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Marmara Credit Loops: A Blockchain Solution to Nonredemption problem in Post-dated Cheques

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ABSTRACT

The money creation based on credit has been the practice of human being for at least 5000 years. In the past 300 years of industrial age, the vast majority of money in the World is being created as credit in banking institutions by means of centralized banking regulations on a global scale. On the contrary of the common belief, the banks have not been intermediary bodies in money creation. Instead, they create money directly when they make loans. Bank loans create both credit and deposit directly out of thin air. Credits stay as mutual contracts between borrowers and banks until they get paid, while deposits circulate in economies as virtual money. Physical money has no direct relation to the credit creation and should not be confused with the reserve requirements which are just costs of credit creation. Despite this fact, money creation in some countries do happen on a peer-to-peer basis with a kind of analog chain. Turkey is unique in this sense with the way post-dated cheques being used in economy for several decades. Currently, at least 1/4 of economy in Turkey has been running on active use of post-dated cheques. The greatest global problem in post-dated cheques is bouncing, i.e. defaulting, or nonredemption. For example, the non-redemption rate has been around 3% in Turkey and 5% in India for the last decade after the 2008 financial crisis. Nonredemption rates tend to increase during financial crisis.

The way post-dated cheques are used in Turkey is actually an analog chain on papers. This study suggests a generic blockchain solution to nonredemption problem for peer-to-peer credits similar to post-dated cheques. The blockchain maintains the smart contracts of so called Credit Loops depicting the analog blockchain of post-dated cheques. The Marmara name in blockchain comes from the Marmara region in Turkey, as being the region producing nearly half of GDP in Turkey. The system has been developed and proof of concept was tested on real blockchain based on trustless mode. The trust based version has been specified to solve the problem further towards a zero-nonredemption goal by introducing community layer to solution. The paper explores the common problems in post-dated cheques and how nonredemption problem could be solved through Marmara Credit Loops.

1 INTRODUCTION

Peer-to-peer version of electronic cash to allow the transfer of online payments directly between two parties without involvement of third parties came to life in 2008 with the introduction of famous bitcoin blockchain and has been working continuously since that time [1]. The method involves sending online payments between two parties without the need of going through a financial institution. All transactions are timestamped and chained continuously based on same hashing techniques by so called miners who collectively maintain a network of blockchain in a distributed manner. The system relies on the pool of collective CPU power to solve the problem of conflicts among which the 51% attack is the most famous one known as "The Byzantine Generals Problem" [2].

The trust need when transferring money by a financial institution in the central banking system is actually replaced by collective computational power of miners in the blockchain system in a decentralized way. The system works very similar to notary system with the difference that many notaries need to verify the same records. The blockchain notaries, i.e. the miners get rewards from the system based on finding hashes to connect the blocks. A blockchain system with mining support is hence self-maintained due to reward for nodes freely joining the network at will.

The system also works very similar to gold mining process. The original goal to remove the need for an intermediary to transfer electronic cash was achieved with almost all cryptocurrencies since the birth of Bitcoin. Since that time, efforts focused on solving problems such as more privacy, security, simplicity, scalability and interoperability. One of the recent developments was crypto conditions based smart contracts. Among all these developments, there is a real challenging task that is not focused fundamentally. In fact, it is the most effective function of banks: It is credit creation. In today's modern world, the vast majority of fiat money is created by banks as mere credits. It is really surprising that this function still remains unsolved by blockchain communities. There are lending platforms. But lending is nothing to do with credit creation since there must be assets created already to make lending. There actually exists a peer-to-peer credit creation system already in Turkey and some other countries. It is the use of post-dated cheques and promissory notes with almost quarter of GDP in Turkey [3] and half of GDP in India [4]. This credit creation and settlement occurs currently on papers only. It is actually an analog version of blockchain. Due to the complexity of redemption processes, the problem could not be solved yet either with centralized or decentralized approach. This paper first explains how money is created through the use existing post-dated cheques as analog blockchain and describes the fundamental rules and culture for them to exist. Then the main problem of non-redemption in post-dated cheques is explained. The paper then explains Marmara Credit Loops and how they can be used to solve non-redemption problem via the use of stakeable timelocked coins as collaterals by coding Crypto Conditions in Komodo blockchain technologies.

2 POST-DATED CHEQUES AND PROMISSORY NOTES AS MONEY CREATION TOOLS

During the lending process, banks are able to increase two sides of their balance sheets, assets and liabilities, at the same time. When a bank signs a credit protocol called promissory note in literature with a customer, a deposit account is opened at the same time on the name of customer. Approved credit amount is created in customer deposit account side immediately, too. Thus, bank creates loan and deposit simultaneously. The empirical test was conducted to show how banks create money during lending [5]. Although Prof. Werner proves, in his paper with tests by explaining how banks create money through lending, he falls behind in addressing money creation by individual firms in another paper when comparing firms with banks [6]. This lack of explanation may come from looking only at one of the common approaches regarding the way post-dated cheques are used. There are two different approaches for cheque legislation; Mainland Europe Approach and Anglo-Saxon Approach. Anglo-Saxon Approach does not allow a bank to pay for post-dated cheque before its issue

date. Mainland Europe Approach considers cheque "payable on demand" regardless any due date issued. Thus, Mainland Europe Approach does not allow using cheques as a credit instrument [7].

There are two fundamental rules in laws or culture in a country in order to use post-dated cheques or promissory notes to be existing as money creation mechanism in an economy. They are;

- Laws or culture to force not to deem a post-dated cheque or post-promissory note before their due dates,
- Laws or culture with severe punishment in case of non-redemption, i.e. bouncing cheques or promissory notes.

According to laws, the owner of the cheque account is obliged to have the amount of the cheque in the relevant bank account on due-date. In countries such as Turkey and India where post-dated cheques are used at very high rate, there are severe punishments. If the cheque account owner does not pay the judicial fine, it is directly converted into a term of imprisonment in both Turkey [8] and India.

Especially, in developing countries, money supply is limited and cost of money obtained from banks is very high. On the other hand, central banks and commercial banks have absolute control over the money supply. However, because of competition and imported goods, profit margins are very low. Small and middle sized traders and firms struggle with finding cheap funds to keep their business running. Trust based culture has also major effect for such practices. Therefore, post-dated cheque is a vital credit instrument for them. Post-dated cheques reached significant volumes in Turkey and India (Table1 and Table 2). Therefore, post-dated cheque volume has a direct impact on GDP of those countries.

Table 1: Cheque Statistics in Turkey

Years	Presented Cheques		Returned Cheques		Returned Cheques / Presented Cheques (%)	GDP (in million TL)	Presented Cheques / GDP (%)
	Volume	Value (in million TL)	Volume	Value (in million TL)			
2018	20.927.496	939.066	588.297	29.381	3,1	est. 3.800.000	24,71
2017	19.914.164	784.873	435.403	17.076	2,2	3.106.536	25,26
2016	21.191.528	708.363	778.425	27.437	3,7	2.608.525	27,15
2015	22.813.622	674.124	775.852	27.291	3,4	2.338.647	28,82
2014	23.249.147	601.761	673.705	19.924	2,9	2.044.465	29,43

Source: Risk Center of the Banks Association of Turkey (www.riskmerkezi.org)
Turkish Statistical Instute

2.1 Problems with post-dated cheques and promissory notes

Post-dated cheques are controversial issue for many years. Some economists and lawyers claim that a cheque must be payable on demand and a bank cannot postpone any payment to bearer even if the due date is in the future. They also claim that a cheque cannot be used as a credit instrument between individuals. However, the reality is different. The quarter GDP in Turkey and half of GDP in India comprise of post-dated cheques with face values alone without counting the circulation of cheques that will have further effect as money multiplier. The greatest problem is non-redemption, i.e. bouncing cheques. The rate for returned cheques is less than 4 % in Turkey while the rate is nearly 5% in India. The post-dated cheques and promissory notes work based on a simple principle. It is trust. The people obey the due dates on post-dated cheques or promissory notes by keeping the required amount on that specific time. In case of failure to do so, either laws or culture force them to

do that. The issuer creates a post-dated cheque or promissory note with a future date. The issuer does not need to have any money existing in his/her bank account before the due date. He/she issues the cheque to an endorser. Endorser cannot redeem the cheque before the due date and just transfers to another endorser. The cheque circulates until the due date many times. All endorsers use the back side of cheque by simply signing and stamping with company seal. It is a simple analog blockchain existing in paper form and if there is not enough space on the cheque to sign, i.e. to endorse, a paper is attached to cheque. The system is a trust based peer to peer credit creation and circulation system existing as manual blockchain. Although cheque books are given to people by banks, they can write any amount on the cheque slip as long as it is accepted by endorser. By this, they simply create money. Starting from issuer to the last endorser just before the holder, they are all collectively responsible to pay for the debt to the last holder at due date. If the issuer pays at due date, then the case is closed.

Table 2: Cheque Statistics in India

Years	Presented Cheques		Returned Cheques		Returned Cheques / Presented Cheques (%)	GDP (in million Rupee)	Presented Cheques / GDP (%)
	Volume	Value (in million Rupee)	Volume	Value (in million Rupee)			
2018	1.119.690.000	81.279.236	54.065.000	4.953.106	4,8	est. 192.500.000	42,22
2017	1.230.063.000	82.333.806	61.401.000	5.177.470	5,0	167.517.000	49,15
2016	1.017.600.000	71.774.419	46.156.000	3.792.520	4,5	152.537.000	47,05
2015	960.354.000	69.668.960	39.247.000	3.285.394	4,1	137.640.000	50,62
2014	932.821.000	67.448.047	37.825.000	3.265.938	4,1	124.680.000	54,10

Source: National Payment Corporation of India (www.npci.org.in) Reserve Bank of India

Otherwise, a court decision is ruled out to freeze all the available accounts in the chain to pay. The first responsible person is the issuer who creates the credit at the issuance date. Though the punishment is softer than before, there is still imprisonment possible when fines are not paid regarding the non-redemption [9].

The system is a trust based one which works best during exchange of goods and services which means transfer of a post-dated cheque to an endorser requires some equivalent goods or services required. Suppose a post-dated cheque is issued to first endorser with a cheque known as “friendly cheque” without goods or services in return. Then the first endorser and other endorsers circulate this cheque for buying some goods or services until the holder. Then suppose at the due date, the money is paid to holder by the issuer. Then the case is closed from the judiciary point of view. Suppose the first endorser does not pay to the issuer at the end. The issuer cannot demand anything since the case is already settled.

The non-redemption is the greatest problem with those credit instruments. There is not an efficient system for protecting the users. Some tools exist such as use of Qrcodes to check if the issuer has problem with payments before. However, that does not guarantee the payments later even if the issuer had a clear record before. The trust factor is highest between pairs. However, the trust is the weakest between the issuer and the holder who do not know each other in long chains of post-dated cheques.

Non-divisibility is other issue. The main reason is the cost for every pay slip in the cheque book given by banks. The issuer has also to pay around 2000 Lira for every slip as blockage. Therefore, it is useless to issue a cheque for less than that amount. Since cheques are paper documents, people tend to issue them with greater amounts for the practical reasons, too.

The other problem is counterfeiting in the post-dated cheques. They are called twin cheques. Since they exist as papers, people may produce some fake cheques which will not be identified until due dates. Some endorsers might also insert some fake signature of trustful institution prior to their signature to cheat the next person in chain to increase the trust factor. Loss of cheques or damages are other problems.

3 BLOCKCHAIN SOLUTIONS TO NON-REDEMPTION PROBLEM

The greatest problem is non-redemption in post-dated cheques. However, other aforementioned problems existing with paper version may also be solved by blockchain. The solution for non-redemption problem requires a mineable and stakeable blockchain with rewarding mechanism to achieve insurance against the non-redemption. The tokenized system requires financing from outside and subject to regulations in many countries. The solution relies on self-financing feature of blockchain systems. Therefore, token based system is not feasible against non-redemptions. Hence, such a blockchain system named as Marmara Chain was created. Marmara Chain is a peer-to-peer credit creation and circulation system with self-assurance to be maintained by the credit creators and endorsers. The system is inspired from a common culture related to use of post-dated cheques in countries such as Turkey, India etc. The original system works as a trust based one. The processes for credit creation and circulation are managed in so called Credit Loops. The so called Millennium Version is aiming at solving the problem with a trustless system approach based on the way of smart contracts called crypto conditions in Komodo blockchain technologies [10]. In Crypto Conditions, to create a transaction that transfers an asset to new owners, one must fulfill the asset's current conditions. The basic purpose is to solve the most basic and difficult problem in credit loops: It is defaulting. For doing this, a rewarding mechanism acting as a self-assurance is suggested. The blockchain is 25% mineable and 75 % stakeable with the condition of activation, i.e. timelocking. For incentivizing the credit creation and redemption, activated coins in credit loops will be boosted with 3 times more chance during staking.

There are two solutions suggested here in this paper. The first one is a trustless blockchain solution with 100% collateralization at every stage of endorsement while the second version is a blockchain version of trust based paper solution with enhancements. Both versions use the so called credit loops. Credit loop is the analogy of blockchain version of post-dated cheques. However, it is just credit and not an actual cheque. It is much similar to promissory notes circulating like post-dated cheques. They are simply credits and very different than post-dated cheques since they do not need to be issued by any bank. They are peer to peer credits which may be created by any individual not only by firms. The trustless solution for credit loops act like “tea tokens” used in coffee houses in Turkey. The credit is collateralized 100% at the time of issuance.

The most essential mechanism for both trustless and trust based solutions is the rewarding mechanism for finding blocks through staking with activated and especially boosted staking when timelocking in credit loops. There is no other blokchain solution currently utilizing the timelocked coins to reward collateralizations against defaulting in credit creation. Currently, there is no such blockchain solution to create and circulate credits in a trust based manner. This paper also briefly describes requirements of such trust based blockchain solution to non-redemption problem.

3.1 Trustless Blockchain solution for Non-redemption

The first solution is almost complete with settlement examples. There were many test blockhains to test the ideas. Although the problem itself with post-dated cheques requires a trust based solution, the 100 % collateralization made the trustless solution possible. The trustless solution in Marmara Credit Loops is very simple. Anyone can issue a credit if he/she has the enough activated coins in the wallet. Due to 100% collateralization, the credit is already backed 100% with funds and hence redeemable at the due date. So the credits in this version are self-insured. Therefore, the first

solution mainly uses the trustless nature of blockchain without trust based agents that are to be handled in trust based version. It might be questioned if this still may be called a real credit since it is all redeemable at the beginning. When people are involved in credit loops, they will have much more chance of staking which will give them power of creating new credits since activated coins have in credit loops 3 times more chance than other activated coins not locked in credit loops.

The system is 100% collateralized which means 0% default and hence no nonredemption. The full credit is issued by the issuer. The credit issuers have the highest chance of staking since they have their coins locked in credit loop where they have 3 times more chance for staking than other activated coins. An example of Credit Loop is shown in Figure 1. The sample credit loop has three nodes. The first is the issuer, the second node is endorser and the last node is the holder. The issuer is to create a credit of 3000 MCL in credit loop.

At the first step, the endorser, the Pubkey 2 starts the process with the request for 3000 MCL (Marmara Credit Loop). The necessary function to use is `marmarareceive`. The pubkey 1, the issuer needs to have 3000 MCL to be locked to issue the credit with 100% collateralization. Then the node has 3000 activated to get rewards with staking. The issuance is done with the function `marmaraissue` at step 2. The 3000 locked MCL coins is transferred to LCL (Locked in Credit Loop) and at the same time a digital baton is transferred to Pubkey 2. Now the pubkey 2, the endorser has the baton which presents the credit. The Pubkey 1 starts boosted staking with 3000 MCL. Later Pubkey 3 makes a request with `marmarareceive` to get the credit from Pubkey 2. In this case, the Pubkey 2 needs to lock the half of credit with 1500 MCL for taking the credit of 3000 MCL. Then the first Pubkey 1 gets half of its collateralized MCL as normal which is 1500 MCL. The formula is `Credit/(n-1)` for every stage. `n` is the number of nodes at any time during transfers in credit loop. At the first stage, if there is only issuer and holder, the 3000 MCL is paid to Pubkey 2 which is called holder in that case. After the request of Pubkey 2 with marmarareceive, the baton, credit is transferred to Pubkey 3 by using `marmaratransfer` function. While this is happening, the 1500 MCL is transferred to LCL for boosted staking. Now in the system, there is again 3000 in total but now shared as 1500 MCL by both Pubkey 1 and Pubkey 2. At the due date, when the blocks mature with time, each 1500 MCL is transferred from both Pubkey 1 and Pubkey 2 to the holder, i.e. the Pubkey 3 making 3000 MCL in total. Suppose there are 101 nodes in the system, the last holder only pays `3000/(101-1)` which is only 30 MCL to get a credit of 600 MCL. The system is collateralized at any stage and hence needing no avalists or blockchain fund to help in protection against the nonredemption process. Table 3 shows the results with all three Pubkeys for 3000 MCL issued by the Pubkey 1.

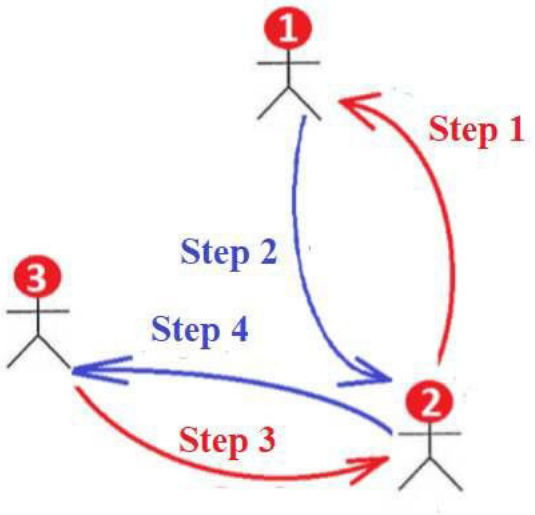

Figure 1. A Credit Loop with 3 Nodes

Table 3. Step by step explanation for 3 node-credit loop with settlement

		PUBKEY 1			PUBKEY 2			PUBKEY 3		
STEP	FUNCTION	NORMAL	LOCKED	LCL	NORMAL	LOCKED	LCL	NORMAL	LOCKED	LCL
1	MARMARARECEIVE		3000							
2	MARMARAİSSUE		0	3000						
4	MARMARARECEIVE					1500				
5	MARMARATRANSFER	1500		1500		0	1500			
	After Auto Settlement	1500		0			0	3000		

Figure 2 shows the credit loop settled at the end successfully. The function to display a creditloop is `marmaracreditloop` and the user just needs to know the baton txid (transaction id) owned by the holder. The result is actual output from the system and the source code and instructions for installation are given in [11].

```
./komodo-cli -ac_name=MCL3 marmaracreditloop 34555846919e6d1abf389978d9a818dcb66be1e18932bc96d8e024e126dabff7
{
  "result": "success",
  "myNormalAddress": "RM3TY6xvhcRADrWCpNcWLgo9FyGHwvnHde",
  "myCCaddress": "RMqibPZDKfWPxSYx8DT8fJkVirKZ7er1gn",
  "funcid": "T",
  "currency": "MARMARA",
  "batontxid": "34555846919e6d1abf389978d9a818dcb66be1e18932bc96d8e024e126dabff7",
  "createtxid": "bc653836bdaefaeb3089ed2c0c2a54febdc0bd3f1cb0fad87212dfac0667bd5d",
  "amount": 3000.00000000,
  "matures": 1265,
  "batonpk": "020d7616a0136ceeddfed3bc5c42137baf8c212cbce7632737108ffdfbdf537843",
  "batonaddr": "RM3TY6xvhcRADrWCpNcWLgo9FyGHwvnHde",
  "batonCCaddr": "RMqibPZDKfWPxSYx8DT8fJkVirKZ7er1gn",
  "ismine": 1,
  "LockedInLoopCCaddr": "RM1DDGMQQyiMYdz6XSW3GwQWMiNv2y7gFE",
  "LockedInLoopAmount": 0.00000000,
  "n": 2,
  "numerrors": 0,
  "creditloop": [
    {
      "txid": "bc653836bdaefaeb3089ed2c0c2a54febdc0bd3f1cb0fad87212dfac0667bd5d",
      "funcid": "R",
      "issuerpk": "020f8598553bc987e24e4706acc631c5dabd85d8997db6b5444eec7455f8fa5e08",
      "issueraddr": "R9xyUQ29eM1tVd3A3ryirpPVAqaTB43Kzf",
      "issuerCCaddr": "RV8gfUibQQcedQRRPU2T8JD3BV1B4V76ci"
    },
    {
      "txid": "ca22d0236a9efdd59f18e2c983fe00efd4644a0d9cf02aeb8573c12c879673db",
      "funcid": "I",
      "receiverpk": "03a4d6da38777ad8e3b4824910929b06231209f93dfc0086f376a254c9d490aa2c",
      "receiveraddr": "RVwSzCCD5hAprKkKfNvG1Q1QN8GU9a7TES",
      "receiverCCaddr": "RCTNiwwbCtPHfn8etmrxJvGHURjAzcGPyA"
    }
  ]
}
```

Figure 2. Credit loop settled successfully at the end.

3.2 Trust based Blockchain solution for Non-redemption

Trust based blockchain solution is not fully implemented on blockchain yet. But the requirement specifications are completed. This system works similar to existing trust based analog blockchain in paper based post-dated cheques however with several schemes against non-redemption. The Figure 3 shows how it is used. In trust based blockchain system, the issuer creates money, i.e. the credit similar to banking system. The difference is that credit created herein is circulated in a credit loop unlike the bank where credit in general stays as contract between the bank and borrower. All nodes starting from the issuer until the prior node to holder are collectively responsible to pay for the debt of holder.

There are several protection layers against the defaulting. First of all, each node will most probably have activated, i.e. locked coins which may be used as collaterals in case of defaulting. There may be avalists behind any of the endorsers or issuer nodes. Avalists back the credit with the activated coins collateralized against non-redemption. There may be also physical collateralizations to be used in case of non-redemption. A blockchain fund as final land of resort against nonredemption is also to be utilized.

In trust based mode, the credit loops cannot be participated by anyone if the data is not validated by a trustful escrow service such as distributed notaries. All nodes in a credit loop should have their

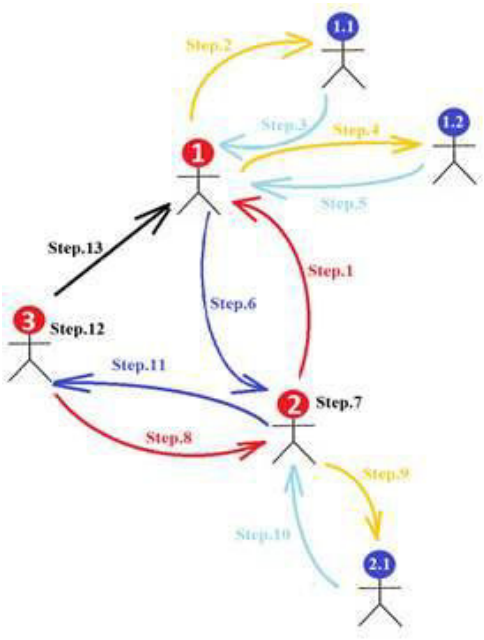

Figure 3. Trust based Blockchain for Credit Loops

data validated by an escrow service to participate in credit loop system. Pure miners or stakers can still be happily using the system without associating their data in the Marmara blockchain. Data entry is the most critical process. Not anyone should be able to insert data into Oracles. Data entry should be through escrows. Escrows may be Web based escrow services, Crytpo Exchanges, Notaries, Post-offices, Law Bureaus, Credit Unions and even Banks. Escrows provide trust layer into blockchain. Currently in analog version of post-dated cheques, the cheques are initiated by banks and banks do not give a cheque to every one. They provide both data and manual settlement process. Oracles should provide data to blockchain only through escrows to make sure there is no identity theft. It will be done through a Know-Your-Customer (KYC) procedure by those escrows.

The trust based system needs to use Oracles functions in blockchain.

Table 4 gives step by step explanation shown in Figure 3.

Table 3. Step-by-step explanation for 3 nodes in the credit loop.

Step1: Pubkey2 makes `marmarareceive` from Pubkey1 by requesting 2 avalists without escrow.
Step2: Pubkey1 makes `marmararequestaval` from Pubkey1.1 (Avalist 1)
Step3: Pubkey1.1 (Avalist 1) makes `marmaraapproveaval` to Pubkey1
Step4: Pubkey1 makes `marmararequestaval` from Pubkey1.2 (Avalist 2)
Step5: Pubkey1.2 (Avalist 2) makes `marmaraapproveaval` to Pubkey1
Step6: Pubkey1 makes `marmaraissue` to Pubkey2.
Step7: Pubkey2 makes `marmarabatonapproval`
Step8: Pubkey3 makes `marmarareceive` from Pubkey2 for 1 avalist
Step9: Pubkey2 makes `marmararequestaval` from Pubkey2.1 (Avalist 3)
Step10: Pubkey2.1 (Avalist 3) makes `marmaraapproveaval` to Pubkey2
Step11: Pubkey2 makes `marmaratransfer` to Pubkey3
Step12: Pubkey3 makes `marmarabatonapproval`
Step13: Autosettlement is made by miners with `marmaraclaimautosettlements`.

4 CONCLUSION

Two blockchain solutions were suggested to solve the main problem of non-redemption in post-dated cheques. The paper explains Marmara Credit Loops and how they can be used to solve non-redemption problem via the use of stakeable timelocked coins as collaterals by using Crypto Conditions in Komodo blockchain technologies.

The trustless solution is almost complete while the requirements for trust based system are completed. Both trustless solution and trust based one are to be accommodated on the same blockchain.

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