Acikgoz, A., F., Apak, S. / Journal of Yasar University, 2019, 14/53, 31-41

A Conceptual Proposal on Blockchain: Distributed Ledger of Corporate Liquidity

Blokzincir Üzerine Kavramsal Bir Öneri: İşletme Likiditesi Dağıtık Kayıt Defteri

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Abstract: Referring to the famous analogy which explains blockchain concept as "A wants to transfer money to B", the study reverses it as "B wants to have trade credit from A" then the paradigm will rather be crediting instead of debiting. To what extent will a supplier allow trade credit upon request is a decision of accounts payable, but the extent to which a third party will offer more trade credit for the first borrower will require a reconsideration of that customer's liquidity which is restricted by the accumulation of trade credit along with bank credit already held. The usage of trade credit and the level of bank credit are the main liquidity generators in a supply chain. The study reveals the need for a distributed ledger of liquidity based on trade credit by proposing the use blockchain technology to create zones of private distributed ledgers on liquidity. In the future, the suggested zones are expected to cooperate with government agencies and central bank in the challenge for eliminating informal transactions within the economy. Hence, trade credit in the short-term and relative liquidity indicators are presented in order to reveal the potential for an economy by giving evidence with the long-term data available in Turkey. The study depicts a conceptual proposal with the potential implications therein. Along with their blockchain challenge, the proposal in this study will strategically help the commercial banks which could consider investing on such a shared ledger of liquidity in terms of trade credits on firm-level.

Keywords: Blockchain, Distributed Ledger, Liquidity, Trade Credit

Öz: Çalışma, blokzincir kavramını "A, B'ye para transferi yapmak istiyor" şeklinde açıklayan meşhur analojiyi "B, A'dan ticari borç edinmek istiyor" şeklinde tersine çevirmekte ve böylece paradigmayı değiştirerek borçlanmaya yönlendirmektedir. Bir tedarikçinin; bir müşterisinden gelen talep üzerine hangi düzeye kadar ticari borç kullandırabileceği, bir ticari alacak edinme kararıdır. Ancak, üçüncü bir tarafın ilk borç alana açacağı ilave ticari borç veya kredi ise o müşterinin potansiyel olarak hali hazırdaki ticari borcunun ve/veya banka kredisinin birikimli düzeyleri ile sınırlandırılmış olan likiditesinin tekrar değerlendirilmesini gerektirecektir. Ticari borç ve banka kredisi bir tedarik zincirindeki temel likidite yaratıcıları olmaktadırlar. Çalışma, ticari borcu esas alan dağıtık bir likidite kayıt defteri gereksinimini ortaya çıkartarak, likidite konusunda özel dağıtık kayıt alanlarının yaratılabilmesi için blokzincir teknolojisinin kullanımını önermektedir. Gelecekte, önerilen bu alanların devlet kuruluşları ve merkez bankası ile ekonomideki kayıtdışı işlemlerin azaltılmasında işbirliği yapmaları beklenmektedir. Bu kapsamda, kısa vadeli ticari borç ve ilgili likidite göstergeleri ile bir ekonomideki bu yönde bulunan potansiyeli ortaya koyabilmek amacıyla Türkiye örneğinde mevcut uzun vadeli veriler çalışmada kanıt gösterilerek sunulmaktadır. Çalışma kavramsal önerisiyle ilgili potansiyel sonuçları ve etkileri de ortaya koymaktadır. Bu çalışma ile getirilen öneri, özellikle ticari borç üzerinden firma düzeyinde burada ifade edilene benzer bir paylaşımlı kayıt ortamına yatırım yapmayı değerlendirebilecek ticari bankalara, blokzincirinin yarattığı gelişime karşılık vermenin yanı sıra stratejik yararlar da sağlayacaktır.

Anahtar Sözcükler: Blokzincir, Dağıtık Kayıt Defteri, Likidite, Ticari Borç

1. Introduction

A blockchain or a distributed ledger is mostly competitive with trustworthiness, and yet, trust is considered as a function of liquidity, no matter what or how to transfer, invest, save, or be found credible. This study therefore tries to take the attention on the other side of the "trust street" which is not debiting but crediting by suggesting an addition of a liquidity ledger. Thus, this study hereby proposes the use of a distributed ledger to track the short-term assets and liabilities of all types of businesses within a preserved supply chain extension. Those assets and liabilities in the short-run refer to the firm liquidity appraised by its own indicators. Banks evaluate the liquidity in the first place to determine the credibility of a potential credit customer. The suggested ledger can be either public or private between chain participators. Nevertheless businesses would prefer to have trade credit, as much as they can, rather than bank credit or any type of financial credit. However, the potential of both is measured by liquidity. If a firm uses trade credit option for short-term financing to the extent its liquidity power allows, its bank credit option would consequently be restricted. Banks would like to sell much more bank credit to the businesses, yet businesses may limit the scene by rather using trade credit.

Blockchain is an innovative technology for which no actor could have been ready and equipped enough for its challenges. As the most affected side of the economy, the banks consider this new comer technological structure as a threat, and they have been investing in blockchain technology. However, most of their efforts focus on the cryptocurrencies and money transfer. The banks are not expected to be the crypto miners of tomorrow neither. They are rather overwhelmed with the explicit characteristics of blockchain via cryptocurrencies on money transfer, payment, and investment issues.

Trust is the most competitive specification of a blockchain or a distributed ledger. Nonetheless, trust or creditability is also a result of liquidity power in business life which requires saving, investing, transferring, and paying. What if some of the banks' customers use the blockchain technology for their money transfer? Is all of the potential customers ready for such a transition? Apparently, not at all. Will the world use only noncash payments tomorrow or are all of the retailers

ready to accept cryptocurrencies in payments? It will really take some time. Have the cryptocurrencies offered a safe and sustainable portfolio return recently? Barely not. Is the only customer type that the banks offer credit or deposit accounts are individuals? No. Money is needed to facilitate trade which is becoming more complex as new actors are participating the game every day. In addition, trade could only exist by crediting first and by paying what was owed at the end. This study therefore tries to take the attention on the other side of the trust street as crediting this time, by proposing the use of a distributed ledger to track the short-term assets and liabilities of the businesses. Those assets and liabilities in the short-run refer as the liquidity which is commonly appraised by liquidity indicators. Banks evaluate the liquidity, in the first place, so as to determine the credibility of a potential credit customer. The suggested ledger will be either public or private including a bank as an intermediate transition point. To what extent will a supplier release trade credit is a decision of accounts payable. A reconsideration of the customer's liquidity which is restricted by the accumulation of trade credit or bank credit already held will be needed to assess the level for a third party in offering more trade credit for the first actor.

Short-term trade credit along with bank credit used are considered to be the main liquidity developers for the businesses in a typical supply chain. The study reveals the need for a distributed ledger of liquidity based on trade credit and proposes the use blockchain technology to create zones of private distributed ledgers with a bank among trading participants based on trade credit. In the future, the suggested zones are expected to cooperate with government agencies and central bank in the challenge for eliminating informal transactions in the economy. Hence, trade credit in the short-term and relative liquidity indicators are presented in order to reveal the potential for an economy by giving evidence with the long-term data available in Turkey. The study depicts a conceptual proposal with the potential implications therein. Along with their blockchain challenge, the proposal in this study is expected to strategically favour the commercial banks which will possibly invest in such a shared ledger of liquidity content on firm-level explicitly in terms of trade credit. The study concludes that the evidence for Turkey on liquidity indicators, especially for the potential of trade credit, ensures this conceptual proposal with the potential implications worth considering and favourable for the commercial banks in their challenge with blockchain technology development.

2. Literature Review and Theoretical Framework

2.1. Blockchain

Distributed ledgers or blockchain as a technology have received extensive attention in both financial and nonfinancial applications recently (Nofer et al., 2017). The relevant academic literature on blockchain has started to develop by 2012 (Yli-Huumo et al. 2016). Blockchain technology comes with wide innovations on the transaction systems in terms of security, resiliency and efficiency (Ahram et al. 2017). Predating smart contracts are useful within a blockchain as the most known solution of this technology (Christidis and Devetsikiotis, 2016; Mik, 2017; Zuberi, 2017). Distributed ledgers have the potential to alter payment, clearing and settlement within the framework of central banks (Bott and Milkau, 2017). Blockchain and related technological innovations can promote banking by lowering operation costs, clearing trades, and increasing transparency (Zuberi, 2017). A blockchain or a set of ordered blocks is a ledger of transactions both recorded chronologically in a set of linearly associated blocks where the later retain the hash of the previous ones (Crosby et al. 2016; Gupta, 2017). Public blockchains are open to anyone who wants to participate, however, in consortium blockchain there are a set of preselected participants or a private blockchain has a central institute rather serving in its own supply chain (Lavanya, 2018).

Trade credit has not specifically been among the applications of blockchain technology yet. Blockchain supplies decentralization with a countless level of transactions that could be stored in a chain and they are nearly impossible to damage or alter, however, scalability still remains as a technical challenge (Zheng et al., 2016). Decentralization is an asset, on the other hand, the most ensured financial vulnerability for businesses is determined by the banks along with the credit assessment processes. Blockchain based systems can alter traditional information systems even in supply chain operations (Namiot et al., 2017).

Lewenberg et al. (2015) recommends a directed acyclic graph with blocks to be reference multiple predecessors and larger volumes of transaction along with security in forgiving nature against malicious attacks. We similarly think that the main supply chains, which are trade credit initiated, will therefore be beneficial in such a blockchain structure. Trade credit ledger will consequently contain the shared blockchain transactions in the recentralized system with a bank and every party in the private chain will continuously synchronize information on trade credit flows and repayments with the other parties. Nevertheless, transformation in governmental service may also benefit from the general purpose technology of blockchain (Olnesa et al., 2017). Blockchain's distributed architecture may challenge with scalability and efficiency, however, we can still benefit on the gaps that our financial system creates by the use of distributed ledgers which will fill those gaps in rather than substituting them. (Larios-Hernández, 2017). Blockchain provides basically a cryptographic digest for the proof of existence in documentation (Crosby et al., 2016). Banks are found to be one of the most presumably ready type of institutions in confirming transactions for the blockchain which requires a high level of computational power (Yli-Huumo et al. 2016). The blockchain technology does not have only challenges but also offers opportunities for banking (Cocco et al. 2017).

The core and novelty of blockchain technology is recognized with the Bitcoin protocol which comes with the ledgers of transactions that keep track of the trading that occurs within the partners of the protocol (Reuter, 2015). Thus, the blockchain technology can provide a potential and efficient support to the current financial system and infrastructures (Cocco et al., 2017), nonetheless this support requires new ideas worth to discuss. Besides, the challenges, such as

scalability and governance, the irrevocability of transactions and the required legal framework or litigation as a regulation technology remain limiting for the blockchain technology in banking as well (Lootsma, 2017; Zuberi, 2017; Webster and Charfoos, 2018). Lenders would rather like a central authority to control deposits (Martinson and Masterson, 2014).

R3 consortium has started with 9 members in 2014 and recently spread across 22 countries, with more than 80 institutions with the initiative Corda, which works as a collective body of member banks on distributed ledgers and blockchain of the future. Since banks have challenges on costs and revenue generation, they rather work together on the potential of blockchain. R3 with Corda works as a distributed ledger so as to record and manage financial agreements with the expectation of a global network in order to favour shared costs and common data in a new platform (Khan et al. 2017).

2.2. Trade Credit and Blockchain

Firms either use trade credit or bank credit for short-term financing, the latter is rather a source of long-term financing. The potential of trade credit has been neglected as a whole except money transfer, payment in drafts, checks and bonds and/or discounting by the banks. Trade credit is widely preferred by smaller firms, as well as in the periods of financial distress (Petersen and Rajan, 1997; Molina and Preve, 2012).

Recent financial literature also confirms this potential by the wide consideration and appraisal of trade credit as a supplement or a complement for bank credit (Burkart and Ellingsen, 2004; Chong and Yi, 2011; De Blasio, 2003; Demirguc-Kunt and Maksimovic, 2001; Gupta et al., 2014; Psillaki and Eleftheriou, 2015). Trade credit is positively significant on profits (Martinez-Sola et al., 2014), improves financial flexibility (Harris, 2015), and relies mostly on trust (Troya-Martinez, 2017) which is the main strength of the blockchain technology as well.

3. Methodology

The study depicts the idea with the original designs by the authors (Figure 1a, 1b, 2, and 4). In these figures, the study basically visualizes and asserts a proposal with the help of a conceptual framework of blockchain or distributed ledger technology available. The study demonstrates that the main liquidity developer is rather trade credit than bank credit in a typical supply chain, and it also reveals the need for a distributed ledger of liquidity based on trade credit and it proposes the use of blockchain technology to create zones of private distributed ledgers. The expectations on these suggested Private Distributed Ledger (PDL) zones of the future are also added to refer the potential cooperation with government agencies and central bank in the challenge for eliminating informal transactions in the economy.

The evidence has been added on corporate liquidity dynamics in Turkey for all types of businesses using real sector (non-financial) data archives of the Central Bank of the Republic of Turkey (CBRT) offered for 1996 to 2015 in the years 1999 to 2016. The study also follows a fundamental methodology so as to determine the potential of trade credit focused on the liquidity characteristics of the firms from NACE II Classification of CBRT data. The study uses the three years average values from aggregate balance sheets between 2002 and 2016 for the last three years on each year revealing the descriptive properties of the raw data of a selection for all types of businesses in Turkey. These averages are considered to reflect the potential for the main variables of liquidity. Those variables have been assessed and calculations have been done for the below given liquidity indicators.

For the non-financial businesses in Turkey, the study uses a data set consisting of 45 observations for approximately 8,187 firms a year as an average for the total of 122,803 businesses from all industries or sectors within the time span of 15 years (2002 to 2016) which begins by 2002 (average of last three years; 1999, 2000, and 2001) till 2016. It practices a similar methodology as Acikgoz and Apak (2017a and 2017b) by using the ratio of short-term trade credit to short-term bank credit (Acikgoz and Apak, 2017b and 2017c) to measure the potential of trade credit as the main source of value transaction need. The study represents trade credit and some leading liquidity indicators in the long-term in Turkey[1].

Discussing the idea with the help of relevant references in the literature, the study basically checks whether trade credits are worth considering as an interim transaction vehicle for liquidity by presenting and discussing the findings on the long-term so as to endorse strategies and policy implications along with the suggestions. The suggested distributed ledger of liquidity will keep track of a set of variables. These variables serve as the eminent and concealing components and/or indicators of liquidity. All variables, which are suggested to be followed, are given in the abbreviations below:

CA (Current Assets) is taken as the sum of: C&CE (Cash and Cash Equivalents); STS (Short Term Securities); STAR (Short Term Accounts Receivable); STI (Short Term Inventories); and OCA (Other Current Assets).

STL (Short-Term Liabilities) is taken as the sum of: STBC (Short-Term Bank Credit); STTC (Short-Term Trade Credit); STCII of LTBC (Short-Term Capital Installments and Interest of Long Term Bank Credit); and OSTL (Other Short-Term Liabilities).

Other variables are:

[1] Note that, inflation accounting standards are implemented in Turkey in 2004, for one year, consequently financial statements for 2004 are adjusted by inflation (Table 1 and Figure 3).

BC (Bank Credit); LTBC (Long-Term Bank Credit); and TL (Total Liabilities)[2].

The ratios and other variables are as follows:
CR (Current Ratio); C&CER (Cash and Cash Equivalents Ratio); NWC (Net Working Capital as the difference of CA and STL); and ATR (Acid-Test Ratio).

Unless otherwise stated, all variables of the study are given as a percentage of STL.

4. Results and Suggestions

The study follows the fundamental titles of CA and STL to determine the potential of using trade credit. First, we assume that the more firms use their trade credit potential with respect to their liquidity allowance, the less their new trade credit could be validated or authenticated within the private blockchain unless they could offer new assets as collateral.

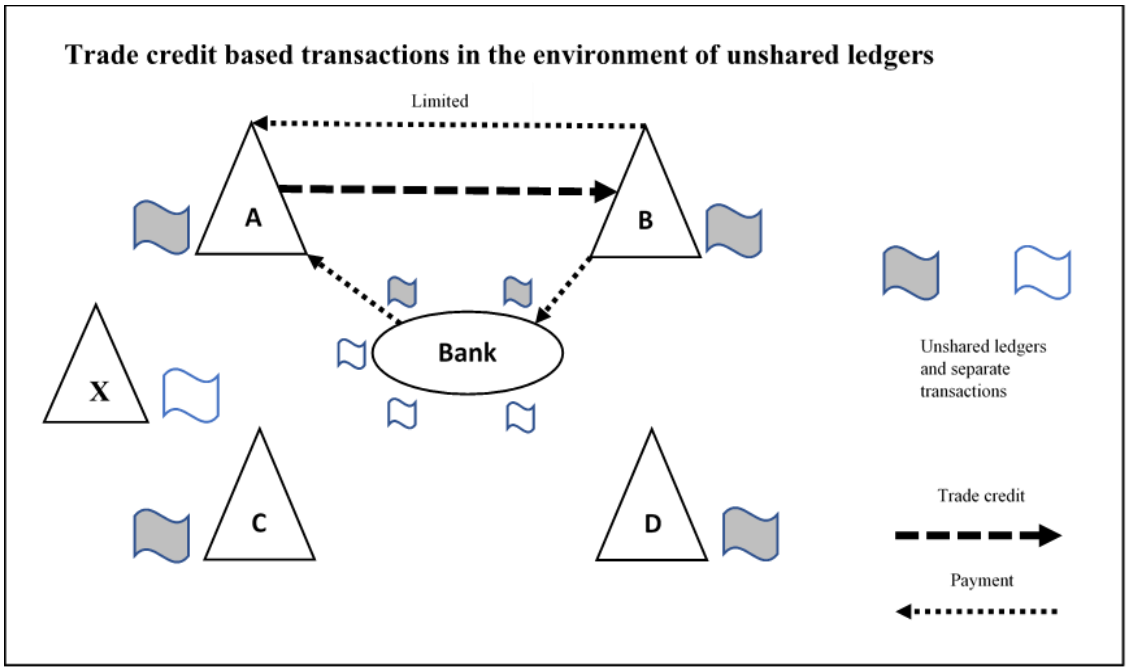

Figure 1a. The need for a distributed ledger of liquidity based on trade credit

Source: Original design of the authors.

[2] Note that STBC includes STCII of LTBC, and BC consists of STBC and LTBC.

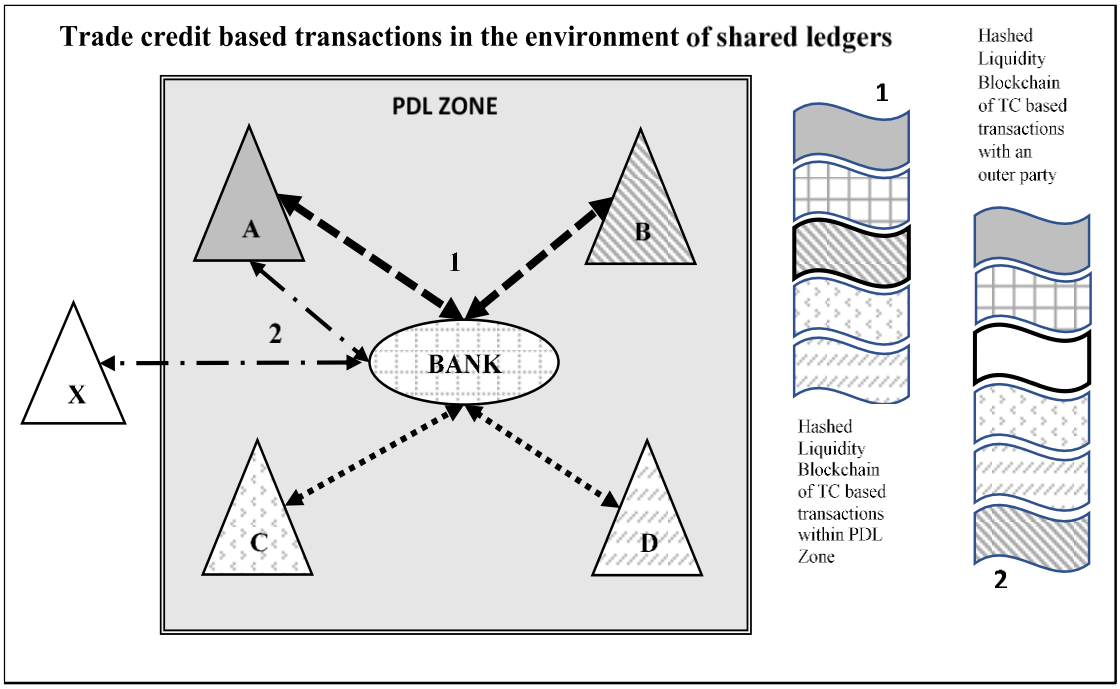

Figure 1b. Blockchain in a PDL zone of liquidity based on trade credit

Source: Original design of the authors.

Figure 1a represents the need for a distributed ledger of liquidity based on trade credit. In the environment of unshared ledgers, no business is aware of the amount of trade credit owed to each party in a supply chain. For instance, Firm A allows trade credit to Firm B with the expectation of a repayment mostly via a bank transaction and the cash payment remains very limited as a result of the current regulations. However, other parties such as Firm C and Firm D are not informed on the amount of trade credit owed by Firm B at least in the accounting year and they eventually could not consider the risk of accumulating trade credit on Firm B or whether Firm A could receive the payment in order to appraise their financial risk in trading.

In Figure 1b, the conceptual proposal of the model presents a Private Distributed Ledger (PDL) zone with a participating bank, helping for not only the partakers of the zone but also the firms which are not yet contributed in the zone, such as Firm X. Through the blockchain and shared ledger transactions, the firms in the zone will therefore be precisely and concurrently aware of the trade credit and the relevant payment flows within the firms of the zone. The proposal adds the hashed liquidity blockchain of trade credit-based transactions with an inner (1) and/or an outer party Firm X (2). The banks will therefore have the opportunity to track the flow in terms of trade credit which is the only substitution for bank credit in the short term. The banks could also have the chance of pursuing the trade credit flows in their credit demand assessment processes for their corporate customers.

The level of trade credit held by the firms of a supply chain deserves to be considered in terms of bank transactions for payments. These bank transactions in between the parties of a typical supply chain will be reconsidered by the boundaries of trade credit owed. Nevertheless, any amount of supplementary liquidity developed in the supply chain will be a result of either STTC or STBC with an assumption of limited load transferred from the LTBC.

Figure 2 lightens the potential use of short-term trade credit. There is only a limited influence of long-term trade credit on liquidity, since the firms generally use trade credit rather in the short-term. Similarly, long-term bank credit has a predictable effect or load on the short-term bank credit. Therefore, a better assessment of liquidity could be attained much practically by the intermediary bank which could assess the transactions in terms of the trade credit allowed and repaid.

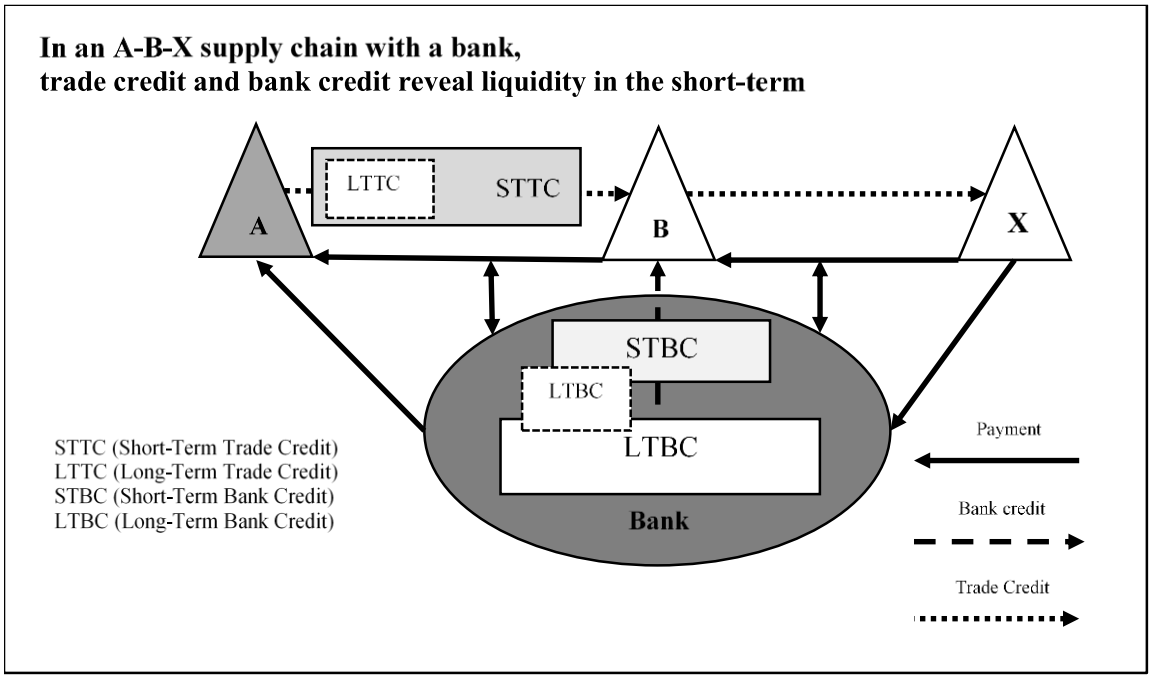

Figure 2. Trade credit with bank credit as liquidity developers in a supply chain

Source: Original design of the authors.

Table 1 summarizes the aggregate liquidity indicators as a potential for the conceptual proposal. The ratio of STTC to STBC signals the significance of STTC for all firms in the long-term evidence of Turkey. Since the real source of transaction is always trade credit component which is most likely to exist in the short-run within the firm's liabilities and bank credit has been rather a supplement for trade credit in the nature of business life, the study concentrates on trade credit and/or its ratio to bank credit.

The formation of the proposed "distributed ledger of liquidity" will simply require smart contracts in order to be a part of the blockchain actors in the infrastructure designed and run by a commercial bank.

Table 1. Aggregate trade credit and relative liquidity indicators of all sectors in Turkey

Average aggregate ratios of last three years in percentages	*Last 15 years (2002 – 2016)*
STTC / TL	14.22
BC / TL	22.61
STTC / STBC	165.69
STTC / STL	36.54
STBC / STL	22.38
STCII of LTBC / STL	4.39
CR	134.17
C&CER	25.38
ATR	94.97
NWC	34.17
Number of firms	122,803
Average number of firms a year	8,187

Source: Calculations from CBRT data.

Trade credit serves rather as a variable of short-run. STL of the firms consist rather of inventories or of trade credit in Turkey (Table 1). Additionally, the bank credit level is found to be relatively limited in the short-term. The level of short-term liabilities would better to be decreased for a better liquidity position in terms of NWC, CR, and ATR. Table 1

and Figure 3 reflect the potential on liquidity in terms of trade credit with the long-term evidence of nonfinancial sector businesses operating in Turkey. This potential of trade credit could be easily traced with the increased visibility by the STTC/STBC ratio in Figure 3, which reflects calculations based on CBRT data for STTC and STBC as percentage of STL (CBRT, 2016; Acikgoz and Apak 2017a, 2017b, and 2017c). Figure 3 also depicts that STBC serves as a substitute for STTC in the long-term.

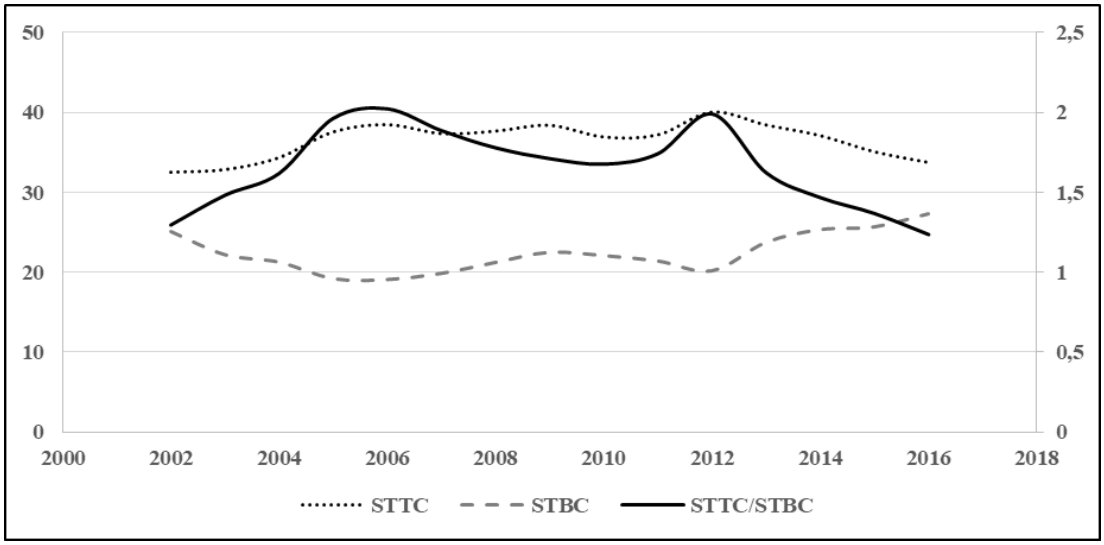

Figure 3. STTC and STBC as a percentage of STL versus STTC to STBC ratio in Turkey (2002-2016)

Source: Calculations from CBRT data.

5. Conclusion

The commercial banks could strategically favor in investing on such a shared ledger of liquidity in terms of trade credits on the firm-level along with their reactions for the ongoing blockchain challenge. The suggestion of the study for the commercial banks is to act in a leading role on the scene of the efforts for the formation of such a proposed distributed ledger of liquidity in terms of trade credit pathways.

The most trusted third party to facilitate and approve any firm's trade credit-based transactions will most expectedly be the banks, since they always act as an intermediary in all transactions.

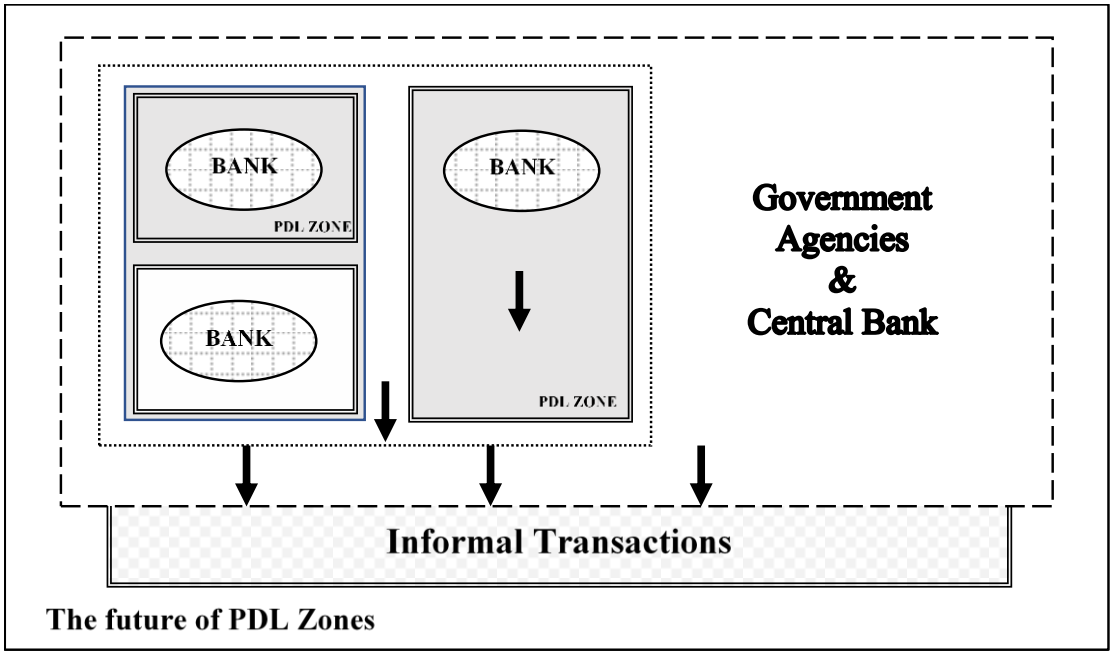

Figure 4. PDL Zones in the future (cooperating with government agencies and central bank)

Source: Original design of the authors.

The study presents the idea of using trade credit as the value of transactions. Presumably, the designers of blockchain technology will expectedly find this idea strategically appealing to create the relative and immutable ledgers on a decentralized basis. Figure 4 replicates that PDL Zones in the future will cooperate with the government, governmental agencies, and the central bank, in the challenge for eliminating any kind of informal transactions. As a limitation for of the study, we agree that it is a conceptual proposal and that the findings consist of local and aggregate averages mainly derived from ratio analysis. We also agree that trade credit is in the scope of trade secrets. However, we believe that taking the totals of trade credit as a percentage of STL, or more practically, the ratio of STTC to STBC as the variable will preserve the confidentiality in trading. The study can-help the commercial banks consider trade credit as the main value of transaction on their way to construct a set of private distributed ledgers of liquidity on firm levelto cope strategically with threatening blockchain framework for the near future. The possible losses due to blockchain challenge could be prevented with the conceptual suggestion of this study as an alternative proactive strategy. The blockchain technology could therefore help crediting transactions to improve trust in between firms and intermediating commercial banks.

Acknowledgments

We present our gratitude to the Central Bank of the Republic of Turkey (CBRT) for the nonfinancial sector's data archives and statistics, and all of the remarkable works by the authors and/or the institutions cited in the below given references.

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