs online. On average, vendors who began online spent 26.5 hours each week managing their cryptomarkets (SD = 24.5), with some only spending an hour each week and others up to 100 hours. In contrast, vendors who began in offline markets spent an average of 24.1 hours each week (SD = 23.0), ranging from a low of two hours to a high of 80 hours each week. However, both report a median of 20 hours per week in managing their online cryptomarkets. Again, there are no statistically significant bivariate differences between our online-first and offline-first vendors for their total annual earnings or number of hours spent selling drugs online.

TABLE 3

Lastly, we examine bivariate differences in the hourly wage for vendors selling drugs online. We find that, on average, vendors who began selling drugs online make, on average, 20 USD per hour (SD = 22 USD) with a median hourly wage of 13 USD. In contrast, vendors who

have prior histories of selling drugs offline make, on average, 79 USD per hour (*SD* = 116 USD), with a median hourly wage of 18 USD. As shown in Table 3, these differences between vendors are statistically significant, although we are cautious in making conclusions based on the small convenience sample. Figure 1 plots the hourly wage of cryptomarket vendors, comparing vendors who began in online markets versus those who began in offline markets. We show that there are a high number of vendors who began in online markets reporting a wage between 0-50 USD an hour. However, the hourly wage of vendors who began offline is more spread out. While a substantial portion of vendors report earnings in the 1 to 50 USD range, many report much higher earnings from 50 to 350 USD per hour.

FIGURE 1

Discussion

Our study raises questions about the popular image of online offenders as a distinct cohort of criminals. Our study suggests that online drug offenders may not be so distinct from their offline counterparts. In fact, consistent with studies of traditional offenders, those with offline drug selling experience are more successful than those who only sold drugs online. This suggests that the skills necessary to be successful in online drug markets may depend, at least partially, on offline experience. This finding joins a growing body of research that demonstrates that cryptomarkets show some important similarities with offline markets (Norbutas, 2020).

Our study also provides preliminary evidence that experience accrued in offline settings leads to higher criminal achievement online. Online drug vendors whose onset began in offline drug markets had higher illegal wage rates for their online drug sales. This finding suggests that online drug vendors with prior histories selling in physical drug markets may be more proficient at receiving returns. Our results are consistent with a long line of research on criminal capital,

which shows that prior experience increases the returns to crime. One explanation for these differences may be that vendors who began selling drugs online have fewer years of experience than those who began offline. However, as shown earlier, our offline sellers tended to have fewer years' experience selling drugs online than those who had begun selling drugs in digital markets.

The differences we do observe between the earnings of online and offline offenders may be partly explained by the embeddedness of cryptomarkets in physical drug markets. Paquet-Clouston et al. (2018) showed how vendors must source their drugs in physical markets and that the shipping of drugs through the postal service constrained who and how illicit drugs could be sold on the darkweb. Munskgaard (2021) more recently expanded on this idea and investigated the social aspect of cryptomarkets. He found that transactions were facilitated through social ties and that the size of transactions was even explained by positive past communications and transactions. These studies suggest that it would be challenging to dissociate online from offline drug dealing. However, there are clearly environmental differences that prevent all offline dealers from moving their business online. This includes mastering anonymizing technologies and even attracting clientele through showcasing their products on online storefronts.

Our findings are also consistent with prior work emphasizing the role of offline social ties for cybercrimes (Leukfeldt et al., 2017; 2019; Lusthaus, 2019). Thus, individuals who initially engaged in drug sales offline may continue to rely on their established contacts with suppliers to provide a better product and create reliable supply chains. Likewise, it is possible that clients themselves are moving online and turning to the same suppliers they relied on in physical settings, which may be able to deliver larger quantities in person. Cryptomarkets may therefore be classified more as an iterative than a paradigm-shifting innovation, as suggested before (Aldridge & Décary-Hétu, 2013).

Limitations and Conclusion

Drug vendors represent a hidden population that requires innovative study designs to access them. Much of the research on cryptomarket drug vendors rely on digital trace data available through product listings and posts publicly reported on cryptomarkets (e.g., Duxbury & Haynie, 2018; 2021; Martin et al., 2018; Norbutas, 2020; Soska & Christin, 2013). This has led to unprecedented access to the transactions of drug vendors; however, it misses information on the vendors themselves. The current study aimed to fill this void by reaching out directly to vendors about their online drug sales. However, this raises concerns about issues of selection bias and the reliability and validity of responses. We attempted to assuage concerns about the validity of responses by ensuring the anonymity of the respondents, such as disabling JavaScript of the survey so that we could not identify any information about the respondents and maintain the anonymity of the individuals who accessed it. In addition, we only advertised the survey through news sites popular to drug market vendors, including Reddit, direct messages to vendors, and the dark web news forum DeepDotWeb. We assume that each entry is from a separate vendor; however, we are unable to verify multiple responses.

Interpretation of the study's findings should consider that our estimates of criminal earnings come from self-reports. Although self-reports of criminal earnings have been shown to be reliable and valid measures in physical markets (Nguyen, 2020), this finding has not been extended to online surveys. If we compare our estimates of criminal earnings to other studies using transaction data available on cryptomarkets, we find similar results. For instance, Décary-Hétu et al. (2016) estimated vendors' yearly revenue on cryptomarkets to range from zero USD to 1,484,334 USD with a median of 7,296 USD, which is comparable to our median of 10,000 USD annually, particularly when you consider that one vendor account may reflect more than one

individual. However, to our knowledge, estimates of vendors' offline drug sale histories are not available and would be challenging to obtain. These estimates provide an insider's look into the background of vendors online.

The findings of this study are exploratory and rely on survey techniques of dark web drug vendors. Although this represents one of the largest samples of cryptomarket vendors, it is still quite small and only represents the first step towards better understanding this population. We know moreover that online drug vendors are active on other platforms. The challenges with accessing Tor and exchanges in cryptocurrencies means that many drug sales will occur on other platforms such as social media sites (see Bakken & Demant, 2019). We encourage future research to move beyond the darknet and explore online illicit drug sales in the wider context of the internet. The current study provides a first step, but more information is needed about entry into online drug sales. For instance, how do drug sellers make the transition into online markets? Prior research suggests that online drug vendors used to be buyers, procuring drugs from online markets before making the switch (Martin et al., 2020). But this tells us very little about the processes and mechanisms that drive the shift from offline to online. The barriers that drive this shift may be key to understanding offender pathways and developing future prevention strategies.

Table 1. Sample Characteristics of Online Drug Vendors

	N	Mean	SD	Median	Range
Age	20	35.050	10.272	32.5	23-56
Male	24	0.958	0.204	1	0-1
Race/Ethnicity					
White	24	0.792	0.415	1	0-1
East Asian	24	0.083	0.282	0	0-1
Black	24	0.042	0.204	0	0-1
Other	24	0.083	0.282	0	0-1
Education					
No High School	27	0.074	0.267	0	0-1
High School	27	0.185	0.396	0	0-1
College	27	0.222	0.424	0	0-1
University	27	0.333	0.480	0	0-1
Graduate	27	0.185	0.396	0	0-1
Continent					
North America	32	0.563	0.504	1	0-1
Western Europe	32	0.344	0.483	0	0-1
Eastern Europe	32	0.063	0.246	0	0-1
Oceania	32	0.031	0.177	0	0-1
N years sold drugs online	51	2.765	1.924	3	0-6
N vendor accounts	35	2.114	2.125	1	1-10
N co-offenders	37	2.647	2.806	2	0-10
Value drug sales past yr ($)	35	83,404	243,021	10,000	600-1,280,000
N hours spent selling drugs online (weekly)	49	25.551	23.740	20	1-100
Hourly wage selling drugs online ($)	34	47.810	85.303	15.4533	1.803-344.497
Sold drugs offline prior to selling online	51	0.412	0.497	0	0-1

Table 2. Comparison of Drug Selling Experiences between Vendors Who Began Selling Drugs Offline and Vendors Who Began Selling Drugs Online

Online-First	**N**	**Mean**	**SD**	**Median**	**Range**
N years sold drugs online	30	3.033	1.991	3	0-6
N vendor accounts	23	2.304	2.530	1	1-10
N co-offenders	24	2.250	2.691	1	0-10
Value drug sales past yr ($)	18	35,089	61,429	11,000	600-250,000
N hours spent selling drugs online (weekly)	30	26.500	24.541	20	1-100
Hourly wage selling drugs online ($)	18	19.738	21.829	13.049	2.404-96.154
Offline-first	**N**	**Mean**	**SD**	**Median**	**Range**
N years sold drugs online	21	2.381	1.802	2	0-5
N vendor accounts	12	1.750	0.965	1	1-4
N co-offenders	10	3.600	2.989	3	0-9
Value drug sales past yr ($)	17	134,562	340,713	10,000	2,500-1,280,000
N hours spent selling drugs online (weekly)	19	24.053	22.994	20	2-80
Hourly wage selling drugs online ($)	16	79.390	116.013	17.628	1.803-344.497

Table 3. Bivariate Tests Comparing Drug Selling Experience

	Online vs. Offline-first Cryptomarket Vendors		
	N	***r***	**p-value**
N years sold drugs online	51	-.169	.237
N vendor accounts	35	-.126	.472
N co-offenders	34	.223	.206
Value drug sales past yr ($)	35	.208	.232
N hours spent selling drugs online (weekly)	49	-.051	.729
Hourly wage selling drugs online	34	.354	.040

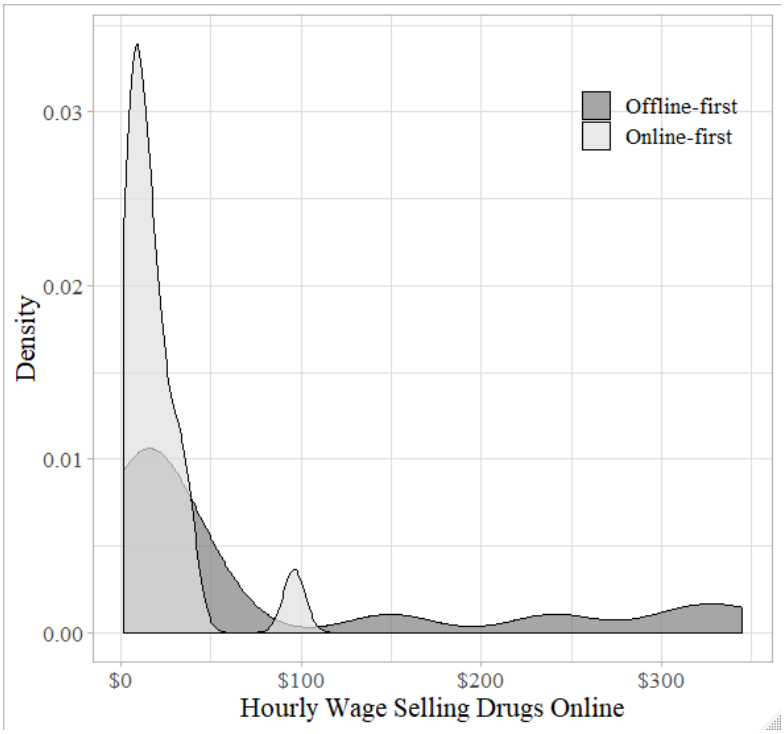

Figure 1. Hourly Wage of Vendors Selling Drugs Online, Comparison of Vendors Who Began Selling Drugs Offline and Vendors Who Began Selling Drugs Online. N = 34

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