WORKING PAPER SERIES

WORKING PAPER
N. 101
DECEMBER 2018

CRYPTOCURRENCY OR USURY? CRIME AND ALTERNATIVE MONEY LAUNDERING TECHNIQUES

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Abstract

The article presents a novel dynamic setting to compare old – usury – and new – cryptocurrency – money laundering techniques and uses it for calibration to shed light on their relative role as an effective device for the criminal organizations to clean their illegal revenues. The specialness of the usury contract depends on its role in laundering illegal revenues originating from criminal activities and it is independent from the interest rate level, while the cryptocurrency money laundering is associated with an initial coin offering (ICO) tool. The calibration compares the leverage effect on the overall capital owned by the criminal organizations triggered by the two money laundering techniques.

JEL CLASSIFICATION NUMBERS: K40, K42, K14, G18.

KEYWORDS: CRIME, MONEY LAUNDERING, CRYPTOCURRENCY, USURY, BANKING.

1. Introduction

Can usurers work in a world with a the zero lower bound on the one side and new credit technology on the other side?

After the Lehman Brothers failed in 2008, the central banks of almost all advanced economies designed and implemented highly aggressive monetary policies in order to address the Great Financial Crisis. The severity of the crisis forced central bankers to come up with conventional and unconventional tools to generate a macroeconomic turnaround.[1] Despite the low interest rate policy,[2] the weakness of the banking system in some countries, such as Italy, Spain, and the United Kingdom, left banks cautious about granting commercial loans, especially to small and medium-sized enterprises (SMEs).[3]

SMEs represent a significant segment of the nonfinancial corporate sector.[4] All but 0.2% of enterprises that operated in the EU-28's non-financial business sector in 2016 were SMEs. These SMEs accounted for 67% of total employment in that sector.[5] The global financial crisis made it difficult for SMEs to access credit. Credit quality worsened more in Europe than in the United States and Japan: albeit in the EU the average rate of non-performing loans (NPLs) was slowly decreasing (it amounted at the end of 2016 to 5.1%, which was a value lower than the corresponding figures of 5.7% and 6.5% for 2015 and 2014), it remained higher than the in other advanced economies[6]. Therefore, although in general the conditions for credit were easier to meet, new loans were less frequently granted to riskier borrowers. The eased monetary conditions did not appear to avoid credit rationing phenomena[7], particularly among the SMEs, that generally include those individuals most exposed to usury risk, such as families, salespeople, small entrepreneurs, and craftsmen.[8]

But the usurers have to address and fix one more challenge: the emerging role of the cryptocurrencies as a device for money laundering. The recent wave of innovation in private payment systems has been characterized by the issuance of cryptocurrencies. Cryptocurrencies are private supplies of means of payment that are produced and distributed using a decentralized, peer-to-peer transfer system, which is known as the blockchain technology (or distributed ledger technology, DLT) (Halaburda 2016, Bech and Garratt 2017, Chiu and Koeppl 2017, Huberman et al. 2017, Abadi and Brunnermeir 2018, Casey et al. 2018). Notably, the blockchain technology can shape industrial and commercial networks in ways that different from the payment systems (Cong and He 2018), including initial coin offering (ICO) sales (Howell et al. 2018).

The characteristics of such as cryptocurrencies and the opportunity to grant money anonymously and without any central authority interference make it suitable for money laundering purposes (Danton, 2014; Stokes, 2012). In the case of the bitcoin – so far the more common cryptocurrency – is has been claimed - Foley et al (2018) - that one-quarter of bitcoin users are likely to be involved in illegal activity and they estimated that around $76 billion of illegal activity per year involves bitcoin (46% of bitcoin transactions), which is close to the scale of the US and European markets for illegal drugs.

[1] On unconventional monetary policies, see Ball et al. (2016), Borio and Hofmann (2017), Borio and Zabai (2016), Den Haan (2016), Gertler and Hofmann (2016), and Orphanides (2017).
[2] The Federal Reserve (the Fed) decreased its policy rate from 5.25% to 2%, while the European Central Bank (ECB) and the Bank of Japan (BoJ) kept their policy rates unchanged. In 2009, interest rates were cut until they were at or near the zero lower bound. See Labonte (2018).
[3] See OECD (2017) for Italy, and Havrylchyk and Kierzenkowski (2015, p. 11) for the United Kingdom.
[4] Bergthaler, Kang, Liu, and Monaghan (2015).
[5] Muller et al. (2017).
[6] Magnus et al. (2017).
[7] OECD (2016, p. 15); ECB (2017, pp. 8-9).
[8] Venturi (2011).

Regarding the usury markets, in recent years the economic analysis has been focused on the design of the usury laws, and on the effects of capping interest rates on both lenders' and borrowers' behavior.[9] Those contributions assumed that usury contracts have the same *qualitative* characteristics of bank contracts, but with tighter quantitative requirements. Few researchers have theoretically speculated on the possibility that a lender could be a criminal who uses the credit market for money-laundering purposes and being substantially indifferent respect to the interest rate level[10]. Such researches elaborate on the anecdotes that judicial and media reports: the usury markets seem to be a channel used by organized crime to camouflage in the legal economy. The quantitative features of such markets are likely to be underestimated, given that usually the anecdotal descriptions offer information on the interest rate flow and/or on the rate of return, missing other crucial loan features, as the original loan and/or the value of the collateral [11]. Notwithstanding in general the statistics on the illegal markets have to handle with great prudence, some estimates for Italy indicate that usury profits amounted to almost EUR 45 billion in 2015,[12] while the annual turnover in the usury market was approximately EUR 15-18 billion between 2011 and 2012.[13]

More recent empirical studies have tried to estimate again the features of the usury markets. Scaglione (2014) offered an assessment of the usury market in Italy as of 2012[14], highlighting, in a period of low interest rates, the relationships between credit rationing and usury risk. Marinaro (2017) focused on the relationships between organized crime, usury and asset expropriation – both homes and corporate assets - in Rome, confirming the role of lending as a device for the criminals to exploit goals different from the simple optimization of the interest rate stream.

But now, given both the low interest rate environment and the new credit technologies, it is still convenient for the criminal organizations to use usury as a money laundering technique? In this paper we will show under which conditions the answer is positive.

The paper is organized as follows. In Section 2 and 3 we develop our dynamic model that analyze the relationships between the criminal revenues and the alternative money laundering techniques – usury and cryptocurrency. In Section 4 we implement the calibration in order to compare the effects of the two techniques in producing a leverage effect on overall capital that the criminal organizations can handle. Section 5 concludes.

2. Crime, Money Laundering and Usury

Are usurers just illegal bankers? The economic literature generally answers this question in a positive way, suggesting that no specific feature other than the interest rate differentiates the usury contracts from the legal banking contracts.[15] The traditional approach[16] views the usurer as offering a loan contract with the same qualitative characteristics as a standard bank contract except that the usury contract includes more tough conditions from a quantitative point of view.

Yet, another perspective is possible: the specialness of a usury contract can be found in the different technologies that can be adopted in designing and implementing the loan, which produce an expected

[9] More recent literature includes Bodenhorn (2005), Barone and Olivieri (2015), Peterson (2008), Littwin (2008), Temin and Voth (2008), Ashta et al. (2011), Rigbi (2013), and Burke (2014).
[10] Cifarelli et al. (2002), Masciandaro (1997), (2001) and (2002).
[11] See, for example, DIA (2017), Ministero dell'Interno (2016, pp. 4-5), Eurispes (2016), Rusev et al. (2016).
[12] Eurispes (2016).
[13] Scaglione (2014).
[14] Previous estimates of the usury market were offered by Guiso (1995) and Goisis et al. (1999). However, these studies were only published in Italy, thereby restricting the international aspect.
[15] See, among others, Basu (1984).
[16] See Blitz and Long (1965), Boyes (1982), Brucker (1977), Crafton (1980), Glaeser and Scheinkman (1998), Greer (1977), Ostas (1976), Peterson (1977), Robins (1974), Villegas (1982).

value of the borrower assets – both flows and stocks, i.e. income streams and collaterals - which is different from the legal lender evaluation. In such as perspective the profile of the interest rates is just one element of the loan contract, rather than the crucial feature; on top of that, in such as perspective emerged the effectiveness of the usury contract as a device for money-laundering operations.[17]

The irrelevance of the interest rate specification for the specialness of the usury contract has been theoretically analyzed in Masciandaro (2001), Cifarelli et al. (2002) and Barone (2004), while Dalla Pellegrina (2008) performed an econometric analysis of the usury phenomenon in the Italian provinces from 1999 to 2002, confirming that the interest rates cannot be considered the main driver. Barone et al. (2012) further explored the role of the interest rate to finalize other goals of the illegal lender: they dealt with a stochastic dynamic optimization problem with the aim of identifying the best interest rate that a usurer could apply to bring about the borrower's bankruptcy while securing the maximum value for the collateral. Here we adopt such as approach.

We assume that, in a given region, a criminal organization that committed a crime earns an illegal monetary return, D_0, from that activity. The use of this revenue has some costs, arising from the probability of being discovered and convicted for the crime. Therefore, in order to minimize such as costs, the organization seeks to launder its dirty money. From several money-laundering techniques, we assume that the criminal organization chooses usury credit.

Given an amount of dirty money, the criminal must decide the share to be laundered. We define that percentage as "y". The cleaned money, W, can be used in the legal market to minimize the risk of being discovered and convicted. The remainder, $(1-y)D_0$, will be reinvested in the illegal sector.

However, money-laundering activities is costly; the existent literature offers information on the technological costs of money laundering.[18] When money laundering occurs via usury credit, two sources of costs can be assumed: 1) the possibility that the borrower does not pay back the loan (*default costs*); and 2) the likelihood that the criminal is accused by the borrower (*incrimination costs*).

Starting from the default costs, the specialness of the usurer with respect to a formal lender - i.e. thereafter a bank - is due to the value of the loan collateral – that we will call "G" - which plays a decisive role for money-laundering purposes.

In general, we can assume that the default costs are likely to be higher for the bank than for the usurer, given the different nature of the two moneylenders. On top of that, the collateral *per se* can have a different values for the bank and the usurer[19]. If a liquidation occurs – i.e. the ownership of the collateral changes, where the usurer becomes the effective beneficial owner - we assume that the collateral has an intangible value for the criminal organization, given that it can be used for money-laundering purposes. The existing research[20] shows that the criminal organizations use any asset in their ownership – including expropriated collaterals – for money laundering, investment and

[17] The relationships among crime, money laundering, and usury have been explored by Masciandaro (1999, 2000) and Barone (2004), Unger (2017).

[18] Such costs roughly amount to 5-15% of the dirty money that needs to be laundered (Reuter and Truman 2004). However, for the sake of transparency and so far no robust empirical evidence of such as cost has been produced in the special case of a usury contract.

[19] Bester (1994) shows under which conditions the optimal contract for a bank could be a loan without guarantee. With such as contract, the borrower must pay a higher interest rate on the loan, but the collateral is not lost in case of default. Nevertheless, in order to remain in the more standard and general framework, we follow to use a banking contract with collateral, where as usual collateral's value at the beginning of the contract is higher than the initial loan. At the same time, Cifarelli et al (2002) and Masciandaro (1997), (2001) and (2002) show under which conditions the borrower prefers the usury contract instead of the banking loan. Here for the sake of our purposes we assume that the borrower already chose the usurer.

[20] Among others Ruggero (1996), Masciandaro (2000) and Turone (2007).

reinvestment with an entrepreneurial approach; needless to say, the money laundering use of the collateral will depend on the nature of such as asset (factories, real estate, and the like).

Regarding the incrimination costs, it is worth noting that their actual shape and size can be different time to time; illegal lenders utilize debt-collection procedures based on fear, intimidation, and the threat of violence, which make customers deeply reluctant to report their activities to the authorities.[21]

Starting from the usury contract design, at time t_1, assuming that the borrower pays off the loan according to a standard amortization framework with a variable usurious interest rate $r_{u(k)}$, the cleaned money will be equal to:

$$W_1 = \frac{yD_0}{n}\left[1 + nr_{u(0)}\right] \tag{1}$$

where 1/*n* is the periodicity of the loan and the initial usurious rate amounts to $r_{u(0)}$. The laundered money will be equal to the principal that has been paid off plus the usurious interests.

Two alternative cases - *pay-off case* and *default case* - can be explored. With probability "a_k", the borrower pays off the loan plus the interest $r_{u(k)}$. The symmetric probability that this does not happen is "$(1 - a_k)$". In the latter case, the borrower can either lose the collateral (with probability ρ) or report the usurer to the authorities (with probability 1- ρ).[22] It is worth noting that in the real world the victim rarely accuses the usurer[23], i.e. the ownership change - our ρ - is relatively high. The usury interest rate is time dependent, and as it has been already shown[24], such interest rate could be lower than the legal interest rate (r_l, here it is considered constant) at the beginning of the contract and then rise after several months; consequently the default case probability "$1 - a_k$" is positively associated with the level of the usury interest rate.

If the borrower pays off the loan, some share of the cleaned money will be spent on consumption goods $(1 - \eta)$,[25] while the remainder will be invested in the legal sector at the legal risk-free interest rate (r_l).[26] This operation produces an amount equal to:

$$S_1 = \eta W_1(1 + r_l) \tag{2}$$

In the second period, the legal capital (F_1) that results from the legal investment will be:

$$F_1 = a_1 S_1 + (1 - a_1)[\rho G + (1 - \rho)\emptyset] \tag{3}$$

where $\emptyset$ proxies the event that the usurer will be reported to the authorities; and:

$$a_1 = \frac{1}{1 + r_{u(0)}^2} \tag{4}$$

In general:

$$a_k = \frac{1}{1 + r_{u(k-1)}^2} \tag{5}$$

with:

[21] See Ellison et al. (2006), cited in Savona and Riccardi (2017, p. 23).
[22] Cnel (2008).
[23] See EURISPES (2016), p. 41.
[24] Cifarelli et al. (2002), Masciandaro (1997), (2001) and (2002).
[25] According to Unger (2007a, p. 152), the percentage of laundered money spent on consumption goods is equal to 11%.
[26] A person who wishes to launder dirty money has the possibility to invest in market capital. In order to minimize the risk of losing money, he or she generally prefers risk-free risk investments, such as bonds or other low-risk investments (see Unger 2007a).

$$r_{u(k)} = r_{u(0)} e^{ln(1.08)k} \tag{6}$$

In parallel the share of illegal capital reinvested in the first period in the illegal sector at a constant rate r_i produces new illegal capital:

$$D_1 = (1 - y)D_0(1 + r_i) \tag{7}$$

Again, a share "*y*" of this new illegal amount will be laundered using the usury loan:

$$W_2 = \frac{yD_1}{n}\left[1 + nr_{u(0)}\right] \tag{8}$$

Thereafter, legal assets will arise from three sources: 1) the share of illegal starting capital that was laundered in the first period and later invested in the legal sector; 2) the second payment on the first loan; and 3) the share of illegal capital immediately reinvested in the illegal sector and laundered in the second period to be consumed and invested in the legal market.

All in all, we will have:

$$F_2 = a_2 S_2 + (1 - a_2)[\rho G + (1 - \rho)\emptyset] \tag{9}$$

with:

$$S_2 = S_1 + \eta(1 + r_l)\left\{W_2 + \frac{yD_0}{n}[1 + r_{u1}(n - 1)]\right\} \tag{10}$$

Therefore:

$$F_k = a_k S_k + (1 - a_k)[\rho G + (1 - \rho)\emptyset] \tag{11}$$

with:

$$S_k = \eta(1 + r_l)\frac{yD_0}{n}\left[\begin{array}{c} \frac{1-q^k}{1-q}\left(-\frac{q}{1-q} + \frac{\eta r_{u(0)}}{1-b} - \frac{r_{u(0)}b}{(1-b)^2}\right) + \\ r_{u(0)}b\frac{b^k - q^k}{b-q}\left(\frac{b}{(1-b)^2} - \frac{n}{1-b} - \frac{q}{(1-b)(b-q)}\right) + \\ k\left(\frac{r_{u(0)}b^{k+1}}{(1-b)(b-q)} + \frac{1}{1-q}\right) \end{array}\right] \tag{12}$$

where:

$b = 1.08$[27] and $q = (1 - y)(1 + r_i)$.

Suppose that every period holds a time interval, *h*. Therefore, the difference (ΔS) between two successive steps is given by:

$$\Delta S = \eta(1 + r_l)\frac{yD_0}{n}\left\{\begin{array}{c} q^k(1 - q^h)(c_1 + c_2) + c_2 b^k(b^h - 1) + \\ kb^k(b^h - 1)c_3 + hc_3 b^{k+h} + hc_4 \end{array}\right\} \tag{13}$$

where:

[27] This value has been chosen in order to mimic the anecdotal on usury phenomenon.

$$c_1 = \frac{1}{1-q}\left[-\frac{q}{1-q} + \frac{nr_{u(0)}}{1-b} - \frac{r_{u(0)}b}{(1-b)^2}\right]$$
$$c_2 = \frac{r_{u(0)}b}{b-q}\left[\frac{b}{(1-b)^2} - \frac{n}{1-b} - \frac{q}{(1-b)(b-q)}\right]$$
$$c_3 = \frac{r_{u(0)}b}{(1-b)(b-q)} \tag{14}$$
$$c_4 = \frac{1}{1-q}.$$

After dividing by *h* and calculating the limit for $h \to 0$, we have:

$$S(t) = \eta(1 + r_l)\frac{yD_0}{n}[(c_3 b^t + c_4)t + c_2 b^t - (c_1 + c_2)q^t + c_1 - c_2 + c_3] \tag{15}$$

with $S(0) = 0$.

At the end, the cumulative legal capital produced by organized crime will be equal to:

$$F(t) = a(t)S(t) - [a(t) - a(0)][\rho G + (1 - \rho)\emptyset] \tag{16}$$

where: "*a*" - the probability that the borrower will be able to pay off the loan - is a function of the usurious rate of interest, as it has been already mentioned. In other words, the payoff case likelihood decreases as $r_{u(t)}$ increases. "$S(t)$" is the cumulative mortgage gain, which increases over time due to the dynamic of the usurious interest rate. As time passes, the probability of paying back the loan decreases, and the borrower could repay the usurer or give up the collateral. At the same and other things being equal, the incrimination costs, which reduced the capital accumulation, will be associated in the real word with the overall features of the regions under scrutiny.

Summing up, given the demand for usury, the criminal organization involved in the usury activities might take advantage of such as business for reasons other than the interest rate flows. Given the abovementioned two cases, in the payoff scenario the criminals clean directly their illegal revenues, while in the default scenario they can use the collateral to build up further channels for money laundering.

3. Crime, Money Laundering and Cryptocurrencies

In this section, we try to answer another but parallel question: "how a new credit technology, the initial coin offering (ICO), can be an effective device for money laundering?".

An ICO is a type of funding using cryptocurrencies. ICOs became popular in 2017, when the first five (Tezos, Filecoin, Kin, Blockstak, BAT) raised roughly $674milions (Catalani and Gans, 2018 and https://icowatchlist.com/statistics/year). Other things being equal, the success of the cryptocurrencies has been connected with the demand for trustlessness (Pagnotta and Buraschi, 2018, Kahn 2018), or demand for anonymity (Masciandaro 2018). Trustless networks produce exchanges in a manner that does not require the players to either know or trust each other.

Among the individuals that like the anonymity property are people who appreciate this property for illegal reasons, as an anonymous currency can be an effective device for money laundering.

The risk that cryptocurrencies, and ICO in particular, can be used for illegal activities (Foley et al. 2018) grew the concerns of the authorities of several countries (Klöhn, Parhofer, Resas, 2018).

In US the securities exchange commission (SEC) has started several proceedings against the initiators of ICOs. The SEC considered tokens used in ICOs similar to securities and therefore they should be subject to the registration and prospectus requirements.

Moreover, Jay Clayton, the chair of the SEC, recently provided his official remarks on ICOs, and he expressed concerns about money laundering and illegal activity as well (Clayton, 2018).

In EU[28], regulatory authorities warmed that the ICOs' regulation is coming and they considered them similar to securities. Steven Maijoor, the chair of European Securities and Markets Authority (ESMA) clarified to the European Parliament that some ICOs are similar to financial instruments and therefore would be submitted to a specific regulatory framework. In particular, ESMA suggested issuers to evaluate if own activities may be part of prospectus directive, in MIFID II, in alternative Investment Fund Managers Directive (AIFMD) or in IV anti-money laundering directive.

In Germany, the Federal Financial Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht), try to answer the question whether tokens and virtual currencies offered to investors in ICOs are considered to be financial instruments. In order to give an answer to the question, it published an advisory letter in which it states its position on the regulatory classification of tokens in the field of securities supervision. In order to fully satisfy any legal requirements, these market participants must give careful consideration to whether the tokens constitute a regulated instrument, for instance a financial instrument or a security. In 2017 BaFin undertook thirteen procedures on suspicion of unlawful business operations (Section 37 KWG).

In United Kingdom the Financial Conduct Authority (FCA) does not offer a universal criterion to determine whether an Initial Coin Offering (ICO) falls under its regulatory reach. According to the FCA, this can be decided only on a case by case basis. As a result, a multitude of ICOs are not subject to the FCA's clearance. However, due to a variance in structure, ICOs often involve regulated investments. At the same time, the firms which are a part of the ICO process may also be subject to regulation.

In France, in view of the recent development of fundraising based on the use of crypto assets and blockchain technology, and the risks associated with these transactions, the Autorité des marchés financiers (AMF) conducted a public consultation on possible supervisory options. The AMF received 82 responses from digital economy players, individuals, finance professionals, market infrastructures, academics and law firms. Among the 82 responses made to the Autorité des marchés financiers' consultation, a large majority of respondents expressed support for setting up an appropriate legal framework for this new type of fundraising. The AMF Board has decided to continue work on definition of a specific legal framework for ICOs.

Given concerns from supervisory authorities about the risk that cryptocurrencies can be used for illegal activities and money laundering, in the following we analyzed a lending plan where the lender is an organized crime who grant money to small and medium enterprises using the initial coin offering (ICO) instrument[29]. In order to participate to an ICO, the lender have to register for the offering and confirm personal identities to avoid violations of Know Your Customer (KYC) and Anti-Money Laundering (AML) regulations (Benedetti and Kostovetsky, 2018).

3.1. Crime, Money Laundering and Cryptocurrencies: a theoretical model

The criminal organization will decide to launder dirty money via ICO instrument on the base of a cost benefit analysis. The benefit consists of the expected return of the investment $yD_0(1 + r_{ICO})P\,r(x = S)$, where $P\,r(x = S)$ is the probability that a firm will survive after the end of the ICO and r_{ICO} is the monthly return of ICO investment.

[28] Esma 50-157-828

[29] ICO is a kind of crowdfunding used by startups to raise funds bypassing the bureaucratic procedure required by venture capitalists or banks.

The costs are twofold: 1) the probability that the borrower (i.e. the firm) does not survive $Pr(x = F)$ (*default costs*); 2) the probability $(1 - \square)$ to be discovered and convicted for the illicit gotten money which required to be laundered, i.e. the anti-money laundering regulation cost (*incrimination cost*)[30].

Given an illegal capital D_0, at time $t_1$the criminal will launder a share "y" of this amount via ICO, achieving the expected cleaned money W_1 equals to:

$$W_1 = yD_0(1 + r_{ICO})Pr(x = S) \tag{32}$$

Some share of the cleaned money will be spent on consumption goods $(1 - \eta)$, while the remainder η will be invested in: 1) the legal sector for a share $z\eta$ at the legal risk-free interest rate r_l; 2) in a ICO for a share $\eta(1 - z)$. This operation produces an amount equal to:

$$S_1 = \eta z W_1(1 + r_l) + \eta(1 - z)W_1(1 + r_{ICO})Pr(x = S) \tag{33}$$

Now two alternative cases can be explored. With probability $\square$, the lender achieve the expected return of the ICO investment. With probability $(1 - \square)$ the lender can be discovered and convicted for the money laundering activity. In this case, the lender should pay the sanction "$\emptyset$" (including the risk of jail). The legal capital (F_1) that results from the legal investment will be:

$$F_1 = \square S_1 + (1 - \square)\emptyset \tag{34}$$

where $\emptyset$ is the sanction payed by the lender in the event that s/he will be discovered and convicted for the crime.

In the same time the remainder of dirty money will be reinvested in the illegal sector, achieving a illegal return $(1 + r_i)$. Therefore, the criminal organization produced a new dirty money

$$D_1 = D_0(1 - y)(1 + r_i) \tag{35}$$

A share of this illegal capital reinvested in the illegal sector at a constant rate r_i will be laundered for a share yD_1 via ICO instrument, overall producing :

$$\begin{aligned} S_2 = {} & \eta z y D_0(1 + r_{ICO})Pr(x = S)(1 + r_l) + \eta(1 - z)yD_0(1 + r_{ICO})^2 Pr(x = S)^2 + \\ & \eta z y D_0(1 - y)(1 + r_i)(1 + r_{ICO})Pr(x = S)(1 + r_l) + \\ & \eta(1 - z)yD_0(1 - y)(1 + r_i)(1 + r_{ICO})^2 Pr(x = S)^2 \end{aligned} \tag{36}$$

Thereafter, legal assets will arise from three sources: 1) the share of illegal starting capital that was laundered in the first period and later invested in the legal sector; 2) the share of illegal starting capital that was laundered in the first period and later invested in ICO instrument; and 3) the share of illegal capital immediately reinvested in the illegal sector and laundered in the second period to be consumed and invested in the legal market.

All in all, we will have:

$$F_2 = \square S_2 + (1 - \square)\emptyset \tag{37}$$

Therefore:

$$F_n = \square S_n + (1 - \square)\emptyset \tag{38}$$

[30] For sake of simplicity and in order to make possible a comparison between the different financial channels proposed, we assume that the probability to be discovered and convicted for the crime corresponds to the probability "1-ρ" assumed in the usury scenario. However, in this section we replace it with 1-Φ. In this event the lender should pay the sanction "$\emptyset$" (including the risk of jail).

with:

$$S_n = yD_0(1 + r_{ICO})Pr(x = S)K[A^0 + A^1 + A^2 + A^3 + \cdots + A^{n-1}] \quad (39)$$

Where $A = (1 - y)(1 + r_i)$ and $K = \eta z(1 + r_l) + \eta(1 - z)(1 + r_{ICO})Pr(x = S)$.

Suppose that every period holds a time interval, h. Therefore, the difference (ΔS) between two successive steps is given by:

$$\Delta S = yD_0(1 + r_{ICO})Pr(x = S)\frac{K^{n-1}}{1-\left(\frac{A}{K}\right)}\left[(K^h - 1) - \frac{A^n}{K^n}(A^h - 1)\right] \quad (40)$$

After dividing by h and calculating the limit for $h \to 0$, we have:

$$S(t) = y\frac{D_0(1+r_{ICO})Pr(x=S)}{K}\frac{1}{1-\left(\frac{A}{K}\right)}(K^t - A^t) \quad (41)$$

with $S(0) = 0$.

At the end, the cumulative legal capital produced by organized crime will be equal to:

$$F(t) = \square S(t) + (1 - \square)\emptyset \quad (42)$$

4. Criminal Capital and Alternative Money Laundering Techniques: Calibrations and Comparisons

Our model highlights how alternative money laundering techniques can trigger a leverage effect on the overall capital owned by the criminal organizations. Such effects become even more clear using calibration, where, given some reasonable parameters[31], the evolution of the capital stock is associated with different values of the relevant parameters.

Starting from the usury technique, let us start from ρ, i.e. the probability that the usurer gets the collateral. For the sake of simplicity, we define it the camouflage probability, i.e. the usurer successfully implemented her money laundering operation without being incriminated.

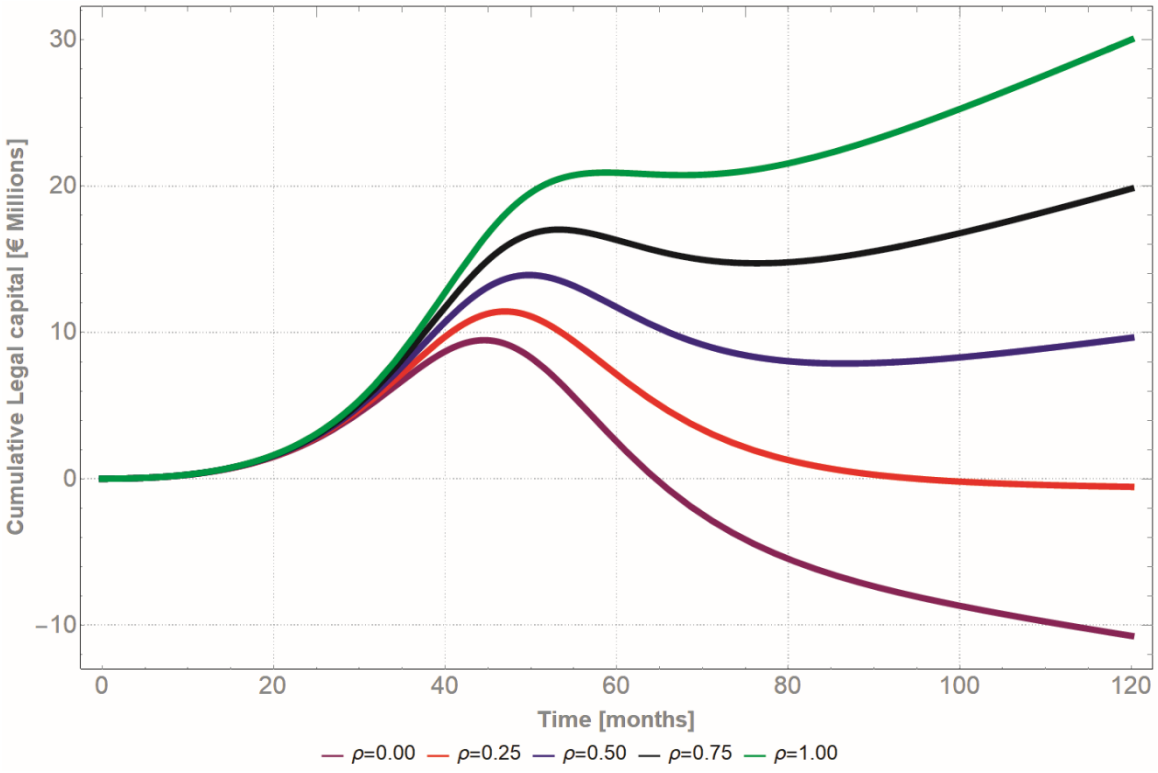
When the camouflage probability is below 0.3, the capital stock will be negative for medium to long periods of time. In a sense the simulation captures the crucial role played by the collateral in the overall money-laundering strategy. As time passes, the criminals increases the usurious interest rate in order to implement its win-win game, given that all the two possible equilibria - payoff event and default event – are both effective respect to the money laundering goal, with one exception: the borrower reports the usurer to the authorities, and the potential incrimination losses become actual costs. In contrast, when ρ rises above 0.3, the cumulative legal capital follows an increasing trend for long periods of time.

In Figure 1 we plotted various scenarios for different values of ρ. It is worth noting that, as we highlighted in the previous section, in the real world the probability of camouflage is high, that is the victim rarely accuses the usurer. Therefore, the more feasible scenario is depicted by the upper curve in the figure (the green curve) which is a monotonically increasing function. According to this curve,

[31] For a discussion of the parameters used in the calibration see Appendix 1.

for example, assuming that the usurer grants a loan that amount to €100,000 for borrower, other things being equal, ten years later s/he received a legal cumulative capital equals to about €30,000,000.

Fig. 1 Criminal Capital and Usury



The comparative advantages that the use of the usury business for money laundering purposes can produce for the criminal organizations is further evident if we compare the usury leverage effect with the banking leverage effect.

The comparison can be made applying our model when the lender is a banker. We assumed that at time t_0 she loans a percentage "y" of an amount of legal money equals to "L_0". This loan consists of a monthly fixed rate "r_B" mortgage[32]. The remaining $(1-y)L_0$ will be reinvested in the legal sector at the rate r_l[33], then it will be lent. Therefore, at time t_1, assuming that the borrower pays off the loan according to a French amortization schedule with a fixed interest rate, the first mortgage payment will be:

$$R_1 = yL_0(1+r_B)^n \frac{r_B}{(1+r_B)^n-1} \tag{17}$$

where *n* is the hypothesized duration of the loan. Then we define $\xi = (1+r_B)^n \frac{r_B}{(1+r_B)^n-1}$.

The new amount for the bank will be equal to the principal loan that has been payed off and the monthly interest. The guarantee offered by the borrower is "G". The bank evaluated it σG with $0 < \sigma < 1$. Indeed, as it has been already mentioned in the previous section, the usurers can use illegal tools and procedures to take gains from the collateral expropriation, while for the banker the value of the collateral ownership is likely to be discounted, given the existence of well-known transaction costs (legal procedures, inefficiencies in the property right re-allocation, and the like). With probability "a", the borrower pays off the loan plus the interest; while, with the symmetric probability

[32] The most common loan used by banks is French mortgage monthly.
[33] For the sake of simplicity, we considered an interest rate equals to the legal one chosen by the usurer (see footnote 26)

"$(1-a)$" s/he loses the collateral. For the sake of our purposes we can assume that the default probability "$(1-a)$" is relatively low (it roughly ranges between 0-10%)[34].

The money payed back to the bank will be used for risky operations for a share $(1-\eta)$,while the remainder will be invested in the legal sector at the legal free risk interest rate r_l, producing an amount

$$S_1 = \eta y \xi L_0 (1 + r_l) \tag{18}$$

In the second period the legal capital (S_2) will be equal to:

$$S_2 = S_1 + \eta(1 + r_l)[y\xi L_0 + (1-y)(1 + r_l) y\xi L_0] \tag{19}$$

where $y\xi L_0$ is the second mortgage payment of the first loan and $(1-y)(1+r_l)y\xi L_0$ is the first mortgage payment of the second loan granted.

In the third period the legal capital (S_3) will be equal to:

$$S_3 = S_2 + \eta(1 + r_l)[y\xi L_0 + (1-y)(1 + r_l) y\xi L_0 + (1-y)^2(1 + r_l)^2 y\xi L_0] \tag{20}$$

or

$$S_3 = \eta y \xi L_0 (1 + r_l)[3 + 2(1-y)(1 + r_l) + (1-y)^2(1 + r_l)^2] \tag{21}$$

Given $\omega = \eta y \xi L_0 (1 + r_l)$ and $p = (1-y)(1+r_l)$, it will be:

$$S_1 = \omega \tag{22}$$

$$S_2 = \omega(2 + p) \tag{23}$$

$$S_3 = \omega(3 + 2p + p^2) \tag{24}$$

$$S_k = \omega \sum_{\alpha=1}^{k} \alpha p^{k-\alpha} = \omega \left[\frac{k}{1-p} - p \frac{1-p^k}{(1-p)^2} \right] \tag{25}$$

Taking in to account also the probability of default of the borrower, then the overall capital gained by the banks is:

$$F_k = aS_k + (1-a)\sigma k G \tag{26}$$

$$F_{k+h} = aS_{k+h} + (1-a)\sigma(k+h)G \tag{27}$$

Let change k in t, then it will be:

$$\begin{gathered} \Delta F(t) = a(S_{t+h} - S_t) + (1-a)\sigma h G = \\ a\omega \left[\frac{h}{1-p} + \frac{p^{t+1}}{(1-p)^2}(p^h - 1) \right] + (1-a)\sigma h G \end{gathered} \tag{28}$$

Multiplying all by $\frac{1}{h}$ and taking the limit for $h \to 0$

we have:

$$\frac{dF(t)}{dt} = \frac{\Delta F(t)}{h} \underset{h \to 0}{\longrightarrow} = a\omega \left[\frac{1}{1-p} + \frac{p^{t+1}}{(1-p)^2} \ln p \right] + (1-a)\sigma G \tag{29}$$

and

$$\int_0^t \frac{dF(\tau)}{d\tau} d\tau = a\omega \int_0^t \left[\frac{1}{1-p} + \frac{p^{\tau+1}}{(1-p)^2} \ln q \right] d\tau + (1-a)\,\sigma G \int_0^t d\tau \tag{30}$$

[34] See Netzer, Lemaire, Herzenstein (2017), Altman et al. (2005).

Therefore, the cumulative capital produced by the bank will be equal to:

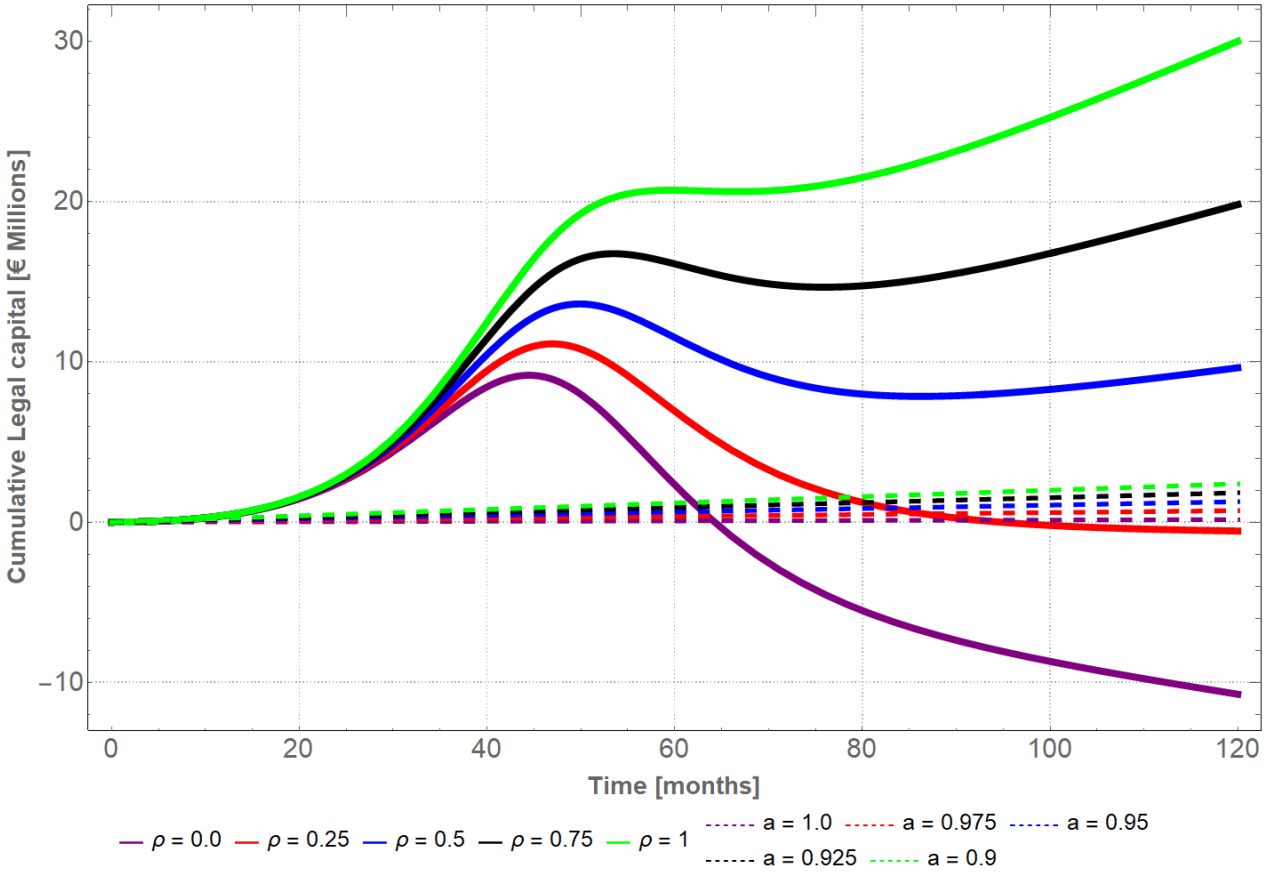
$$F(t) = a\omega\left[\frac{t}{1-p} + \frac{p(p^t-1)}{(1-p)^2}\right] + (1-a)\sigma tG \tag{31}$$

where "*a*", is the probability that the borrower will be able to pay off the loan plus the interest and it is constant. It is worth noting that for the banker the lending is not a win-win game, as in the case of the usurer; therefore, an increasing rate of interest would increase the default event and the consequent losses due to the collateral devaluation.

In the following we plotted a comparison between legal and illegal lender behavior. In order to make it possible, we used the same values for some parameters (η, T, y, G, r_l, $L_0 = D_0$) in both cases.

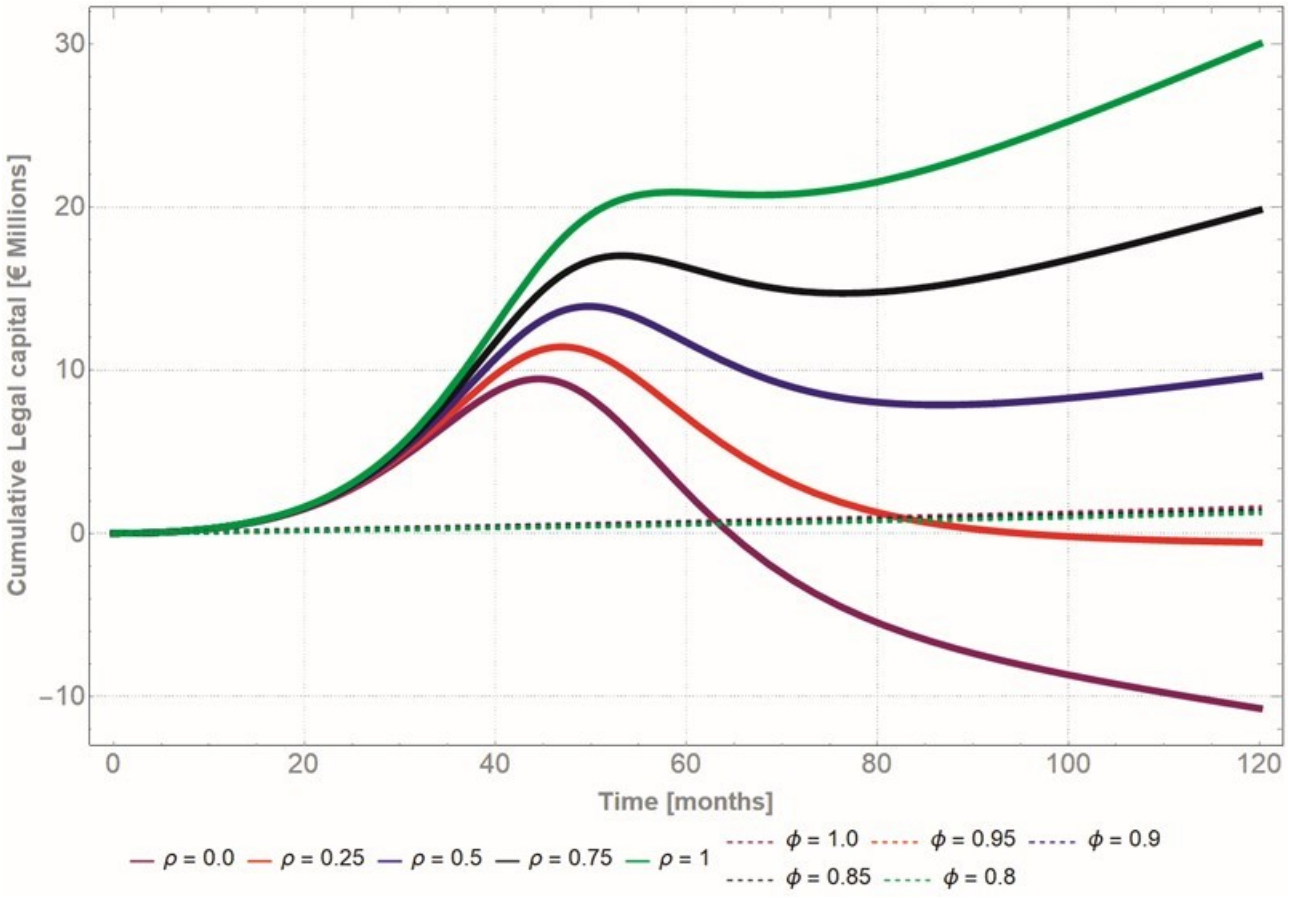
As showed in Figure 2, the cumulative capital produced by a bank loan is roughly comparable with the usurious loan only if ρ - the camouflage probability - is near zero, i.e. when the usurer faces very high incrimination risk. In other words, the more the criminal organizations can become usurers and be able to use the moneylending business to implement their money laundering activities, the more they will accumulate more capital – i.e. more wealth, influence and power – respect to the banking sector, which is likely to imply more wealth, influence and power in the overall economic and social structure of the region under observation. However - as we already pointed out – the case $\rho = 0$ is very unlikely to occur.

Fig.2 Capital Accumulation: Usury vs Bank Loan



Finally we can compare the cryptocurrency technique with the usury technique. As showed in Figure 3, the comparative advantages that the use of the usury business for money laundering purposes can produce for the criminal organizations is still evident if we compare the usury leverage effect with the ICO loan. Even banks perform better than ICO.

Fig.3 Capital Accumulation: Usury vs ICO Loan



The effect is due to the high riskiness of this kind of loan. As the probability that a startup will survive increases, the investors returns became profitable. However, given a low probability of startup success, as economic literature reported (see Appendix 1), ICO loan seems to be not suitable for a money laundering lender.

In the best scenario, when the probability to be discovered for the committed crime (the anti-money laundering regulation cost) is roughly equals to zero, the organized crime gains a legal cumulative capital which is about ten time the initial illegal capital. Anyway, fifteen months will be spent to recover the starting capital.

Conclusions

In a macroeconomic environment with abundant legal credit and new technological credit channels, usury can be still present and relevant. If a demand for illegal credit exists, the criminal organizations can match such as demand supplying illegal moneylending services for reasons other than the

possibility to gain from the interest rates, being the usury market a device to launder directly or indirectly flows of illegal revenues. The more effective will be the channel between usury and money laundering, the bigger will be the overall capital that the criminal organizations can owned. The effectiveness of the usury business as a leverage device for the criminal organization is independent from the interest rate mechanism. The efficiency of the cryptocurrencies as money laundering vehicle is correlated with the riskiness of such as loans; the more the risk profile will be higher the more the usury markets will produce a bigger leverage effect on the criminal organization revenues.

Appendix 1.

In the following, we describe specify the parameters of the model.

- **Parameters only for usury contract:**
  - $r_{u(t)}$ is the usurious interest rate and it is time dependent. At the beginning of the contract it is equal to $r_{u(0)}$ and it amounts to 3%. In other words we consider this interest rate equivalent to the legal interest rate r_l and so, lower than the minimum threshold rate provided by the formal market. Until March 2017, this legal rate was equal to 7.15% for a loan covered by mortgage warranty with a variable interest rate.
  - r_i is the illegal rate of return and it could range between 50% and 600% (Unger, 2007). For a conservative simulation, we assume an average illegal rate of return equals to 250%.
  - "$a(r_{u(t)})$" is the probability that the borrower will be able to pay off the loan. Such value is a function of the usurious rate. In particular, it decreases when $r_{u(t)}$ increases. While its complementary "$1 - a(r_{u(t)})$" stands for the default probability. In this case, the usurer gains the collateral or the borrower will accuse the lender.
  - ρ is the probability that, in the case of default, the usurer gets the collateral. While "1-ρ" is the probability that, in the same scenario, the lender will be reported to the authorities. Really such event is unlikely, also for the limits in the credit access, so "1-ρ" is very low. In our calibration ρ ranges between 0 and 1.
  - The empty set "∅" stands for the cost for the usurer in the event that the borrower reports the crime. To fix the amount of "∅" we take into account the length of criminal proceedings. Today in Italy, the length of criminal proceeding is longer than the average value computed in the seventies (see Dalla Pellegrina 2008). Furthermore, the prescription's terms are also relevant. The "ex Cirielli" law (i.e. the Law of 05/12/2005 n° 251), reduced the prescription terms associated with some types of crimes (including usury credit that prescribed in 7.5 years). Nevertheless, today, the Law of 23 June 2017 n. 103 (known as reform of the penal code), increased the prescription terms for several crimes, and among those there is usury. For the last one the prescription time range from 15 years to 21 years. Therefore, we assume that in the case of discovery of a usurious crime, the sanction (including the risk of jail) will amount to double the maximum sanction provided by the law (€45000). Therefore, we assume that "∅" amounts to €90.000.
- **Parameters only for banking contract:**
  - "r_b" is the monthly banking interest rate. It is equals to the average of the last ten years' interest rates charged to families and non-financial institution by banks (source: database of Bank of Italy) and amounts to 3.11%/12.
  - σ is a discount factor for the collateral. It takes account of the costs for the legal recovery of the collateral. We assumed σ = 0.75% based on the analysis of Altman et al. (2005), Hamilton et al. (2001), Hamilton et al. (2004), Van de Van de Castle and Keisman (2000).
- **Parameters for legal and illegal contracts:**
  - The share "*y*" of illegal capital to be laundered amounts to 70%. This value for the parameter is the result of an analysis of the estimates produced in the literature. Several authors (WODC, 2003; Smekens and Verbruggen, 2004; Unger et al., 2006; Walker, 2007) pointed out that this percentage of crimes proceeds, that needs to be laundered, range between 10% and 100%, according to the crime type. Since drug trafficking remain the main activity producing illegal funds that need to be laundered (Europol 2006, 2008, 2009), we assumed for our parameter a

middle value between Walker's and Smekens's data for this crime (In particular Walker, 2007 estimated that the percentage of drug proceeds that is laundered ranges from 50 to 100%, depending on the country where the money is laundered. Smekens and Verbruggen, 2004 – as Unger et al., 2006 reported – evaluated this parameter equal to 70%).

- r_l is the legal interest rate free risk. Barone et al. (2018) obtained such parameter as the annual average of long term interest rates for OECD member countries, for the period ranging from 1962 to 2015. It amounts to 3%.
- η is the share of cleaned money invested in the legal sector at the legal risk-free interest rate r_l. We assume that this parameter amounts to 89%. We calculate this percentage using data from Unger (2007a) on the share of laundered money which is spent in consumption, equal to 11%.
- For the collateral "G" we fixed an average value for the SMEs equal to €250.000.
- D_0 is the initial criminal capital. We assume a loan $(yD_0)$for each borrower of about €100000. Therefore, given the value of "y", (i.e. The share of illegal capital to be laundered), we supposed that the criminal group allocate an amount $D_0 = €150000$ of own illegal capital to each borrower[35]. In the banking contract we assume $(D_0 = L_0)$.
- $1/n$ is the periodicity of the loan, where $n = 12$ months.
- T is the maturity of the loan, where $T = 120$ months.

- **Parameters for the bitcoin lending plan:**
  - $Pr(x = S)$is the probability that the firm funded by ICO will survive after 120 days (from the end of the ICO). According to Benedetti and Kostovetsky (2018), $Pr(x = S)$ is equal to 44.2%.
  - r_{ICO} is the average return of ICO investment and it is equal to 179%[36].
  - $z\eta$ is the share of laundered money invested in the legal sector at the legal risk-free interest rate r_l. $\eta(1 - z)$ is the share of laundered money invested in a ICO. Since a person who laundered dirty money wishes to minimize the risk of losing it, s/he generally prefers risk-free investments, such as bonds or other low-risk investments (see footnote 29). Therefore, we assume that the percentage $(1 - z)$ will be low and precisely we fixed it equals to 30%.

[35] For a depth analysis on overall illegal capital owned by organized crime see Barone et al. (2018).
[36] Benedetti and Kostovetsky (2018).

5. References

- Abadi J. and Brunnermeier M., (2018), *Blockchain Economics*, Princeton.
- Altman E. I., Brady B., Resti A., and Sironi A. (2005), "The Link between Default and Recovery Rates: Theory, Empirical Evidence, and Implications", *The Journal of Business*, 78(6), pp. 2203-2228. DOI: 10.1086/497044
- Ashta A., Attuel-Mendès L., Ditter J.G. (2011), "Another 'French Paradox': Explaining Why Interest Rates to Microenterprises Did Not Increase with the Change in French Usury Legislation", in *Cahiers du CEREN* 37, pp.27-42. ISSN 1768-3394.
- Ball L., Gagnon J., Honohan P., Krogstrup S. (2016), *What Else Can Central Banks Do?*, Geneva Reports on the World Economy, n.18.
- Barone E. and Olivieri G. (2015), "Derivatives and Usury: The Role of Options in Transactions Used to Act in Fraud of the Law", Available at SSRN: https://ssrn.com/abstract=2683355 or http://dx.doi.org/10.2139/ssrn.2683355
- Barone R. (2004), "Riciclaggio e credito d'usura: un modello di analisi economica", *Rivista Internazionale di Scienze Sociali, Vita e Pensiero*.
- Barone R. and Masciandaro D. (2011), "Organized Crime, Money Laundering and Legal Economy: Theory and Simulations", *European Journal of Law and Economics*, 32(1), pp. 115-142.
- Barone R., Cerqueti R. and Quaranta A.G. (2012), "Illegal finance and usurer behaviour", *European Journal of Law and Economics*, 34(2), pp. 265-277.
- Barone R., Delle Side D. and Masciandaro D. (2018), "Drug Trafficking, Money Laundering and the Business Cycle: Does Secular Stagnation Include Crime?", *Metroeconomica*, 69(2), pp. 409-426. https://doi.org/10.1111/meca.12193
- Barone R. (2017), *Money Laundering: A Review Essay and Policy Implication* (April 17, 2017). SSRN: https://ssrn.com/abstract=2954167 or http://dx.doi.org/10.2139/ssrn.2954167
- Barone R. (2018), The Italian CCB Reform and Usury Credit Risk: A Quantitative Analysis, *ITEJ forthcoming* DOI: 10.1007/s40797-018-0071-9
- Basu K. (1984), Implicit Interest Rates, Usury and Isolation in Backward Agriculture, *Cambridge Journal of Economics*, vol. 8, n.2, pp. 145-160.
- Bech M. and Garratt R., 2017, *Central Bank Cryptocurrencies*, BIS Quarterly Review, September.
- Benedetti, Hugo E and Kostovetsky, Leonard, *Digital Tulips? Returns to Investors in Initial Coin Offerings*, (2018), mimeo.
- Bergthaler W., Kang K., Liu Y. and Monaghan D. (2015), Tackling Small and Medium Sized Enterprise Problem Loans in Europe, IMF Staff Discussion Note, International Monetary Fund.
- Bester H. (1994), The Role of Collateral in a Model of Debt Renegotiation, *Journal of Money, Credit and Banking*, vol. 26, n.1, pp. 72-86. DOI: 10.2307/2078035
- Blitz R. - Long M. (1965), The Economics of Usury Regulation, *Journal of Political Economy*, vol. 73, December, pp. 608-619.
- Bodenhorn H. (2005), "Usury Ceilings, Relationship and Bank Lending Behavior: Evidence from Nineteenth Century New York", NBER Working Paper Series, n. 11734.
- Borio C.E.V., Hofmann B. (2017), *Is Monetary Policy Less Effective When Interest Rates Are Persistently Low*?, BIS Working Paper Series, n. 628.

- Borio C.E.V., Zabai A. (2016), *Unconventional Monetary Policies: A Re- Appraisal*, BIS Working Paper Series, n. 570.
- Boyes W.J. (1982), In Defence of the Downtrodden: Usury Law?, *Public Choice*, vol. 39, n.2, pp. 269-276.
- Brucker E. (1977), Usury Legislation and Market Structure: An Alternative Approach, *Journal of Finance*, vol. 32, September, pp. 1339-1344.
- Bryans Danton (2014), Bitcoin and Money Laundering: Mining for an Effective Solution, *Indiana Law Journal*, vol. 89 issue 1, Article 13, pp. 441-472
- Burke J. (2014), "The Scholastic Analysis of ZIRP: Justice, Usury, and the Zero Interest Policy", *Journal of Markets & Morality*, 17(1), pp.105-124.
- Casey M., Crane J., Gensler G., Jonson S. and Narula N., 2018, *The Impact of Blockchain Technology on Finance: A Catalyst for Change*, Geneva Report on the World Economy, n.21, CEPR.
- Chiu J. and Koeppl T., 2017, *The Economics of Cryptocurrencies – Bitcoin and Beyond*, Bank of Canada, mimeo.
- Cifarelli M.D., Masciandaro D., Peccati L., Salsa S., Tagliani A. (2002), "Success or Failure of a Firm under Different Financing Policies: A Dynamic Stochastic Model", *European Journal of Operational Research*, 136(3), pp. 471-482.
- Clayton J. (2018), "Before the Committee on Banking, Housing, and Urban Affairs", United States Senate. https://www.sec.gov/news/testimony/testimony-virtual-currencies-oversight-role-us-securities-and-exchange-commission
- CNEL (2008) Usura: Diffusione territoriale, evoluzione e qualità criminale del fenomeno. Rapporto finale, Osservatorio Socio Economico sulla Criminalità.
- Coeuré B. (2016), "Assessing the implications of negative interest rates", *Speech by Benoît Cœuré, Member of the Executive Board of the ECB, at the Yale Financial Crisis Forum*, Yale School of Management, New Haven, 28 July 2016. https://www.ecb.europa.eu/press/key/date/2016/html/sp160728.en.html. Available on 13/09/2017.
- Cong L.W and He Z., 2018, Blockchain Disruption and Smart Contracts, NBER Working Paper Series, n. 24399.
- Crafton S.M. (1980), An Empirical Test of the Effects of Usury Law, *Journal of Law and Economics*, 23(1), pp. 135-146.
- Dalla Pellegrina L. (2008), "Illegal Finance, interest rates and bank lending: The missing supply side of usury", *Global Business and Economics Review*, 10(3), pp. 265–283.
- Danton B., (2014), Bitcoin and Money Laundering: Mining for an Effective Solution, *Indiana Law Journal*, 89(1), 13.
- Den Haan W.J. (2016), *Quantitative Easing*, A VoxEU Book, CEPR Press.
- DIA (2017), Relazione del Ministro dell'Interno al Parlamento sull'a Attività Svolta E Risultati Conseguiti Dalla Direzione Investigativa Antimafia (Gennaio-Giugno 2017), Direzione Investigativa Antimafia, Ministero dell'Interno, Roma http://direzioneinvestigativaantimafia.interno.gov.it/semestrali/sem/2017/1sem2017.pdf
- Ellison A., Collard S., and Forster R. (2006). Illegal Lending in the UK: Final Research Report. DTI/Policis. Retrieved from https://www.policis.com/pdf/Old/DTI_Illegal_Lending_in_the_UK_Final_research_report.pdf
- Eurispes (2016), *Usura: quando il credito è 'in nero'*, Rapporto Usura, Eurispes-Istituto di Studi Politici Economici e Sociali.

- Europol (2006), OCTA 2009: EU organized crime threat assessment. The Netherlands: European Police Office.
- Europol (2008), OCTA 2009: EU organized crime threat assessment. The Netherlands: European Police Office.
- Europol (2009), OCTA 2009: EU organized crime threat assessment. The Netherlands: European Police Office.
- ECB (2017), The euro area bank lending survey, EUROSYSTEM, July 2017.
- Fiorentini G. – Peltzman S. (1995), *The Economics of Organized Crime*, Cambridge University Press, Cambridge.
- Foley S., Karlsen J.R., Putnins T.J., (2018), *Sex, Drugs and Bitcoin: How Much Illegal Activity is Financed through Cryptocurrencies?,* mimeo.
- Gertler P., Hofmann B. (2016), *Monetary Facts Revised*, BIS Working Paper Series, n. 566.
- Glaeser E.L. - Scheikman J. (1998), Neither a Borrower nor a Lender Be: An Economic Analysis of Interest Restrictions and Usury Laws, Journal of Law and Economics, vol. XLI, April, pp. 1-36.
- Goisis G. and Parravicini P. (1999), Tassi di interesse usurari e mercati regionali del credito: un'analisi in termini di efficienza", *Rivista Internazionale di Scienze Sociali*, gennaio-marzo, n.1.
- Greer D.F. (1977), Usury Legislation and Market Structure: Reply, *Journal of Finance*, 32(4), pp. 1345-1347.
- Guiso L. (1995), "Quanto è grande il mercato dell'usura?", *Temi di discussione della Banca d'Italia*, n. 260.
- Halaburda H., 2016, *Digital Currencies: Beyond Bitcoin,* NYU-Stern and Bank of Canada, mimeo.
- Hamilton D.T., Gupton G.M., Berthault A. (2001), "Default and Recovery Rates of Corporate Bond Issuers: 2000", *Moody's Investors Service.*
- Hamilton D. T., Varma P., Ou S., Cantor R. (2004), "Default & Recovery Rates of Corporate Bond Issuers A Statistical Review of Moody's Ratings Performance, 1920-2003", Report Number: 80989, *Moody's Investors Service*.
- Havrylchyk O., Kierzenkowski R. (2015) Enhancing the financing of the real economy and financial stability in the United Kingdom, *OECD Economics Department Working Papers*, No. 1245, OECD Publishing, Paris. http://dx.doi.org/10.1787/5jrxqbk75c43-en Available on 02/03/2018.
- Howell S.T., Niesser M. and Yermack D., (2018), *Initial Coin Offerings: Financing Growth with Cryptocurrency Token Sales*, NBER Working Paper Series, n. 24774.
- Huberman G. – Leshno J.D. and Moallemi C., (2017), *Monopoly without a Monopolist: An Economic Analysis of the Bitcoin Payment System*, Bank of Finland, Discussion Paper Series, n. 27.
- Klön L., Parhofer N., Resas D. (2018), Initial coin offering (ICOs), Economics and Regulation". ZBB online, 89.
- Labonte M. (2018), Monetary Policy and the Federal Reserve: Current Policy and Conditions, Congressional Research Service Report.
- Littwin A. (2008), "Beyond Usury: A Study of Credit Card Use and Preference Among Low-Income Consumers", *Texas Law Review*, 86(3), pp. 451-506.
- Magnus M., Margerit A, Mesnard B., Katopodi C. (2017), *Non-performing loans in the Banking Union: state of play*, European Parliament

http://www.europarl.europa.eu/RegData/etudes/BRIE/2017/602072/IPOL_BRI(2017)602072_EN.df Available on 13/09/2017
- Marinaro I.C. (2017), "Loan sharking in a time of crisis: lessons from Rome's illegal credit market", *Trends in Organized Crime*, 20(1-2), pp. 196-215.
- Masciandaro D. (1997), Shylock era banchiere o usuraio? Una teoria del credito d'usura, *Moneta e Credito*, vol. 50, giugno, pp. 167-202.
- Masciandaro D. (1999), Money Laundering: The Economics of Regulation, *European Journal of Law and Economics*, vol. 7, n. 3, pp. 225-240.
- Masciandaro D. (2000), "Southern Italy: White Caterpillar, Grey Chrysalis, Black Butterfly: Organised Crime, Financial Crime and Entrepreneurial Distress", *Journal of Financial Crime*, 7(3), pp.274-287, https://doi.org/10.1108/eb025949.
- Masciandaro D. (2001), "In Offense of Usury Laws: Microfoundations of Illegal Credit Contracts", *European Journal of Law and Economics*, 12(3), pp. 193–215.
- Masciandaro D. (2002), Why Shylock Can Be Efficient? A Theory of Usury Contract, *Kredit und Kapital*, 2002, vol.24, n.3, pp. 381-399.
- Masciandaro D. (2018), Central Bank Digital Cash and Cryptocurrencies: Insights from a Baumol-Friedman Demand for Money, *Australian Economic Review*, 51, n.4, 1-11, October 2018.
- Masciandaro D., Takáts E. and Unger B. (2007), *Black Finance: The Economics of Money Laundering*, Edward Elgar, Cheltenham.
- Ministero dell'Interno (2016), Le Relazioni annuali del Comitato di Solidarietà vittime dell'estorsione e dell'usura, interno.gov.it http://www.interno.gov.it/sites/default/files/relazione_racket_2016.pdf Available on 01/03/2018
- Muller P., Julius J., Herr D., Koch L., Peycheva V., McKiernan S. (2017), Annual Report on European SMEs 2016/2017 Focus on self-employment SME Performance Review 2016/2017, European Union, ISBN 978-92-79-74126-5, doi: 10.2873/742338
- Netzer O., Lemaire A. and Herzenstein M. (2017),"When Words Sweat: Identifying Signals for Loan Default in the Text of Loan Applications", in *NA - Advances in Consumer Research* Volume 45, eds. Ayelet G., Vladas G. and Patti W., Duluth, MN, Association for Consumer Research, pages: 53-56.
- OECD (2016), OECD Economic Survey: Germany. http://www.oecd.org/eco/surveys/2016%20Germany%20survey%20-%20Overview%20in%20ENGLISH.pdf Available on 02/03/2018
- OECD (2017), OECD Economic Surveys: Italy. http://www.oecd.org/eco/surveys/italy-2017-OECD-economic-survey-overview.pdf Available on 02/03/2018
- Orphanides A. (2017), *Central Bank Policies and the Debt Trap*, MIT Sloan School Working Paper Series, n.5187, n.17.
- Ostas J.R. (1976), Effect of Usury Ceiling in the Mortgage Market, *Journal of Finance*, vol. 31, n. 3, pp. 821-834.
- Peterson R.L. (1977), Usury Laws and Consumer Credit: A Note, *Journal of Finance*, vol. 32, n. 4, pp. 1809-1304.
- Peterson C.L. (2008), "Usury Law, Payday Loans, and Statutory Sleight of Hand: Salience Distortion in American Credit Pricing Limits", *Minnesota Law Review*, 92(4), pp. 1110-1164.
- Reuter P, Truman EM (2004) Chasing Dirty Money: Progress on Anti-Money Laundering. Institute for International Economics, Washington D.C.

- Rigibi O. (2013), "The Effects of Usury Laws: Evidence from the Online Loan Market", *The Review of Economics and Statistics*, 95(4), pp. 1238–1248.
- Robins P.K. (1974), "The Effect of State Usury Ceiling on Single Family Home-Building", *Journal of Finance*, vol. 29, n. 1, pp. 227-235.
- Ruggero, V. (1996), "*Organized Crime in Europe: Offers That Can't Be Refused*", Aldershot, Dartmouth Publishing Company.
- Rusev A., Garofalo L., Sciandra E., Giménez-Salinas A., Jordá C., de Juan M. (2016), Estorsione organizzata nell'Unione Europea: fattori di vulnerabilità. Rapporto finale del Progetto CEREU – Countering Extortion and Racketeering in EU. Milano: Transcrime – Università Cattolica del Sacro Cuore.
- Savona E. U. and Riccardi M. (eds) (2017), Assessing the risk of money laundering in Europe – Annex. Methodological Annex of the Final Report of Project IARM. Transcrime – Università Cattolica del Sacro Cuore, Milano. ISBN 978-88-99719-07-4
- Scaglione A. (2014), "Estimating the size of the loan sharking market in Italy", *Global Crime*, 15(1-2), pp. 77-92.
- Smekens, M., and Verbruggen, M. (2004). *De illegale Economie in Nederland*. Centraal Bureau voor de Statistiek.
- Stokes R. (2012), Virtual money laundering: the case of Bitcoin and the Linden dollar, *Information & Communications Technology Law*, vol. 21, issue 3, 221-236.
- Temin P. and Voth H-J. (2008), "Interest rate restrictions in a natural experiment: loan allocation and the change in the usury law in 1714", *The Economic Journal*, 118, pp. 743-758.
- Turone, G. (2007), "The Legal Frameworks and Investigative Tools for Combating Organized Transnational Crime in the Italian Experience", Resource Material Series No. 73, Tokyo, Japan: UNAFEI, pp. 48-64.
- Unger, B., Ferwerda, J., de Kruijf, W., Rawlings, G., Siegel, M., & Wokke, K. (2006), "The amounts and the effects of money laundering". *Report for the Dutch Ministry of Finance*.
- Unger B. (2007), *The Scale and Impacts of Money Laundering*, Edward Elgar, Cheltenham.
- Unger B. (2007a), "International Economics", in Masciandaro D., Takáts E. and Unger B. (2007), *Black Finance, The Economics of Money Laundering*, Edward Elgar, Cheltenham.
- Unger B. (2017), Offshore activities and money laundering: recent findings and challenges, Policy Department A: Economic and Scientific Policy, European Parliament.
- Van de Castle K. and Keisman D. (2000), "Suddenly structure mattered: Insights into recoveries of defaulted loans", *Standard & Poor's Corporate Ratings*.
- Venturi M. (2011), Le mani della criminalità sulle imprese, XIII rapporto di Sos Impresa. Aliberti, Correggio. Isbn-10: 8874248393
- Villegas D. J. (1982), "An Analysis of the Impact of Interest Rate Ceilings", *The Journal of Finance*, 37(4), pp. 941-954. https://doi.org/10.1111/j.1540-6261.1982.tb03590.x
- Walker, J. (2007), "The extent of money laundering in and through Australia in 2004", *Criminology Research Council.*
- WODC. (2003), *European sourcebook of crime and criminal justice statistics*, United Nations Economic Commission for Europe.