



# Cashlessness and Street Crime: A Cross-national Study of Direct Deposit Payment and Robbery Rates

William Alex Pridemore, Sean Patrick Roche & Meghan L. Rogers

To cite this article: William Alex Pridemore, Sean Patrick Roche & Meghan L. Rogers (2018): Cashlessness and Street Crime: A Cross-national Study of Direct Deposit Payment and Robbery Rates, Justice Quarterly, DOI: [10.1080/07418825.2018.1424923](https://doi.org/10.1080/07418825.2018.1424923)

To link to this article: <https://doi.org/10.1080/07418825.2018.1424923>



Published online: 22 Jan 2018.



Submit your article to this journal [↗](#)



Article views: 73



View related articles [↗](#)



View Crossmark data [↗](#)

# Cashlessness and Street Crime: A Cross-national Study of Direct Deposit Payment and Robbery Rates

*William Alex Pridemore, Sean Patrick Roche  
and Meghan L. Rogers*

Substantial variation in national crime rates suggests social structure and cultural context influence offending and victimization. Several prominent criminological theories anticipate a positive association between the prevalence of cash in a society and its rates of pecuniary crime. We examined the association between one form of “cashlessness” and national robbery rates across nations ( $n = 67$ ), controlling for several structural covariates of national crime rates. We obtained data on robbery from the United Nations Office on Drugs and Crime, and data on government-based cashlessness from the Global Financial Inclusion Database. We found nations with higher levels of government-based cashlessness had lower robbery rates ( $\beta = -.41$ ,  $p = .02$ ). We also undertook several sensitivity analyses, including tests for a relationship with commercial cashlessness and for crimes like homicide and burglary. Our results suggest technological advancements that reduce cash in a society may have implications for a nation’s robbery rates.

*Keywords* cash; electronic financial transactions; economy; cross-national

William Alex Pridemore is the Dean and distinguished professor in the School of Criminal Justice at the University at Albany – State University of New York, where he is also affiliate faculty of the Department of Sociology and of the Center for Social and Demographic Analysis. His primary criminological research interests include social structure and violence, alcohol and violence, cross-national homicide rates, and rural criminology. He also carries out research on alcohol epidemiology, the sociology of health and illness. Sean Patrick Roche is an assistant professor in the School of Criminal Justice at Texas State University. His primary research interests include public opinion on crime and justice issues, police and offender decision-making, and the relationship between social technologies and emerging trends in criminology and criminal justice. Meghan L. Rogers is an assistant professor in the Department of Sociology and Criminology at the University of North Carolina-Wilmington. Her research interests include cross-national research, violence, quantitative research methods, criminological theory, social structures and crime, and measurement of crime. Correspondence to: William Alex Pridemore, School of Criminal Justice, University at Albany—State University of New York, 135 Western Avenue, Albany, NY 12222, USA. E-mail: [pridemore@albany.edu](mailto:pridemore@albany.edu)

## Introduction

Street crime can occur for many reasons and cash is closely tied to several of them. In robberies and burglaries the goal is often to obtain cash either immediately or eventually via fencing stolen goods. In the various forms of illicit merchandise sales—drug dealing, prostitution, illegal gambling, and other organized crime—cash is a crucial store of value and means of payment (Warwick, 1993). Even expressive crimes lacking a direct connotation of money may be the consequence of an attempt to gain money, such as when a robbery “goes bad” and becomes a homicide. Yet Zelizer (1989, p. 343) notes that with few exceptions (Smelt, 1980; Turner, 1986) “the sociological bibliography on money remains remarkably sparse.”

The situation is similar in criminology. Many of the leading theories in our discipline—self-control, routine activities, rational choice—anticipate cash prevalence in society should heavily influence crime rates. While studies have assessed the impact of cash-heavy businesses, like payday loan offices, on crime rates (Kubrin & Hipp, 2016; Kubrin, Squires, Graves, & Ousey, 2011; Wo, 2016), the direct relationship between cash and crime has all but escaped direct empirical attention (Wright et al., 2014). Perhaps this is because cash is so commonplace its concentration and use are assumed to be largely invariant across space and time. This is incorrect. For both security and convenience, national governments increasingly encourage citizens to transition from cash to other payment systems like debit and credit cards (Sunstein, 2014). For our purposes we define cashlessness as the degree to which average citizens forgo cash in lieu of other forms of currency (e.g. digital payment systems), and our study is one of the first to assess the cross-national relationship between cashlessness and street crime.

Cash has several properties that make it attractive or even obligatory for would-be offenders of some crimes. Cash is almost always anonymous, allowing an individual to pay for goods and services while revealing little if any personal identifying information. Cash is liquid. It is an extremely versatile medium of exchange, and it is sometimes the only possible medium of exchange in environments where discretion is paramount, such as in underground economies (Naylor, 2004; Schneider & Enste, 2013; Tekin, Topalli, McClellan, & Wright, 2014). In most nations the value of cash is durable over time, making it a store of value that can be laid aside and revisited at a later time with little loss of worth. This is particularly valuable for an offender who must “lay low” for a period of time to avoid detection.

Still, cash is such a normal part of everyday life that its criminogenic properties might be overlooked. As a cornerstone of modern society it does not seem possible for cash to fall out of fashion. Yet the move away from cash is already underway. In 2011, nearly 40% of Americans ages 23–34 used cash for all or most of their purchases. By 2016 that number fell to only 21% (Swift & Ander, 2016). Digital payment systems are also making direct inroads in traditional

cash-based areas of the economy: roughly 80% of Americans shop online, 15% make online purchases on a weekly basis, and almost 25% make no purchases at all using cash during a typical week (Pew Research Center, 2016). While it is unlikely truly cashless societies will appear in the near future (Erling, 2013), over the last two decades cash has begun to lose its global preeminence in favor of electronic payment systems, but with wide heterogeneity in rates of adoption (Demirgüç-Kunt, Klapper, Singer, & Van Oudheusden, 2014).<sup>1</sup> In high-income OECD nations, three-quarters of all adults had a debit card in 2014, with some nations (e.g. New Zealand and Norway) having over 90% adoption. At the same time, in developing nations only one-quarter of adults had debit cards (Demirgüç-Kunt et al., 2014, pp. 19–20).

As information technology has advanced rapidly since the early 1990s, so too have payment systems. Debit and credit cards, online shopping, and smartphone-based payment services (e.g. Venmo, PayPal, and Apple Pay) are increasingly ubiquitous. This may lead large numbers of people to avoid carrying cash altogether, making them less attractive victims for predatory acquisitive crime. The ease and security of electronic payment systems may also lead businesses to avoid taking cash whenever possible, which damages cash's utility for potential offenders.

A small literature suggests this shift toward cashlessness may reduce some forms of crime (Armey, Lipow, & Webb, 2014; Wright et al., 2014). Some national governments have begun to actively encourage electronic payment systems and discourage high denomination cash use, ostensibly for its convenience and in an effort to reduce criminal or terrorist activity and to promote stability in developing nations (Forbes, 2016; Gilbert, 2016). More empirical analysis on the potential link between cashlessness and street crime is needed. Using data from the United Nations Office on Drugs and Crime (UNODC), the World Health Organization's WHOSIS database, and the World Bank's Global Financial Inclusion Index in a sample of over fifty countries, we investigated the relationship between national levels of government-based electronic payment system use and rates of instrumental crime, including robbery, burglary, and homicide.

## The Criminophilic Properties of Cash

The acquisition of money, especially untraceable money, is the principal goal of a great deal of criminal activity (Rosenfeld & Messner, 2013), and instrumental crime comprises a large proportion of all crime. UCR and NCVS estimates indicate property crimes make up two-thirds to three-quarters of all criminal offenses (Federal Bureau of Investigation, 2012; Truman & Langton,

1. Electronic or digital payment systems lack a standardized definition, but both refer to transfers of value that are initiated and/or received using electronic devices and channels. These include debit cards, credit cards, electronic funds transfers, and e-commerce payment systems (Better Than Cash Alliance, 2016).

2015). The UCR underestimates the number of property crime offenses for many reasons, including the hierarchy rule that only the most serious offense is counted in an incident involving multiple offenses (Biderman & Lynch, 1991). Offenders choose acquisitive crimes (e.g. burglary, motor vehicle theft, fraud) and some types of violent crimes (e.g. robbery) to obtain cash or for property that may be later exchanged for cash. Yet perhaps because of its strong association with the field of economics (see Ingham, 2004) there has been little research on cash's starring role in crime.

Classical economic theory holds money has three main functions: a measure of value, a store of value, and a medium of exchange (Ingham, 2004, p. 3). These functions create important properties that make cash the primary goal of most instrumental crime. First, by functioning as a store of value cash can be hidden away for a later time and place. Unlike a stolen credit card or gift card that may immediately lose its value by being canceled, or worse for the offender may lead to apprehension by tracking purchases, cash has durable value. Second, by functioning as a medium of exchange, cash is accepted throughout societies and is the preferred or only method of payment accepted by some businesses and people (Foley, 2011; Varjavand, 2011). Finally, and most important as it relates to criminal activity, paying in cash allows buyer and seller to maintain anonymity, which means only minimal trust is required between buyer and seller and allows both parties to plausibly deny any transaction took place between them.

Like incidences of street crime, use of cash varies in many ways within and between nations. The poor are both more likely to experience criminal victimization (Van Kesteren, Mayhew, & Nieuwbeerta, 2000; Xie, Heimer, & Lauritsen, 2012) and to be underbanked or unbanked (Federal Deposit Insurance Corporation, 2012; Rhine & Greene, 2013). Countries vary substantially in the development of their monetary systems. There are enormous disparities in account ownership between developed and developing nations and between regions in the developing world (Demirgüç-Kunt et al., 2014, p. 4). Cash is now waning, albeit at different rates, as the payment system of choice for many nations (Erling, 2013), and is almost categorically impossible to use in the growing online economy. This online commerce trend has its own criminogenic implications (Tcherni, Davies, Lopes, & Lizotte, 2016), but our focus is predatory street crime.

Because use of cash in transactions and rates of instrumental street crime vary by nation, it follows the two may be systemically related. Economists have noted drug consumption patterns in low-income areas seem to mirror monthly government transfer payments via welfare checks (Dobkin & Puller, 2007; Foley, 2011), so too may theft and robbery from those receiving these payments. In addition to these temporal patterns, researchers have noted geographic relationships between cash-heavy businesses and criminality. For instance, fringe banking institutions like payday lenders that provide cash in large sums to their clients are often associated with hot spots of street crime (Kubrin & Hipp, 2016; Kubrin et al., 2011; Wo, 2016). These studies do not

directly assess the impact of cash's presence in a situational context but they provide strong supporting evidence that the pooling of cash in space and time provides fertile conditions for acquisitive criminality.

A body of qualitative criminological scholarship in the United States suggests the presence of cash is important for understanding the etiology of crime, providing a rich description of intermediary causal linkages. These studies find many chronic offenders participate in hedonistic loops of bingeing, with conspicuous consumption and excess drug and alcohol use followed by periods bereft of money. The latter necessitates finding quick cash, leading to acquisitive crimes like robbery or burglary (Topalli, Wright, & Fornango, 2002; Wright & Decker, 1997). Availability of cash serves this hedonistic process by providing reliable, fast, anonymous financing for drugs, alcohol, prostitution, and other purchases.

Three prominent criminological theories seem most salient to the potential cash–crime relationship: self-control theory, routine activities theory, and rational choice theory. Self-control theory argues most crime is trivial, banal, and ill planned, a result of offenders being impulsive and present-focused (Gottfredson & Hirschi, 1990). Put another way, self-control theory identifies a criminogenic trait catalyzed by opportunity. Due to the underlying opportunity structure in society many acquisitive crimes consist of short-term gains (e.g. immediate cash and consequent pleasure) offset by long-term costs (e.g. legal punishments). Gottfredson and Hirschi (1990, 2003) argued this opportunity structure is stable. Other scholars (Hay & Forrest, 2006, 2008) suggested opportunity structure varies, and thus the impact of self-control on crime may be moderated by the prevalence of opportunities. While cash presents a short-term gain, credit cards may not. Converting stolen property or credit cards into desired goods, services, or cash may present a logistical burden many offenders are unwilling or unable to shoulder, perhaps deterring potential offenders with low self-control. An increasingly cashless society may have a “long-term benefits vs. long-term costs” opportunity structure for acquisitive street crimes, in contrast to a traditional cash-heavy society’s “short-term gains vs. long-term costs” structure.

From a more macro-level perspective, but still focusing on the role of criminal opportunities, routine activities theory posits large-scale economic and social changes can influence crime rates in the context of a population’s stable underlying criminal propensities (Cohen & Felson, 1979; Felson, 1987, 1994). Instead, rates of street crime are the result of a confluence of motivated offenders and suitable targets in the absence of capable guardians (Cohen & Felson, 1979, p. 589). Cashlessness reduces the suitability of targets because the presence of cash is often the most salient characteristic of a target, if not the target itself. Widespread electronic payment systems reduce the cash value (or amount of cash expected) of victimizing any given individual and change the aggregate economic context such that characteristics that made targets suitable (e.g. being alone on a street with a purse) may no longer signal economic benefit for offenders.

Rational choice theory suggests rational agents choose to engage in crime if the expected return exceeds both the potential benefits of legal economic activities and the risks of arrest and punishment (Becker, 1968; Gibbs, 1975). If there is less cash in circulation this may make acquisitive crimes—which are already inherently fraught with risk and provide relatively small returns—even less objectively productive. Payment systems like checks and credit cards may be less reliable sources of value (e.g. easily canceled), more labor-intensive (requiring special knowledge or a knowledgeable collaborator/fence), and more amenable to tracking the offender (e.g. where the card was used, cross-referencing with cameras, etc.).

Subjective judgments of the celerity, severity, and certainty of punishment are central to deterring offenders (Nagin, 1998; Paternoster, 1987; Waldo & Chiricos, 1972), and these perceptions may be intuitive and generated using mental shortcuts (Pogarsky, Roche, & Pickett, 2017, 2018). Concurrently, research suggests individuals are often averse to ambiguous situations (Ellsberg, 1961; Kahn & Sarin, 1988). Insofar as increasing cashlessness increases the intuitive perception there is ambiguity regarding risk of apprehension (Loughran, Paternoster, Piquero, & Pogarsky, 2011; Pickett & Bushway, 2015) for certain acquisitive street crimes, or subtly increase offenders' perceptions of riskiness for those crimes, one may expect offenders to be deterred (see also, Jacobs & Cherbonneau, 2017). Adoption of electronic payment systems may also have emergent properties at the societal level that affect offenders' perceptions of risk and reward. One example is the concept of herd immunity (Fine, 1993): if there is widespread perception among potential offenders most people do not carry cash this may deter offenders and protect people who still do carry large sums of cash. Reductions in cash do not necessarily need to be drastic, only enough to substantially affect perceived gains of engaging in acquisitive street crime.

Understanding how social structure, culture, and policy influence temporal changes in crime rates within nations and variation in crime rates between nations tells us something about the fundamental character of crime. Societies may experience a criminological transition (Pridemore, 2007, 2016) as they develop, in which there are shifts not simply in the rate of crime but in the nature of the typical criminal event, such as the average distance of the victim–offender relationship, the main motives for engaging in crime, individual characteristics of offenders, or weapon choice (Pridemore, 2007, 2016; see also Gruenewald & Pridemore, 2009). The move toward cashlessness may contribute to that transition.

Some national governments have already begun enacting initiatives that treat cash as criminogenic, particularly in developing nations. In 2008, the United States Department of Defense sponsored the Cashless Battlefield initiative in Iraq and Afghanistan, encouraging local merchants and contractors to switch from cash to mobile banking (Kunkel, 2008). In 2012, the United States Agency for International Development—along with the Bill & Melinda Gates Foundation, the Ford Foundation, Visa, and MasterCard—sponsored the Better than

Cash Alliance, a bid to stabilize regions and reduce terrorism and conventional crime. This ongoing initiative encourages citizens, governments, and private companies in several nations, especially developing nations, to switch from cash to mobile banking. This trend is also seen in developed nations. Sweden and Israel are both pursuing domestic cashlessness initiatives (Shamah, 2013; Tomlinson, 2012). China, Ecuador, Canada, the Philippines, and the United Kingdom are exploring fully digital currencies ('Bring on the cashless future,' 2016).

### Studies of Cashlessness and Crime

While others speculated about the connection between cash and crime (Warwick, 1993) or discovered qualitative evidence cash is an important feature of the criminal milieu (Topalli et al., 2002; Wright & Decker, 1997), only two studies quantitatively assessed the potential relationship between cashlessness and acquisitive crime rates. Wright et al. (2014) examined crime rates in Missouri counties, taking advantage of a natural experiment via the introduction of a new form of welfare distribution: electronic benefit transfer (EBT) cards rather than checks. The change from paper check was important because many welfare recipients were unbanked and exchanged welfare checks for lump sums of cash at regular intervals. Offenders were sensitive to this pattern of cash influx. The authors found the EBT program had a negative and significant effect on the overall crime rate, and on burglary, assault, and larceny specifically. They estimated the overall crime rate decreased about 10% in response to the program.

Taking a cross-national approach, Armeiy et al. (2014) used data from the World Bank's Payments Systems Worldwide and the UNODC to assess the relationship between point-of-sale (POS) devices (e.g. debit card readers) per capita and crime rates across seventy countries. They found a statistically significant negative relationship between electronic POS devices per capita and rates of the acquisitive crimes of robbery and burglary. Consistent with their predictions, they found little relationship between POS devices per capita and rates of non-economic crimes like homicide and rape.

Wright et al.'s (2014) use of the shift to EBT cards as an exogenous policy change was novel and methodologically rigorous. Wright et al.'s (2014) focus, however, was limited to one U.S. state. One limitation of the Armeiy et al. (2014) study was that their use of POS devices per capita as a proxy for cashlessness missed government-based disbursement of money. This is a key element of the equation, especially among those in the lower end of the income distribution who are at greater risk of predatory street crime. Another limitation of the Armeiy et al. (2014) study was their use of rape rates as an outcome variable. Estimates of rape are notoriously unreliable, legal definitions vary by nation, and the proportion of rape incidents reported by victims and recorded by police both vary substantially by nation. The use of this variable, though,

does not alter the general conclusions drawn by the authors about the effects of cashlessness on acquisitive crime rates like robbery.

## The Current Study

We are interested in the impact of the use of cash on national rates of acquisitive street crime. Nations differ in use of cash relative to other forms of payment and we took advantage of this to determine if use of cash covaries with robbery rates. Following Wright et al. (2014) we paid particular attention to government-based cashlessness by examining the percentage of a nation's citizens that received government remittances via an account rather than cash or check.

## Methods

### Sample

Table 1 provides a list of nations that had data available for each of our three outcome variables, rates of robbery, burglary, and homicide. The sample varies in size because of missing data for the outcome variables. Between the years 2006 and 2011, 67 nations had data for robbery offending, 57 nations for burglary offending, and 71 nations for homicide victimization.

### Data

Appendix provides a list of all of variables in our analyses and the data sources. To prevent extreme values in any given year from biasing analyses we averaged offending and victimization rates from 2006 to 2011. Our main outcome of interest was robbery, though we also examined burglary and homicide. We defined this as the number of robberies per 100,000 residents and obtained these data from the UNODC (2016). According to the UNODC, robbery is defined as "theft of property from a person, overcoming resistance by force or threat of force" (UNODC, 2016, para. 1). This includes muggings (e.g. bag snatching) and theft with violence, but excludes pickpocketing or extortion.

To be sensitive to alternative etiological pathways, and in keeping with earlier studies, we also used homicide victimization and burglary rates as outcome variables, since robberies may result in homicides and cash can be a target of burglars (especially for victims who are unbanked). Burglary is defined as "gaining unauthorized access to a part of a building/dwelling or other premises, including by use of force, with intent to steal goods" (UNODC, 2016, para. 1). Burglary also includes theft from place of dwelling, factories, shops, offices, and military establishment. We obtained burglary data for 2006 to

**Table 1** Sample of nations by dependent variable

Robbery		Homicide victimization		Burglary	
Argentina	Kyrgyzstan	Argentina	Lithuania	Armenia	Kuwait
Armenia	Latvia	Armenia	Luxembourg	Australia	Kyrgyzstan
Australia	Lithuania	Australia	Malta	Austria	Latvia
Austria	Luxembourg	Austria	Mauritius	Azerbaijan	Lithuania
Azerbaijan	Malta	Azerbaijan	Mexico	Belarus	Luxembourg
Belarus	Mauritius	Belarus	Montenegro	Belgium	Malta
Belgium	Mexico	Belgium	Netherlands	Brazil	Mauritius
Brazil	Montenegro	Brazil	New Zealand	Bulgaria	Mexico
Bulgaria	Netherlands	Bulgaria	Panama	Canada	Netherlands
Canada	New Zealand	Canada	Paraguay	Chile	New Zealand
Chile	Panama	Chile	Philippines	Colombia	Panama
Colombia	Paraguay	Colombia	Poland	Costa Rica	Paraguay
Costa Rica	Philippines	Costa Rica	Portugal	Croatia	Poland
Croatia	Poland	Croatia	Qatar	Cyprus	Portugal
Cyprus	Portugal	Cyprus	Republic of Korea	Czech Republic	South Korea
Czech Republic	Republic of Korea	Czech Republic	Republic of Moldova	Denmark	Moldova
Denmark	Republic of Moldova	Denmark	Romania	Egypt	Romania
Ecuador	Romania	Ecuador	Russian Federation	El Salvador	Russia
Egypt	Russian Federation	Egypt	Serbia	Estonia	Serbia
El Salvador	Serbia	El Salvador	Singapore	Finland	Singapore
Estonia	Singapore	Estonia	Slovakia	France	Slovakia
Finland	Slovakia	Finland	Slovenia	Germany	Slovenia
France	Slovenia	France	South Africa	Greece	Spain
Germany	Spain	Germany	Spain	Guatemala	Sweden
Greece	Sri Lanka	Greece	Sri Lanka	Hungary	TFYR Macedonia
Guatemala	Sweden	Guatemala	Sweden	Israel	Trinidad & Tobago
Hong Kong, SAR	Thailand	Hong Kong SAR	Thailand	Italy	Turkey
Hungary	TFYR Macedonia	Hungary	TFYR Macedonia	Japan	Ukraine
Ireland	Trinidad and Tobago	Ireland	Trinidad and Tobago	Kazakhstan	
Israel	Turkey	Israel	Turkey		
Italy	Ukraine	Italy	Ukraine		
Japan	United Arab Emirates	Japan	United Arab Emirates		

*(Continued)*

Table 1 (Continued)

Robbery	Homicide victimization	Burglary
Kazakhstan Uruguay	Kazakhstan United Kingdom	
Kuwait	Kuwait Uruguay	
	Kyrgyzstan Venezuela	
	Latvia	

2011 from UNODC. We obtained 2006–2011 homicide data from the World Health Organization (Bennett & Lynch, 1990; Smit, de Jong, & Bijleveld, 2012; Smit, Meijer, & Groen, 2004; World Health Organization, 2015). WHO homicide victimization is defined using the International Classification of Diseases 10th revision, categories X85-Y09: “homicides and injury purposely inflicted by another person” (World Health Organization, 2015).

Our measure of cashlessness was the percent of the poorest 40% of citizens aged 15+ years who received a direct deposit of money or payment from the government in the past 12 months at Wave 1 of the Global Financial Inclusion Database (Findex) (World Bank, 2012). This closely approximates Wright et al.’s (2014) focus on government remittances. This is important because governments have direct control over how social welfare payments are disbursed, which constitutes perhaps the least invasive policy nudge toward a cashless society (Sunstein, 2014; Thaler & Sunstein, 2008). This measure is of particular interest as individuals among the poorest 40% are usually at greater risk for street crime offending and victimization (Wright et al., 2014).

We included several control variables based on the prior cross-national crime empirical literature. These included the infant mortality rate as a proxy for poverty (Pare & Felson, 2014; Pridemore, 2008, 2011), the sex ratio (number of males per 100 females), the education index from the Human Development Index, unemployment rates, percent of the population that lives in an urban area, and the Gross Domestic Product per capita in 2005 constant US dollars. We also included a measure of the number of ATMs per 100 residents, which performs as a control for the technology within a nation and suggests the potential for cashlessness in a nation (i.e. citizens rarely or no longer carry cash).

## Analyses

We estimated a series of multiple linear regression models. We included sensitivity tests to explore if variables were approximately normally distributed (Shapiro–Wilk, quantile–quantile normal plots, and Tukey’s ladder), Breusch–Pagan and Cook–Weisberg tests for homoscedasticity, Variance Inflation

Factors (VIFs) for multicollinearity, and multiple tests for outliers (studentized residuals, Cook's distance, and leverage values).<sup>2</sup>

## Results

Table 2 provides means and standard deviations for each variable and the correlation matrix. Table 3 provides results for each of the three outcomes using multiple linear regression. Given directional hypotheses, *p*-values are for one-tailed tests. As expected, our measure of cashlessness was significantly and negatively associated with robbery offending rates across nations ( $b = -.43$ ,  $p = .024$ ). We found no relationship between cashlessness and burglary ( $b = .08$ ,  $p = .692$ ) or between cashlessness and homicide victimization rates ( $b = -.21$ ,  $p = .115$ ). While the *p*-value for the latter does not allow for strong statements against an association with homicide rates, we are confident in our

**Table 2** Correlation matrix and descriptive statistics

	1	2	3	4	5	6	7	8	9	10
1. Ln Robbery	—									
2. Ln Homicide Victimization	<b>.49</b>	—								
3. Ln Burglary	<b>.49</b>	.00	—							
4. Ln Cashlessness	.16	<b>-.42</b>	<b>.65</b>	—						
5. Ln Infant Mortality	.14	<b>.53</b>	<b>-.41</b>	<b>-.66</b>	—					
6. Ln GDP	<b>.28</b>	<b>-.43</b>	<b>.63</b>	<b>.81</b>	<b>-.74</b>	—				
7. Ln Sex Ratio	<b>-.18</b>	<b>-.28</b>	<b>-.23</b>	.04	.02	.14	—			
8. Education Index	<b>.32</b>	<b>-.28</b>	<b>.65</b>	<b>.74</b>	<b>-.65</b>	<b>.81</b>	<b>-.06</b>	—		
9. % Urban	<b>.30</b>	<b>-.18</b>	<b>.34</b>	<b>.62</b>	<b>-.51</b>	<b>.72</b>	.15	<b>.61</b>	—	
10. Sqrt ATM's per 100	<b>.29</b>	<b>-.25</b>	<b>.60</b>	<b>.72</b>	<b>-.50</b>	<b>.81</b>	<b>-.05</b>	<b>.80</b>	<b>.64</b>	—
Mean	3.57	.91	4.77	1.80	-.35	8.55	4.60	.64	59.99	6.39
SD	1.69	1.40	2.01	1.68	.64	1.59	.14	.16	24.12	3.24

Note: Bold values mean they are significant at  $p < .05$ .

2. Based on the results of the Shapiro–Wilk Test, quantile–quantile normal plots, and Tukey's ladder, the distributions of robbery, homicide victimization, cashlessness, poverty, GDP, and sex ratio all became approximately normal after applying a natural logarithmic transformation. When the natural log transformation was applied to burglary rates, however, it was still not approximately normal. ATMs per 100 residents became approximately normally distributed after utilizing the square root transformation. The education index and percent urban were approximately normally distributed without transformation.

**Table 3** Results for multiple linear regressions

	Ln robbery			Ln homicide victimization			Ln burglary		
	<i>b</i> ( $\beta$ )	SE	<i>p</i>	<i>b</i> ( $\beta$ )	SE	<i>p</i>	<i>b</i> ( $\beta$ )	SE	<i>p</i>
Ln cashlessness	-.43 (-.41)	.21	.024	-.21 (-.21)	.18	.115	.08 (.07)	.20	.346
Ln poverty	1.77 (.75)	.48	<.001	.98 (.46)	.34	.003	.70 (.30)	.48	.074
Ln GDP	1.22 (.96)	.33	<.001	.08 (.07)	.27	.384	.63 (.48)	.34	.036
Ln sex ratio	-3.19 (-.31)	1.26	.007	-2.21 (-.31)	.82	.005	-1.32 (-.04)	3.81	.365
Education index	.42 (.03)	2.43	.432	-2.35 (-.17)	2.01	.123	6.63 (.43)	2.32	.003
% Urban	.02 (.27)	.01	.028	.01 (.08)	.01	.262	.00 (-.02)	.01	.426
Sqrt Atm per 100	-.01 (-.02)	.08	.455	.04 (.07)	.07	.285	.06 (.10)	.07	.210
Constant	7.59	5.98	.105	12.30	3.78	.001	.44	17.01	.490
<i>F</i>	3.80			7.20			8.39		
<i>R</i> / <i>Adj R</i>	.31 .23			.44 .38			.55 .48		
<i>n</i>	67			71			57		

Note. *p*-Values are for one-tailed tests.

interpretation given this is a one-tailed test and the causal pathway of cashlessness on homicide is indirect and less clear.

### Sensitivity Analyses

Multicollinearity is present in our models. Some VIFs were high, including a VIF of 8.29 for GDP. When we removed those individual variables from the model, however, overall conclusions remained the same for all three outcome variables. To further explore if multicollinearity is biasing our results we undertook a principal component analysis on just the control variables (ln poverty, ln GDP, ln sex ratio, education index, and percent urban). Based on the eigenvalues, factor loadings, and scree plot we only needed two components to capture the six control variables. Due to heteroskedasticity in models with only the components as control variables we estimated effects using a series of weighted least squares regression models, weighting by the square root of the total population. Once again, the overall conclusions remained the same despite the reduction of variables and reduction of the VIFs to 3.84 or less.

Second, all models were homoscedastic. Third, when we removed nations that studentized residuals, Cook's distance, or leverage values indicated were outliers our conclusions remained the same. Finally, we examined commercial cashlessness as opposed to government-based cashlessness. We measured this by using an index with percent of respondents who had credit or debit cards, percent of respondents who obtained pay via direct deposit, and percent of respondents who received a direct deposit for governmental benefits. We examined these both for all residents and, as above, for those who were in the poorest 40% of the population. This index of commercial cashlessness was not significantly associated with robbery offending, burglary offending, or homicide victimization rates.<sup>3</sup>

## Discussion

Cash occupies a unique place in modern society, though it is frequently overlooked because it is so ubiquitous and ensconced in everyday life (Ingham, 2004). Cash functions as a versatile, durable, and largely anonymous medium of exchange, making it an invaluable ingredient for underground economies and, crucially, the primary target of acquisitive street crimes. We used data on public and private payment systems from the Global "Findex" (Demirgüç-Kunt et al., 2014) and crime data to assess the potential cashlessness–crime connection. There is a very small literature on this topic (Armey et al., 2014; Wright et al., 2014), which we extend by testing two contrasting varieties of cashlessness, government-based and private-based, and assessing the relationship between cashlessness and crime at the cross-national level.

We first examined government-based cashlessness via the relationship between national homicide, robbery, and burglary rates and account-based government disbursements for the poorest 40% of residents. This operationalization of government-based cashlessness is based on Wright et al.'s (2014) focus on a state-level initiative to reduce cash use among the poor via EBT cards. This test also provides more evidence to the ongoing discussion of whether government-funded conditional cash transfers are criminogenic (Borraz & Munyo, 2015) or not (Chioda, de Mello, & Soares, 2012). Consistent with our expectations, robbery rates were negatively related to government-based cashlessness. Nations with higher levels of disbursements via deposits directly into some type of banking account have lower robbery rates.

In a set of sensitivity analyses not shown here we also examined the impact of private-based (or commercial) cashlessness on national crime rates. We found no association between the two, though we note the measure of

3. All data, Stata code, sensitivity analyses and results for this study are available online at the following location: <https://sites.google.com/site/homicidedata/cashlessness-and-street-crime-a-cross-national-study-of-direct-deposit-payment-and-robbery-rates>.

private-based cashlessness was an index of very broad measures of the use of electronic payment systems (e.g. credit cards and debit cards). This finding is in contrast with the results of Armeij et al. (2014), who found negative and statistically significant relationships between a commercial measure of cashlessness (i.e. point of sale devices, more colloquially known as "credit card readers," per 1,000 people in a population) and robbery and burglary, but found no associations with expressive crimes like homicide and rape.

This inconsistency of findings between our study and Armeij et al. (2014) may result from the measure failing to capture heterogeneity of private cash use within nations. A more targeted measure of how those most at risk of criminal victimization do or do not use cash would provide a better indicator of the potential private-based cash–crime hypothesis. On the other hand, private-based adoption of electronic payment systems and point of sale devices may be driven by a range of factors related to business owners (e.g. innovation, computer literacy, perceived crime and security), businesses themselves (e.g. organization size and competition with local retailers), and consumers (e.g. security) (Adeoti & Oshotimehin, 2011; Crowe, Rysman, & Stavins, 2010; Omotayo & Dahunsi, 2015; Plomp, Huiden, & Batenburg, 2011). If there is a causal relationship between cashlessness and acquisitive street crime, all of these factors may have differential effects on crime until a tipping point of private-based cashlessness is reached in a society.

We found no relationship between our main, government-based cashlessness measure and burglary, which does suggest only partial support for the link between cashlessness and acquisitive crime. Yet, it is possible that scarcity of cash would not directly influence the profitability of the theft and sale of real goods such as electronics, jewelry, and the like. On the other hand, since citizens of countries with higher cashlessness should perceive less profitability in the direct acquisitions of cash (e.g. robbery) we might expect higher burglary rates as offenders displace to those crime types. We saw no evidence of such displacement. This may not be problematic since displacement itself is a disputed phenomenon in the crime prevention literature (Guerette & Bowers, 2009; see also, Kleck, 2016), or alternatively this displacement may be to forms of online property crime (Tcherni et al., 2016) not captured in traditional crime statistics. We did not find a significant association between cashlessness and homicide victimization rates. The statistically significant relationship between cashlessness and robbery, and the lack of such relationships for burglary or homicide, lends partial and tentative support to the hypothesis that cashlessness will differentially influence crime types.

## Limitations

Our study has some notable limitations. First, as with other studies of cross-national robbery and burglary rates we faced the usual limitations with measurement errors associated with potential differences in definitions across nations

and with the limitations associated with police reported crime data. Second, we were constrained by the number of nations that report crime data. As a result of this general limitation, small sample sizes are common in cross-national crime research (Messner, Raffalovich, & Sutton, 2011; Pridemore, 2008; Savolainen, 2000) and we chose not to use crime types that are the least reliably measured cross-nationally (e.g. sexual assault, larceny). Third, our tests were cross-sectional, whereas the narrative suggests changes over time in a nation in its level of cashlessness will create changes in crime rates. While our preference would be to test this hypothesis using time series or panel models to examine within-nation changes over time, annual data on cashlessness are unavailable.

Finally, while we drew from two prior studies (Armeij et al., 2014; Wright et al., 2014) to inform our measures of government- and private-based cashlessness, neither these varieties nor our measures are definitive. Similarly, our operationalization of cashlessness may partially capture the extent of government-based social protection in a society. Given Wright et al.'s (2014) findings, however, our results suggest even if social protection plays a part, the removal of cash from society may be influential. Further, substantial research shows significant direct and indirect effects of social protection on cross-national homicide rates that persist across a broad range of measures of social protection (Rogers & Pridemore, 2013). In contrast, our measure of cashlessness was not associated with homicide rates. Prior cross-national research on the effects of social protection on crime also focused on homicide, so there is not a literature that concludes social support is negatively associated with cross-national robbery rates, which was the focus of our study. Still, this is a clear limitation, we recognize the potential confounding, and we hope for measures in the future that more closely align with the theoretical concept.

## Conclusion

Future research should continue to assess whether a cashlessness–crime relationship exists at the cross-national level. Certainly there are many theoretical traditions that would suggest so, but further and more comprehensive empirical tests of such a relationship are required. The Global Financial Inclusions Index data-set is one example of a new rich data-set for examining the relationships between the financial habits of everyday people and crime rates across many nations. Researchers should look for other novel approaches to examining this relationship and improve upon our initial exploratory research. In particular, aggregated nation-level estimates alone may mask important within-nation heterogeneity in both cashlessness and crime. Multi-level frameworks may be particularly useful in assessing this issue. At the individual level, qualitative and experimental survey vignette research may also be useful in investigating how offenders view cash versus electronic payment systems. Research should explore how these different payment systems impact offenders' perceptions of

the benefits of crime and if offenders perceive a greater risk of arrest when using electronic payment methods. Such research can help to illuminate any processes that may connect cashlessness to aggregate crime rates.

Future research also could examine if cashlessness, street crime, and online property crime are interrelated in some way. Cashlessness, and more generally the digitization of money and commerce, presents a wide array of new criminal opportunities. Thus, any reduction in street crime as a result of increasing adoption of cashlessness may be offset by an increase in forms of electronically based theft. This is consistent with Pridemore's (2007, 2016; see also, Gruenewald & Pridemore, 2009) ideas of a criminological transition. It indicates societal development could lead not only to changes in rates of crime but to shifts in the nature of crime and the criminal event, including modes of victimization, the social distance of the victim–offender relationship, and weapon use. For instance, do local crime rates drive small business owners' adoption of electronic payment systems? Does an economy characterized by greater cashlessness discourage many offenders from crime altogether, or does it motivate them to become more technologically sophisticated? How strongly are these alternative pathways based on offenders' age, computer skills, or access to technology? These and many other questions will require answers in the coming years, not only as the world moves on a seemingly inexorable course towards electronic payment systems but more generally experiences technological advances that possess implications for crime and justice.

## Disclosure Statement

No potential conflict of interest was reported by the authors.

## References

- Adeoti, O. O., & Oshotimehin, K. O. (2011). Factors influencing consumers adoption of point of sale terminals in Nigeria. *Journal of Emerging Trends in Economics and Management Science*, 2, 388-392.
- Armey, L. E., Lipow, J., & Webb, N. J. (2014). The impact of electronic financial payments on crime. *Information Economics and Policy*, 29, 46-57. doi:10.1016/j.infoecopol.2014.10.002
- Becker, G. S. (1968). Crime and punishment: An economic approach. *Journal of Political Economy*, 76, 169-217.
- Bennett, R. R., & Lynch, J. P. (1990). Does a difference make a difference? Comparing cross-national crime indicators. *Criminology*, 28, 153-181. doi:10.1111/j.1745-9125.1990.tb01322.x
- Better Than Cash Alliance. (2016). *How to define digital payments*. Retrieved May 31, 2016, from <https://www.betterthancash.org/tools-research/toolkits/payments-measurement/focusing-your-measurement/introduction>
- Biderman, A. D., & Lynch, J. P. (1991). *Understanding crime incidence statistics: Why the UCR diverges from the NCS*. New York, NY: Springer Science & Business Media.

- Borraz, F., & Munyo, I. (2015). *Conditional cash transfers and crime: Higher income but also better loot* (Working Paper). Centro de Economía, Sociedad y Empresa del IEEM, Universidad de Montevideo.
- Bring on the cashless future. [Editorial]. (2016, January 31). *Bloomberg View*. Retrieved from <http://www.bloombergvew.com/articles/2016-01-31/bring-on-the-cashless-future>
- Chioda, L., de Mello, J. M. P., & Soares, R. R. (2012). *Spillovers from conditional cash transfer programs: Bolsa Família and crime in urban Brazil* (Discussion Paper, No. 6371). Forschungsinstitut zur Zukunft der Arbeit.
- Cohen, L. E., & Felson, M. (1979). Social change and crime rate trends: A routine activity approach. *American Sociological Review*, 44, 588-608.
- Crowe, M., Rysman, M., & Stavins, J. (2010). Mobile payments at the retail point of sale in the United States: Prospects for adoption. *Review of Network Economics*, 9, Article 2. doi:10.2202/1446-9022.1236
- Demirgüç-Kunt, A., Klapper, L., Singer, D. & Van Oudheusden, P. (2014). *The Global Findex Database 2014: Measuring financial inclusion around the world* (World Bank Policy Research Working Paper, 7255).
- Dobkin, C., & Puller, S. L. (2007). The effects of government transfers on monthly cycles in drug abuse, hospitalization and mortality. *Journal of Public Economics*, 91, 2137-2157. doi:10.1016/j.jpubeco.2007.04.007
- Ellsberg, D. (1961). Risk, ambiguity, and the savage axioms. *The Quarterly Journal of Economics*, 75, 643-669.
- Erling, G. (2013). Cash is dead, long live cash. *Journal of Payments Strategy & Systems*, 7, 43-49.
- Federal Bureau of Investigation. (2012, September). *Crime in the United States, 2011*. United States Department of Justice. Retrieved from <https://www.fbi.gov/about-us/cjis/ucr/crime-in-the-u.s/2011/crime-in-the-u.s.-2011/tables/table-1>
- Federal Deposit Insurance Corporation. (2012). *National survey of unbanked and underbanked households: Executive summary*. Retrieved from [http://www.fdic.gov/householdsurvey/2012\\_unbankedreport\\_execsumm.pdf](http://www.fdic.gov/householdsurvey/2012_unbankedreport_execsumm.pdf)
- Felson, M. (1987). Routine activities and crime prevention in the developing metropolis. *Criminology*, 25, 911-932. doi:10.1111/j.1745-9125.1987.tb00825.x
- Felson, M. (1994). *Crime and everyday life: Insights and implications for society*. Thousand Oaks, CA: Pine Forge Press.
- Fine, P. E. (1993). Herd immunity: History, theory, practice. *Epidemiologic Reviews*, 15, 265-302.
- Foley, C. F. (2011). Welfare payments and crime. *Review of Economics and Statistics*, 93, 97-112. doi:10.1162/REST\_a\_00068
- Forbes, S. (2016, March 1). Why big government is waging war against cash. *Forbes*. Retrieved from <http://www.forbes.com/sites/steveforbes/2016/03/01/the-great-cash-grab/>
- Gibbs, J. P. (1975). *Crime, punishment, and deterrence*. New York, NY: Elsevier.
- Gilbert, M. (2016, February 22). Both sides can declare victory in the war on cash. *Bloomberg View*. Retrieved from <http://www.bloombergvew.com/articles/2016-02-22/how-both-sides-can-declare-victory-in-the-war-on-cash>
- Gottfredson, M. R., & Hirschi, T. (1990). *A general theory of crime*. Stanford, CA: Stanford University Press.
- Gottfredson, M. R., & Hirschi, T. (2003). Self-control and opportunity. In C. L. Britt & M. R. Gottfredson (Eds.), *Control theories of crime and delinquency* (pp. 5-19). New Brunswick, NJ: Transaction Publishers.
- Gruenewald, J. A., & Pridemore, W. A. (2009). Stability and change in homicide victim, offender, and event characteristics in Chicago between 1900 and 2000. *Homicide Studies*, 13, 355-384. doi:10.1177/1088767909348587

- Guerette, R. T., & Bowers, K. J. (2009). Assessing the extent of crime displacement and diffusion of benefits: A review of situational crime prevention evaluations. *Criminology*, 47, 1331-1368. doi:10.1111/j.1745-9125.2009.00177.x
- Hay, C., & Forrest, W. (2006). The development of self-control: Examining self-control theory's stability thesis. *Criminology*, 44, 739-774. doi:10.1111/j.1745-9125.2006.00062.x
- Hay, C., & Forrest, W. (2008). Self-control theory and the concept of opportunity: The case for a more systematic union. *Criminology*, 46, 1039-1072. doi:10.1111/j.1745-9125.2008.00135.x
- Ingham, G. (2004). *The nature of money*. Cambridge: Wiley.
- Jacobs, B. A., & Cherbonneau, M. (2017). Nerve management and crime accomplishment. *Journal of Research in Crime and Delinquency*, 54, 617-638.
- Kahn, B. E., & Sarin, R. K. (1988). Modeling ambiguity in decisions under uncertainty. *Journal of Consumer Research*, 15, 265-272.
- Kleck, G. (2016). Objective risks and individual perceptions of those risks. *Criminology & Public Policy*, 15, 767-775.
- Kubrin, C. E., & Hipp, J. R. (2016). Do fringe banks create fringe neighborhoods? Examining the spatial relationship between fringe banking and neighborhood crime rates. *Justice Quarterly*, 33, 755-784. doi:10.1080/07418825.2014.959036
- Kubrin, C. E., Squires, G. D., Graves, S. M., & Ousey, G. C. (2011). Does fringe banking exacerbate neighborhood crime rates? *Criminology & Public Policy*, 10, 437-466. doi:10.1111/j.1745-9133.2011.00719.x
- Kunkel, P. E. (2008). How Jesse James, the telegraph, and the Federal Reserve Act of 1913 can help the Army win the War on Terrorism: The unrealized strategic effects of a cashless battlefield. *Military Review*, 6, 88-96.
- Loughran, T. A., Paternoster, R., Piquero, A. R., & Pogarsky, G. (2011). On ambiguity in perceptions of risk: Implications for criminal decision making and deterrence. *Criminology*, 49, 1029-1061. doi:10.1111/j.1745-9125.2011.00251.x
- Messner, S. F., Raffalovich, L. E., & Sutton, G. M. (2011). Poverty, infant mortality, and homicide rates in cross-national perspective: Assessments of criterion and construction validity. *Criminology*, 48, 509-537. doi:10.1111/j.1745-9125.2010.00194.x
- Nagin, D. S. (1998). Criminal deterrence research at the outset of the twenty-first century. *Crime and Justice*, 23, 1-42.
- Naylor, R. T. (2004). *Wages of crime: Black markets, illegal finance, and the under-world economy*. Ithaca, NY: Cornell University Press.
- Omotayo, F., & Dahunsi, O. (2015). Factors affecting adoption of point of sale terminals by business organizations in Nigeria. *International Journal of Academic Research in Business and Social Sciences*, 5, 115-136. doi:10.6007/IJARBS/v5-i10/1856
- Pare, P.-P., & Felson, R. (2014). Income inequality, poverty and crime across nations. *The British Journal of Sociology*, 65, 434-458. doi:10.1111/1468-4446.12083
- Paternoster, R. (1987). The deterrent effect of the perceived certainty and severity of punishment: A review of the evidence and issues. *Justice Quarterly*, 4, 173-217. doi:10.1080/07418828700089271
- Pew Research Center. (2016, December). *Online shopping and e-commerce*. Retrieved from <http://www.pewinternet.org/2016/12/19/online-shopping-and-e-commerce/>
- Pickett, J. T., & Bushway, S. D. (2015). Dispositional sources of sanction perceptions: Emotionality, cognitive style, intolerance of ambiguity, and self-efficacy. *Law and Human Behavior*, 39, 624-640. doi:10.1037/lhb0000150
- Plomp, M. G. A., Huiden, R. P., & Batenburg, R. (2011). Determinants of point of sale system adoption: A survey among small retailers in the Netherlands. In *Proceedings of the Americas conference on information systems*, Detroit, MI.
- Pogarsky, G., Roche, S. P., & Pickett, J. T. (2017). Heuristics and biases, rational choice, and sanction perceptions. *Criminology*, 55, 85-111. doi:10.1111/1745-9125.12129

- Pogarsky, G., Roche, S. P., & Pickett, J. T. (2018). Offender decision-making in criminology: Contributions from behavioral economics. *Annual Review of Criminology*, 1, 4.1-4.22. doi:10.1146/annurev-criminol-032317-092036
- Pridemore, W. A. (2007). Change and stability in the characteristics of homicide victims, offenders and incidents during rapid social change. *The British Journal of Criminology*, 47, 331-345. doi:10.1093/bjc/azl029
- Pridemore, W. A. (2008). A methodological addition to the cross-national empirical literature on social structure and homicide: A first test of the poverty—Homicide thesis. *Criminology*, 46, 133-154. doi:10.1111/j.1745-9125.2008.00106.x
- Pridemore, W. A. (2011). Poverty matters: A reassessment of the inequality-homicide relationship in cross-national studies. *British Journal of Criminology*, 51, 739-772. doi:10.1093/bjc/azr019
- Pridemore, W. A. (2016, November). *The criminological transition model: A new theory of how societal evolution influences the nature of crime*. Paper presented at the annual meeting of the American Society of Criminology, New Orleans, LA. Retrieved from at <https://sites.google.com/site/homicidedata/the-criminological-transition-model-a-new-theory-of-how-societal-evolution-influences-the-nature-of-crime>
- Rhine, S. L. W., & Greene, W. H. (2013). Factors that contribute to becoming unbanked. *Journal of Consumer Affairs*, 47, 27-45. doi:10.1111/j.1745-6606.2012.01244.x
- Rogers, M. L., & Pridemore, W. A. (2013). The effect of poverty and social protection on national homicide rates: Direct and moderating effects. *Social Science Research*, 42, 584-595. doi:10.1016/j.ssresearch.2012.12.005
- Rosenfeld, R., & Messner, S. F. (2013). *Crime and the economy*. Los Angeles, CA: Sage.
- Savolainen, J. (2000). Inequality, welfare state, and homicide: Further support for the institutional anomie theory. *Criminology*, 38, 1021-1042. doi:10.1111/j.1745-9125.2000.tb01413.x
- Schneider, F., & Enste, D. H. (2013). *The Shadow Economy: An International Survey*. Cambridge: Cambridge University Press.
- Shamah, D. (2013, September 24). Government dream of a cashless society already a reality. *The Times of Israel*. Retrieved from <http://www.timesofisrael.com/government-dream-of-a-cashless-society-already-a-reality/>
- Smelt, S. (1980). Money's place in society. *The British Journal of Sociology*, 31, 204-223. doi:10.2307/589688
- Smit, P. R., de Jong, R. R., & Bijleveld, C. C. J. H. (2012). Homicide data in Europe: Definitions, sources, and statistics. In M. C. A. Liem & W. A. Pridemore (Eds.), *Handbook of European homicide research* (pp. 5-23). New York, NY: Springer.
- Smit, P. R., Meijer, R. F., & Groen, P.-P. J. (2004). Detection rates, An international comparison. *European Journal on Criminal Policy and Research*, 10, 225-253. doi:10.1007/s10610-004-3398-8
- Sunstein, C. R. (2014, April 29). Fighting crime by going cashless. *Bloomberg View*. Retrieved from <http://www.bloombergvew.com/articles/2014-04-29/fighting-crime-by-going-cashless>
- Swift, A., & Ander, S. (2016, July 12). *Americans using cash less compared with five years ago*. Retrieved from <http://www.gallup.com/poll/193649/americans-using-cash-less-compared-five-years-ago.aspx>
- Tcherni, M., Davies, A., Lopes, G., & Lizotte, A. (2016). The dark figure of online property crime: Is cyberspace hiding a crime wave? *Justice Quarterly*, 33, 890-911. doi:10.1080/07418825.2014.994658
- Tekin, E., Topalli, V., McClellan, C., & Wright, R. (2014). Liquidating crime with illiquidity: How switching from cash to credit can stop street crime. *CESifo DICE Report*, 12, 45-50.
- Thaler, R. H., & Sunstein, C. R. (2008). *Nudge: Improving decisions about health, wealth, and happiness*. New Haven, CT: Yale University Press.

- Tomlinson, S. (2012, March 20). Sweden could be first country to go cashless as even churches are taking cards for offerings. *The Daily Mail*. Retrieved from <http://www.dailymail.co.uk/news/article-2117643/Sweden-Country-cashless-churches-accepting-cards-offerings.html>
- Topalli, V., Wright, R., & Fornango, R. (2002). Drug dealers, robbery and retaliation: vulnerability, deterrence and the contagion of violence. *British Journal of Criminology*, 42, 337-351. doi:10.1093/bjc/42.2.337
- Truman, J. L., & Langton, L. (2015). *Criminal victimization, 2014*. United States Department of Justice. Retrieved from <http://www.bjs.gov/content/pub/pdf/cv14.pdf>.
- Turner, B. S. (1986). Simmel, rationalisation and the sociology of money. *The Sociological Review*, 34, 93-114. doi:10.1111/j.1467-954X.1986.tb02696.x
- United Nations Office on Drugs and Crime. (2016). *Crime and criminal justice statistics*. Retrieved January 29, 2016, from <https://data.unodc.org/>
- Van Kesteren, J., Mayhew, P., & Nieuwebeerta, P. (2000). *Criminal victimization in seventeen industrialised countries: Key findings from the 2000 International Crime Victims Survey*. The Hague: Ministry of Justice, WODC [Research and Documentation Center].
- Varjavand, R. (2011). Growing underground economy: The evidence, the measures, and the consequences. *Journal of International Management Studies*, 11, 133-142.
- Waldo, G. P., & Chiricos, T. G. (1972). Perceived penal sanction and self-reported criminality: A neglected approach to deterrence research. *Social Problems*, 19, 522-540. doi:10.2307/799929
- Warwick, D. R. (1993). *Reducing crime by eliminating cash*. San Francisco, CA: National Council on Crime and Delinquency.
- Wo, J. C. (2016). Community context of crime: A longitudinal examination of the effects of local institutions on neighborhood crime. *Crime & Delinquency*, 62, 1286-1312. doi:10.1177/0011128714542501
- World Bank. (2012). *Global Financial Inclusion Database*. Retrieved January 29, 2016, from [http://databank.worldbank.org/data/reports.aspx?source=global-findex-\(global-financial-inclusion-database\)](http://databank.worldbank.org/data/reports.aspx?source=global-findex-(global-financial-inclusion-database))
- World Health Organization. (2015). *World Health Organization Mortality Database*. Retrieved January 29, 2016, from <http://apps.who.int/healthinfo/statistics/mortality/whodpms/>
- Wright, R., & Decker, S. (1997). *Armed robbers in action*. Boston, MA: Northeastern University Press.
- Wright, R., Tekin, E., Topalli, V., McClellan, C., Dickinson, T., & Rosenfeld, R. (2014). *Less cash, less crime: Evidence from the electronic benefit transfer program* (NBER Working Paper Series, 8402) (pp. 1-35).
- Xie, M., Heimer, K., & Lauritsen, J. L. (2012). Violence against women in U.S. Metropolitan areas: Changes in women's work status and work. *Criminology*, 50, 105-143. doi:10.1111/j.1745-9125.2011.00245.x
- Zelizer, V. A. (1989). The social meaning of money: "special monies". *American Journal of Sociology*, 95, 342-377.

## Appendix. Data Sources and Definitions for Variables

Variable	Definition	Source
Robbery	Theft of property from a person, overcoming resistance by force or threat of force	United Nations Office on Drugs and Crime (UNODC)
Homicide	International Classification of Diseases 10th revision, categories X85-Y09: "homicides and injury purposely inflicted by another person"	World Health Organization (WHO)
Burglary	Gaining unauthorized access to a part of a building/dwelling or other premises, including by use of force, with intent to steal goods	UNODC
Ln cashlessness	Percent of the poorest 40% of respondents who reported receiving a direct deposit of aid from the government in the past year	World Bank
Ln poverty	Number of infant deaths per 100 live births	WHO
Ln GDP	Gross Domestic Product per Capita in Constant 2005 US dollars.	
Ln sex ratio	Number of males per 100 females	WHO
Education index	Index of mean years of schooling and expected years of schooling	Human Development Index from the United Nations
% Urban	Percent of the entire population that lives in an urban area	World Bank
Square root of ATMs per 100	Number of automated teller machines per 100 residents	World Bank