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The bonfire of banknotes

by Michele Manna

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THE BONFIRE OF BANKNOTES

by Michele Manna*

Abstract

In this paper we examine the role played by cash in crime. Our sources include research papers by economists (which point to a link between cash and corruption/shadow economy), works by crime scholars, and reports by international institutions and law enforcement agencies. Overall, opinions differ on how best to frame such role, as cash could be broadly regarded as a component of crime (our opinion), a catalyst, or even a cause of it. This range of views partly owes to the fact that good quality data with enough time depth are not easily available in this field of research. As an additional factor of complexity, crime is a multi-line business and the odds are that cash weighs more prominently on, say, the street selling of drugs than on wholesale segments. Finally, the role played by cash in criminal activity ought to be cast against the complexity and financial dimension of crime in our days, including its ongoing transition toward crypto-assets and the Darknet. The paper thus explores this dimension too.

JEL Classification: C18, E42, K42.

Keywords: banknotes, crime, money laundering, crypto-assets.

Sintesi

In questo articolo si esamina il ruolo svolto dal contante nel crimine. Le nostre fonti comprendono ricerche di economisti (che indicano presenza di un legame tra il contante e corruzione/economia sommersa), lavori di criminologi, rapporti di istituzioni internazionali e forze di polizia. Nel complesso, le opinioni differiscono su come rappresentare questo ruolo, dato che il contante potrebbe in generale essere considerato un elemento del crimine (la nostra opinione) fino a esserne considerato un catalizzatore o perfino la causa. L'eterogeneità di valutazioni in parte riflette la circostanza che in questo campo è difficile disporre di dati di buona qualità con sufficiente profondità temporale. Un ulteriore elemento di complessità attiene alla natura trasversale del crimine come attività economica; ad esempio, è verosimile che il contante pesi nella vendita al dettaglio di droghe e meno nelle transazioni all'ingrosso. Per ultimo, questo ruolo va esaminato anche tenute presenti la complessità e dimensione finanziaria del crimine al giorno d'oggi, compresa la transizione in corso verso le crypto attività e il Darknet. L'articolo esplora anche quest'ultima dimensione.

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CONTENTS

1. Introduction	7
2. What economists say on cash and crime (and what they measure)	9
3. Voices from the field: reports of leading international institutions, agencies and fora	12
4. What crime scholars say (or better don't say) on cash	17
5. The future is already here: crime in cyberspace	18
6. Fundamental economic laws are going to rule in the future too	20
7. Connecting the dots and data issues	21
8. Conclusions	24
Additional tables and figures	27
References	36

Because of a need to impose order on our environment, we seek and often believe we find causes for what are actually accidental or random phenomena

People also tend to assume that causes are similar to their effects, in the sense that important or large effects must have large causes

R. Heuer, Psychology of Intelligence Analysis

1. Introduction¹

The argument could not be more compelling. We are informed that ‘cash still plays a crucial role in most criminal and terrorist financing activities’ (Riccardi and Levi, 2018), given that in ‘the drug economy, cash dominates [and in] human trafficking and human smuggling, cash is key’ (Sands, 2016). Accordingly, one would expect law-abiding citizens to concur with the statement that ‘circumscribing cash will not end crime and terrorism, but it will deal them a significant blow’ (Rogoff, 2016).

The sheer fact that we could organize this opening statement quoting three recent contributions speaks volumes about how lively the current debate on cash and its use is. The ‘if’ dimension of this debate – namely the fact that Crime Inc. uses cash, among other things, to store wealth and to conduct their business – is beyond discussion (why shouldn’t they, anyway). The contentious topic is rather the ‘how much’ element, namely whether cash is actually key to the actions of organized crime, or else it is just one financial instrument along many others, including the latest wave of crypto-assets.

The fresh interest in this debate may owe also to the apparent paradox between the relentless rise of electronic means of payment and the fact that in several countries the number of banknotes in circulation keeps expanding stubbornly. Hopefully, the following reasoning provides a fair representation of the views of those who are more vocal in claiming banknotes’ sins: (1) the average number of banknotes per capita – especially as far as large denomination notes are concerned – is well above what most of us would find coherent with our daily needs; (2) households pay ever more frequently through electronic instruments, relying on cash mainly for small purchases, as far as licit and widely-accepted purposes are involved; (3) hence, a significant number of banknotes in circulation ‘must’ have to do with illicit purposes.

While there is some logic to this sequence – but beware of details, as we shall argue in this paper – one could nevertheless be forgiven for noticing a sense of hype in sentences such as: ‘the massive

¹ The author would like to thank Pietro Catte, Antonio Di Cesare, Steven Fioco, Mario Gara, Francesco Montaruli, Andrea Nobili, Eloisa Perazzolo, two anonymous referees, and participants to an internal seminar for useful suggestions, as well as Riccardo Imbimbo for great research assistance. The views expressed in the article are those of the author and do not necessarily represent those of the Bank of Italy.

quantities of cash circulating today [...] are a huge public policy problem that needs to be urgently discussed' (Rogoff, 2016)² and 'Eliminating high denomination notes would disrupt their [that of the 'bad guys'] business models' (Sands, 2016). Wording such as 'huge problem' and 'disruption' (not just 'reduction') raises legitimate questions on what the facts are.

The debate on Rogoff's influential book does not lack irony. White (2018) observes that the main indictment of large-denomination banknotes by anti-cash warriors is guilt by association: criminals use large notes, so anyone who uses them may be a criminal. Begović (2017) quips that in Rogoff's narrative, cash is the devil at the very heart of some of the most intractable public policy problems to the point that only global warming seems to be missing from the list. Given that things usually come in threes, Garber (2016) also judges Rogoff as a relentless prosecutor, who loads the indictment with every conceivable crime, making paper currency a vector for disease.³ There is not just irony though in the debate and the authors we have just cited – to whom we would add Hummel (2017), Rösl, Seitz and Tödter (2017) and Dowd (2019)⁴ – review Rogoff's analysis critically.

In this paper we set out to verify the quantitative weight played by cash in criminal activities by carrying out a broad-ranging and multidisciplinary fact-finding exercise. Borrowing the title of a well-known report in the field by Europol (2015), the issue is whether there exist enough systematic data supporting the view that cash is king in crime.

An inquiry into the link between cash and illicit transactions requires an examination of a literature that is not only vast but which also requires a wide range of skills. Bearing this in mind, we directed our work in several directions. Firstly, we gathered the evidence offered by the 'anti-cash camp', including a (brief) survey of econometric results on the aforementioned relationship. Secondly, we turned to international institutions, agencies and fora dealing with crime, looking at what their recent reports tell us about cash. Thirdly, we looked at criminology journals to understand how frequently and in what terms scholars in that field speak about cash.

In *Animal Farm*, George Orwell creates a fictional farm staging a revolution aimed at getting rid of injustice and evil. Led by Snowball and Napoleon (two pigs), the animals overthrow their irresponsible farmer and establish a new society, from which human beings are banned. At first, the new life seems promising: food is plentiful and the farm runs relatively smoothly. We all know how the plot of the book ensues: the idyll gradually leaves room to less edifying behaviour while the farm and their inhabitants end up being captivated by the same vices they had meant to eradicate in the first place. Or probably worse.

² Rogoff (2016) suggests to phase out currency '*beginning with all notes of \$50 and above (or foreign equivalent) [...] small bills would be left in circulation for an indefinite period. In the final phase, small bills would be replaced by equivalent-denomination coins of substantial weight*' (page 93). He is careful to leave both options open: getting rid of all paper currency (after a transition phase) or only the largest denominations. On balance, his main arguments – banknotes serve for criminal purposes and narrow the room for manoeuvre in monetary policy making – truly work only in a cashless society, which we thus understand being his bottom-line project. One can purchase illicit drugs at a retail level using medium denomination notes; likewise, if cash remains, whatever the denomination of the note, the risk remains of a run on banks in case of negative interest rates. He was more clear-cut in works aimed at the academia and not to the wider public as his 2016 book, as visible in the title of his 1994 paper '*Costs and benefits to phasing out paper currency*' (paper currency, not just large denomination notes).

³ There is a certain element of exaggeration in these reviews too and Rogoff later complained about the dramatic representation of his thesis, to which then White (2018) retorted that this was '*a bit ironic coming from the author of a book entitled *The Curse of Cash, not The Disadvantages of High-Denomination Bills**'.

⁴ Of course, this is not an exhaustive list of works prompted by or related to the economic points raised by Rogoff (2016).

If this novel teaches something, one should at least consider what could come next once cash were no longer part and parcel of our daily lives, as suggested by some anti-cash literature – no matter how well intended is the premise to this step. Nowadays, an obvious place to look for cash-less developments is the cyberspace and, notably, that region of the Internet known as the Darknet, whose marketplaces host significant criminal activity. We will argue that this virtual region provides a ‘land in the middle’, a neutral ground where crime gangs and ordinary citizens can meet and undertake all sorts of trade using crypto-assets. Indeed, in a recent article, Rogoff (2021) too points to some risks relating to crypto-assets, which he defines as ‘A Curse Worse than Cash’.⁵ Accordingly, we shall also examine some issues relating to illicit trades involving such assets, including what could hamper their development (besides, of course, police action).

This introduction would not be complete without the admission of a conflict of interest: the author of this piece works at a banknote printing plant. Bearing this in mind, precautions have been adopted to try to render this research as open and balanced as possible. Firstly, we broadened the scope of the research, reaching a literature well beyond that prompted by Rogoff’s book. Secondly, we opted for quoting original sentences written by the ‘anti-cash camp’, rather than paraphrasing them. Pedantic as it may sound, we chose to adopt a non-interpretative approach to render their views. Thirdly, we restricted to a minimum our own original computations, since any selection of data and variables, not to mention models, inevitably implies subjectivity to some degree.

The rest of the paper is organized as follows. Section 2 surveys contributions by economists on the link between cash and crime. Section 3 turns to recent reports from a number of international institutions. Section 4 reports the results of an extensive search conducted on a number of leading international criminology journals. Section 5 introduces some basic concepts about the Darknet and crypto-assets. Section 6 briefly discusses within an economic framework the potential of these assets to crowd out banknotes in illicit trade, more than they have already done. In Section 7 we examine data on money laundering and cash use. Section 8 concludes.

2. What economists say on cash and crime (and what they measure)

The title says it all: *The Curse of Cash* (Rogoff, 2016). Credit to the author when he clarifies right from the start his line of thinking: ‘*The world is drowning in cash – and it’s making us poorer and less safe*’. As to what less safe means:

There is little question that cash plays a starring role in a broad range of criminal activities, including drug trafficking, racketeering, extortion, corruption of public officials, human trafficking, and, of course, money laundering (Rogoff, 2016, p. 2)⁶

The key word in this excerpt is ‘*starring*’: cash is not described as being used in illicit activities, it is reckoned to be central to them. The following two paragraphs add to the message:

There is little question that cash is still king, offering anonymity and real-time clearing of transactions at every level of criminal activity [...] It would be difficult to list all the areas

⁵ For a more academic contribution along the same lines, see Group of Thirty (2020), a report on digital currencies drafted by a group of experts chaired by Rogoff and Rajan.

⁶ Corruption is the ‘*the abuse of public office for private gains*’ (World Bank, 1997) while money laundering is ‘*the process of concealing and disguising the identity of illegally obtained proceeds, making the origin appear legitimate and leaving no link to the real source of the funds, their real owner or intended beneficiary*’ (Europol, 2015).

where cash has pernicious effects without turning this book into an encyclopedia of criminal activity (Rogoff, 2016, p. 47)

In this chapter and the preceding one, we have seen just how huge the costs of cash are in terms of tax evasion and crime (Rogoff, 2016, p. 79)

In truth, the title nearly says it all. Indeed, only two chapters in Rogoff's book deal directly with the evil of cash⁷, while much longer sections discuss more standard monetary policy topics such as the zero interest rate threshold. As to the cash & crime link, the book offers an impressive sequence of bits of information on the market for illegal drugs, corruption, human trafficking, smuggling, illegal immigration, terrorism, counterfeiting. However, one struggles to find data of more systematic, macro nature. With respect to one of the key themes put forward in the book – the increase in transaction costs that criminal business would have to bear once cash were out of the picture – Begović (2017) observes that *'there is no insight whatsoever into what is the relative magnitude of these costs compared to the expected gain from crime. Without that information, which cannot be found in the book, there is very little ground on which one could consider the impact of the elimination of the cash to criminal activities'*.

Let's turn to Sands (2016)⁸, who argues that

Eliminating high denomination notes would not stop tax evasion, crime, terrorism or corruption. But it would increase costs and risk for the 'bad guys' (Sands, 2016, p. 3)

Cash and particularly high denomination notes are the payment instrument of choice in financial crime (Sands, 2016, p. 15)

Sands relies on a range of sources to support his thesis, among them Schneider and a report by Europol stand out. In fact, studying the various background pieces, Schneider (2011)⁹ adopts a rather cautious tone:

to arrive at an estimate of the extent and development of the amount of the financial means of transnational crime over time is even more difficult [...] All estimated figures have a large error, the estimation procedures are very difficult to use. Hence the published figures should be interpreted with great care (Schneider, 2011, p. 12)

Schneider and Schneider (2013) examine the slump in the shadow economy in 2011 and 2012 compared to 2008 and do not see the need to center their analysis on cash (something which ought to cast at least a doubt on the role played by cash itself). That is, the 'Schneider' works display a nuanced tone, in contrast with the assertive one of the above quote by Sands (2016). For fairness sake, we note that Seitz, Reimers and Schneider (2018) – a paper which clearly could not be cited in Sands (2016) and follows on also Rogoff (2016); we will say more on this chronology of events later – find a significant relationship between net issuance of medium-denomination notes and the size of the shadow economy (not for small- and large-ones).

⁷ We refer to chapters 4 and 5, which count 32 out of the 220 pages of the book (figures based on the 1996 hard cover issue, net of acknowledgements, appendix, notes, references and index).

⁸ The proposal by Sands (2016) is *'to eliminate high denomination, high value currency notes, such as the €500 note, the \$100 bill, the CHF 1,000 note and the £50 note'*.

⁹ In effect, Sands cites a presentation (?) by Schneider as of 2015 which, maybe our fault, we did not manage to retrieve. As a close proxy we turned to Schneider (2011) and Schneider and Schneider (2013), two working papers with nearly the same title as the said Schneider (2015).

As to Europol (2015), it is interesting to reflect also on what that report doesn't state, besides its highly effective title, as we shall discuss in Section 3.

More fact based evidence is offered by a different strand of econometric literature.

Singh and Bhattacharya (2017) detect a statistically significant contribution of either of two ratios relating to cash – currency in circulation and banknotes of large denomination, respectively, divided the M1 monetary aggregate – onto indices of corruption.¹⁰ Could that be the smoking gun, in the form of the robust and statistically significant proof we missed to find in the works *à la* Rogoff and Sand? In a way, it could. However, a number of remarks are in place. First, stating that cash adds to corruption (which is not the whole of crime but one segment of it) does not cast light on our main research question, whether cash is central to crime or rather a facilitator of it. Second, Singh and Bhattacharya caution about the intrinsic limits of any study on corruption, a phenomenon which is not easily measurable in an accurate way not least because available indices tend to refer to perceived corruption more than to actual one.¹¹ Third, these two authors take pains in informing their reader that there is also lack of consensus on the proper regression model for the analysis of corruption. Fourth and finally, they point out that corruption is higher in less-developed countries, which happen to be also more cash intense (a similar conclusion is in Treisman, 2007), thus stressing the challenge to disentangle causal links from correlation.

Schneider (2017) finds that when the share of cash decreases by 10%, the shadow economy decreases by 2%. To contextualize this finding, in his simulations when GDP decreases by 10%, the shadow economy increases by more than 18%.

Giammatteo (2019) uses granular data as of 2015 for Italy to measure the explanatory power of a proxy variable of the shadow economy on a cash ratio, using a number of control variables.¹² Across various specification of the model, the estimated coefficient of the shadow economy variable is found to be statistically higher than zero: namely, more shadow economy is associated to higher levels of the cash ratio across the country. However, the estimated parameters imply that the impact of the shadow economy on the cash ratio is very small in size.¹³

Again on Italian data, Ardizzi, Petraglia, Piacenza and Turati (2014) fit different specifications of a model – in effect, an aggregate money demand equation – whose dependent variable is the flow of cash withdrawn from bank accounts relative to total non-cash payments. They find that variables measuring tax evasion and crime contribute significantly, according to standard statistical tests, to explain the dependent variable. In a related paper, Ardizzi, Petraglia, Piacenza, Schneider and Turati (2014) find that the average amount of cash laundered at the national level is around 6% of GDP.

¹⁰ Singh and Bhattacharya examine two indices of corruption: (1) the Control of Corruption Index (CC) published by the World Bank's Worldwide Governance Indicators and (2) the International Country Risk Guide's corruption index (ICRG).

¹¹ Comparison between surveys on perception of crime and statistics on crime prove that the former may happen to be plainly wrong as regards actual trends; see fn. 51 and related text.

¹² The shadow economy variable is compiled as share of firms operating in building, trade and restaurants in each municipality. As explained by Giammatteo, these *'are traditionally the sectors in which the number of irregular workers is wider and their cumulative size can be fruitfully deployed as a good proxy for evasion of taxes and social contributions'*. As to the cash ratio, this is defined as cash inflows and non-cash (electronic) inflows observed at each bank branch.

¹³ While Singh and Bhattacharya (2017) use cash ratios as explanatory variables, in Giammatteo (2019) the cash ratio is the dependent variables. In our opinion, this signals that the role of cash is conceptually ambiguous, and sounds an alarm bell about potential endogeneity bias in applied work in this field.

The list of contributions exploring statistics on malign uses of cash can be expanded further.¹⁴ However, it is also enlightening to gather a sense on how diverse can be the lines of research pursued in this field, where some authors focus on cash while others consider it at best a marginal component in a broader picture. Two papers using (partially) overlapping samples come in handy: Wright *et al.* (2017) identify the reduction in the circulation of cash on the streets associated with the electronic benefit transfer (EBT) program as a factor contributing to the downward trending rates – burglaries, assaults and larcenies – in Missouri, US, from 1990 to 2011; Rosenfeld (2014) undertakes a full study on US (and also European) data on rates in homicides, robberies, and burglary rates from the early 1980s and 2010 in which economic growth and inflation play the lions' share, while banknotes are not examined.

It can be argued, with some basis, that the success of Rogoff's book set a trend, while the not-so-positive reviews we have cited above have had less resonance. This assessment relies on comparing works on the shadow economy, corruption, etc. published until 2016 with those that have appeared in more recent years. Earlier on, there was often at best limited reference to cash, as one can see in Schneider and Enste (2000), Lagrange (2003), Levitt (2004), Serra (2006), Treisman (2007) and Elbahnasawy and Revier (2012), Rosenfeld and Levi (2016). Farrell, Tilley and Tseloni (2014) test 17 hypotheses of which none of them is related to dynamics in the circulation of cash / banknotes.¹⁵ That does not mean that cash was altogether off-topic – the two aforementioned studies by Ardizzi *et al.* as of 2014 but also Goel and Mehrotra (2012) offer relevant counter examples and so does the pivotal work of Tanzi (1980) – but overall the mood seems to have changed after 2016. The following list of titles may help to support the point: 'Cash, Crime and Anti-Money Laundering' (Riccardi and Levi, 2018), 'It's Time to Kill the \$100 Bill' (Summers, 2016), 'Cash in Circulation and the Shadow Economy: An Empirical Investigation for Euro Area Countries and Beyond' (Seitza, Reimers and Schneider, 2018), 'Pecunia olet. Cash usage and the underground economy' (Giammatteo, Iezzi and Zizza, 2021), and counting.¹⁶

3. Voices from the field: reports of leading international institutions, agencies and fora

Papers by economists on cash & crime often cite UNODC (2011) and Europol (2015). Thus, it makes sense to examine these two reports, in the spirit of not leaving any stone unturned.

UNODC (2011) is a comprehensive, 140-page long report on illicit financial flows originated by transnational organized crime. In its field it remains a milestone; probably, its single more important contribution is an estimate of the magnitude of all criminal proceeds: 3.6% of global GDP, in a range

¹⁴ Further results on Italian data are in Russo (2020) and Giammatteo, Iezzi and Zizza (2021) while using European data Immordino and Russo (2018) find empirical evidence supporting the view that non-cash payments are negatively related to VAT evasion.

¹⁵ The 17 hypotheses are: strong economy, concealed weapons laws, capital punishment, gun control laws, rising prison population, policing strategies, more police, legalization of abortion, immigration, consumer confidence, waning crack market, childhood head, changing demographics, civilizing process, improved security, Internet and phone guardianship.

¹⁶ As there are exceptions in the pre-2016 pattern, recent contributions too are of different colours. Mocetti and Rizzica (2021) put forward an economic analysis of organized crime in Italy without involving cash at all. On an international scale, using data for 72 economies from 2001 to 2014, Jobst and Stix (2017) reject the hypothesis that the size of the shadow economy is an important factor to explain the increase in cash demand during the period under observation.

from 2.3% to 5.5%, corresponding to US\$ 2.1 trillion in 2009 (the year of reference for the report).¹⁷ Figures like that remain the accepted order of magnitude: in 2018 The Global Initiative Against Transnational Organized Crime reported figures for the retail value of transnational organized crime from US\$ 1.6 to 2.2 trillion (Hunter, 2018; Mavrellis, 2017).

The UNODC report puts forward the theme of the triplet of placement, layering and integration:

One specific difference between legitimate businesses and transnational organized crime is in the tendency of many crime types to generate proceeds in the form of cash, because cash is not traceable. When cash is generated, placement processes are required prior to layering and integration [...] (UNODC, 2011, p. 56)

In the jargon of crime scholars and law-enforcement agencies, placement, layering and integration are the three stages defining money laundering: the placement represents the initial entry of the 'dirty' cash or proceeds of crime into the financial system; then, the layering involves the attempt to conceal the illegal income through several transactions within the financial system, often across borders; finally, the integration is the stage where the money is returned to the criminal from what seem to be legitimate sources.¹⁸ To the extent that cash is found in the placement stage, and it is reckoned to do so heavily, then it could fuel the money laundering process as a whole. Bearing this point in mind, lacking more precise figures, one ought to remain prudent on what could be the overall role played directly and indirectly by cash.

Let's turn to Europol (2015). If one searches for the founding stone of the war on cash, this is it. The title of this report – *Why is cash still king?* – offers a phrase we also used to summarize some views on the malign use of cash. The subtitle sounds even more eloquent: *'A strategic report on the use of cash by criminal groups as a facilitator for money laundering'*. In this respect, the report refers to law enforcement agencies' findings according to which cash *'remains the criminals' instrument of choice to facilitate money laundering'* (Europol, 2015, page 7). Noticeably, the same report turns more cautious in tone when it comes to the extent cash is actually used in money laundering:

Physical cash smuggling remains a prevalent method, although it is difficult to assess the scale or nature of the phenomenon. [...] The movement of cash via freight or mail remains a blind spot and the movement of other high value liquid assets, such as gold, across borders are not captured under EU legislation [...] This is not to say that the issue of demonstrating the underlying criminality is specific to cases involving cash, however the inability to trace physical cash money movements intensifies the problem when compared to other instruments for which records are kept (Europol 2015, pages 7 and 11)

In fact, two passages of the report offer what can be regarded as hard, quantitative evidence

highly conservative estimates based on records received by Europol indicate that in excess of EUR 1.5 billion in cash is detected and/or seized by Competent Authorities each year [...] suspicious transaction reports (STRs) filed by financial institutions and other regulated entities on transactions and activities of clients which may be linked to criminality, money laundering or terrorist financing indicate that the primary reason for reporting suspicion

¹⁷ In his preface to the report, the UNODC Executive Director points out that less than 1% of global illicit financial flows are seized and frozen. This hints at how difficult it is to come up with precise figures on the magnitude of the unlawful business.

¹⁸ See the website of Business Crime Solutions Inc., (https://www.moneylaundering.ca/public/law/3_stages_ML.php) and Ardizzi, Petraglia, Piacenza, Schneider and Turati (2014).

across the EU is the use of cash: these reports account for in excess of 30% of all STRs
(Europol 2015, page 11)

As regards the 1.5 billion figure, while this very big sum awes most of us – not to mention the fact that the true figure could be a multiple of it if one could add what goes undetected – the duty remains to cast it against the overall financial dimension of crime.

Turning to the STRs, these are reports which, across the European Union, financial intermediaries and other persons engaging in financial and non-financial activities¹⁹ are required to send to their national Financial Intelligence Unit (FIU) whenever they know, suspect or have reason to suspect that money-laundering or terrorist financing is being or has been carried out or attempted.²⁰

That said by way of introduction of what an STR is, the 30% statistics mentioned by Europol counts the frequency of STRs involving cash. In this field, already counting the beans seems to be a hard job. Tellingly, the Department of Justice-Canada (2020) points out that *'Suspicious Transaction Reports which require frequently underpaid and poorly educated bank staff to form a purely subjective opinion about a client, who is left in the dark that such a process is taking place. In such reports there is ample room for stereotype and prejudice'*.²¹ Moreover, an educated guess is that a weight-based statistics of cash-related STRs, if that were available, would be (much?) lower than 30% since cash is likely used mostly to execute small transactions, and Europol (2015) does not offer evidence to argue that law-breakers behave much differently in that respect from law-abiding citizens.

These remarks work 'at the margin' and should be understood as follows: the chances are that the 30% ratio describes an order of magnitude, not an exact figure, and cash-related STRs could involve on average smaller sums than non-cash related ones. Even with such qualifications, the fact remains that a significant number of STRs involve cash, an outcome which is beyond discussion.²²

Accordingly, there is no question that the 30% statistics supports the view that cash is used in crime. However, the devil's advocate could raise the following counter-argument. Compare the purchase of an economy car (whose price is roughly € 15,000 in Western Europe) via a bank order with the deposit of 75 notes of € 200 each at the local bank²³: the odds are that the former transaction would go unnoticed, while the latter would draw attention. That is, the same sum is inconspicuous when transferred via electronic means, while it becomes noticeable when it involves cash. There could therefore be reasons why the use of cash for criminal purposes is avoided whenever conditions allow, given that the use of cash beyond certain levels draws attention and prompts reports of suspicion.

¹⁹ This includes i.a. dealers in high-value goods, such as precious stones or metals, or works of art, and auctioneers.

²⁰ <https://uif.bancaditalia.it/adempimenti-operatori/segnalazioni-sos/index.html?com.dotmarketing.htmlpage.language=1>.

²¹ Panel on Emerging Crimes, 2000, https://www.justice.gc.ca/eng/rp-pr/csj-sjc/crime/rr03_20/p3.html.

²² The relationship between money laundering, STRs and cash could be non-linear. Using data for Italy as of 2010, Ardizzi, De Franceschis and Giammatteo (2018) find that cash deposits are positively correlated with the relevance of local money laundering activity. However, they also point out that such positive relationship wanes for increasing levels of STRs riskiness, implying that cash is a good indicator for potential money laundering-related financial conducts only up to a certain level of riskiness; beyond that, operational experience suggests that high-profile money laundering cases typically would involve more complex financial transactions.

²³ We take here the sum of € 15,000 as a yardstick, being this a threshold set by the EU Directive 2015/60 on 'the prevention of the use of the financial system for the purpose of money laundering and terrorist financing'.

Financial Action Task Force (FATF, 2015) goes further in pointing out that *'the inability of a criminal to adequately account for the large amount of cash in his possession – the fact that it is anonymous – can actually be a hindrance, rather than an advantage'*.²⁴ Based on this authoritative conclusion, it does not seem far-fetched to deduct that for Crime Inc. cash is not the most suitable financial instrument to store significant chunks of its wealth. Quite another matter is the demand for cash for transactions, when Crime Inc. (i) sells illicit goods (drugs, guns, etc.) to consenting non-criminals, (ii) pays its workforce and (iii) pays its suppliers. To the extent Crime Inc. relies on cash – and according to common wisdom it does so extensively in respect to items (i) and (ii)²⁵ – one could conjecture that it relies mostly on small- or at best medium-denomination banknotes; dispatching large-denominations ones is arguably conspicuous.²⁶ Hence, if the aim is to counter the illicit use of cash, then the action should be broad-based, on all denominations. In fact, if one bears in mind the proposal by Sands (2016) but also what observed on Rogoff's thesis in fn. 2, the debate by that literature centers rather on large-denomination notes.

Let's now turn to activities which, although not illicit in themselves, are not in law or in practice subject to national labour legislation, income taxation, social protection or entitlement to employment benefits. This is the so-called informal economy, in which cash is reckoned to stand out so prominently that in a recent book World Bank (2021) describes the 'informal workers' as follows: *'[they] tend to be lower-skilled and lower-paid, with less access to finance and social safety nets, than workers in the formal sector. [...] They often live and work in crowded conditions and conduct all transactions in cash'*.

The inquiry undertaken by World Bank (2021) focuses on developing countries but with all likelihood the link it establishes between cash and the informal economy holds on a global scale. Indeed, wherever you are, it demands a lot of faith to believe someone claiming that he or she has never been confronted with the request by an 'informal worker' to be paid in cash for his services, to avoid income taxation (not to mention similar requests by professionals and the like). No room for complacency here. The same authoritative source points out that the informal sector, on average, is characterized by lower productivity and, across countries, GDP per capita is negatively correlated with the share of informal employment out of total employment. Even the view that the informal employment would provide a safety net when the formal sector sheds jobs seems to be more a commonplace than reality: World Bank (2021) points out that the reverse may hold true as well, namely the informal sector amplifies the business cycles (at least in some circumstances).

Against this background, it should definitively be of interest to gauge the quantitative role of cash vs. the informal economy and how causality runs, if there is any. However, and tellingly, World Bank (2021) does not address cash in itself when dissecting policy options to tackle the informal economy itself. The report does dwell on the positive contribution financial development can offer but even there – should one take a very narrow view of this development simply meaning less cash and more electronic money – it concludes: *'There is no presumption of causality going either from financial development to informality or vice versa'* (page 262), *'Both theory and empirical evidence indicate*

²⁴ This inability stands in contrast with the fact that, according to the same source, *'Criminals tend to be able to justify holding small to medium levels of cash when challenged'*.

²⁵ Payment to suppliers could be less anchored to cash, being more about the wholesale level of the business.

²⁶ Based on ECB data as of end-2021, for every €200 or €500 banknote in circulation there are 17 banknotes in the range from €10 to €50. That is, the two largest denominations are relative rare and given their purchasing power are infrequently used for ordinary purchases; the same two denominations account for almost a fourth of total circulation in value (<https://sdw.ecb.europa.eu/reports.do?node=1000004111> and <https://sdw.ecb.europa.eu/reports.do?node=1000004112>).

that more advanced financial development is associated with a smaller informal economy, although the direction of causality remains a matter of debate and may run both ways (page 292).

The Transcrime (2017) report fits well in this section, as it adds value in two important ways.²⁷ Firstly, it presents results based on robust quantitative analyses, a marked step forward compared to anecdotal stories or subjective assessments (even if by experts) too often plaguing the debate on cash.²⁸ Secondly, while it does provide evidence on why cash-intensiveness can be regarded as vulnerable towards money laundering, it sheds light on the complexities of this nexus. Being once again a fairly massive report – it counts 184 pages – we focus here on two noticeable results offered by the report, relating to indicators of money laundering risk – inferred from a principal component analysis – based respectively on Italian and Dutch data.

- Figure 30 of the report is a scatterplot of two of the four main principal components fitted on Italian data: ‘mafia presence and infiltration’ (MPI) on the horizontal axis and ‘underground and cash-intensiveness economy’ (UCIE) on the vertical one.²⁹ Out of the 10 provinces where MPI is highest, seven are associate with levels of UCIE higher than national average. At the same time, when observing the provinces with low MPI, dots are scattered along the entire vertical axis including in roughly even numbers high and low levels of UCIE. We dare to read this chart as follows: plenty of cash may ease crime but it is not a sufficient condition for crime to thrive.
- Turning to Dutch data, the report (page 109) states that the ‘*OC [Organized Crime] infiltration threat with beneficial ownership secrecy is shown to be the main component of money laundering risk*’ while out of the four main components ‘*The third component of ML [Money laundering] risk points to cash intensive and profitable companies with tax elements*’. Besides reflecting on what this ranking implies in terms of the cash role, it is worth quoting the interpretation offered by the report: ‘*Interestingly, this [third] component is negatively related to OC investments (based on Organised Crime Monitor data), indicating that the sectors related to cooking the books [the way the report refers to the third component] are not the same in which the police more often find organised crime investments*’. So there is a need to be clear on what kind of crime one is concerned with, tax evasion in this case, when the role of cash involvement is examined.

²⁷ Transcrime (2017) is the final report of the IARM (Identifying and Assessing the Risk of Money Laundering) project, carried out by an international consortium coordinated by Università Cattolica del Sacro Cuore (Italy), with Vrije Universiteit Amsterdam (The Netherlands) and University of Leicester (United Kingdom) as research partners. As such, the report is not, strictly speaking, a document issued by an official institution. However, it should be regarded as a quasi-official document as it counts among its contributors the Italian and Dutch Ministries of Finance, the Italian Financial Intelligence Unit, the Dutch Ministry of Security and Justice, the UK Police.

²⁸ The report (page 24) acknowledges that ‘*as regards NRA [National Risk Assessment] by countries, most of them adopt a qualitative approach based more often on experts’ assessments than on hard data*’, echoing points made earlier in the main text of this paper.

²⁹ The report (page 83) explains that the first principal component – business ownership opacity and volume of irregular labourers – accounts for 47% of the variability in the model. Other principal components relating to measures of cash-intensive business, gross profitability and cash intensiveness, and mafia-organized crime infiltration account for respectively 23%, 16% and 14% of the variability.

4. What crime scholars say (or better don't say) about cash

Since the premise of this research is that cash could have a strong link to crime, it seems sensible to collect information on what crime scholars say about cash. To this end, we ran a search over the terms 'cash' and 'banknotes' in 10 international journals specialized on crime/criminology through all research articles published from 2010 to 2020.³⁰

We found either or both terms in 179 research articles out of 3633 being examined, that is 4.9% (summary results are in Table 1; more details are in Table A.2 in Annex).³¹ Breaking down the results, the term 'banknote(s)' appeared in 11 papers, or 0.3%, while 'cash' was relatively more frequent, with 171 returns.³² According to The Concise Oxford Dictionary, cash is 'money in coins or notes, as distinct from cheques or orders' but it can also represent the more general concept of 'money paid as full payment at the time of purchase, as distinct from credit'.³³ Hence, a positive return to our search could imply that the author(s) of the article really meant to deal with banknotes but also that he or she used the term cash in a broad sense, without necessarily referring in a specific way to banknotes. To understand better what was what, we deepened our search examining in detail for each of the 179 articles the abstract, introduction and table of contents; if doubts still remained, we examined the whole paper. Based on this extensive examination, we assigned to each article a score of 'high' when banknotes were identified as the paper's main research topic, 'medium' as one of the research topics, and 'low' otherwise. Overall, only three articles earned a score of 'high' and other two of 'medium', for a total share of 0.14%.³⁴ One can't help thinking that if crime scholars pay very limited attention to cash in their research, they do not regard it as a crucial component to understand why some inner cities or *banlieues* are plagued by violence.³⁵

³⁰ The journals are: 1) American Journal of Criminal Justice; 2) Crime and Justice; 3) European Journal of Crime, Criminal Law, and Criminal Justice; 4) European Journal of Criminology; 5) International Criminal Law Review; 6) Journal of Criminal Justice; 7) Journal of Criminal Law & Criminology; 8) State Crime Journal; 9) The British Journal of Criminology; 10) The Howard Journal of Crime and Crime and Justice.

³¹ The total number of papers is partly estimated. We counted the number of research papers appeared in each of the 10 journals in the issues published in 2010, 2015 and 2020. Then, we worked out the total number under the assumption that those three years were a representative sample. In three journals which did not operate over the entire decade, the sampling was undertaken using the first, last and middle year of issuance.

³² The sum of the two figures we report here, 171 and 11, is higher than 179 since in 3 papers we found both terms.

³³ The online version of the Oxford Dictionary describes cash as 'money in the form of coins or notes' but also very broadly as 'money in any form' (<https://www.oxfordlearnersdictionaries.com/>).

³⁴ This tiny subset includes one paper dealing banknote counterfeiting and another paper (Murphy, 2016) challenging the ECB decision of 2016 (<https://www.ecb.europa.eu/press/pr/date/2016/html/pr160504.en.html>) to discontinue the production of the € 500 banknote. Namely, within this tiny subset, when crime experts speak about cash, they don't feel bound to do so as the 'anti-cash camp' would probably like to read.

³⁵ This silence could also mean that crime experts regard as a truism that cash is heavily linked to crime, so that it is not worth studying it further. Possibly, this could be the case. However, the next question should be why economists in recent years have found so interesting to inquiry on this link, if the topic is fully settled.

Table 1

Papers published in selected crime / criminology journals using the terms 'cash' and 'banknotes' ^(a)				
(issues published from 2010 to 2020)				
	Number of published articles ^(b)	of which using the terms:		With either of two terms and relevance medium to high ^(c)
		'cash' or 'banknote(s)'	only 'banknote(s)'	
American Journal of Criminal Justice	442	34	0	0
Crime and Justice	60	6	0	0
European journal of crime, criminal law, and criminal Justice	235	20	3	3
European Journal of Criminology	303	43	4	1
International Criminal Law Review	470	3	0	0
Journal of Criminal Justice	895	12	1	0
State Crime Journal	86	13	0	0
The British Journal of Criminology	686	4	1	0
The Howard Journal of Crime and Justice	266	23	2	1
The Journal of Criminal Law and Criminology	191	21	0	0
Total	3633	179	11	5

(a) Survey of research articles (excluding reviews of books, opinions from the editor, counterblasts). (b) Number partly estimated: based on exact counting of research articles published in 2010, 2015 and 2020, then proportionated up to the entire period 2010-2020. (c) The score is medium when either 'cash' or 'banknote(s)' appear in the abstract – missing an abstract the search was expanded to the introductory section of the article and its table of contents – and, based on a comprehensive assessment, banknotes represent one of the research topics addressed in the paper; it is raised to 'high' when banknotes are the main research topic.

5. The future is already here: crime in cyberspace

So far about the association between cash and crime in the physical space. In this section, we turn to the conduct of financial transactions relating to criminal purposes in the virtual space.

The purchase of a good³⁶ can be thought of as a process based on three pillars: (a) a market infrastructure that allows the buyer to meet the seller, to assess the items on sale, to compare price with same or similar items offered by other traders, etc.; (b) the agreement by the two sides on a suitable means of payment; (c) an accepted framework of rules and customs governing the transaction and any post-sale disputes.

Described in these general terms, it hardly makes much of a difference whether the good is a licit or an illicit one. If one wishes to buy cocaine, then no doubt that person will need to know where to find the pusher. Likewise, the two sides will need to agree on a means of payment and, arguably, there exist rules and customs in the criminal world too, although they may not be exactly the ones found in law textbooks.

At the same time, a few adaptations are in order when crime is involved. To start with, one can imagine, in effect hope for, a market where licit goods only are traded. By contrast, there is a range of transactions that the crime world undertakes with consenting non-criminal persons – examples include the participation of the latter to illegal gambling, purchase of unlawful drugs, purchase of weapons, hiring of prostitutes where this is not legal – which prosper better if mixed to legal and

³⁶ For the sake of brevity, we will refer to 'good(s)' where the full sentence would be 'goods and services'.

acceptable activities. Such transactions between criminals and consenting non-criminals are not at all an exception against the whole spectrum of activities performed by the criminal world: roughly speaking, these segments of business could account for at least half of the proceeds of organized crime while what remains implies transfer of wealth through acts of force (thefts, burglaries, robberies, etc.).³⁷

Crime gangs need to organize their business model in such a way that non-criminal, consenting persons can reach them, with relative ease and without taking undue risks. The ordinary person needs to know where the pusher operates in order to purchase an illicit drug. Moreover, the 'point of sale' should not be easily associated with criminality; otherwise, such a business would become an easy target for law enforcement agencies. The ordinary person would be wary to walk in the 'shop' for fear of being earmarked. Hence, the need for what we define a 'land in the middle', namely a place mixing licit and illicit trades and which can draw willing ordinary people acting in the most casual way, minimizing the risk of being noticed not to mention being searched by police forces.³⁸

The fact that a significant portion of the criminal business involves transactions with consenting non-criminals brings us to the second feature of adaptation to the aforementioned three-pillars scheme. In the criminal context a means of payment is suitable if, first and foremost, it cannot (easily) be tracked down. Coherently with the 'land in the middle' hypothesis, both sides, seller and buyer, criminal and non-criminal, are keen to stay anonymous.

Quite crucially, markets taking place in a region of Internet known as the Darknet where settlement takes place through cyber- (or crypto-) assets meet the requirements of the 'land in the middle'; mixing with legal and more acceptable forms of business, anonymity in payment, relative ease in procuring / laundering the currency.

The Darknet is one of the three main regions of Internet in a loose but widely accepted classification. One is the clear or surface web, which is the publicly accessible section of Internet. Here we find those websites we can retrieve through standard search engines. Next, one has the Deep Web, to refer to those regions that are not usually indexed by standard web search engines but can nevertheless be directly accessed once one knows the appropriate URL or IP address (often on condition of passing some security conditions such as a password).³⁹ Finally, there is the Darknet, a region or perhaps better a network within the Internet, accessible only by means of specific software, configurations, or authorization. That does not mean that the Darknet is out of reach. To the contrary, it is generally open and free to everyone equipped with dedicated software such as

³⁷ Schneider (2010) puts forward the following percentages based on data for Central Europe, 2000-2004: (i) drugs and narcotics, 30%; (ii) theft, illegal car movements and burglaries, 15%, (iii) investment fraud, economic subsidy fraud and payment fraud, 20%; (iv) armed robberies, protection money and kidnapping, 5%; (v) procurement of prostitution, illegal gambling and human trafficking, 10%; (vi) weapons and break of embargos, 20%. Violence is clearly in place as regards categories (ii) and (iv). Consent by the non-criminal side could be the rule more than the exception with respect to categories (i), (v) and (vi), yielding a total of 60%. Category (iii) could be of more mixed nature.

³⁸ Of course, there are also highly secretive segments of criminal activity, in which the hypothesis of the 'land of the middle' does not apply. One example is the trading of illicit drugs from one criminal syndicate to another. However, such trading usually defines the wholesale level of the business. Eventually, when the retail level is involved, the need for more open places of sale emerges.

³⁹ The deep web includes very common uses such as webmail, online banking, restricted access social-media pages.

The Onion Router (better known by its acronym TOR), catering for a type of communication which makes it difficult to trace the user's internet activity.⁴⁰

Moreover, while the Darknet hosts all sorts of infamous businesses, there is more than that and available research suggests that 'only' 57% of its content is illegal (Weimann, 2016). Due to these components, the Darknet fits well the aforementioned concept of 'land in the middle', with the plus of its global, borderless reach, compared to the street corner known to local customers seeking drugs. This fits also the finding by Payne, Hawkins and Xin (2019), who observe that cybercrime is not just the evolution of traditional crime out of the physical space – although both categories share the prevailing number of young males among offenders – since the former category retains distinguishing features of its own: more white-collar crimes and more acts crossing international borders than ordinary unlawful action of the traditional sort.

Likewise, cyber assets are of increasing use in mixed environments. Kethineni and Cao (2020) stress that 'Cryptocurrency such as bitcoin, Ethereum, and, more recently, Monero have become the currency of choice for many drug dealers and extortionists'. At the same time, these authors highlight also the increasing degree of acceptance of such crypto-assets by legal and traditional commercial vendors, e-retailers and payment processors. Namely, the use of these assets for illicit purposes could be on the rise exactly because also their use for legal trades is becoming increasingly common. Arguably, anonymity of this kind in payment does matter, especially when illicit or more down-to-earth 'immoral' trades are involved.⁴¹

To offer an order of magnitude of the turnover we are discussing, in a press release first issued on 12 January 2021 (later updated on 18 November of the same year) Europol announced that it had taken DarkMarket offline, the then world's largest illegal market place on the Dark web. A summary of main figures of DarkMarket mentioned 500,000 users, 2,400 sellers, and 320,000 outstanding transactions amounting to 4,650 bitcoins and 12,800 Moneros; overall, more than € 140 million at the then current rates.⁴² This is a modest amount compared to overall estimates we quoted earlier in terms of financial dimension of crime, although likely it fares well in a ranking of individual seizures. As a clear sign on the scale reached by the phenomenon, Europol felt the need to advise in the same press release on its initiative to set up a coordinated law enforcement approach to tackle crime on the dark web.

6. Fundamental economic laws are going to rule in the future too

Krugman (2018) points out an oddity in crypto-assets. He argues that the whole process from gold and silver, to banknotes, then credit and debit cards and finally digital methods of payments can be described in terms of the search for lower and lower transaction costs (which embody also ease of shipment and transfer of the currency). In pointing out this line of development, Krugman finds surprising the enthusiasm for crypto-assets since they entail quite relevant frictions, a feature that he sees not owing to a by-product of limited development in technology but rather introduced by

⁴⁰ TOR is a free and open-source software. This ought to speak volumes on the fact that there is nothing especially secret or forbidden in the access to Darknet.

⁴¹ Lowrey (2018) notes how Bitcoin, while still being the leading crypto-asset also for criminal purposes, is falling out of favour on the Dark web to make room for other digital coins which are reputed to offer more privacy. Monero is one such more protected crypto-asset.

⁴² <https://www.europol.europa.eu/media-press/newsroom/news/darkmarket-worlds-largest-illegal-dark-web-marketplace-taken-down>.

design, to build trust in crypto-assets themselves lacking the support of a central bank or a government behind them.

That would not be a huge obstacle since the ample margins usually associated to illicit deals offer a large enough cushion to bear even high transaction costs (in that sense Lowrey, 2018). Clearly, the argument does not work well when using crypto-assets in legal segments (or at very least it works much less perfectly), which usually cater for more ordinary margins of profit. In that light, one understands the point made by Krugman who sees Bitcoins, among the crypto-assets, as the only viable bet for the future – being the incumbent matters – and in any case only for black market transactions and tax evasion. Otherwise, he is skeptical about the outlook for other crypto-assets, at least in the medium term.

We are not convinced by this prediction though, since it clashes with the idea that crime needs a ‘land (and a currency, we now add) in the middle’ to prosper. Should Bitcoins eventually be used only for illicit purposes, then law enforcement agencies would know that wherever they spot them, they have a clue of a breach of law. In turn, this would deter mainly law-abiding citizens to trade with criminals using Bitcoins, breaking the circle. That is, either Bitcoin and its brethren continue to be used extensively also for fully legal purposes, or their use will be much more limited, if at all, for any purpose.⁴³

However, Krugman strikes a chord when he reminds us that the future of crypto-assets will be set by the same fundamental factors that, throughout the history, have dictated the fortunes of any form of money: transaction costs and stability of value over time. As to the former, developments are already under way: in October 2018 transaction fees on Monero fell in one shot by around 96%, after the activation of a new form of cryptography (Peterson, 2018). A more ominous obstacle to enduring success for crypto-assets is their volatility. While the purchase of drugs in the Darknet may take place through Bitcoins and suchlike, sellers and borrowers ultimately peg their prices to traditional currencies. That is, they think in terms of dollars and euros when they evaluate the price of the good being exchanged (Lowrey, 2018). Unless there is some fundamental revolution in economic theory, achieving more stability in the value of a money requires the management of its supply in a flexible and competent way. This is what aptly-named ‘stablecoins’ try to achieve (a non-technical introduction on the main issues associated to stablecoins is in Di Maggio and Platias, 2020). The future will tell us how well such experiments with crypto-assets fare, also in terms of their potential to further crowding out banknotes.

7. Connecting the dots and data issues

We have examined a number of issues on illicit activities, paper currency and Internet. To connect the dots, it is helpful to recall that, as already noted, according to a widely held view people truly tend to think in terms of standard currencies such as the US dollar and the euro when exchanging crypto-assets. Moreover, professionals in the field reckon that even when the proceeds of a crime are initially generated in electronic form, cash may resurface in the process, sooner or later. To cut

⁴³ We believe the same logic applies to banknotes. Should in the future their circulation become limited, we expect criminals jumping off the boat earlier than others along a clear scheme: they do not want to be spotted easily.

a long story short, the digital and physical spaces are intertwined more than we might be ready to think, not least because the digital world has a marked physical dimension.⁴⁴

Money laundering (ML) – to be broadly understood as any financial transaction scheme that aims to conceal the identity, source, and destination of illicitly-obtained money⁴⁵ – epitomizes this flow of money, in various forms and across different regions. ML has been the subject of extensive study and in this section we use ML data to highlight a methodological point. It sounds wise to start by saying that, on the one hand, the magnitude of ML can hardly be measured exactly, since its very aim is the concealment, but, on the other hand, researchers have been devising increasingly advanced methods to fill the gap (Ardizzi, Petraglia, Piacenza, Schneider and Turati, 2014, is an example of such applied research).

A basic ML taxonomy singles out its domestic and international dimensions, depending on whether the country where the illicit money is parked coincides or not with the one where it was generated. FATF (2015) stresses that a key ML feature *'is to remove [the money derived from criminal activity] from the jurisdiction in which the predicate offence was committed'*; this is because *'Even if the cash is detected in the destination country at some stage of the process, the legal and practical implications of information and intelligence exchange and evidence gathering between the countries of origin and destination can frustrate law enforcement efforts to prosecute offenders and seize the cash'*. Hence, while, domestic laundering is easier to undertake than its foreign version (it does not require to overcome border controls), it weakens the scope of the entire operation, namely to conceal the illegitimate origin of money also through distance.

Table 2 shows summary statistics of a cluster analysis on a dataset that exploits estimates by Fewerda, van Saase, Unger and Getzner (2020; hereinafter FSUG) of ML in percent of GDP for 24 developed countries, broken down in its domestic and foreign components, together with data on the use of cash at points of sale in the same countries (data for individual countries are in Table A.2 in Annex; clusters are shown in Charts A.1 and A.2).⁴⁶ There is in principle no reason why the use of cash at points of sale, which is a widely used indicator of (licit) transaction cash demand, should be correlated with crime and money laundering.⁴⁷ Nevertheless, we use it here to highlight the following methodological point.

The analysis identifies three main clusters in the dataset using domestic ML data and two main clusters in the one using foreign ML data. The coefficient of correlation between the ML observations and the ratio of cash use is indeed close to zero within the two clusters on foreign ML data (+0.08 and -0.08 respectively) but is significantly and markedly negative in each of the three clusters on domestic ML data (-0.42, -0.69 and -0.74 respectively). A partisan storytelling could exploit the fact the correlations turn out to be either negative or at best around zero to counter today's conventional wisdom on the malign use of cash (which could have predicted that where there is more cash use, there is more ML). Whenever such approaches are tried out, no matter if

⁴⁴ It is estimated that 99% of international data is transferred through cables stretching across the floor of the world's oceans (World Economic Forum, <https://www.weforum.org/agenda/2016/01/how-does-the-internet-cross-the-ocean/>; CNN, <https://edition.cnn.com/2019/07/25/asia/internet-undersea-cables-intl-hnk/index.html>).

⁴⁵ Cornell Law School, https://www.law.cornell.edu/wex/money_laundering.

⁴⁶ The dataset covers 24 out of the 36 countries surveyed by FSUG for which we found suitable data on use of cash.

⁴⁷ The use of cash could rather depend on (licit) socio-economic factors that determine differences in payment habits amongst countries. For instance, development factors, such as innovative capability and income per capita, explain why cash usage in Italy is still relatively high (see Ardizzi and Iachini (2012)); perhaps surprisingly, the shadow economy basically plays no role in explaining the limited use of electronic retail payment instruments.

pro- or anti-cash, a fair reaction ought to be that descriptive statistics tell us nothing on what leads what. That being stressed, sticking to the approach we outlined in Section 1 – to restrict to a minimum our own original computations – we will not expand the current exercise to develop a fully-fledged econometric model. Rather, we confine our contribution here to underline how crucial is to avail of data along an adequate time dimension to verify whether there is causality and how it runs. We make this methodological point, which ought to be self-evident to any expert econometrician, because it seems to us that it does not receive the required attention in the debate on cash, even in quantitative analyses.

Table 2

Money laundering (ML) and use of cash (1)				
Clusters identified on domestic ML data				
	Laundering, % of GDP (average)	Use of cash, % of value of transactions (average)	Coefficient of correlation	countries
Cluster 1	1.2%	24%	-0.42	Norway, Finland, Australia, Canada, Japan, Netherlands, Denmark, United States
Cluster 2	0.6%	66%	-0.69	Lithuania, Spain, Slovakia, Slovenia, Austria, Germany, Greece, Italy
Cluster 3	0.8%	38%	-0.74	Belgium, Luxembourg, United Kingdom, Estonia, France, Portugal, Latvia, Ireland
All obs.	0.9%	42%	-0.61	
Clusters identified on foreign ML data				
Cluster 1	1.6%	28%	-0.08	Canada, Denmark, United Kingdom, Finland, France, Netherlands, Luxembourg, United States, Norway, Germany, Australia, Belgium
Cluster 2	1.9%	57%	+0.08	Italy, Slovakia, Lithuania, Greece, Austria, Slovenia, Spain, Latvia, Portugal, Ireland, Estonia, Japan
All obs.	1.7%	42%	+0.08	

Sources: Bagnall, Bounie, Huynh, Kosse, Schmidt, Schuh and Stix (2016); Esselink and Hernandez (2017); Ferwerda, van Saase, Unger and Getzner (2020); Khiaonarong and Humphrey (2019).

To further emphasize this point, we put forward an example based on data on homicides. While this example does not involve cash, it hopefully clarifies why one should dig deep when analysing (the roots of) crime. The example does not resort to sophisticated econometric arguments; yet, it exemplifies why an appropriate time dimension and a careful selection of explanatory variables are needed when dealing with crime-related phenomena.

As of 2017 (latest data available) the share of deaths from homicide in Italy was one third lower than in Sweden: 0.08% and 0.13% respectively.⁴⁸ This could be regarded as surprising, particularly if one bears in mind that: (i) if one goes back to 1990, the opposite ranking is found (the rates then being 0.25% and 0.15% in Italy and Sweden respectively), and (ii) Sweden fares better than Italy on an on-topic measure such as the Global Peace Index (Institute for Economics & Peace, 2021). What has happened between those two dates? Simply speaking, Italy has been ageing much quicker than Sweden⁴⁹ and, as a result, the share of young males (who tend to commit violent crimes disproportionately more than any other age-sex group) has shrank. The relationship between the share of young males and the homicide rate is so well established that a report issued in 2007 by Italy's Ministry of Interior identifies it as the first factor driving down the number of homicides across the country.⁵⁰

The bottom line is that if one neglects the time dimension (or inadequately deals with it) and does not include relevant variables in the analysis (demographic variables, in this case), then an inquiry on why Italy is now less-homicide prone than Sweden would turn out to be frustrating. Furthermore, it is advisable to be very clear about that type of crime is being examined. The comparison between Italy and Sweden carried out above only involved the most prominent example of violent crime; different results would be obtained should one probe, say, the causes of corruption or tax evasion. Generalizations do not help.

8. Conclusions

This paper investigates the role played by cash in crime using a broad range of sources. We looked at papers by economists, reports by international organizations, and research articles from scholars in criminology.

Contributions by economists such as Rogoff and Sands set out the general stage, describe the phenomenon in qualitative terms, and offer several anecdotal examples. However, to the best of our reading of their works, we did not find in those contributions robust, systematic time series data proving that cash is central to the financial management of the criminal world. Other papers of a less biased nature, as Singh and Bhattacharya (2017) and Schneider (2017), do offer econometric evidence of a link that goes from cash to illicit activities of various sorts. It is fair to add that these authors are careful in attaching a number of caveats to their results.

Working on Italian data, Giammatteo (2019) and Ardizzi, Petraglia, Piacenza and Turati (2014) offer, among others, evidence of a significant link between cash and measures of the shadow economy and tax evasion. Analysing Dutch data, Transcrime (2017) links money laundering to cash-intensive and profitable companies, noting that the sectors where this tax evasion component is found are not those in which the police more often find organized crime investments. Europol (2015) finds a strong link between cash and crime, but fails to provide what the economist profession would understand as robust evidence, suitable for standard statistical tests. More balanced conclusions emerge from reports by UNODC (2011) on illicit financial flows and by the World Bank (2021) on the

⁴⁸ See Our World in Data website, <https://ourworldindata.org/homicides>.

⁴⁹ In 1990 Italy's and Sweden's population median ages were respectively 37 and 38.4 years; by 2020, Italy had turned markedly older than Sweden's at 47.3 years vs. 41.1 years (source: Statista).

⁵⁰ Besides demography, the Ministry's report identifies the second contributing factor in the much improved action put up by police forces, especially in the Southern regions more ridden by organized crime. Incidentally, the report does not credit cash of any relevant role in supporting or contrasting the aforementioned downward trend.

informal economy. Finally, an extensive search over articles published between 2010 and 2020 by ten internationally recognized scholarly journals on criminology returned few papers dealing with banknotes. While this might not be the only explanation, in accordance with the principle of Occam's razor, we tend to read this silence as evidence that scholars in the field do not regard banknotes as central to crime.

Overall, based on the sources we cited (and likely the extant literature is broader than we could ever manage to summarize in one paper), there is enough evidence to alert us to illicit uses of cash. That does not prevent us from remaining unconvinced by the aggressive stance of the anti-cash literature *à la* Rogoff and Sands. To start with, while it is reasonable to discuss about cash as a facilitator of crime, this is not enough to identify the former as the pivot of the latter, as the drivers could better be identified in overarching factors such as demography (the ratio of young males out of overall population) and police action quality. Moreover, the fact remains that cash is only truly anonymous in small amounts; its possession in large amounts can actually be a hindrance, rather than an advantage. In turn, this implies that cash may serve well some lines of the crime business but not necessarily all of them. Generalizations do not help to understand the phenomenon. Furthermore, in those lines where cash likely plays a greater role – say, the retail selling of illicit goods to consenting non-criminal persons – long time series of data of adequate quality are difficult to obtain. Who can really say with sufficient precision how much cocaine is sold per year in a given country against payment by cash? In general terms, this does not make such trade any less concerning. However, it does affect what econometrics can achieve in quantitative analyses on data loaded with noise; a fortiori, this caveat applies in respect to cross-section samples without a time dimension, an issue we have often met in this literature.

We are aware that the evidence we offered in this paper – based on hundreds of pages of reports and a smorgasbord of sources – could look contradictory at first sight, sometimes tilting the balance in one direction, sometimes in the other. Overall, based on our investigation, we converged to the view that cash may be described as a component of crime (possibly an important one in segments such as the street selling of drugs and the shadow economy) but not as its fulcrum. We fully accept that opinions differ on how best to frame the actual relationship between cash and crime. This is only natural when there is no consensus model and it is hard to utter a solid final word based on good, systematic time series. In addition, it seems to us that one could identify a bias in perception, namely in the tendency to overestimate the role of cash in illicit activities. We present four arguments that could help to explain why such a bias applies.

Firstly, while movies and TV series have made popular the cliché of drug lords hiding stashes of cash, the sheer magnitude of global crime – which dwarfs those stashes – is much less understood.

Second, as a general behavioural feature, we tend to assign excessive importance to patterns around us, e.g. those we meet in our daily lives or we see routinely in movies and TV series. This frequency bias is well identified in different fields and backed by experimental evidence e.g. in the perception of inflation (Georganas, Healy and Li, 2014; Del Giovane and Sabbatini, eds., 2008). Confusingly enough, there is often a misperception of crime across the board. To mention one example, a 2019 survey by the University of Zurich confirmed that two-thirds of the Swiss population believed that crime had increased in recent years in their country while official statistics proved the opposite.⁵¹

⁵¹ See <https://www.swissinfo.ch/eng/reality-check--is-switzerland-really-as-unsafe-as-the-swiss-think-/46271092> (in English) and <https://www.zhaw.ch/de/ueber-uns/aktuell/news/detailansicht-news/event-news/kriminalitaet-in->

Third, this bias in perception against cash is compounded by the symmetric tendency to downplay what is more remote from us. Probably, not enough is widely known about the use of crypto-assets in the Darknet for illicit purposes. The fact is that with relatively simple equipment in terms of software, one can access the Darknet, something which is instrumental to the business model pursued by criminal organizations and should not be regarded as the result of underdeveloped technologies or unfinished work. The ‘land in the middle’ concept identifies an area where illicit trade takes place in a mixed context, along with other and more reputable businesses, which is advantageous to both sides of the deal. The risks related to crypto-assets are highlighted in the recent article by Kenneth Rogoff mentioned in the Introduction.

Fourth, there is a technical point which might elude the wider public. Regarding the debate on the informal economy, the World Bank (2011) is keen to stress that the direction of causality between financial development (which in turn may be conducive to less use of cash in daily life) and the magnitude of the informal economy remains a matter of debate and could run both ways. Hence, until proof is given, one ought to speak more prudently in terms of correlation.

A final thought. In the past, civilizations thrived without banknotes⁵² and, accordingly, we should accept the idea that future civilizations may equally dispense with them; in some jurisdictions cash is already declining while digitalization is increasing, as a result of developments in technology and in the financial industry. Against this background and recalling that the central banking function is strictly intertwined with the provision of payment services and instruments, one can appreciate the following statement included in a 2020 report issued by the Group of central banks (2020⁵³): ‘CBDC [central bank digital currency] could also play an important role in maintaining access to, and expanding the utility of, central bank money’.⁵⁴ At the same time, the commitment is to continue providing and supporting access to cash. In a coherent way, the Bank of Italy declares that it ‘promotes the reliability and efficiency of payment instruments in order to preserve confidence in money [i.e. also cash] and non-cash alternatives’.⁵⁵ Lighting a bonfire of banknotes can wait.

[der-schweiz-sinkt-waehrend-die-sorge-davor-steigt/](#) (in German). What the Swiss survey found (perception of crime rise, while data prove the opposite) is not an exception; see <https://fivethirtyeight.com/features/many-americans-are-convicted-crime-is-rising-in-the-u-s-theyre-wrong/> for a similar finding in the US.

⁵² Considered against the long history of trading and money – already the first forms of agricultural settlements led to seasonal surpluses but also constrained the mobility of those living off of the land, limiting their access to other staples and tools, both elements providing scope for trade – banknotes represent a relatively recent experiment, especially if one counts from the time banknotes have become a routine instrument of payment.

⁵³ The Group comprises the following: Bank of Canada, European Central Bank, Bank of Japan, Sweriges Riksbank, Swiss National Bank, Bank of England, Board of Governors Federal Reserve System and Bank for International Settlements.

⁵⁴ The literature on central bank digital currency is rapidly expanding and any effort to provide even a short list of contributions is daunting. We refer our reader to the documents available at the website <https://www.suerf.org/webinars/1475/cbdc-state-of-play-challenges-open-issues> for an outline of the state of play and to Urbinati *et al.* (2021) for a discussion of technical design choices regarding the digital currency.

⁵⁵ <https://www.bancaditalia.it/compiti/sispaga-mercato/strumenti-pagamento/index.html?com.dotmarketing.htmlpage.language=1>.

Additional tables and charts

Table A.1

Results of the search for the terms 'cash' and 'banknote(s)' in 10 journals on criminology, 2010-2020 (1)				
Journal	Term(s) found	Title of article	Year	Score
American Journal of Criminal Justice	cash	Exploring the Influence of Elements of the Social and Physical Environment on Neighborhood Gun Crime	2021	Low
	cash	Get Jailed, Jump Bail? The Impacts of Cash Bail on Failure to Appear and re-Arrest in Orleans Parish	2020	Low
	cash	A Consideration for Increasing Post-Release Financial Success	2020	Low
	cash	Low Self-Control and Environmental Harm: A Theoretical Perspective and Empirical Test	2020	Low
	cash	"Just because Somebody Is in a White Jacket and Has a Medical Degree doesn't Mean they're Not a Drug Dealer": Law-Enforcement Experiences Investigating Occupational Offenders	2020	Low
	cash	Debt, Incarceration, and Re-entry: a Scoping Review	2020	Low
	cash	It's F**ing Chaos: COVID-19's Impact on Juvenile Delinquency and Juvenile Justice	2020	Low
	cash	Criminals Work from Home during Pandemics Too: a Public Health Approach to Respond to Fraud and Crimes against those 50 and above	2020	Low
	cash	Exploring Alternatives to Cash Bail: An Evaluation of Orange County's Pretrial Assessment and Release Supervision (PAPS) Program	2020	Low
	cash	Use of Bitcoin in Darknet Markets: Examining Facilitative Factors on Bitcoin-Related Crimes	2018	Low
	cash	Debt, Incarceration, and Re-entry: a Scoping Review	2020	Low
	cash	Separated by Bars or Dollar Signs? A Comparative Examination of the Financial Literacy of Those Incarcerated and the General Population	2016	Low
	cash	Massacre at Waco: Biker Violence and Police Overreaction	2016	Low
	cash	The Effect of Variation in Intact Family Forms on Deviant and Antisocial Behavior	2016	Low
	cash	Familial Identity Theft	2016	Low
	cash	From Bail to Jail: The Effect of Jail Capacity on Bail Decisions	2015	Low
	cash	A Macro-Social Exploratory Analysis of the Rate of Interstate Cyber-Victimization	2015	Low
	cash	Women Parolees' Perceptions of Parole Experiences and Parole Officers	2015	Low
	cash	Sentenced to Pretrial Detention: A Study of Bail Decisions and Outcomes	2015	Low
	cash	Above the Law': Changes in Methamphetamine Laws and the Deterrent Impact on Market-Involved Women	2014	Low
cash	The Role of Type of Offense and Work Qualifications on Perceived Employability of Former Offenders	2014	Low	
cash	Banking Options and Neighborhood Crime: Does Fringe Banking Increase Neighborhood Crime?	2013	Low	
cash	Spatial Patterns of Robbery at Tourism Sites: A Case Study of the Vieux Carré in New Orleans	2012	Low	
cash	Collective Bargaining and Job Benefits in Florida Municipal Police Agencies, 2000-2009	2012	Low	

	cash	Police GPS Surveillance on Vehicles and the Warrant Requirement: "For a While I've Been Watching You Steady"	2012	Low
	cash	The Association of Occupational Stressors with Different Forms of Organizational Commitment Among Correctional Staff	2012	Low
	cash	Designing Programming and Interventions for Women in the Criminal Justice System	2012	Low
	cash	Police Impersonation: Pretenses and Predators	2012	Low
	cash	An Examination of the Influence of Strength of Evidence Variables in the Prosecution's Decision to Dismiss Driving While Intoxicated Cases	2012	Low
	cash	You're so Vain You Probably Think this Keynote is about You: Expanding Art and Music in Criminal Justice	2012	Low
	cash	Prisoners' Perceptions of Father-Child Relationships and Social Support	2012	Low
	cash	Ethnographic Methods in Criminological Research: Rationale, Reprise, and Warning	2012	Low
	cash	The Tools, Tactics, and Mentality of Outlaw Biker Wars	2011	Low
	cash	American Based Biker Gangs: International Organized Crime	2011	Low
	cash	The Association Between Work-Family Conflict and Job Burnout Among Correctional Staff: A Preliminary Study	2010	Low
Crime and Justice	cash	Community Design and Crime: The Impact of Housing and the Built Environment	2015	Low
	cash	Crime and Inflation in Cross-National Perspective	2014	Low
	cash	Community and Problem-Oriented Policing	2010	Low
	cash	School Crime Control and Prevention	2010	Low
	cash	Why the Crime Drop?	2014	Low
	cash	Prosecution and Prosecutors in Poland: In Quest of Independence	2012	Low
	cash	Laundering the Profits of Ransomware	2020	Low
	cash	"Whom Should We Target to Prevent? Analysis of Organized Crime in England using Intelligence Records	2019	Low
	cash	The Heart of Know Your Customer Requirements: The Discriminatory Effect of AML and CTF Policies in Times of Counter-Terrorism in the UK	2018	Low
	cash	Balancing Mutual Trust and Fundamental Rights Protection in the Context of the European Arrest Warrant	2018	Low
European Journal of crime, criminal law, and criminal Justice	cash, banknote	Pecunia Non Olet: The Case for the €500 Banknote	2016	High
	cash	Western Europe under Terrorist Attack, also after the Military Defeat of is	2016	Low
	cash	'Peeling Back the Mask': Sociopathy and the Rhizomes of the eu Food Industry	2016	Low
	cash	The Effectiveness of eu Law: Insights from the eu Legal Framework on Asset Confiscation	2016	Low
	cash	Fourth EU AML Directive: What is Missing? Section 319 patriot Act and the New eu aml Directive	2015	Low
	cash	Extended Confiscation and the Proposed Directive on Freezing and Confiscation of Criminal Proceeds in the EU: On Striking a Balance between Efficiency, Fairness and Legal Certainty	2013	Low
	cash	The Social Life of Illegal Drug Users in Prison: A Comparative Perspective	2013	Low
	cash	Individual Responsibility and the Application of Ignoratio Juris Non Excusat in International Law	2011	Low

	cash	Out of Sight, Out of Mind? Awareness Space and Mobile Offenders	2011	Low
	cash	The Burden of Proof in Confiscation Cases: A Comparison between the Netherlands and the United Kingdom in the Light of the European Convention of Human Rights	2010	Low
	cash	EU Cross-Border Policing Provisions, the View from One of the Schengen Opt-out States	2010	Low
	cash	Macro Networks, Collectives, and Business Processes: An Integrated Approach to Organized Crime	2010	Low
	cash	Pre-trial Detention in Spain	2010	Low
	cash	Punishing Corruption in the Public and the Private Sector: The Legal Framework of the European Union in the International Scene and the Greek Legal Order	2010	Medium
	banknote	The EU Response to Criminal Misuse of Cryptocurrencies: The Young, already Outdated 5th Anti-Money Laundering Directive	2020	Low
	banknote	Banknote Counterfeiting Phenomenon in Poland	2020	High
	cash	Outlaw motorcycle gangs and their members' crime: Examining the social organization of crime and its relationship to formal club hierarchy	2020	Low
	cash	The financial management of cocaine trafficking in Italy	2020	Medium
	cash	House, bells and bliss? A longitudinal analysis of conventional aspirations and the process of desistance	2019	Low
	cash	The client side of everyday corruption in Central and Eastern Europe: The case of Chinese migrant entrepreneurs in Romania	2019	Low
	cash	Counterfeit alcohol distribution: A criminological script network analysis	2018	Low
	cash	Macro-brothels as crime attractors: Impact of closure, displacement, and diffusion of benefits	2018	Low
	cash	Playing Pac-Man in Portville: Policing the dilution and fragmentation of drug importations through major seaports	2020	Low
	cash	'King, Warrior, Magician, Lover': Understanding expressions of care among male prisoners	2020	Low
	cash	Scripting the mechanics of the benchmark manipulation corporate scandals: The 'guardian' paradox	2019	Low
	cash	The institutional context of financial fraud in a post-transition economy: The Quaestor scandal	2019	Low
	cash	'Diving for dope': Identity in submarine drug policing at the 'maritime gateway to Europe'	2019	Low
	cash	Making drug harms: Punishments for drugs offenders who pose risks to children	2019	Low
	cash	Banking malware and the laundering of its profits	2018	Low
	cash	Crime and terror of social exclusion: The case of 13 imams in Bulgaria	2019	Low
	cash	Jihadism and crime in Spain: A convergence settings approach	2019	Low
	cash	The profile and detection of bribery in Norway and England & Wales: A comparative study	2018	Low
	cash	'I'd say it's around me': Introducing field analysis into bouncer ethnography – the case of a Czech city	2017	Low
	cash	Fighting like M-Cats and dogs: Users' accounts of the links between mephedrone use and violence	2017	Low
	cash	Bourdieu on supply: Utilizing the 'theory of practice' to understand complexity and culpability in heroin and crack cocaine user-dealing	2016	Low
	cash	Organizing the finances for and the finances from transnational corporate bribery	2016	Low
	cash	Explaining attrition: Investigating and confiscating the profits of organized crime	2016	Low
	cash	Basic human values and white-collar crime: Findings from Europe	2016	Low

	cash	Female pathways to crime and prison: Challenging the (US) gendered pathways perspective	2015	Low
	cash	Citizen confidence in private security guards in Portugal	2015	Low
	cash	Safe storage and thefts of firearms in Sweden: An empirical stud	2014	Low
	cash	Practitioner perspectives on risk: Using governmentality to understand contemporary probation practice	2013	Low
	cash	A very gradual suppression: A history of Turkish opium controls, 1933–1974	2013	Low
	cash	Keeping out of trouble: Female crack cocaine dealers in England	2013	Low
	cash	Powers, liabilities and expertise in community safety: Comparative lessons for 'urban security' from the United Kingdom and the Republic of Ireland	2013	Low
	cash	Moral emotions and offending: Do feelings of anticipated shame and guilt mediate the effect of socialization on offending?	2013	Low
	cash	The experience of gambling in an illegal casino: The gambling spin process	2013	Low
	cash	Dealing with a gendered economy: Female drug dealers and street capital	2012	Low
	cash	Ethnic heterogeneity in the activity and structure of a Black street gang	2012	Low
	cash	The impact of performance management culture on prison-based Therapeutic Communities	2012	Low
	cash	Developing European indicators of trust in justice	2011	Low
	cash	Do drug policies affect cannabis markets? A natural experiment in Switzerland, 2000-10	2011	Low
	cash	Established or excluded? A longitudinal study of criminality, work and family formation	2011	Low
	cash, banknote	Eavesdropping on the Mob: the functional diversification of Mafia activities across territories	2011	Low
	cash	Social structures and desistance from crime	2010	Low
	banknote	Testing Situational Action Theory: A narrative review of studies published between 2006 and 2015	2018	Low
	banknote	Nordic vagabonds: The Roma and the logic of benevolent violence in the Swedish welfare state	2017	Low
	banknote	The interaction between self-control and morality in crime causation among older adults	2015	Low
International Criminal Law Review	cash	The Legal Relationship between Terrorism and Transnational Crime	2017	Low
	cash	Specific Reparation for Specific Victimization: A Case for Suitable Reparation Strategies for War Crimes Victims in the DRC	2013	Low
	cash	Beyond the Juristic Orientation of International Criminal Justice: The Relevance of Criminological Insight to International Criminal Law and its Control A Commentary	2010	Low
Journal of Criminal Justice	cash	The social organization of methamphetamine manufacturing: Roles, identities and persistence	2021	Low
	cash	'Rhetoric without reality' or effective policing strategy? An analysis of the relationship between community policing and police fatal force	2021	Low
	cash	Effects of pretrial risk assessments on release decisions and misconduct outcomes relative to practice as usual	2020	Low
	cash	How does the welfare state reduce crime? The effect of program characteristics and decommmodification across 18 OECD-countries	2020	Low
	cash	Impact of recreational marijuana legalization on crime: Evidence from Oregon	2021	Low
	cash	Risk factor and high-risk place variations across different robbery targets in Denver, Colorado	2019	Low

	cash	Gauging detention dosage: Assessing the impact of pretrial detention on sentencing outcomes using propensity score modeling	2020	Low
	cash	The routine activities of violent crime places: A retrospective case-control study of crime opportunities on street segments	2019	Low
	cash	The psychology of justice buildings: A survey experiment on police architecture, public sentiment, and race	2020	Low
	cash	Recidivism and community context: Integrating the environmental backdrop	2021	Low
	cash	School police officers' roles: The influence of social, developmental and historical contexts	2021	Low
	banknote	Can self-control theory explain offending in late adulthood? Evidence from Germany	2017	Low
State Crime Journal	cash	COVID-19 and the U.S. Health Care Industry: Towards a "Critical Health Criminology" within State Crime Studies	2021	Low
	cash	State-Corporate Crime and the Case of Bt Cotton: On the Production of Social Harm and Dialectical Process	2017	Low
	cash	Developmental Faith, Sacrifice and the Betrayal of Transitional Justice: A Bougainvillean Case Study	2017	Low
	cash	Criminology's Time: Settler Colonialism and the Temporality of Harm at the Assiniboia Residential School in Winnipeg, Canada, 1958-1973	2018	Low
	cash	Perceptions of Blameworthiness and Punitiveness Towards Government Officials and Business Executives in State-Corporate Crime Cases	2021	Low
	cash	Greening the Concept of State Crime	2019	Low
	cash	Crimes of the Powerful in Conflict-Affected Environments: False Positives, Transitional Justice and the Prospects for Peace in Colombia	2017	Low
	cash	Corporate Agents and Individual Criminal Liability under the Rome Statute	2015	Low
	cash	States of Impunity: Bhutanese Refugee Camps in Nepal	2017	Low
	cash	The Quantum Mechanics of Israeli Totalitarianism	2016	Low
	cash	State-Corporate Crime and Major Financial Institutions: Interrogating an Absence	2014	Low
	cash	Civil Society and State-Corporate Crime: A Case Study of Ivory Coast	2014	Low
	cash	BETWEEN CRIME AND "DOXA": RESEARCHING THE WORLDS OF STATE-CORPORATE ELITES	2012	Low
The British Journal of Criminology	banknote	A SOUNDTRACK TO (ILLEGAL) ENTREPRENEURSHIP: Pirated CD/DVD Selling in a Greek Provincial City	2011	Low
	cash	Financial Channels of Money Laundering in Spain	2012	Medium
	cash	'Why Should I Trust You With My Money?': Credible Commitments in the Informal Economy in China	2019	Low
	cash	The Modus Operandi of Burglary in Turkey	2019	Low
The Howard Journal of Crime and Justice	cash	Understanding the Proceeds of Crime Act 2002: Cash Seizure and Frontline Policing	2012	High
	cash	Home as a Site of State-Corporate Violence: Grenfell Tower, Aetiologies and Aftermaths	2020	Low
	cash	Progression from Cafeteria to la carte Offending: Scottish Organised Crime Narratives	2018	Low
	cash	Labouring out of Adversity: Maconochie, Political Economy and Penal Labour	2018	Low
	cash	Labouring out of Adversity: Maconochie, Political Economy and Penal Labour	2018	Low
	cash	American Bail and the Tinting of Criminal Justice	2017	Low
	cash	How Well Does Theory Travel? David Garland in the Global South	2016	Low

	cash	Privatising Probation: The Death Knell of a Much-Cherished Public Service?How Well Does Theory Travel? David Garland in the Global South	2016	Low
	cash	Why Probation Matters	2015	Low
	cash	Closing the Gap: Confronting the Problem of Hotels as Venues for Child Sexual Exploitation	2015	Low
	cash	Becoming a Hitman	2015	Low
	cash	The Impact of the Criminal Justice Act 2003 on Theft and the Custody Threshold	2014	Low
	cash	Challenges Facing Young Men Returning from Incarceration in Hong Kong	2014	Low
	cash, banknote	The British Hitman: 1974–2013	2014	Low
	cash	A Systematic Literature Review of Doorstep Crime: Are the Crime-Prevention Strategies More Harmful than the Crime?	2013	Low
	cash	A Taxonomy of Male British Family Annihilators, 1980–2012	2013	Low
	cash	The Definitional Ambiguities of Kidnapping and Abduction, and its Categorisation: The Case for a More Inclusive Typology	2013	Low
	cash	Counterblast: Punitive Payne, Justice Campaigns, and Popular Punitivism – Where Next for ‘Public Criminology’?	2013	Low
	cash	The Relationship between Job Stressors and Job Involvement among Correctional Staff: A Test of the Job Strain Model	2012	Low
	cash	From Counter-terrorism to Criminal Justice: Transformation or Business as Usual?	2012	Low
	cash	Elusive Evidence: Hard-to-Reach Drug Users and the Missing Values in Drug Policy Decision Making	2012	Low
	cash	The Division of Labour in Crime Prevention: Crime Science, Criminology and Criminal Justice	2012	Low
	banknote	Crime and Punishment in Classical and Libertarian Utopias	2013	Low
	cash	Progressive Prosecution in a Pandemic	2020	Low
	cash	When Prosecutors Politick: Progressive Law Enforcers Then and Now	2020	Low
	cash	Inaccuracy and the Involuntary Confession: Understanding Rogers v. Richmond Rightly	2020	Low
	cash	Inaccuracy and the Involuntary Confession: Understanding Rogers v. Richmond Rightly	2020	Low
	cash	Retroactive Legality: Marijuana Convictions and Restorative Justice in an Era of Criminal Justice Reform	2020	Low
	cash	Race, Reform, & Progressive Prosecution	2020	Low
	cash	Toward a Just Model of Pretrial Release: A History of Bail Reform and a Prescription for What's Next	2018	Low
	cash	The Downstream Effects of Bail and Pretrial Detention on Racial Disparities in Incarceration	2018	Low
	cash	Principles of Pretrial Release: Reforming BailWithout Repeating its Harms	2018	Low
	cash	Kassouf-The Sixth Circuit's Misguided Attempt toRein in the IRS	2018	Low
	cash	Assessing Dangerousness Amidst RacialStereotypes: An Analysis of the Role of Racial Biasin Bond Decisions and Ideas for Reform	2018	Low
	cash	Missing White Woman Syndrome: An EmpiricalAnalysis of Race and Gender Disparities in OnlineNews Coverage of Missing Persons	2016	Low

	cash	The Foreign Corrupt Practices Act: Unbridled Enforcement and Flawed Culpability Standards Deter SMEs from Entering the Global Marketplace	2016	Low
	cash	Secular Dissent: Protecting Non-Believers from Coercive Religious Parole Programs	2016	Low
	cash	Some Sources Of Crime Guns In Chicago: Dirty Dealers, Straw Purchasers, And Traffickers	2015	Low
	cash	Transforming Piecemeal Social Engineering into "Grand" Crime Prevention Policy: Toward a New Criminology of Social Control	2015	Low
	cash	Technology and the Guilty Mind: When Do Technology Providers Become Criminal Accomplices	2015	Low
	cash	Imposing Indigence: Reclaiming the Qualified Right to Counsel of Choice in Criminal Asset Forfeiture Cases	2014	Low
	cash	Autocorrect? A Proposal to Encourage Voluntary Restitution Through the White-Collar Sentencing Calculus	2014	Low
	cash	"Obtaining" the Right Result: A Novel Interpretation of the Computer Fraud and Abuse Act That Provides Liability for Insider Theft Without Overbreadth	2014	Low
	cash	Realizing Reliability in Forensic Science from the Ground Up	2014	Low

(1) The table returns all research articles in which "cash" and/or "banknote(s)" where found at least once. The score is "low" when neither "cash" nor "banknote(s)" appear in the abstract – missing an abstract the search was expanded to the introductory section of the article and its table of contents; it is "medium" when either of the two terms was found at least once in the abstract (with likewise expansion when there was no abstract) and, based on a comprehensive assessment, banknotes represent one of the topics addressed in the paper; it is "high" when banknotes are identified as the main topic of the paper.

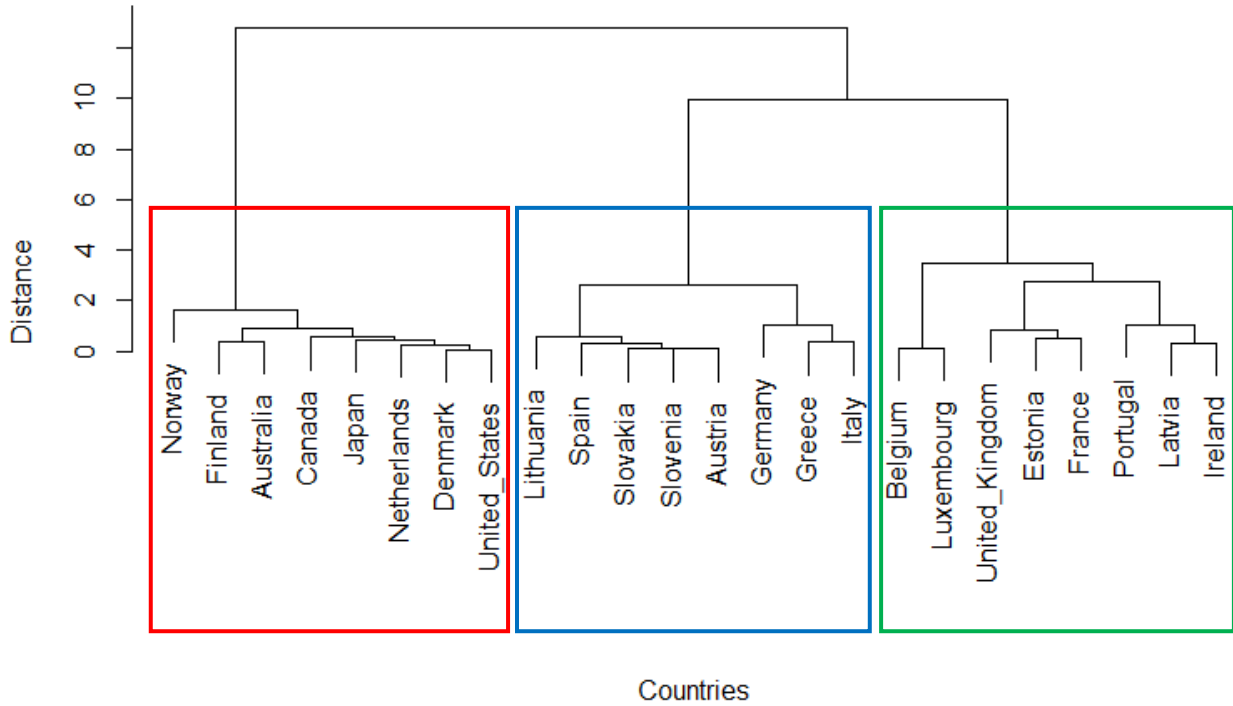
Table A.2

Money laundering and cash transactions						
Country	Money laundering (1)			Cash transactions, on total value (2)		
	domestic money	foreign money	total	share at points of sale	year of survey	source
Australia	1.7%	0.1%	2.3%	32%	2010	BB et al
Austria	0.6%	0.2%	2.5%	67%	2016	EH
Belgium	1.5%	0.5%	6.1%	32%	2016	EH
Canada	1.1%	0.2%	2.1%	23%	2009	BB et al
Denmark	1.3%	0.0%	1.8%	24%	2016	KH
Estonia	0.6%	0.2%	3.1%	31%	2016	EH
Finland	1.0%	0.1%	2.1%	33%	2016	EH
France	1.0%	0.4%	2.8%	28%	2016	EH
Germany	1.4%	0.0%	1.8%	55%	2016	EH
Greece	0.4%	0.1%	1.1%	75%	2016	EH
Ireland	0.4%	0.5%	3.2%	49%	2016	EH
Italy	0.8%	0.1%	1.3%	68%	2016	EH
Japan	0.2%	0.0%	0.3%	22%	2016	KH
Latvia	0.5%	0.3%	3.0%	54%	2016	EH
Lithuania	0.4%	0.3%	2.6%	62%	2016	EH
Luxembourg	0.8%	0.5%	5.5%	30%	2016	EH
Netherlands	1.0%	0.1%	1.6%	27%	2016	EH
Norway	2.2%	0.0%	2.4%	5%	2017-18	KH
Portugal	0.4%	0.6%	4.2%	52%	2016	EH
Slovakia	0.3%	0.2%	2.1%	66%	2016	EH
Slovenia	0.5%	0.2%	2.3%	68%	2016	EH
Spain	0.5%	0.3%	2.0%	68%	2016	EH
United Kingdom	1.2%	0.6%	4.3%	24%	2016	KH
United States	0.9%	0.1%	1.4%	23%	2012	BB et al

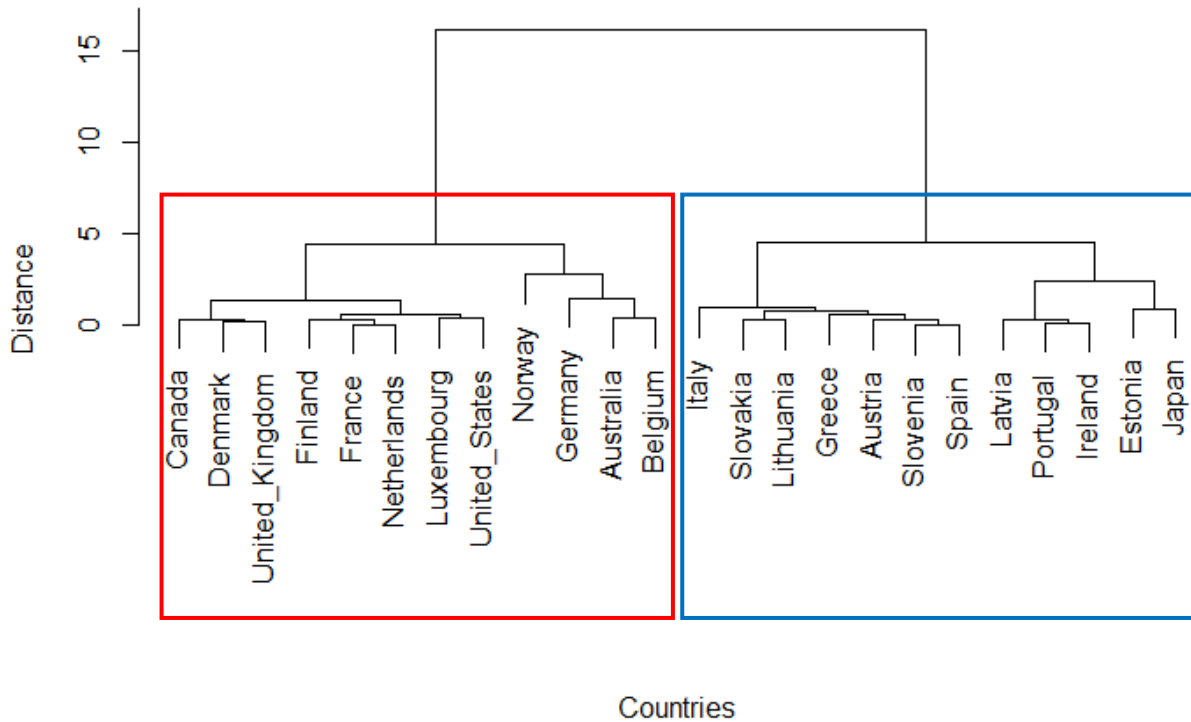
Sources: Based on data from (1) Ferwerda, van Saase, Unger and Getzner (2020); (2) BB et al: Bagnall, Bounie, Huynh, Kosse, Schmidt, Schuh and Stix (2016); EH: Esselink and Hernandez (2017); KH: Khiaonarong and Humphrey (2019).

Cluster analysis on money laundering and cash transactions data

Clusters identified on domestic ML data



Clusters identified on foreign ML data



Sources: Based on data from (1) Ferwerda, van Saase, Unger and Getzner (2020); (2) BB et al: Bagnall, Bounie, Huynh, Kosse, Schmidt, Schuh and Stix (2016); EH: Esselink and Hernandez (2017); KH: Khiaonarong and Humphrey (2019).

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