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Digital Money Adoption and Redemption Convenience[*]

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Abstract

This paper studies how platform redemption policy affects digital money adoption. Using spatial variation and transaction-level data from the Toronto-based Bunz barter platform, we document that proximity to redemption opportunities is associated with increased user token acceptance, redemption, and inflows from other users but not statistically different token outflows to other users or token holdings. Moreover, token inflows and outflows both dropped dramatically when token redemption was halted. We interpret these results using a quantitative heterogeneous-agent search-theoretic model of money and characterize the optimal platform redemption policy.

JEL Classification: *E41, E42, G23*

Keywords*: Redemption, Token Adoption, Digital Currency*

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1 Introduction

Redeemability has played a central role in the rise and fall of different forms of money throughout history. It is widely observed that when new forms of money emerge, they are more likely to be accepted as a medium of exchange if they come with a guarantee of being "redeemed at face value" by their issuer, and they often collapse when this promise is cast into doubt. Redeemability has been used to explain the circulation of early promissory notes in the 10th century (Von Glahn, 2005), the universal success of token coinage systems (Steinsson, 2021), the booms and busts of banknotes observed in major European countries and the U.S. during the 18th to 19th centuries (Volta, 1893; Hamilton, 1946; Gorton, 1996; Velde, 2007; Friedman and Schwartz, 2008; Sanches, 2016), the prevalence of bank deposits in current day transactions (Weber, 2012; Gu et al., 2013), and the recent crisis of cryptocurrencies, specifically the stablecoin UST (Liu, Makarov, and Schoar, 2023).[1] However, to date, there is little quantitative evidence on how redeemability affects the circulation of money.

In this paper, we provide micro-level empirical evidence on the effect of redeemability on the circulation of money. We make use of a unique data setting of an online platform where, through a series of quasi-experiments, the platform introduced a redeemable digital currency and later discontinued its redemption policy. We posit a simple conceptual framework through which we dissect the aggregate circulation of money on the platform into individual users' decisions to accept, hold, spend, and redeem money. Then, we analyse how the roll-out and cessation of redemption affected these micro-level decisions both theoretically and empirically. By doing so, we provide detailed evidence of the mechanisms through which redeemability affects the circulation of money.

Our data documents user activities in the Bunz barter economy in Toronto, a simplistic

[1]Historically, the promise of redemption has been offered in many ways, including the conversion of currency into gold, other circulating currencies, government-backed fiat, reductions in taxes or regulatory expenses, and conversion into other valuable commodities or assets. (CITE ADD)

setting that allows for identifying the effect of redemption on money circulation through quasi-experiments. Founded in 2013, the Bunz community at its peak consisted of roughly ten thousand daily active users meeting in person to conduct barter of used goods without cash after connecting through a mobile app platform. At one point, the platform introduced its own digital currency, BTZ, to facilitate transactions. The platform initially made BTZ redeemable at a set of local stores for retail goods at a fixed exchange rate to Canadian dollars, but later discontinued its redemption policy. These events create a unique opportunity to study how redeemability affects the circulation of money on the platform.

To study the effect of redeemability, we examine both the aggregate monetary shocks, as well as cross-sectional variation in redemption convenience driven by the spatial heterogeneity of redemption merchants. Formally, we model a search economy where redeemable money could endogenously emerge as the medium of exchange, and agents have heterogeneous access to redemption. Under this framework, redeemability encourages the acceptance of money both directly because of demand for redemption goods and indirectly because of strategic complementarity in the use of money as a medium of exchange. At the aggregate level, redeemability ensures that money circulates in equilibrium, whereas the lack of redeemability leads to equilibria where money is never accepted. However, micro-level decisions reveal a more complicated story. At the cross-sectional level, higher exposure to redemption opportunities causes agents to be more willing to accept and redeem money but not necessarily more willing to hold or spend money in peer-to-peer transactions. Thus, it takes optimally designed redemption policies to maximize the effect of strategic complementarity in the use of money and obtain maximal gains in economic transactions, especially when redemption is costly to the monetary authority. The tension between the redemption value and payment value of money is also important to the financial risk of the monetary system, in line with Goldstein, Yang, and Zeng (2023).

We take these model predictions to the data and quantify the size of each effect. We leverage the rollout and cessation of BTZ redemption as exogenous variations to examine the effects of aggregate redeemability shocks. To further study the effect of cross-sectional variation in redemption opportunities, we construct a sample of frequent users and measure their exposure to redemption opportunities by their geographical proximity to redemption stores. Specifically, we measure redemption exposure by the monthly average number of redemption merchants within a radius of one kilometre around the user's location over the BTZ redemption program rollout period. We construct a set of measurements to capture users' decisions to accept, hold, spend, or redeem BTZ, as well as the flow of BTZ at the user level. With our measurements, we estimate the effect of aggregate redeemability shocks, cross-sectional variation in redemption opportunities, and their interaction on individual decisions and money flows. Our empirical strategy leads to the following findings.

First, in the period of redemption rollout, we find that exposure to redemption opportunities was associated with higher token acceptance and inflow from other users, higher outflow due to redemption, but not increased token holdings or outflow to peer-to-peer transactions. Users whose average distance to redemption stores was 3 km were 7.218% more likely to accept BTZ relative to users whose average distance to redemption stores was 20 km. They had 184.969% larger BTZ inflows[2] and they had 297.175% higher BTZ outflows to BTZ redemption stores. Specifically, users whose average distance to redemption merchants is 3 km on average receive BTZ tokens equivalent to 0.45 CAD, while users whose average distance to redemption merchants is 20 km on average receive BTZ tokens equivalent to 0.18 CAD. However, we do not detect any statistically important difference in BTZ holdings or BTZ outflows to peer-to-peer transactions. Consistent with the model, these results suggest that the redemption value of money is a first-order driver underlying the effect of redeemability on money acceptance. In addition, through examining the transaction network of users, we find that all users, regardless of their own exposure to

[2] This constitutes 23.205% more transactions with BTZ inflows, 123.531% larger inflows per transaction, and 6.195% more likely to have any BTZ inflow each month.

redemption opportunities, primarily transact with users with high redemption exposure.[3] This suggests that redeemability further drives global acceptance of money through the strategic complementarity nature of using money.

Second, after the collapse of redeemability of BTZ, we find that the initial cross-section differences in money acceptance and inflows disappeared, and the aggregate drop in token acceptance and token flows to and from other users far exceeded the cross-sectional difference between users due to different spatial proximity to redemption opportunities. In fact, the effect size of the aggregate shock to redeemability is comparable to [10 to 20] times the effect of one standard deviation increase in the cross-sectional exposure to redemption during the rollout period. Consistent with model predictions, these results suggest that the collapse of redeemability does not only affect individuals' behaviour proportional to their respective redemption exposure, but also generates a global effect where the economy transitions from an equilibrium that accepts money as a medium of exchange to one that does not.

Combining these results together, we quantify how redeemability increases money acceptance both directly due to the demand for redemption goods and indirectly due to strategic complementarity in money's role as the medium of exchange. In addition, our empirical analysis sheds light on an important caveat that suggests that when the redemption value is greater than the transaction value of money, the monetary authority risks draining reserves in supporting frequent redemption. Therefore, it takes optimally designed redemption policies to promote money circulation and sustainability simultaneously. Calibrating our model to the data, we show that in the Bunz economy, [holding fixed the average level of redemption exposure, uniformly distributed redemption opportunities attain the maximal level of aggregate transaction and sustainability.]

Our paper contributes to several strands of literature related to money and monetary

[3] Specifically, a user who was 10km away from redemption stores transacted on average with users who were only 1.1km away from redemption stores.

systems.

First, our paper is closely related to the literature focusing on the endogenous emergence of money as a medium of exchange (Kiyotaki and Wright, 1993; Burdett, Trejos, and Wright, 2001; Diamond and Rajan, 2006; Lagos, Rocheteau, and Wright, 2017; Goldstein, Yang, and Zeng, 2023) (add more). The literature has formally examined many features that affect the capacity of an object to circulate as a medium of exchange[4], and redeemability is widely acknowledged as among the important factors determining the success of money. (Volta, 1893; Hamilton, 1946; Gorton, 1996; Velde, 2007; Friedman and Schwartz, 2008; Weber, 2012; Gu et al., 2013; Sanches, 2016; Steinsson, 2021; Liu, Makarov, and Schoar, 2023; Rogoff and You, 2023) However, the analysis to date has been mostly qualitative or theoretical.[5] We contribute by presenting comprehensive empirical evidence on how the rollout and reduction of redeemability affect agents' micro-decisions of money adoption and aggregate circulation behavior of money, guided by a simple theoretical framework that extends the "first generation" new-monetarist search models.[6]

More specifically, our paper contributes to the literature on the adoption of digital currencies and electronic payment systems. (Ackerberg and Gowrisankaran, 2006; Jack and Suri, 2014; Beck et al., 2018; Aggarwal, Kulkarni, and Ritadhi, 2020; Li, McAndrews, and Wang, 2020; Ho et al., 2022; Crouzet, Gupta, and Mezzanotti, Forthcoming; Alvarez et al., 2023) A central question in this literature is to investigate the factors that determine the adoption of a new currency or payment technology. In particular, Crouzet, Gupta, and Mezzanotti (2023) and Alvarez et al. (2023) are the most closely related to our work. Both papers highlight that strategic complementarities significantly affect the adoption dynamics of electronic payment systems and that policy interventions in the forms of an adoption

[4]Either mediating transactions between individuals or entities such as banks.

[5]Within this literature, Rogoff and You (2023) formally present a model of redeemable money, where the authors model redeemable platform money as a claim for future consumption that users can obtain from a monopolistic platform seller, rather than a medium of exchange among individuals. Our model incorporates the valuation of money deriving from both the redemption goods and peer-to-peer transactions.

[6]See Lagos, Rocheteau, and Wright (2017) for a comprehensive survey of "first generation models" and their extensions.

subsidy or a reduction of alternative payment methods can increase the levels of adoption. In our paper, rather than viewing money adoption as a single action, we further investigate the decisions to accept, spend, and redeem money as the constituents of adoption, and quantify the effects of redemption on each individual decision. In addition, while Alvarez, Argente, and Van Patten (2022) examine the optimal subsidy that promotes adoption, the analyses do not take into consideration the costs of subsidizing adoption. In our paper, we make explicit the cost and benefits of offering high redemption value in promoting money acceptance and derive the optimal redemption policy that arises from this tradeoff.

The rest of the paper is organized as follows. Section 2 provides more details on the Bunz economy. Section 3 formally introduces the model. Section 4 presents the empirical results of the redemption program. Section 5 concludes.

2 Background

This section provides relevant background regarding the BTZ redemption program in the Bunz economy and the data used for studying the effects of redeemability.

2.1 History of Bunz and BTZ Redemption

The Bunz barter community was founded in 2013 and consisted primarily of young millennial adults in Toronto who arranged to trade second-hand items such as clothing, accessories, plants, and groceries through a mobile app platform. The community's founder forbade cash transactions for ideological reasons, so the platform's roughly ten thousand daily active users, who were largely strangers meeting bilaterally in a decentralized manner, initially had to barter.[7]

The Bunz platform introduced a redeemable digital token, BTZ, in April 2018. Each user was endowed with 1000 BTZ upon digital wallet activation. Users could then send BTZ to other users and earn BTZ from the app by answering a survey, inviting friends to

[7]The platform enforced this ban on cash by removing any items asking for cash from the mobile app. Further details are provided in Wong (2022).

join the app, or posting new items. To promote the token, Bunz operated a token redemption program, which allowed users to purchase goods using BTZ at partner local stores at a fixed exchange rate of 100 BTZ to one Canadian dollar (CAD).[8] After accepting BTZ payments, the owners of local stores would then receive cash from Bunz HQ at the same fixed exchange rate. The platform did not buy or sell tokens apart from direct issuance to users and redemption at partner stores.

Figure 1 shows the location of the merchants and active users located in Toronto. As shown in the grey dots on the map, most active users live in the city centre of Toronto. Other users live sporadically in Toronto. As for the merchants. A total of 216 merchants at some point accepted BTZ as the payment method, and 155 of the merchants were located in Toronto. These merchants included 50 retail shops, 34 restaurants, 33 cafes, 20 service merchants, 15 bars, two beauty merchants, and one gallery in Toronto. Most of the merchants in Toronto are also located in the city centre of Toronto. Generally, users located in the city centre have higher redemption network exposure than users located in other areas. [9] Section 4 studies the cross-sectional relationship between token use and redemption convenience during the period when the BTZ redemption program was in operation.

Figure 2 shows the number of active merchants over time. We define the active merchants after they start to accept BTZ payments. Suppose the merchants do not accept BTZ redemption after a specific month. In that case, these merchants will be excluded from the active merchants group after that month. From April 2018 to December 2018, the number of active merchants increased continuously. Additionally, Bunz expanded the monetary supply from August 2018 to October 2018. The number of active merchants grew faster during this period. On September 10, 2019, Bunz halted redemption at retail and service-providing stores without giving any prior notice, causing some users to stop accepting BTZ

[8] In 2018, the average exchange rate was 1 CAD to 0.77 USD.

[9] Between September and November 2018, Bunz dramatically increased the supply of BTZ through helicopter drops to users in an attempt to drive user traffic. As documented by Wong (2022), the monetary expansion caused large and persistent increases in transaction volume and items posted on the platform among existing users, but did not detectably alter token acceptance patterns.

and rush to the remaining merchants to redeem their BTZ. On February 26, 2020, Bunz completely halted the Shop Local program but called it a temporary pause. Figure **??** plots the dynamic effect of redemption network exposure on redemption transaction volume over time, and no redemption can be found in the BTZ transaction record after March 2020. As documented by Wong (2022), reduced redeemability reduced aggregate transaction volume but did not alter the BTZ price of posted items. The lack of price adjustment likely reflects the difficulty of coordinating prices without a centralized currency exchange. Section 5 documents the change in token use following the collapse of the BTZ redemption program.

2.2 Data Description

Bunz provided timestamped data for the universe of items posted, messages sent, BTZ transactions, and user ratings after transactions. A unique feature of the data provided by the Bunz platform is that user activity with and without BTZ are both observed at high frequency. The geolocation of a large subset of users is also known. For these reasons, we can study how the adoption of digital money depends on a given user's proximity to redemption opportunities.

Our analysis sample includes users located in Toronto who posted more than 20 items from April 2018 to August 2019. We drop the users who post more than 70% of their items in only one month to ensure they are active for most of the months. Some users only provide their city of residence without specifying their exact location, so the Bunz platform assumes that these users live in the city centre. Hence, we exclude the users located in the area where the majority of users reside. This leaves 7,162 users in our sample.

Table IA1 reports the summary statistics of our baseline sample. On average, a user in our sample made 0.69 selling transactions and 0.60 buying transactions each month with standard deviations of 2.28 and 2.30, respectively.[10] The users posted 7.58 items per month

[10]A selling transaction refers to a BTZ transaction from the user to any other user address; similarly, a buying transaction refers to a BTZ transaction from any other user address to the user.

on average, of which 2.61 had an associated BTZ price, with standard errors of 20.12 and 9.89, respectively. It took on average 4.36 and 5.09 months for an average user to post the first item with BTZ value and to make the first selling transaction separately after they gain the ability to do so.[11] 1,332 users did not post anything with BTZ value, and 1,388 users did not sell anything from April 2018 to August 2019.

Table 1 summarizes the redemption transactions by merchant type: the total redemption Canadian dollar value, the total number of redemption transactions, the Canadian dollar amount per transaction, and the number of redemption transactions per merchant for different types of merchants in Toronto from April 2018 to August 2019. Cafes in Toronto receive the largest portion of the total number of transactions from users, which is 38.3%, followed by restaurants (24.5%) and retailers (26.8%). Retail shops in Toronto receive the largest portion of BTZ from users, which is 40.9%, followed by cafes (18.8%). Cafes receive the least BTZ per transaction (7.91 CAD per transaction), while service merchants are the most expensive to redeem (37.78 CAD per transaction). In terms of visiting frequency, cafes, and restaurants are the most popular merchant types: 46 times and 34 times per merchant; service shops are the least redeemed with only 8 times per visit.

One concern in our baseline sample pertains to selection bias: the users included in our sample may be influenced by the introduction of BTZ tokens. To mitigate this selection bias, we employed a different approach by selecting users based on their activities from April 2017 to April 2018, a year before the creation of BTZ. Similar to the selection criteria for the baseline user sample, these users are located in Toronto and have posted more than 20 items between April 2018 and August 2019. To ensure consistent activity throughout most months, we excluded users who posted more than 70% of their items in a single month. The summary statistics of the pre-BTZ rollout sample are presented in Table IA2. Not surprisingly, users in this sample are less active compared to our baseline sample as

[11] If users register an account before April 2018, we assume the registered month of the user is April 2018. Then we calculate the months between the first month they post items with BTZ value and receive BTZ from other users and the registered month of the user.

our selection criterion only. On average, each user in this sample conducted 0.43 selling transactions and 0.39 buying transactions per month, with respective standard deviations of 1.87 and 2.23. Additionally, users posted an average of 5.04 items per month, of which 1.62 had an associated BTZ price, with standard errors of 15.85 and 8.06, respectively.

3 Theory

In this section, we model the Bunz barter economy by extending the search-theoretic model of money with heterogeneous agents and partial acceptability proposed by Shevchenko and Wright (2004).[12] The novel feature of this model is that agents face heterogeneous opportunities for money redemption. This gives rise to new predictions on how money acceptance and money flow depend on cross-sectional differences in redemption convenience.

3.1 Primitives

A set of agents in the economy is denoted by N, with measure $\mu(N) = 1$. Each agent i can produce a unit of a certain type of goods, G^i, and can consume only one type of goods g^i. Agents cannot consume their own products, so they must meet and exchange goods with other agents in order to consume. Goods are perishable, and production is instantaneous. Each agent derives utility $u_i > 0$ from consuming a good, incurs cost $c_i > 0$ from producing a good, and we assume that $u_i - c_i > 0$ for all agents. Each agent discounts utility with time preference $r_i > 0$.

Agents meet randomly with Poisson rate $\alpha > 0$. The probability that agent i meets another agent whose product i can consume is $P(g^i \in G^j) = x$. Conditional on this, a "double coincidence of needs" has probability $P(g^j \in G^i \mid g^i \in G^j) = y$.

Money is indivisible, durable, and has zero storage cost. The money supply is denoted by $M > 0$. Following Wong (2022), we assume that one unit of money is always traded for

[12]Even though our framework features indivisible money, it is arguably more appropriate for our empirical setting than the popular Lagos-Wright (2005) divisible money framework, which does not allow for agent heterogeneity or partial money acceptance and, therefore, cannot be used to analyse cross-sectional currency adoption patterns.

one unit of a commodity, so as to match their finding that there is no inflation in the Bunz economy. Agents can also redeem money whenever a desire for the redemption good arises. Agent i receives a utility flow of u_i for redeeming one unit of money. To account for the fact that BTZ redemption is of varying convenience across users, depending on their distance to local merchants, we let the desire to redeem occur with heterogeneous flow probability ρ_i across agents. ρ_i follows a continuous distribution $\Phi(\rho)$, density ϕ, with $\text{supp}(\Phi) \subset [\underline{\rho}, \overline{\rho}]$ where $\underline{\rho} = 0$, $\overline{\rho} \in (0, +\infty]$.

Since the money supply is largely stable in the Bunz economy except during two periods of monetary expansion, we assume that agents not holding money are randomly issued money so that the total money supply is unchanged. For now, we allow issuance probability, denoted as $\sigma_i \geq 0$ for agent i, to vary across agents.

Therefore, each agent i is described by the vector of attributes $(u_i, c_i, r_i, \sigma_i, \rho_i)$. We assume that ρ_i and $(u_i, c_i, r_i, \sigma_i)$ are independently distributed. We denote the distribution of $(u_i, c_i, r_i, \sigma_i)$ as Ψ. Previously, we assumed that $u_i > c_i > 0$ and $r_i > 0$ for all i, which could be viewed as assumptions on $\text{supp}(\Psi)$. We additionally assume that $\sup\{\frac{u_i - c_i}{c_i} : (u_i, c_i, r_i) \in \text{supp}(\Psi)\} < \infty$.

3.2 Equilibrium Conditions

When agents meet in pairs, they barter and consume upon a double coincidence of needs. Upon a single coincidence of needs, the agent with the ability to produce the desired good faces a decision problem of whether to accept money from their transaction partner. We allow agents to use the mixed strategy of money acceptance and denote agent i's probability of accepting money as $\pi_i \in [0, 1]$. We denote the agents that accept money with positive probability in equilibrium by $\Pi = \{i \in N : \pi_i > 0\}$. We solve for steady-state equilibria where money flows in the economy, and agents' probability of holding money is independent of time.

The value function for agent i is denoted as V_m^i when i is holding $m \in \{0, 1\}$ units of money. Let m_i denote the probability that agent i has money in a steady state. Observe that

$M = \int_N m_i di$. We let $W = \int_N \pi_i(1 - m_i)di$. Then we have the following Bellman equations.

$$r_i V_0^i = \alpha x y(u_i - c_i) + \alpha x(1 - y)\pi_i(V_1^i - V_0^i - c_i)M + \sigma_i(V_1^i - V_0^i) \tag{1}$$

$$r_i V_1^i = \alpha x y(u_i - c_i) + \alpha x(1 - y)(u_i + V_0^i - V_1^i)W + \rho_i(u_i + V_0^i - V_1^i) \tag{2}$$

The following two conditions must hold in steady state. First, to guarantee stable money supply in the economy, we require

$$\int_N m_i \rho_i di = \int_N (1 - m_i)\sigma_i di. \tag{3}$$

Second, to guarantee steady money holdings for individual agents, we require

$$\alpha x(1 - y)m_i W + m_i \rho_i = \alpha x(1 - y)(1 - m_i)\pi_i M + (1 - m_i)\sigma_i. \tag{4}$$

Equation (4) implies that expected individual money holdings must satisfy

$$m_i = \frac{\alpha x(1 - y)\pi_i M + \sigma_i}{\alpha x(1 - y)(\pi_i M + W) + \rho_i + \sigma_i}. \tag{5}$$

3.3 Equilibrium Structure

We now solve for Nash equilibria where agents maximize value functions by simultaneously choosing π_i. Equations (1) and(2) show that each agent's problem simplifies to choosing $\pi_i \in [0, 1]$ to maximize $\pi_i(V_1^i - V_0^i - c_i)$. Their Nash equilibrium strategy is, therefore,

$$\pi_i = \begin{cases} 1 & \Delta_i > 0 \\ [0, 1] & \Delta_i = 0 \\ 0 & \Delta_i < 0 \end{cases} \tag{6}$$

where $\Delta_i = V_1^i - V_0^i - c$. By rearranging the Bellman equations, we have that

$$\Delta_i = \frac{(u_i - c_i)[\alpha x(1 - y)W + \rho_i] - c_i(r_i + \sigma_i)}{r_i + \rho_i + \sigma_i + \alpha x(1 - y)(\pi_i M + W)}. \tag{7}$$

It follows that $\pi_i = 1$ if and only if

$$\rho_i > \frac{c_i(r_i + \sigma_i)}{u_i - c_i} - \alpha x(1 - y)W. \tag{8}$$

Recall that $\mathbf{x_i} = (u_i, c_i, r_i, \sigma_i)$ follows the distribution $\Psi(\mathbf{x})$. We let $t_i = \frac{c_i(r_i+\sigma_i)}{u_i-c_i}$. Note that given $\Psi(\mathbf{x})$, the joint distribution of $(u_i, c_i, r_i, \sigma_i)$, we can derive the distribution of t_i, which we shall denote as $G(t)$ with density g. By our assumptions, $\text{supp}(G) = [\underline{t}, +\infty)$, where $\underline{t} \geq 0$. Therefore,

$$E[\pi_i|\rho_i = \rho] = \int_{\underline{t}}^{\rho+\alpha x(1-y)W} g(t)dt = G(\rho + \alpha x(1 - y)W). \tag{9}$$

Equation (9) shows that in any equilibrium, $E[\pi_i|\rho_i = \rho]$ increases in ρ.

3.4 Existence of Non-monetary Equilibria

The first prediction of this model is that the platform can eliminate the non-monetary equilibrium by raising redemption convenience. To compare the trading behaviour of agents with different redemption convenience ρ_i, we assume that all agents without money are issued the same amount of tokens from the platform in every instance.

Assumption 1. Token issuance $\sigma_i = \sigma > 0$ for all agents i.

The appendix shows that σ always exists to satisfy steady individual money holdings and stable aggregate money supply. The existence of a steady-state Nash equilibrium can then be shown using techniques developed by Shevchenko and Wright (2004). We say that an equilibrium is *non-monetary* if no agent accepts money, i.e., $\mu(\Pi) = 0$. Otherwise, we say it is *monetary*.

Proposition 1. *There exists at least one equilibrium. If $\overline{\rho} \leq \underline{t}$, then there exists a non-monetary equilibrium. Otherwise, all equilibria are monetary.*

Proof. See appendix. □

3.5 Money Acceptance, Flows, and Holdings

The second prediction of the model is that money will flow from agents with low redemption convenience towards those with high convenience because the latter are more likely to accept money for goods.

We characterize equilibrium money acceptance, money holdings, and transaction volume as follows. Equations (6) and (7) imply that there exists a two-dimensional comparison, agents with ρ_i greater than $t_i - \alpha x(1-y)W$ accept money and agents with lower ρ_i do not. Since we assume that $\underline{\rho} = 0$, and $\rho_i \perp t_i$, there always exists a positive measure of agents who do not accept money. Since $\Phi(\rho)$ is continuous by assumption, the boundary case of $\Delta_i = 0$ contains at most a set of agents with measure zero.

By equation (5), the conditional expected money holdings $E[m_i|\rho_i = \rho]$ is globally non-monotonic in ρ, and admits intervals where it is locally increasing, decreasing, or constant in ρ. For each agent, the flow of barter transactions is $B_i = \alpha xy$. The expected flow of money-based sales of goods is $S_i = \pi_i \alpha x(1-y)M(1-m_i)$. The expected flow of money-based purchases of goods is $P_i = \alpha x(1-y)Wm_i$.

Comparative statics can be summarized as follows:

Proposition 2. *In any monetary equilibrium, conditional on redemption convenience $\rho_i = \rho$,*

1. *Expected money acceptance $E[\pi_i|\rho_i = \rho]$ increases in ρ;*
2. *Expected money-mediated sales flow $E[S_i|\rho_i = \rho]$ increases in ρ;*
3. *Under the assumption that $E[m_i|\rho_i = \rho]$ is constant in ρ, expected money-mediated purchase flow $E[P_i|\rho_i = \rho]$ is constant in ρ.*

Proof. See appendix. □

Part (1) of Proposition 2 follows immediately from Equation (9), which states that agents accept money for two reasons — first, to redeem money directly, and second, to purchase goods from other users. Therefore, the likelihood that an agent accepts money increases with the probability that she can redeem money.

Part (2) follows from the fact that to sell a good for money, an agent must (i) be willing to accept money and (ii) currently hold no money. Both are more likely when she is more likely to redeem money.

Part (3) follows from the fact that agents are always willing to exchange money for goods, so the purchase flow of an agent is directly proportional to her money holdings. Therefore, assuming that money holdings are constant in redemption probability, average purchase flow must also be constant in redemption probability.

4 BTZ Rollout and Redemption Network

4.1 Redemption Network and Merchant Visit

We compute the merchant exposure as the number of merchants which accept BTZ as a payment method within a radius of one kilometre around the user's location.[13]

First, we validate whether users with higher network exposure redeem BTZ more often and large token redemption quantity with the merchant. We define redemption network exposure as the average number of merchants within 1 km of users from April 2018 to August 2019. For robustness check, we assign the users to either the high or low exposure group based on whether their average number of merchants is greater or less than the median number of merchants, respectively. Users without any nearby merchants are assigned to the control group.

In Table 2 Columns (1) and (2), we estimate the aggregate redemption response to network exposure. On average, a one standard deviation increase in network exposure is associated with 0.115 (*s.e.*=0.012), 0.111 (*s.e.*=0.012), and 1.973 (*s.e.*=0.204) standard deviation increase in the number of redemption transactions, BTZ redeemed, and the likelihood of redemption per month, respectively. For users with high exposure, we observe even

[13] Bunz provides location-based service and records the user's longitude and latitude.

larger effects, as they redeem 0.344 (*s.e.*=0.029) standard deviation more trades, redeem a higher amount of BTZ by 0.332 (*s.e.*=0.029) standard deviation, and are 5.282 (*s.e.*=0.46) standard deviation more likely to redeem.

Then, we further break down by merchant type in columns (3)-(12). Retail shops induce the largest redemption responses. On average, one standard deviation increase in retail shop exposure induces 0.127 (*s.e.*=0.015) standard deviation more trades per month.

Cafes and restaurants rank second and third. Describe coefficients. A one standard deviation increase in cafes is associated with a 0.091 (*s.e.*=0.013) standard deviation more trades in cafes, while a one standard deviation increase in restaurants corresponds to 0.081 (*s.e.*=0.013) standard deviation more trades in restaurants.

Among merchants that accept BTZ, service shops and bars are the least utilized. However, despite their relatively low usage, we still observe statistically significant impacts on redemption behaviours. Specifically, a one standard deviation increase in bars results in a 0.040 (*s.e.*=0.012) standard deviation of more redemption transactions, while a similar increase in service shops leads to a 0.045 (*s.e.*=0.013) standard deviation of more redemption transactions in those establishments.

We further implement two additional validations. First, we check whether our sample selection criterion drives the redemption results. In Table IA3, we use the pre-BTZ sample[14] to estimate the coefficients. The coefficients are quite similar to our baseline results. Retail shops still induce the largest impact on redemption behaviour, followed by service shops, cafes, restaurants, and bars.

Second, we further test whether the merchant type composition affects users' redemption choices. If the redemption network facilitates token usage, we expect users' redemption composition to be mechanically correlated with the nearby merchant-type composition. Ta-

[14]The pre-BTZ sample is frequent users located in Toronto who posted more than 20 items in 2017. See Appendix Table IA2 of these 4,108 users who registered and were active before BTZ was introduced.

ble 3 reports the regression results of this test:

$$\frac{Redeem\_Num_{merchant\_j}}{TotalRedeemNum_i} = \beta Merchant\_Ratio_{i,j} + \alpha_i + \epsilon_i$$

$$\frac{Redeem\_Amount_{merchant\_j}}{TotalRedeemNum_i} = \beta Merchant\_Ratio_{i,j} + \alpha_i + \epsilon_i$$

where $Merchant\_Ratio_{i,j}$ is the ratio of the number of merchant type j to the total number of merchants in the one kilometre around user i. Users pay more redemption visits and spend more BTZ tokens with the dominant merchant type in their neighborhood. The restaurants exhibit the largest impact: redemption share with restaurants increases by 10.4% (*s.e.*=2.2%) when the restaurant share increases by one standard deviation. The magnitude is followed by retail shops 9.8% (*s.e.*=1.9%), bars (6.2%, *s.e.*=2.1%), cafes (3.4%, *s.e.*=1.9%), and service-type merchants with the least impact of 1.2% (*s.e.*=1.9%). The results still hold if we use the quantity of BTZ tokens: retailers lead with the 10.6% (*s.e.*=1.9%) impact, followed by restaurants (10.0%, *s.e.*=2.2%), bars (5.6%, *s.e.*=2.1%), cafes (3.5%, *s.e.*=2.0%), and the service shops have the minimal positive impacts (2.2%, *s.e.*=1.9%).

4.2 BTZ adoption

Next, we investigate the influence of the redemption network on the introduction of BTZ tokens. We assume users adopt BTZ tokens if they post an item with BTZ value. To assess token adoption, we utilized four variables: the proportion of posts containing BTZ value out of the total posts (*BTZ_Post_Ratio*), a binary variable indicating whether the user made at least one post with BTZ value, the log number of posts with BTZ value, and the time-lapse in days between the user's first post with BTZ value and their registration date. If the user registers before April 1st, 2018, we assume the registration date will be April 1st, 2018.

Table 4 shows the regression results of the following equation at the individual level.

$$BTZ\_Adoption = \beta Exposure_i + \alpha_i + \epsilon_i$$

On average, a one standard deviation increase in network exposure is associated with a 2.067% (*s.e.*=0.348%) increase in the *BTZ_Post_Ratio*, a 1.377% (*s.e.*=0.339%) increase in the likelihood of adopting BTZ, and a 6.3% (*s.e.*=0.020%) increase in the number of posts with BTZ value. Furthermore, a one standard deviation increase in network exposure leads users to adopt BTZ tokens 8.733 (*s.e.*=2.047) days earlier.

For users with high exposure, we observe even more substantial effects. They post 12.6% (*s.e.*=0.050) more items with BTZ value, post their first item with BTZ value earlier by 7.682 (*s.e.*=5.285) days, and are 1.549% (*s.e.*=0.803) more likely to adopt BTZ. Additionally, users with high redemption network exposure exhibit a 4.574% (*s.e.*=0.857) higher *BTZ_Post_Ratio*.

Table IA4 replicates the same set of regressions with the pre-BTZ sample. While the effects are smaller than our post-BTZ sample estimations, they still maintain statistical significance. The reduced magnitudes in the pre-BTZ sample can be expected, considering that some users are categorized as "never-takers" due to their lack of current engagement within the Bunz community. Our baseline sample primarily consists of users who actively interacted with other Bunz users.

We also run one falsification test to rule out the possibility that users with higher redemption exposure are more active, thus with a higher probability of making a post earlier. To examine this, we calculated the time gap in days between the user's initial post, irrespective of whether the post accepted BTZ payment or not. Subsequently, we computed the time difference until the first post that did accept BTZ as a placebo test. Table IA5 shows no evidence that high-exposure users tend to post earlier, on the contrary, they tend to sell the first goods later.

4.3 Bunz Transaction: Buy or Sell

Next, we analyse the BTZ transactions within the Bunz community to examine user payment dynamics. Table 5 illustrates the impact of redemption network exposure on selling and buying transactions. A one standard deviation increase in redemption network exposure results in a 5.8% (*s.e.*=1.2%) more selling transactions, a 27.3% (*s.e.*=4.5%) more tokens received from other users, and a 1.6% (*s.e.*=0.30%) higher likelihood of selling items. Furthermore, we calculate the proportion of selling transactions in relation to the total transactions (*Sell_Ratio*) to determine the extent of selling activities. A one standard deviation increase in redemption exposure is associated with a 2.695% (*s.e.*=0.361%) increase in *Sell_Ratio*. However, the redemption network exposure has no impact on buying transactions. [15] [16]

4.4 Redemption Convenience by Distance

To provide the redemption convenience mechanism, we further test whether more redemption merchants located closer can induce stronger effects in BTZ token adoption. We compute the number of redemption merchants by four different distance ranges from the Bunz user location: nearest merchants ($Distance \leq 0.5km$), closer merchants ($0.5km \leq Distance \leq 1km$), farther merchants ($1km \leq Distance \leq 1.5km$), and farthest merchants ($1.5km \leq Distance \leq 2km$).

Table IA8 presents BTZ adoption effects for these four groups of merchants. The proximity of redemption merchants to users has a varying impact on users. A one standard deviation increase in the number of nearest merchants, closer merchants, farther merchants, and farthest merchants results in a 6.4% (*s.e.*=1.9%), 5.5% (*s.e.*=2.0%), 4.5% (*s.e.*=1.9%), and 1.4% (*s.e.*=2.0%) more posts with BTZ value, respectively. Similarly, one standard deviation more nearest and closer merchants can increase the probability of a BTZ post by 1.219% (*s.e.*=0.333%) and 1.297% (*s.e.*=0.339%); the effect decays to 0.964% (*s.e.*=0.330%) for farther merchants and 0.615% (*s.e.*=0.326%). The merchants located within one kilometre of a user provide the strongest incentive for the user to sell used goods for BTZ tokens, and the incentive gradually decays sharply as the distance increases to two kilometres.

Tables IA9 and IA10 report the heterogeneous effects on BTZ transactions by distance.

[15] Table IA6 demonstrates a positive effect of redemption network exposure on total transactions.
[16] Table IA7 presents slightly smaller coefficients if we use the pre-BTZ sample.

Consistent with token adoption results, the impact on BTZ transactions also diminishes for selling transactions as the distance increases: A one standard deviation increase in the number of nearest merchants predicts a 7.2% (*s.e.*=1.4%) more selling transactions, whereas a one standard deviation increase in the number of farthest merchants only leads to a 3.8% (*s.e.*=1.4%) increase. Moreover, the response of *Sell_Ratio* also drops from 2.74% (*s.e.*=0.35%) for the nearest merchant increase to 1.75% (*s.e.*=0.36%) for the farthest merchant. Then we turn to the buying transactions and find that the presence of redemption merchants does not significantly affect users' purchase behaviour from other users, regardless of where these redemption merchants locate.

4.5 Redemption Convenience by Merchant Type

Merchant type is another interesting dimension heterogeneity to explore: which types of merchants are more effective in promoting new payment adoption? As shown in Table 1, recall that cafes and restaurants are the most attractive BTZ redemption destinations, with 17 transactions per merchant per month, and service merchants are the least used type. Cafes and restaurants provide the largest convenience yields, and service merchants provide the least for users. This section tests whether the token adoption induced by different merchant types correlates with the convenience yields.

Table IA11 illustrates that restaurants and cafes are the most influential types of merchants for encouraging payment adoption, followed by retail shops, bars, and service shops. A one standard deviation increase in the presence of restaurants results in a 2.26% (*s.e.*=0.357%), 1.96% (*s.e.*=0.336%), and 9.0% (*s.e.*=0.019%) increase in *BTZ_Post_Ratio*, the probability of adopting BTZ, and the number of posts with BTZ value, respectively. Additionally, a one standard deviation increase in restaurants leads users to post their first item with a BTZ value 11.069 days earlier. Additionally, a one standard deviation increase in cafes corresponds to a 1.92% (*s.e.*=0.349%), 1.49% (*s.e.*=0.333%), and 7.2% (*s.e.*=0.019%) increase in *BTZ_Post_Ratio*, the probability of adopting BTZ, and the number of posts with BTZ value. Users would adopt BTZ tokens 8.592 days earlier with a one standard deviation increase in cafe exposure.

Similarly, Table IA12 demonstrates that cafes and restaurants are the most effective in facilitating transactions with BTZ. A one standard deviation increase in cafes results in a 5.7% (*s.e.*=0.015%) rise in transactions. Specifically, there is an 8.1% (s.e.=0.014%) increase in selling transactions, while no significant effect is observed on buying transactions. Furthermore, a one standard deviation increase in restaurants leads to an 8.1% (*s.e.*=0.014%) and 2.5% (*s.e.*=0.014%) more selling and buying transactions, respectively.

Table IA13 also shows that restaurants and cafes have the largest effect on the probability of BTZ transactions, followed by retail shops, bars, and service shops. One standard deviation increase in cafes and restaurants exposure elicits 1.8% (*s.e.*=0.003%) and 2.2% (*s.e.*=0.003%) more likely for users to sell items for BTZ.

4.6 Token velocity and Token Holdings

Then, we move to the analysis of the circulation of BTZ tokens. To measure the token circulation, we define the following token velocity:

$$Velocity_{from\_users} = \frac{BTZ\_from\_users_{i,t}}{Disposable\_Holding_{i,t}}$$

$$Velocity_{to\_users} = \frac{BTZ\_to\_users_{i,t}}{Disposable\_Holding_{i,t}}$$

$$Velocity_{redeem} = \frac{BTZ\_redeem_{i,t}}{Disposable\_Holding_{i,t}}$$

$$Velocity_{from\_Bunz} = \frac{BTZ\_from\_Bunz_{i,t}}{Disposable\_Holding_{i,t}}$$

where *Disposable_Holding* and *Holdings* are defined as

$$Holdings_{i,t} = Holdings_{i,t-1} + BTZ\_from\_Bunzi, t + BTZ\_from\_usersi, t - BTZ\_Redeem_{i,t} - BTZ\_to\_users_{i,t}$$

$$Disposable\_Holding_{i,t} = Holdings_{i,t-1} + BTZ\_from\_Bunzi, t + BTZ\_from\_usersi, t$$

In order to comprehend the overall impact of redemption exposure on the circulation of BTZ tokens, we analyse the proportion of total BTZ received from other users in relation to the total BTZ received ($Share_{from\_users}$), as well as the proportion of total BTZ redeemed in relation to the total BTZ sent by users ($Share_{redeem}$). Table 6 characterizes how tokens flow from user to user. A one standard deviation increase in redemption exposure corresponds to 0.97% (*s.e.*=0.146%) and 0.86% (*s.e.*=0.099%) increase in $Velocity_{from\_users}$ and $Velocity_{redeem}$, respectively. Similarly, $Share_{from\_users}$ and $Share_{redeem}$ would increase by 2.779% (*s.e.*=0.347%) and 3.917% (*s.e.*=0.446%) if redemption exposure of users increases by one standard deviation. However, the redemption exposure does not significantly affect $Velocity_{to\_users}$ and $Velocity_{from\_Bunz}$.

We conducted two additional validations to strengthen our findings. Firstly, we assessed the robustness of token velocity and share in relation to merchant exposure across different radii. The results, presented in Table IA14, indicate that merchants in closer proximity to users have a greater impact on the velocity and share of selling and redemption transactions. However, we observed no significant impact on the velocity of redemption transactions and helicopter drop across all distance radii.

Next, we replicated the analysis from Section 4.5 to examine token velocity and share. Table IA15 reveals that restaurants and cafes continue to exhibit the highest effect on the token velocity of selling and redemption transactions, followed by retail shops, bars, and service shops. Conversely, the exposure to all merchant types showed no significant effect on $Velocity_{to\_users}$ and

Tokens earned from selling more goods do not translate into stronger demand for purchase from other users, and no evidence that users accumulate tokens as a store of value. Instead, users immediately spend their money with the redemption network — the additional BTZ token demand created by the redemption network circulates back to Bunz. In this specific BTZ rollout case, we find evidence that the redemption network provides incentives for users to adopt and acquire more BTZ tokens; however, we find little evidence that investors are willing to keep a larger BTZ balance.

5 Redemption Network Collapse

5.1 Description of Redemption Network Collapse

The redemption network collapse provides another natural experiment to see users' behaviour in response to redemption failure. In good equilibrium, users recognise the token value and use BTZ as a medium of exchange to improve the efficiency of the exchange economy. However, in a bad equilibrium, BTZ tokens cannot induce more usage of the platform, that is $r\bar{h}o < \underline{t}$, we still end up with a non-monetary equilibrium. Based on our previous empirical analysis, BTZ only induces more goods selling in the Bunz community, however, the good diversity does not induce more peer-to-peer purchase behaviour. Thus, we find no evidence that BTZ helicopter drop increases the underlying $\bar{\rho}$. This section tests whether the Bunz community degenerated back to the barter economy after the redemption network collapse in March 2020.

5.2 BTZ Adoption Reverse: Evidence from Post data

We start with the selling posts with BTZ price quotes. Figure IA1 depicts the decline in the proportion of posts with BTZ value, which decreased from its peak of approximately 40% to around 10% in March 2021. Figure 3 also shows that the BTZ adoption failure happened almost simultaneously with the redemption collapse. The coefficients quickly dropped toward zero by June 2020.

Then, we run a set of difference-in-difference regressions to evaluate the BTZ adoption response to redemption network collapse:

$$BTZ\_Adoption = \beta Exposure_i * Post + \alpha_i + \epsilon_{i,t}$$

Table 7 Panel A shows the DID coefficients controlling the individual and month fixed effects. The DID coefficient for *BTZ_Post_Ratio*, the number of posts that accept BTZ payment, and the probability for users to post an item with BTZ value are -1.70% (*s.e.*=0.475%), -2.2% (*s.e.*=0.006%), and -1.37% (*s.e.*=0.294%). This suggests that the users with higher exposure to the redemption network give up BTZ payment faster. We then split our sample into pre-collapse and post-collapse and present the coefficients in Panels B and C. After the collapse, we see that BTZ adoption reversed and does not correlate with the redemption network. The higher token adoption almost completely reversed back when nearby merchants did not offer redemption convenience anymore.

5.3 BTZ Transaction usage: Evidence from BTZ Transaction data

After the redemption collapse, users with more merchants nearby do not receive tokens from other users. Figure 4 Panel A shows that users with more redemption network exposure receive more BTZ tokens before the redemption collapse. However, the coefficients decrease to around 0 after Bunz halts the redemption program. Table 8 also shows that one standard deviation increase in the number of merchants within 1 KM of users corresponds to 0.018 (*s.e.* = 0.004), 0.124 (*s.e.* = 0.021), and -1.501% (*s.e.* = 0.260) more decrease in the log BTZ transactions, BTZ received from other users and the probability of receiving BTZ. High-exposure users do not sell more goods for BTZ tokens anymore. Although users with more merchants nearby still successfully sell more items after the redemption collapse, the share of items successfully sold also drops by 0.856 (*s.e.* = 0.180) when the merchants around them increase by one standard deviation. Thus, the more goods induced by BTZ redemption also reversed after the collapse.

We further compute a variable of the number of BTZ selling transactions as a percentage of total posts made before and after the collapse. Column (4) of Table 8 shows that 0.86% (*s.e.*=0.180%) less posts settled with BTZ. However, Table IA16 shows that high-exposure users do not buy more goods from other users both before and after the redemption network collapse. [17]

5.4 Token Holdings after Collapse

Lastly, we examine the token circulation of the Bunz community. Table 9 shows that high-exposure stopped selling extra goods for BTZ as there is no incentive to acquire more tokens. One standard deviation more merchants around users corresponds to 0.724 (*s.e.* = 0.135) and 2.442 (*s.e.* = 0.738) more decrease in $Velocity_{from\_users}$ and $Share_{fromusers}$. However, users with more redemption merchants around still do not send more tokens to other users after the redemption collapse.

5.5 Survival Bias

We rule out redemption network collapse disproportionately squeezed out users in the areas with high redemption convenience. First, high-exposure users were not more likely to quit the Bunz community. Figure 5 shows that account cancellation rates stayed uncorrelated with the redemption network distribution, both before and after the collapse.

Furthermore, we show that high-exposure users do not trade less and have no extra decrease in selling posts. Table 10 shows that the collapse does not reduce the users' activeness more in the high-exposure areas.

We conducted further tests on the channel. Specifically, we ran regressions to examine the relationship between the log number of posts, a dummy variable indicating whether users posted at least one item in a given month, and the log number of ratings sent by users, with respect to redemption exposure on a month-by-month basis. The coefficients obtained from these regressions are reported in Figure IA2. This figure provides evidence that users with higher exposure to the redemption network are not necessarily more likely to remain active on Bunz.

[17] We aggregate the number of peer-to-peer transactions and the BTZ amount involved in buying and selling transactions at the individual level before and after the collapse of the redemption network. Subsequently, we conducted cross-sectional regressions to analyse the data and present the results in Table IA17.

To validate these findings, we replicated the aforementioned regressions and analysed the coefficient trends in Figure IA3. The results indicate no significant differences among the zero-exposure, low-exposure, and high-exposure groups.

6 Conclusion

Digital currency or digital payment rollout is not an overnight change toward a new monetary equilibrium. To address the double coincidence of wants, a standard approach is to build partnerships with merchants and enable consumers to redeem the digital currency for goods and services from these merchants. Our paper exploits the geographical variation of the Bunz community's redemption network to quantify its importance in digital currency adoption. The sudden collapse of the redemption network provides a unique reverse shock to identify the causal impact of redemption convenience.

Convenience yield does not always monotonically benefit the currency issuer. Too much convenience incentivizes users to redeem rather than wait for the next chance to intermediate the next transaction. New digital currency issuers need to balance the disadvantage of redemption convenience with the fees they can charge from transactions intermediate with the digital currency.

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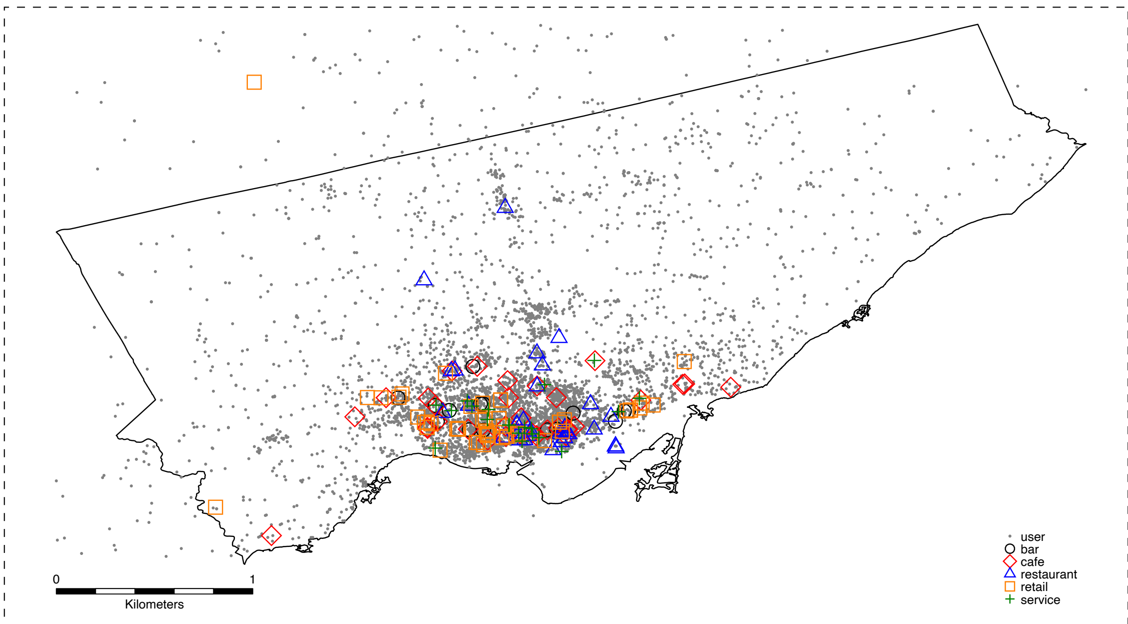
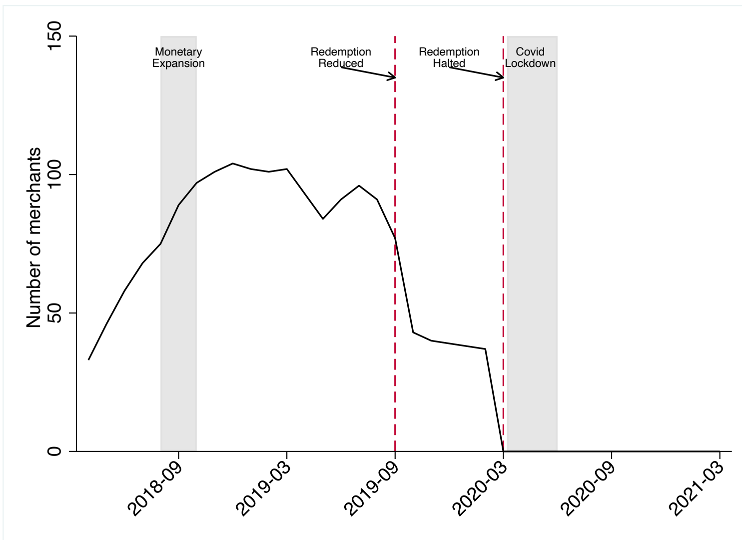
Figure 1. Map of users and redemption store locations



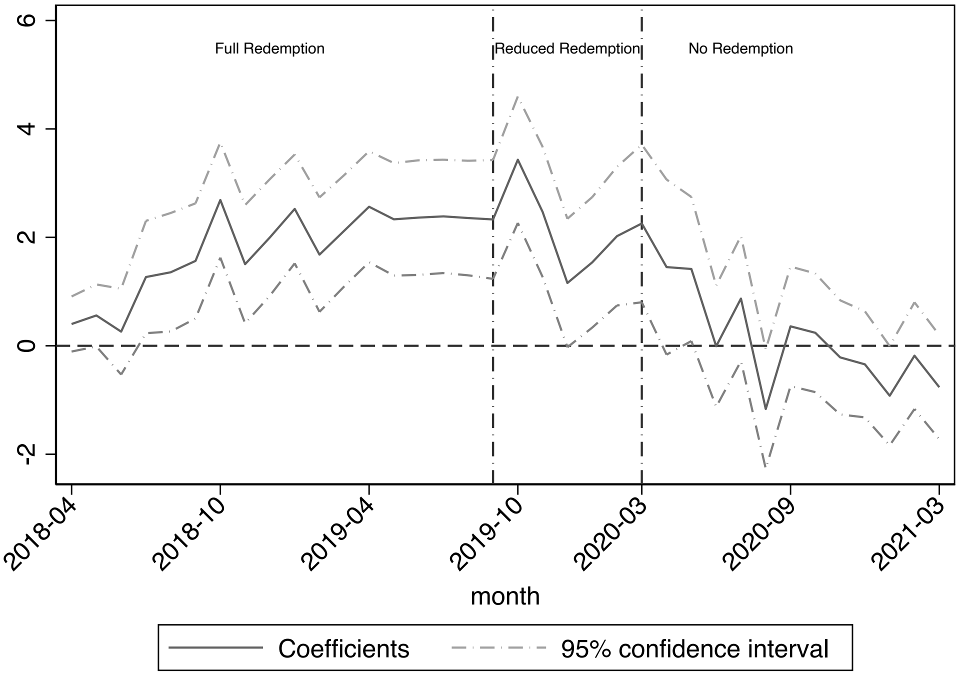
Notes: The map presents the location of the frequent users and redemption stores. Frequent users are defined as users with 20 item posts from April 2018 to August 2019. The users and redemption stores are in an area with a longitude between 79.11524° W and 79.63926° W and a latitude between 43.58100° N and 43.85546° N. This area includes Toronto and parts of its neighborhood.

Figure 2. Total number of merchants over time



Notes: The figure plots the number of active merchants that accept BTZ payments over time. Merchants are defined as active at the month of opening. If merchants no longer have redemption transactions after a specific month, these merchants will be excluded from active merchants.

Figure 3. Dynamic effect of redemption network on BTZ adoption

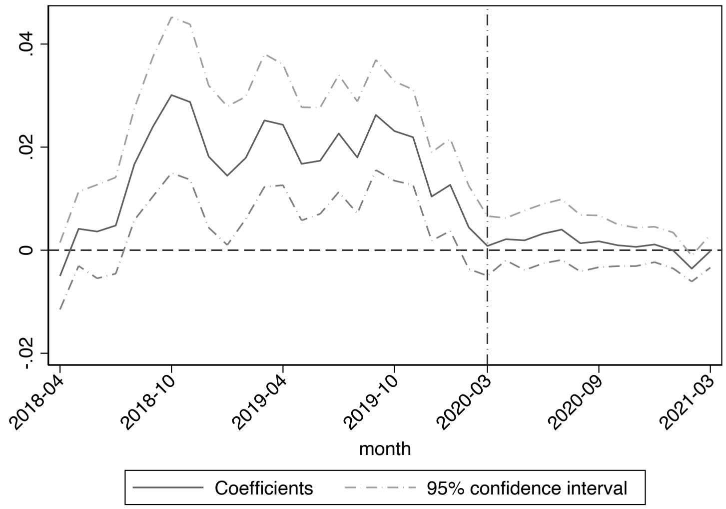


Notes: This figure plots the dynamic responses β_t of the ratio of the post with BTZ value to the redemption network by estimating the following cross-sectional regressions from April 2018 to March 2021:

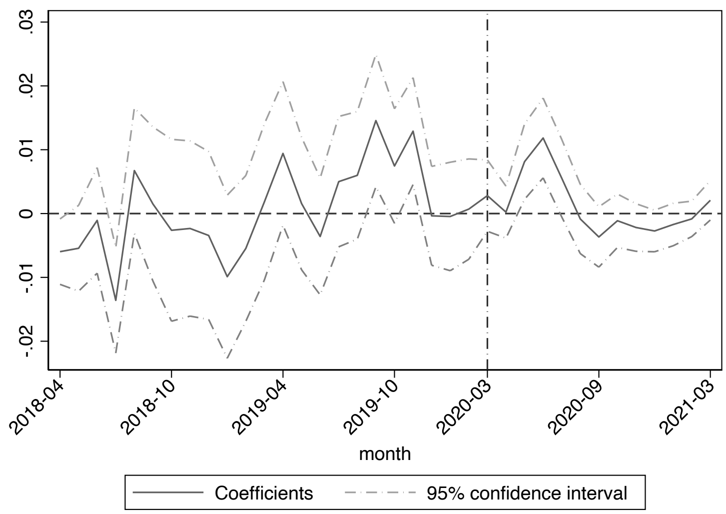
$$BTZ\_Post\_Ratio_{i,t} = \beta_t Exposure_i + \alpha + \epsilon_{i,t}$$

where, $BTZ\_Post\_Ratio_{i,t}$ is the ratio of the post with BTZ value of user i in month t. $Exposure_i$ is the average number of merchants within 1 km of user i.

Figure 4. Dynamic effect of redemption network on BTZ transaction



Panel A: Dependent variable $Trade\_LogNum_{from\_users}$



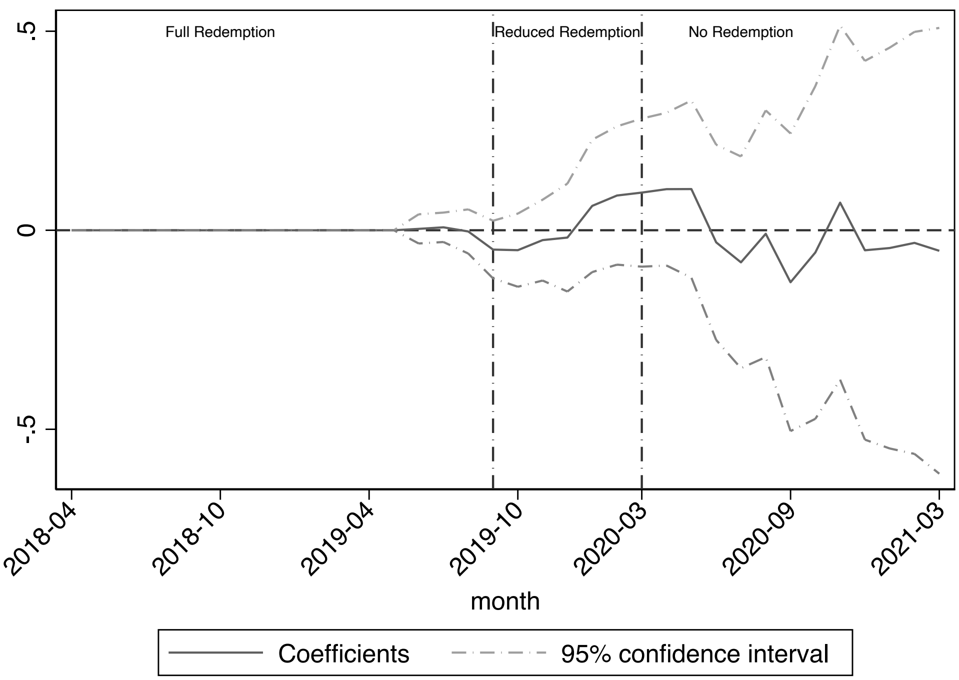
Panel B: Dependent variable $Trade\_LogNum_{to\_users}$

Notes: This figure plots the dynamic responses β_t of the ratio of the post with BTZ value to the redemption network by estimating the following cross-sectional regressions from April 2018 to March 2021:

$$Y_{i,t} = \beta_t Exposure_i + \alpha + \epsilon_{i,t}$$

where, $Y_{i,t}$ denotes the log number of selling transactions in Panel A, and the log number of buying transactions in Panel B. $Exposure_i$ is the average number of merchants within 1 km of user i.

Figure 5. Dynamic effect of redemption network on cancel rate



Notes: This figure plots the dynamic responses β_t of the account cancellation rate to the redemption network by estimating the following cross-sectional regressions from April 2018 to March 2021:

$$Is\_stale_{i,t} = \beta Exposure_t + \alpha + \epsilon_{i,t}$$

where $Is\_stale_{i,t}$ is the dummy variable that equals 1 if the user i cancels his account in month t. $Exposure_i$ is the average number of merchants within 1 km of user i.

Table 1. Summary statistics of redemption by merchant type

	Panel A: All users			
Merchant Type	Redemption Volume (Percentage of Toal)	Redemption Transaction (Percentage of Toal)	Amount Per Transaction (CAD)	# Transactions Per Merchant
Cafes	18.810%	38.283%	7.916	46.175
Retail Shop	40.980%	20.787%	31.760	15.727
Bars	7.995%	12.571%	10.246	28.111
Restaurants	23.216%	24.522%	15.252	33.869
Service Shop	8.999%	3.837%	37.780	8.241
Total	1,134,767.22 CAD	70,439	16.109	26.401
	Panel B: Analysis sample			
Cafes	14.754%	32.283%	8.740	17.351
Retail Shop	46.998%	26.838%	33.488	9.048
Bars	5.222%	9.042%	11.044	9.010
Restaurants	23.488%	27.221%	16.501	16.753
Service Shop	9.539%	4.616%	39.514	4.418
Total	600,250.34 CAD	31,388	19.123	11.765

Notes: The table provides a comprehensive overview of the redemption patterns. Panel A presents the redemption patterns of the sample users across various types of merchants, while Panel B displays the patterns for different types of merchants.

Table 2. Redemption behaviour response to redemption network

This table reports cross-sectional regressions of redemption on the users' exposure to the redemption network. In Panel A, the dependent variable is the normalized log total number of redemption transactions. In Panel B, the dependent variable is the normalized log total amount of BTZ. In panel C, the dependent variable is the average number of the dummy variable equal to 1 if the users make redemption transactions in a month. The independent variables are the number of merchants within 1 km of users and groups with different exposures. Users are allocated to the high(low) exposure group if users, on average, have more(less) merchants than the median average number of merchants, excluding the users who do not have any merchants around them. Users without any exposure to the redemption network are allocated to the control group. Robust standard errors are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	All Merchants		Cafes		Retails		Bars		Restaurants		Services	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Panel A: Dependent Variable $Trade\_LogNum_{redeem}$											
Exposure	0.115***		0.091***		0.127***		0.040***		0.081***		0.045***	
	(0.012)		(0.013)		(0.015)		(0.012)		(0.013)		(0.013)	
Low_Exposure		0.199***		0.086***		0.172***		0.165***		0.050*		0.151***
		(0.028)		(0.027)		(0.028)		(0.034)		(0.028)		(0.034)
High_Exposure		0.344***		0.235***		0.276***		0.074**		0.202***		0.131***
		(0.029)		(0.030)		(0.031)		(0.030)		(0.032)		(0.038)
	Panel B: Dependent Variable $BTZ\_LogAmount_{redeem}$											
Exposure	0.111***		0.093***		0.119***		0.039***		0.090***		0.035***	
	(0.012)		(0.013)		(0.013)		(0.012)		(0.013)		(0.012)	
Low_Exposure		0.195***		0.086***		0.176***		0.166***		0.060**		0.139***
		(0.029)		(0.027)		(0.028)		(0.033)		(0.028)		(0.034)
High_Exposure		0.332***		0.238***		0.275***		0.075**		0.224***		0.100***
		(0.029)		(0.030)		(0.030)		(0.030)		(0.032)		(0.035)
	Panel C: Dependent Variable $Trade\_Dummy_{redeem}$											
Exposure	1.973***		0.837***		1.170***		0.199***		0.735***		0.217***	
	(0.204)		(0.130)		(0.153)		(0.054)		(0.130)		(0.056)	
Low_Exposure		2.870***		0.606**		1.155***		0.815***		0.351		0.635***
		(0.430)		(0.249)		(0.239)		(0.163)		(0.220)		(0.145)
High_Exposure		5.282***		2.027***		2.425***		0.398***		1.634***		0.636***
		(0.456)		(0.293)		(0.290)		(0.141)		(0.271)		(0.171)
# Obs	7,162	7,162	7,162	7,162	7,162	7,162	7,162	7,162	7,162	7,162	7,162	7,162

Table 3. Redemption ratio responses to redemption network ratio by types

This table reports cross-sectional regressions of the ratio of redemption transactions of different types of merchants on the average ratio of different types of merchants within 1 km of users. In Panel A, the dependent variable is the average portion of redemption transactions that the user makes at type j merchants on the total redemption transactions. In Panel B, the dependent variable is the average ratio of BTZ amount redeemed at type j merchants on the total BTZ amount involved in redemption transactions. In our sample, 4,326 users never redeemed any tokens, 1,981 users do not expose to the redemption network, and 1,373 users had no merchants around them and redeemed nothing from merchants from April 2018 to August 2019. Robust standard errors are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	Panel A: Dependent Variable $\frac{Redem\_Num_{merchant\_j}}{TotalRedemNum}$				
	(1) Cafes	(2) Retails	(3) Bars	(4) Restaurants	(5) Services
Merchant_Ratio	0.034*	0.098***	0.062***	0.104***	0.012
	(0.019)	(0.019)	(0.021)	(0.022)	(0.019)
	Panel B: Dependent Variable $\frac{Redem\_Amount_{merchant\_j}}{TotalRedemAmount}$				
Merchant_Ratio	0.035*	0.106***	0.056***	0.100***	0.022
	(0.020)	(0.019)	(0.021)	(0.022)	(0.019)
# Obs	2836	2836	2836	2836	2836

Table 4. BTZ adoption and redemption network

This table reports the effect of the redemption network on BTZ adoption: the ratio of the post with BTZ value in Column (1), the log number of posts with BTZ value in Column (2), the dummy variable that equals 1 if the user posts 1 item with BTZ value in Column (3) and the number of days between when a user first posted an item with BTZ value and when they registered in Column (4). If the user never posts any item with BTZ value, we assume that the user makes the first post at the end of the period, which is August 31st, 2019. If the user registers before April 1st, 2018, we assume the registration date will be April 1st, 2018. In Panel A, the independent variable is the average number of merchants within 1 km of users. In Panel B, the independent variable groups with different exposure. Users are allocated to the high(low) exposure group if users, on average, have more(less) merchants than the median average number of merchants, excluding the users who do not have any merchants around them. Users who do not have any merchants around them would be allocated to the control group. Robust standard errors are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	Panel A: The number of merchants within 1 km of users			
	(1)	(2)	(3)	(4)
	BTZ_Post_Ratio	*BTZ_Post_Dummy*	*BTZ_Post_LogNum*	*Adoption_Time*
Exposure	2.067***	1.377***	0.063***	-8.733***
	(0.348)	(0.339)	(0.020)	(2.047)
	Panel B: Merchant exposure group			
$Low\_Exposure_j$	1.590*	-0.093	0.010	2.266
	(0.847)	(0.802)	(0.051)	(5.346)
$High\_Exposure_j$	4.574***	1.549*	0.126**	-7.682
	(0.857)	(0.803)	(0.050)	(5.285)
# Obs	7,162	7,162	7,162	7,162

Table 5. BTZ transactions and redemption network

This table reports the effect of the redemption network on BTZ transaction: the log number of selling transactions in Column (1), the log amount of BTZ received by users in Column (2), dummy variable that equals to 100 if the users sell 1 item in Column (3), the ratio of selling transactions in peer-to-peer transactions in Column (4), the log number of buying transactions in Column (5), the log amount of BTZ sent by users in Column (6), and dummy variable that equals to 100 if the users buy 1 item in Column (7). In Panel A, the independent variable is the average number of merchants within 1 km of users. In Panel B, the independent variable groups with different exposure. Users are assigned to either the high or low-exposure group based on whether their average number of merchants is greater or less than the median number of merchants, respectively. Users without any nearby merchants are assigned to the control group. Robust standard errors are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	Panel A: The number of merchants within 1 km of users						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	$Trade\_LogNum_{from\_users}$	$BTZ\_LogAmount_{from\_users}$	$Trade\_Dummy_{from\_users}$	$Sell\_Ratio$	$Trade\_LogNum_{to\_users}$	$BTZ\_LogAmount_{to\_users}$	$Trade\_Dummy_{to\_users}$
Exposure	0.058***	0.273***	1.604***	2.695***	-0.012	-0.045	0.042
	(0.012)	(0.045)	(0.300)	(0.361)	(0.012)	(0.046)	(0.293)
	Panel B: Merchant exposure group						
Low_Exposure	0.105***	0.454***	1.252*	3.057***	0.041	0.144	0.286
	(0.030)	(0.116)	(0.708)	(0.914)	(0.030)	(0.113)	(0.702)
High_Exposure	0.167***	0.782***	2.891***	6.927***	-0.007	0.001	-0.575
	(0.030)	(0.114)	(0.716)	(0.912)	(0.030)	(0.114)	(0.697)
# Obs	7,162	7,162	7,162	6,361	7,162	7,162	7,162

Table 6. Token circulation responses to redemption network

This table reports the effect of the redemption network on token velocity and share: $Velocity_{from\_users}$ defined as $\frac{BTZ\_from\_User_{i,t}}{Disposable\_Holding_{i,t}}$ in Column (1), $Velocity_{to\_users}$ defined as $\frac{BTZ\_to\_User_{i,t}}{Disposable\_Holding_{i,t}}$ in Column (2), $Velocity_{Redeem}$ defined as $\frac{BTZ\_to\_Merchant_{i,t}}{Disposable\_Holding_{i,t}}$ in Column (3). $Velocity_{from\_BUNZ}$ defined as $\frac{BTZ\_from\_BUNZ_{i,t}}{Disposable\_Holding_{i,t}}$ in Column (4), the total BTZ amount received from other users divided by the total BTZ amount received in Column (5), and the total BTZ amount redeemed at merchants divided by the total BTZ amount spent by users in Column (6). In Panel A, the independent variable is the average number of merchants within 1 km of users. In Panel B, the independent variable groups with different exposure. Users are allocated to the high(low) exposure group if users, on average, have more(less) merchants than the median average number of merchants, excluding the users who do not have any merchants around them. Users who do not have any merchants around them would be allocated to the control group. Robust standard errors are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	Panel A: The Number of Merchants Within 1000 Meters of Users					
	(1)	(2)	(3)	(4)	(5)	(6)
	$Velocity_{from\_users}$	$Velocity_{to\_users}$	$Velocity_{redeem}$	$Velocity_{from\_BUNZ}$	$Share_{from\_users}$	$Share_{redeem}$
Exposure	0.966***	-0.272	0.862***	-0.040	2.779***	3.917***
	(0.146)	(0.171)	(0.099)	(0.141)	(0.347)	(0.446)
	Panel B: Merchant Exposure Group					
Low_Exposure	0.975***	0.094	1.395***	-0.303	3.939***	6.218***
	(0.329)	(0.413)	(0.200)	(0.312)	(0.868)	(1.023)
High_Exposure	1.868***	-0.964**	2.395***	-0.935***	6.953***	11.485***
	(0.338)	(0.406)	(0.214)	(0.304)	(0.863)	(1.052)
# Obs	6,997	6,997	6,997	6,997	6,997	6,091

Table 7. Difference-in-Difference analysis on BTZ adoption

This table reports the effect of the redemption network collapse on BTZ adoption: the ratio of the post with BTZ value in Column (1), the log number of posts with BTZ value in Column (2), and the dummy variable that equals 1 if the user post 1 item with BTZ value in Column (3). Panel A reports the results of the difference-in-difference analysis. Panels B and C report the regression results before and after the redemption network collapse, respectively. The individual and monthly fixed effects are included in Panel A. The month-fixed effects are included in Panels B and C. Robust standard deviations are two-way clustered at individual and month levels and reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard deviations are two-way clustered at individual and month levels in Panels A, B, and C and reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	Panel A: DID analysis		
	(1)	(2)	(3)
	BTZ_Post_Ratio	$Post\_LogNum_{from\_users}$	$Post\_Dummy_{from\_users}$
$Exposure \times Post$	-1.699***	-0.022***	-1.367***
	(0.475)	(0.006)	(0.294)
Individual FE	YES	YES	YES
Month FE	YES	YES	YES
# Obs	54,142	178,587	178,587
	Panel B: Before the collapse of redemption network		
Exposure	2.202***	0.022**	1.361***
	(0.487)	(0.007)	(0.334)
Month FE	YES	YES	YES
# Obs	31,603	85,481	85,481
	Panel C: After the collapse of redemption network		
Exposure	0.224	-0.0003	-0.002
	(0.458)	(0.003)	(0.178)
Month FE	YES	YES	YES
# Obs	22,539	93,106	93,106

Table 8. Difference-in-Difference analysis on selling transactions

This table reports the effect of the redemption network collapse on selling transactions, including the log number of selling transactions in Column (1), the log amount of BTZ received by users in Column (2), dummy variable that equals to 100 if the users sell 1 item in Column (3), the ratio of total selling transactions to total posts in Column (4), and the ratio of selling transactions in peer-to-peer transactions in Column (5). Panel A reports the results of the difference-in-difference analysis. Panels B and C report the regression results before and after the redemption network collapse, respectively. The individual and monthly fixed effects are included in Panel A. The month-fixed effects are included in Panels B and C. The individual and monthly fixed effects are included in Panel C. As $\frac{Trade\_Num_{from\_users}}{Post\_Num_{all}}$ only has two observations for each user, the month-fixed effect in Column (4) is the dummy variable *Post* that equals to 1 after the redemption network collapse. Robust standard deviations are two-way clustered at individual and month levels and reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	Panel A: DID analysis				
	(1)	(2)	(3)	(4)	(5)
	$Trade\_LogNum_{from\_users}$	$BTZ\_LogAmount_{from\_users}$	$Trade\_Dummy_{from\_users}$	$\frac{Trade\_Num_{from\_users}}{Post\_Num_{all}}$	$Sell\_Ratio$
Exposure × *Post*	-0.018***	-0.124***	-1.501***	-0.856***	-1.952***
	(0.004)	(0.021)	(0.260)	(0.180)	(0.664)
Individual FE	YES	YES	YES	YES	YES
Month FE	YES	YES	YES	YES	YES
# Obs	178,587	178,587	178,587	14,324	25,668
	Panel B: Before the collapse of redemption network				
Exposure	0.019***	0.129***	1.556***	1.062***	1.793***
	(0.004)	(0.025)	(0.303)	(0.151)	(0.405)
Month FE	YES	YES	YES	NO	NO
# Obs	85,481	85,481	85,481	7,162	17,437
	Panel C: After the collapse of redemption network				
Exposure	0.001	0.006	0.062	0.207**	-0.207
	(0.002)	(0.010)	(0.139)	(0.083)	(0.708)
Month FE	YES	YES	YES	NO	NO
# Obs	93,106	93,106	93,106	7,162	8,231

Table 9. Difference-in-Difference Analysis on token circulation

This table reports the effect of the redemption network collapse on token circulation, including the velocity of token received by users in Column (1), the velocity of token sent by users in Column (2), and the share of the total BTZ amount received from other users in the total BTZ amount received in Column (3). Panels A and B report the regression results before and after the redemption network collapse, respectively. Panel A reports the results of the difference-in-difference analysis. Panels B and C report the regression results before and after the redemption network collapse, respectively. The individual and monthly fixed effects are included in Panel A. The month-fixed effects are included in Panels B and C. As $Share_{from\_users}$ only has two observations for each user, the month-fixed effect in Column (3) is the dummy variable *Post* that equals 1 after the redemption network collapse. Robust standard deviations are two-way clustered at individual and month levels and reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	Panel A: DID analysis		
	(1)	(2)	(3)
	$Velocity_{from\_users}$	$Velocity_{to\_users}$	$Share_{from\_users}$
$Exposure \times Post$	-0.724***	0.100	-2.442***
	(0.135)	(0.153)	(0.738)
Individual FE	YES	YES	YES
Month FE	YES	YES	YES
# Obs	170,975	170,975	10,778
	Panel B: Before the collapse of redemption network		
Exposure	0.743***	-0.121	2.365***
	(0.149)	(0.165)	(0.443)
Month FE	YES	YES	NO
# Obs	81,794	81,794	5,389
	Panel C: After the collapse of redemption network		
Exposure	0.027	-0.008	-0.077
	(0.053)	(0.079)	(0.470)
Month FE	YES	YES	NO
# Obs	89,181	89,181	5,389

Table 10. DID Analysis on Activeness

This table reports the effect of the BTZ introduction and redemption network collapse on the users' activeness: the log number of posts in Column (1), the dummy variable that equals 1 if the user post 1 item in Column (2), and the log number of ratings in Column (3). Panel A reports the DID analysis of the BTZ introduction. Panel B reports the DID analysis of the redemption network collapse. The individual and monthly fixed effects are included in all specifications. Robust standard deviations are two-way clustered at individual and month levels and reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	Panel A: BTZ introduction		
	(1)	(2)	(3)
	$Post\_LogNum_{all}$	$Post\_Dummy_{all}$	$Rating\_LogNum$
$Exposure \times Post$	0.009	0.107	0.005
	(0.011)	(0.402)	(0.008)
Individual FE	YES	YES	YES
Month FE	YES	YES	YES
# Obs	118,243	118,243	118,243
	Panel B: Redemption network collapse		
$Exposure \times Post$	0.012	-0.058	0.005
	(0.009)	(0.405)	(0.006)
Individual FE	YES	YES	YES
Month FE	YES	YES	YES
# Obs	127,350	127,350	127,350

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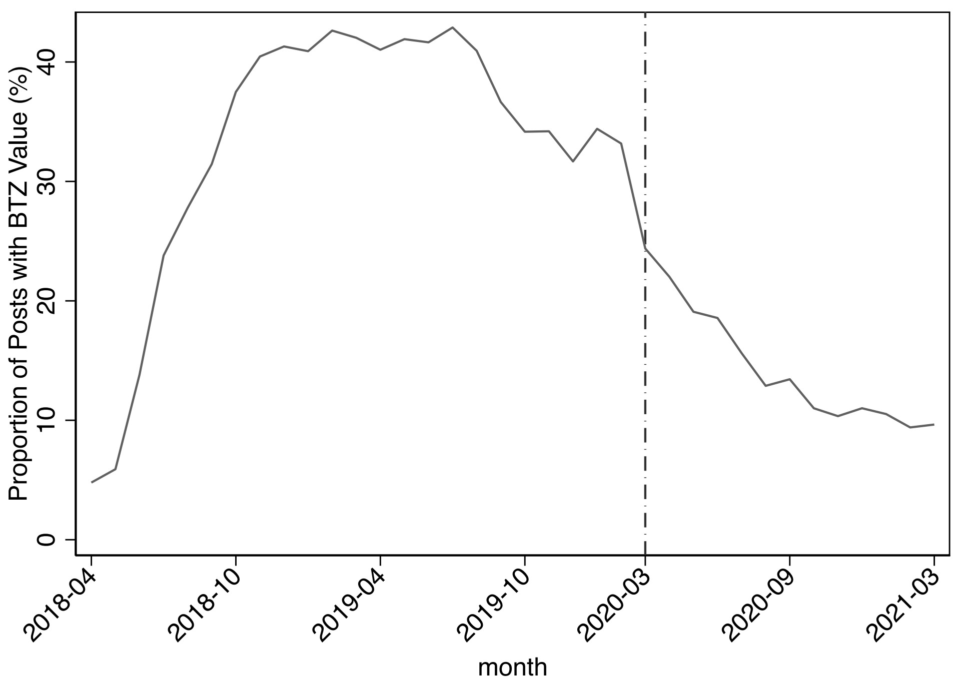
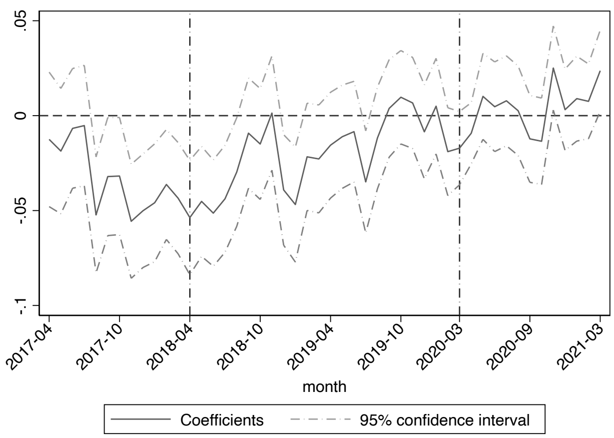
Figure IA1. Proportion of post with BTZ value

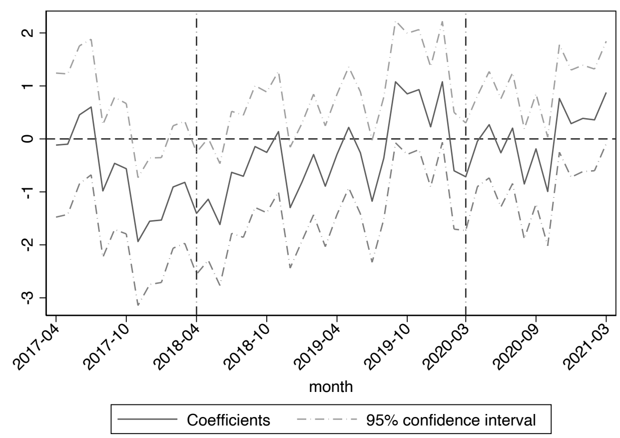


Notes: The figure plots the proportion of posts with BTZ value in total posts from April 2018 to October 2021.

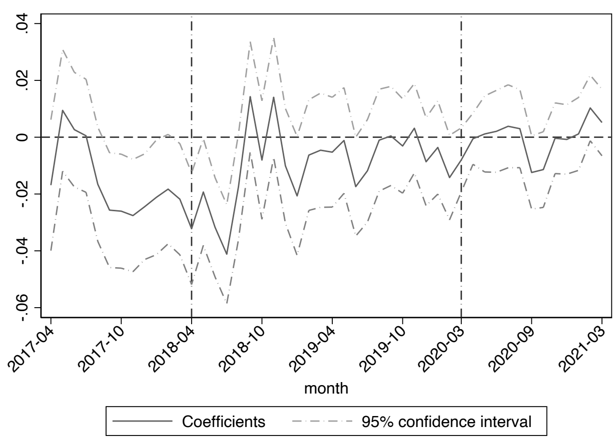
Figure IA2. Dynamic effect of redemption network on users' activeness



Panel A: Dependent variable *Post_LogNum*$_{all}$



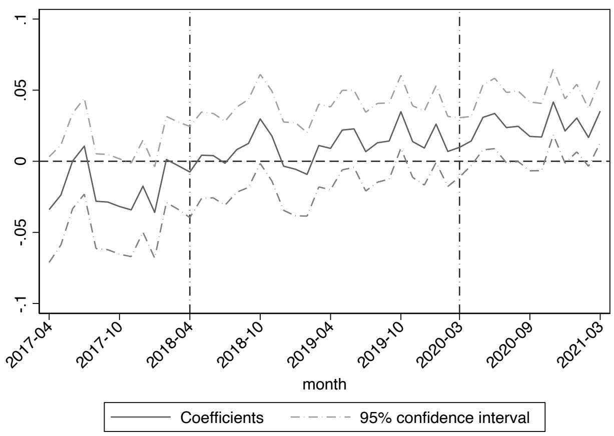
Panel B: Dependent variable *Post_Dummy*$_{all}$



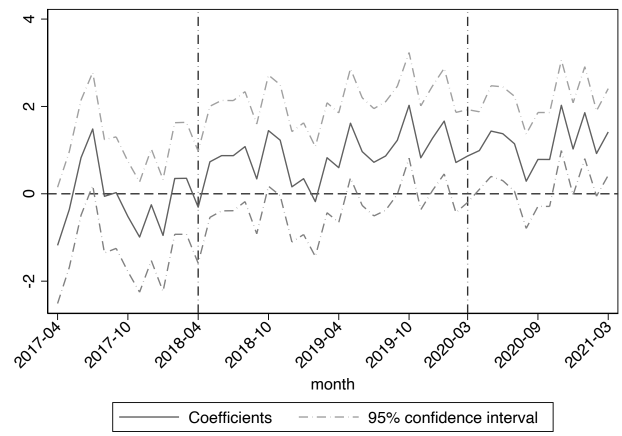
Panel C: Dependent variable: *Rating_LogNum*

Notes: The figure plots the dynamic effect of redemption network on users' activeness, including the log number of posts in Panel A, the dummy variable equal to 100 if the user post at least 1 item in Panel B, and the log number of ratings in Panel C.

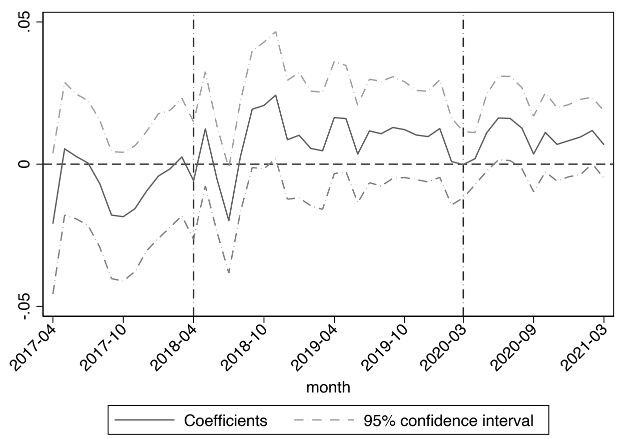
Figure IA3. Dynamic effect of redemption network on users' activeness (Pre sample)



Panel A: Dependent variable *Post_LogNum*$_{all}$



Panel B: Dependent variable *Post_Dummy*$_{all}$



Panel C: Dependent variable: *Rating_LogNum*

Notes: The figure plots the dynamic effect of redemption network on users' activeness, including the log number of posts in Panel A, the dummy variable equal to 100 if the user post at least 1 item in Panel B, and the log number of ratings in Panel C. The sample users post more than 20 items on the platform in 2017 and do not post 70% of the posts in one month.

Table IA1. Summary statistics

This table reports the summary statistics for the cross-sectional analysis: redemption network exposure in Panel A, redemption network visit in Panel B, BTZ adoption in Panel C, BTZ transaction in Panel D, Token velocity and share in Panel E, and DID analysis in Panel F.

	(1)	(2)	(3)	(4)	(5)	(6)
	Mean	S.D.	25^{th} Percentile	Median	75^{th} Percentile	Obs.
Panel A: Redemption network						
$Exposure$	5.123	5.682	0	2.647	9.462	7,162
Panel B: Redemption network visit						
$Trade\_LogNum_{redeem}$	0.692	1.032	0	0	1.099	7,162
$BTZ\_LogAmount_{redeem}$	3.484	4.390	0	0	8.380	7,162
$Trade\_Dummy_{redeem}$	8.95	16.008	0	0	11.765	7,162
Panel C: BTZ adoption						
BTZ_Post_Ratio	31.583	28.895	3.627	25.705	53.146	7,162
BTZ_Post_Dummy	30.682	26.832	5.882	23.529	47.059	7,162
BTZ_Post_LogNum	2.519	1.67	1.099	2.773	3.761	7,162
$Adoption\_Time$	204.818	176.173	53	160	323	7,162
Panel D: BTZ transaction						
$Trade\_LogNum_{from\_users}$	1.691	1.221	0.693	1.609	2.565	7,162
$Trade\_LogNum_{to\_users}$	1.614	1.174	0.693	1.609	2.485	7,162
$BTZ\_LogAmount_{from\_users}$	7.125	3.800	6.399	8.517	9.693	7,162
$BTZ\_LogAmount_{to\_users}$	7.169	3.794	6.686	8.577	9.687	7,162
$Trade\_Dummy_{from\_users}$	25.214	23.902	5.882	17.647	40	7,162
$Trade\_Dummy_{to\_users}$	24.929	23.422	5.882	17.647	40	7,162
$Sell\_Ratio$	50.162	28.739	30.357	50	70	6,361
Panel E: Token velocity and share						
$Velocity_{from\_users}$	10.165	11.148	1.777	6.784	14.748	6,997
$Velocity_{to\_users}$	12.046	13.376	1.679	7.81	18.058	6,997
$Velocity_{redeem}$	3.752	7.546	0	0	4.462	6,997
$Velocity_{from\_BUNZ}$	19.672	10.127	13.278	17.534	23.796	6,997
$Share_{from\_users}$	39.708	28.782	12.144	41.177	64.529	6,997
$Share_{redeem}$	23.215	33.809	0	0	42.169	6,091
Panel F: DID analysis						
$Post\_LogNum_{all}$	0.765	1.15	0	0	1.386	271,063
$Post\_Dummy_{all}$	38.967	48.768	0	0	100	271,063
$Rating\_LogNum$	0.419	0.742	0	0	0.693	271,063
BTZ_Post_Ratio	26.19	37.259	0	0	50	109,710
$Post\_Dummy_{all}$	0.266	0.714	0	0	0	296,061
BTZ_Post_Dummy	16	36.661	0	0	0	296,061
$Trade\_LogNum_{from\_users}$	0.149	0.426	0	0	0	296,061
$BTZ\_LogAmount_{from\_users}$	1	2.591	0	0	0	296,061
$\frac{Trade\_Num_{from\_users}}{Post\_Num_{all}}$	5.538	10.429	0	1.02	7.302	14,324
$Sell\_Ratio$	49.496	40.659	0	50	100	58,407
$Trade\_Dummy_{from\_users}$	13.482	34.153	0	0	0	296,061
$Velocity_{from\_users}$	4.821	15.198	0	0	0	170,975
$Velocity_{to\_users}$	5.946	18.264	0	0	0	170,975
$Share_{from\_users}$	38.85	36.489	2.174	32.611	76.109	10,778

Table IA2. Summary statistics

This table reports the summary statistics for the cross-sectional analysis: redemption network exposure in Panel A, redemption network visit in Panel B, BTZ adoption in Panel C, and BTZ transaction in Panel D.

	(1)	(2)	(3)	(4)	(5)	(6)
	Mean	S.D.	25^{th} Percentile	Median	75^{th} Percentile	Obs.
Panel A: Redemption network						
Exposure	4.752	5.156	0	2.412	8.559	4,108
Panel B: Redemption network visit						
$Trade\_LogNum_{redeem}$	0.493	.937	0	0	0.693	4,108
$BTZ\_LogAmount_{redeem}$	2.461	4.026	0	0	6.909	4,108
$Trade\_Dummy_{redeem}$	6.024	13.687	0	0	5.882	4,108
Panel C: BTZ adoption						
BTZ_Post_Ratio	22.606	27.005	0	10.735	39.593	3,394
BTZ_Post_Dummy	18.042	25.631	0	5.882	29.412	4,108
BTZ_Post_LogNum	1.51	1.794	0	.693	2.996	4,108
Adoption_Time	338.858	194.735	143	465	517	4,108
Panel D: BTZ transaction						
$Trade\_LogNum_{from\_users}$	1.048	1.283	0	.693	1.946	4,108
$Trade\_LogNum_{to\_users}$	1.052	1.232	0	.693	1.946	4,108
$BTZ\_LogAmount_{from\_users}$	4.441	4.582	0	1.792	8.956	4,108
$BTZ\_LogAmount_{to\_users}$	4.738	4.591	0	6.558	9.159	4,108
$Trade\_Dummy_{from\_users}$	14.79	21.83	0	5.882	23.529	4,108
$Trade\_Dummy_{to\_users}$	15.22	21.501	0	5.882	23.529	4,108
Sell_Ratio	47.464	30.545	25	49.479	68.704	2,433

Table IA3. Redemption behavior responses to redemption network (pre-BTZsample)

This table reports cross-sectional regressions of redemption on the users' exposure to redemption network. The sample users posted more than 20 items on the platform in 2017 and did not post 70% of the posts in one month. In Panel A, the dependent variable is the normalized log total number of redemption transactions. In Panel B, the dependent variable is the normalized log total amount of BTZ. In panel C, the dependent variable is the average number of the dummy variable equal to 1 if the users make redemption transactions in a month. The independent variables are the number of merchants within 1 km of users and groups with different exposure. Users are allocated to the high(low) exposure group if users, on average, have more(less) merchants than the median average number of merchants, excluding the users who do not have any merchants around them. Users without any exposure to the redemption network are allocated to the control group. Robust standard errors are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	All Merchants		Cafes		Retails		Bars		Restaurants		Services	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A: Dependent Variable $Trade\_LogNum_{redeem}$												
Exposure	0.096***		0.055***		0.126***		0.026*		0.040**		0.069***	
	(0.016)		(0.017)		(0.020)		(0.015)		(0.016)		(0.020)	
Low_Exposure		0.221***		0.03		0.165***		0.117***		0.089**		0.118**
		(0.036)		(0.036)		(0.034)		(0.042)		(0.038)		(0.046)
High_Exposure		0.265***		0.136***		0.332***		0.056		0.088**		0.181***
		(0.037)		(0.040)		(0.047)		(0.039)		(0.040)		(0.054)
Panel B: Dependent Variable $BTZ\_LogAmount_{redeem}$												
Exposure	0.089***		0.057***		0.114***		0.027*		0.051***		0.056***	
	(0.016)		(0.017)		(0.018)		(0.016)		(0.017)		(0.018)	
Low_Exposure		0.216***		0.033		0.155***		0.112***		0.120***		0.109**
		(0.037)		(0.036)		(0.035)		(0.041)		(0.039)		(0.045)
High_Exposure		0.247***		0.145***		0.311***		0.071*		0.112***		0.143***
		(0.038)		(0.039)		(0.045)		(0.041)		(0.040)		(0.049)
Panel C: Dependent Variable $Trade\_Dummy_{redeem}$												
Exposure	1.234***		0.402***		0.912***		0.074		0.211**		0.232***	
	(0.223)		(0.141)		(0.167)		(0.052)		(0.102)		(0.072)	
Low_Exposure		2.787***		0.213		1.109***		0.448***		0.336		0.394**
		(0.485)		(0.279)		(0.258)		(0.162)		(0.230)		(0.162)
High_Exposure		3.322***		1.002***		2.403***		0.114		0.435*		0.600***
		(0.502)		(0.310)		(0.377)		(0.125)		(0.254)		(0.186)
# Obs	4,108	4,108	4,108	4,108	4,108	4,108	4,108	4,108	4,108	4,108	4,108	4,108

Table IA4. BTZ adoption and redemption network (pre sample)

This table reports the effect of the redemption network on BTZ adoption: the ratio of the post with BTZ value in Column (1), the log number of posts with BTZ value in Column (2), the dummy variable that equals 1 if the user post 1 item with BTZ value in Column (3) and the number of days between when a user first posted an item with BTZ value and when they registered in Column (4). If the user never posts any item with BTZ value, we assume that the user makes the first post at the end of the period, which is August 31st, 2019. We assume that the registration date be April 1st, 2018. These users posted more than 20 items on the platform in 2017 and did not post 70% of the posts in one month. In Panel A, the independent variable is the average number of merchants within 1 km of users. In Panel B, the independent variable groups with different exposure. Users are allocated to the high(low) exposure group if users, on average, have more(less) merchants than the median average number of merchants, excluding the users who do not have any merchants around them. Users who do not have any merchants around them would be allocated to the control group. Robust standard errors are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	Panel A: The Number of Merchants Within 1000 Meters of Users			
	(1)	(2)	(3)	(4)
	BTZ_Post_Ratio	*BTZ_Post_Dummy*	*BTZ_Post_LogNum*	*Adoption_Time*
Exposure	1.260***	0.798*	0.031*	-5.664*
	(0.472)	(0.409)	(0.016)	(3.041)
	Panel B: Merchant Exposure Group			
$Low\_Exposure_j$	3.164***	2.276**	0.073*	-22.861***
	(1.130)	(1.004)	(0.040)	(7.667)
$High\_Exposure_j$	3.304***	1.400	0.048	-13.618*
	(1.149)	(1.000)	(0.040)	(7.687)
# Obs	3,394	4,108	4,108	4,108

Table IA5. BTZ adoption time and redemption network

This table reports cross-sectional regression of the users' adoption time on the redemption network. The sample users in this regression post at least one item before April 2018. In Panel A, the dependent variable is the days between the date when the user posts the first item with BTZ value and April 1st, 2018. If a user never posts any item with BTZ value, we assume that the user posts the first item at the end of the period, which is August 31st, 2019. In Panel B, the dependent variable is the days between the date the user makes the first post before April 1st, 2018, and when the user registers. In Panel C, the dependent variable is the days between the date the user makes the first post after April 1st, 2018, and when the user registers. The regression result of all sample users is shown in Column (1), the users who first make a post with BTZ value in Column (2), and the users who first make a post without BTZ value in Column (3). Robust standard errors are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	Panel A: Dependent Variable Adoption_Time		
	(1) All	(2) First Post with BTZ Value	(3) First Post without BTZ Value
Exposure	-6.897***	7.487*	-7.240**
	(2.603)	(4.429)	(2.892)
	Panel B: Dependent Variable $First\_Post\_Time_{before\_introduction}$		
Exposure	6.452***	2.676	7.026***
	(1.946)	(5.304)	(2.087)
	Panel C: Dependent Variable $First\_Post\_Time_{after\_introduction}$		
Exposure	2.826**	7.487*	0.232
	(1.352)	(4.429)	(1.184)
# Obs	4,408	676	3,732

Table IA6. Peer-to-peer transaction response to redemption network

This table reports the effect of the redemption network on peer-to-peer transaction: the log number of transactions between users in Column (1), the log amount of BTZ involved in transactions between users Column (2), and dummy variable that equals to 100 if the users buy or sell 1 item in Column (3). In Panel A, the independent variable is the average number of merchants within 1 km of users. In Panel B, the independent variable groups with different exposure. Users are allocated to the high(low) exposure group if users have more(less) merchants than the median average number of merchants, excluding the users who do not have any merchants around them. Users who do not have any merchants around them would be allocated to the control group. Robust standard errors are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	Panel A: The number of merchants within 1 km of users		
	(1)	(2)	(3)
	$Trade\_LogNum_{all}$	$BTZ\_LogAmount_{all}$	$Trade\_Dummy_{all}$
Exposure	0.030**	0.128***	1.023***
	(0.012)	(0.039)	(0.327)
	Panel B: Merchant exposure group		
Low_Exposure	0.081***	0.278***	1.130
	(0.030)	(0.101)	(0.795)
High_Exposure	0.096***	0.386***	1.397*
	(0.030)	(0.100)	(0.792)
# Obs	7,162	7,162	7,162

Table IA7. BTZ transaction and redemption network (Pre Sample)

This table reports the effect of the redemption network on BTZ transaction: the log number of selling transactions in Column (1), the log amount of BTZ received by users in Column (2), dummy variable that equals to 100 if the users sell 1 item in Column (3), the ratio of selling transactions in peer-to-peer transactions in Column (4), the log number of buying transactions in Column (5), the log amount of BTZ sent by users in Column (6), and dummy variable that equals to 100 if the users buy 1 item in Column (7). The sample users posted more than 20 items on the platform in 2017 and did not post 70% of the posts in one month. In Panel A, the independent variable is the average number of merchants within 1 km of users. In Panel B, the independent variable groups with different exposure. Users are assigned to either the high or low-exposure group based on whether their average number of merchants is greater or less than the median number of merchants, respectively. Users without any nearby merchants are assigned to the control group. Robust standard errors are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	Panel A: The number of merchants within 1 km of users						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	$Trade\_LogNum_{from\_users}$	$BTZ\_LogAmount_{from\_users}$	$Trade\_Dummy_{from\_users}$	$Sell\_Ratio$	$Trade\_LogNum_{to\_users}$	$BTZ\_LogAmount_{to\_users}$	$Trade\_Dummy_{to\_users}$
Exposure	0.047***	0.238***	1.032***	2.464***	0.004	0.052	0.036
	(0.016)	(0.072)	(0.343)	(0.612)	(0.016)	(0.072)	(0.336)
	Panel B: Merchant exposure group						
Low_Exposure	0.130***	0.594***	3.093***	2.751*	0.096**	0.428**	1.986**
	(0.039)	(0.179)	(0.834)	(1.568)	(0.040)	(0.181)	(0.850)
High_Exposure	0.103***	0.465***	2.542***	7.279***	-0.010	-0.048	-0.028
	(0.039)	(0.179)	(0.832)	(1.597)	(0.039)	(0.182)	(0.828)
# Obs	4,108	4,108	4,108	2,433	4,108	4,108	4,108

Table IA8. BTZ adoption responses by distance to merchants

This table reports the heterogeneous users' willingness to adopt BTZ responses to exposure to the redemption network by distance: the ratio of the post with BTZ value in Column (1), the log number of total posts with BTZ value in Column (2), the average number of dummy variable that equals 1 if the user post 1 item with BTZ value in Column (3), and the number of days between when the users first posted an item with BTZ value and when they registered in Column (4). The dependent variable is the number of merchants located within 0.5 km of the user in Panel A, between 0.5 km and 1 km in Panel B, between 1 km and 1.5 km in Panel C, and between 1.5 km and 2 km in Panel D. Robust standard errors are presented in parentheses. Robust standard errors are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	(1) *BTZ_Post_Ratio*	(2) *BTZ_Post_Dummy*	(3) *BTZ_Post_LogNum*	(4) *Adoption_Time*
	Panel A: Merchants within 0.5 km			
$Distance \leq 0.5km$	1.846***	1.219***	0.064***	-7.065***
	(0.348)	(0.333)	(0.019)	(2.011)
	Panel B: Merchants between 0.5 km and 1 km			
$0.5km < Distance \leq 1km$	1.940***	1.297***	0.055***	-8.548***
	(0.347)	(0.339)	(0.020)	(2.054)
	Panel C: Merchants between 1 km and 1.5 km			
$1km < Distance \leq 1.5km$	1.637***	0.964***	0.045**	-8.486***
	(0.344)	(0.330)	(0.019)	(2.062)
	Panel D: Merchants between 1.5 km and 2 km			
$1.5km < Distance \leq 2km$	1.144***	0.615*	0.014	-6.422***
	(0.340)	(0.326)	(0.020)	(2.059)
# Obs	7,162	7,162	7,162	7,162

Table IA9. Transaction number and BTZ amount responses by distance

This table reports the heterogeneous transaction responses to exposure to the redemption network by distance: the log number of selling transactions in Column (1), buying transactions in Column (2), transactions between users in Column (3), the log amount of BTZ involved in selling transactions in Column (4), buying transactions in Column (5) and transactions between users in Column (6). The dependent variable is the number of merchants located within 0.5 km of the user in Panel A, between 0.5 km and 1 km in Panel B, between 1 km and 1.5 km in Panel C, and between 1.5 km and 2 km in Panel D. Robust standard errors are presented in parentheses. Robust standard errors are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	(1) $Trade\_LogNum_{from\_users}$	(2) $Trade\_LogNum_{to\_users}$	(3) $BTZ\_LogAmount_{from\_users}$	(4) $BTZ\_LogAmount_{to\_users}$
	Panel A: Merchants within 0.5 km			
$Distance \leq 0.5km$	0.072***	-0.012	0.281***	-0.038
	(0.014)	(0.014)	(0.043)	(0.046)
	Panel B: Merchants between 0.5 km and 1 km			
$0.5km < Distance \leq 1km$	0.062***	-0.014	0.239***	-0.043
	(0.014)	(0.014)	(0.045)	(0.045)
	Panel C: Merchants between 1 km and 1.5 km			
$1km < Distance \leq 1.5km$	0.061***	-0.004	0.240***	-0.006
	(0.014)	(0.014)	(0.045)	(0.044)
	Panel D: Merchants between 1.5 km and 2 km			
$1.5km < Distance \leq 2km$	0.038***	-0.014	0.182***	-0.026
	(0.014)	(0.014)	(0.045)	(0.045)
# Obs	7,162	7,162	7,162	7,162

Table IA10. Transaction probability responses by distance

This table reports the heterogeneous transaction probability responses to exposure to the redemption network by distance: the log number of total selling and buying transactions in Column (1), the average number of the dummy variable that equals to 1 if the user makes at least one selling transaction in Column (2), one buying transactions in Column (3), and any transactions between users in Column (4). The dependent variable is the number of merchants located within 0.5 km of the user in Panel A, between 0.5 km and 1 km in Panel B, between 1 km and 1.5 km in Panel C, and between 1.5 km and 2 km in Panel D. Robust standard errors are presented in parentheses. Robust standard errors are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	(1) $Sell\_Ratio$	(2) $Trade\_Dummy_{from\_users}$	(3) $Trade\_Dummy_{to\_users}$	(4) $Trade\_Dummy_{all}$
	Panel A: Merchants within 0.5 km			
$Distance \leq 0.5km$	2.740***	1.446***	-0.042	0.886***
	(0.354)	(0.296)	(0.286)	(0.323)
	Panel B: Merchants between 0.5 km and 1 km			
$0.5km < Distance \leq 1km$	2.367***	1.498***	0.077	0.973***
	(0.362)	(0.300)	(0.292)	(0.327)
	Panel C: Merchants between 1 km and 1.5 km			
$1km < Distance \leq 1.5km$	2.037***	1.185***	0.026	0.798**
	(0.362)	(0.296)	(0.290)	(0.325)
	Panel D: Merchants between 1.5 km and 2 km			
$1.5km < Distance \leq 2km$	1.750***	0.868***	-0.032	0.454
	(0.362)	(0.289)	(0.281)	(0.319)
# Obs	6,361	7,162	7,162	7,162

Table IA11. BTZ adoption responses by merchant type

This table reports the heterogeneous users' willingness to adopt BTZ responses to exposure to the redemption network by merchant type: cafe in Column (1), retail shop in Column (2), bar in Column (3), restaurant in Column (4), and service shop in Column (5). In Panel A, the dependent variable is the average ratio of the post with BTZ value. In Panel B, the dependent variable is the average number of dummy variable that equals 1 if the user post 1 item with BTZ value. In Panel C, the dependent variable is the log number of total posts with BTZ value. In Panel D, the dependent variable is the number of days between when the users first posted an item with BTZ value and when they registered. Robust standard errors are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	(1) Cafe	(2) Retail	(3) Bar	(4) Restaurant	(5) Service
	Panel A: Dependent variable: *BTZ_Post_Ratio*				
Exposure	1.917***	1.351***	1.245***	2.259***	0.836**
	(0.349)	(0.347)	(0.344)	(0.357)	(0.349)
	Panel B: Dependent variable: *BTZ_Post_Dummy*				
Exposure	1.491***	0.637*	0.429	1.957***	0.560
	(0.333)	(0.334)	(0.318)	(0.336)	(0.345)
	Panel C: Dependent variable: *BTZ_Post_LogNum*				
Exposure	0.072***	0.034***	0.032***	0.090***	-0.001
	(0.019)	(0.020)	(0.019)	(0.019)	(0.019)
	Panel D: Dependent variable: *Adoption_Time*				
Exposure	-8.592***	-4.631**	-4.264**	-11.069***	-3.972*
	(2.043)	(2.050)	(2.045)	(1.991)	(2.032)
# Users	7,162	7,162	7,162	7,162	7,162

Table IA12. Transaction number and BTZ amount responses by merchant type

This table reports the heterogeneous users' transaction responses to exposure to the redemption network by merchant type: cafe in Column (1), retail shop in Column (2), bar in Column (3), restaurant in Column (4), and service shop in Column (5). The dependent variable is the log number of total selling transactions in Panel A, buying transactions in Panel B, and transactions between users in Panel C, while the dependent variable is the log total amount of BTZ received from other users in Panel D, BTZ sent to other users in Panel E, and BTZ received from and sent to other users in Panel F. Robust standard errors are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	(1) Cafe	(2) Retail	(3) Bar	(4) Restaurant	(5) Service
	Panel A: Dependent variable: $Trade\_LogNum_{from\_users}$				
Exposure	0.081***	0.036**	0.050***	0.081***	0.021
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
	Panel B: Dependent variable: $Trade\_LogNum_{to\_users}$				
Exposure	0.007	-0.037***	-0.017	0.025*	-0.023*
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
	Panel C: Dependent variable: $Trade\_LogNum_{all}$				
Exposure	0.057***	0.006	0.024	0.066***	0.003
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
	Panel D: Dependent variable: $BTZ\_LogAmount_{from\_users}$				
Exposure	0.284***	0.176***	0.208***	0.266***	0.089**
	(0.044)	(0.045)	(0.044)	(0.043)	(0.045)
	Panel E: Dependent variable: $BTZ\_LogAmount_{to\_users}$				
Exposure	0.002	-0.097**	0.006	0.041	-0.079*
	(0.045)	(0.047)	(0.044)	(0.044)	(0.045)
	Panel F: Dependent variable: $BTZ\_LogAmount_{all}$				
Exposure	0.147***	0.049	0.115***	0.162***	0.030
	(0.038)	(0.040)	(0.038)	(0.036)	(0.038)
# Obs	7,162	7,162	7,162	7,162	7,162

Table IA13. Transaction probability responses by merchant type

This table reports the heterogeneous users' transaction probability responses to exposure to the redemption network by merchant type: cafe in Column (1), retail shop in Column (2), bar in Column (3), restaurant in Column (4), and service shop in Column (5). The dependent variable is the average number of the dummy variable that equals 1 if the user makes at least one selling transaction in Panel A, one buying transaction in Panel B, and any transaction between users in Panel C. In Panel D, the dependent variable is the ratio of total selling transactions to total transactions between users. Robust standard errors are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	Panel A: Dependent variable: $Trade\_Dummy_{from\_users}$				
	(1) Cafe	(2) Retail	(3) Bar	(4) Restaurant	(5) Service
Exposure	0.018***	0.006**	0.007***	0.022***	0.008***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
	Panel B: Dependent variable: $Trade\_Dummy_{to\_users}$				
Exposure	0.004	-0.006**	-0.004	0.010***	-0.000
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
	Panel C: Dependent variable: $Trade\_Dummy_{all}$				
Exposure	0.013***	0.001	0.002	0.018***	0.006*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
# Obs	7,162	7,162	7,162	7,162	7,162
	Panel D: Dependent variable: *Sell_Ratio*				
Exposure	2.447***	2.182***	1.939***	1.862***	1.476***
	(0.357)	(0.366)	(0.359)	(0.354)	(0.366)
# Obs	6,361	6,361	6,361	6,361	6,361

Table IA14. Token velocity and share response by distance

This table reports the heterogeneous token velocity and share response to exposure to the redemption network by distance: $Velocity_{from\_users}$ defined as $\frac{BTZ\_from\_User_{i,t}}{Disposable\_Holding_{i,t}}$ in Column (1), $Velocity_{to\_users}$ defined as $\frac{BTZ\_to\_User_{i,t}}{Disposable\_Holding_{i,t}}$ in Column (2), $Velocity_{Redeem}$ defined as $\frac{BTZ\_to\_Merchant_{i,t}}{Disposable\_Holding_{i,t}}$ in Column (3). $Velocity_{from\_BUNZ}$ defined as $\frac{BTZ\_from\_BUNZ_{i,t}}{Disposable\_Holding_{i,t}}$ in Column (4), the total BTZ amount received from other users divided by the total BTZ amount received in Column (5), and the total BTZ amount redeemed at merchants divided by the total BTZ amount spent by users in Column (6). The dependent variable is the number of merchants located within 0.5 km of the user in Panel A, between 0.5 km and 1 km in Panel B, between 1 km and 1.5 km in Panel C, and between 1.5 km and 2 km in Panel D. Robust standard errors are presented in parentheses. Robust standard errors are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	(1) $Velocity_{from\_users}$	(2) $Velocity_{to\_users}$	(3) $Velocity_{redeem}$	(4) $Velocity_{from\_BUNZ}$	(5) $Share_{from\_users}$	(6) $Share_{redeem}$
	Panel A: Merchants within 0.5 km					
$Distance \leq 0.5km$	0.817***	-0.300*	0.793***	-0.088	2.512***	4.128***
	(0.142)	(0.164)	(0.098)	(0.143)	(0.340)	(0.460)
	Panel B: Merchants between 0.5 km and 1 km					
$0.5km < Distance \leq 1km$	0.928***	-0.229	0.798***	-0.013	2.592***	3.367***
	(0.147)	(0.171)	(0.100)	(0.137)	(0.350)	(0.442)
	Panel C: Merchants between 1 km and 1.5 km					
$1km < Distance \leq 1.5km$	0.823***	-0.149	0.786***	0.089	2.713***	3.399***
	(0.141)	(0.167)	(0.094)	(0.130)	(0.347)	(0.433)
	Panel D: Merchants between 1.5 km and 2 km					
$1.5km < Distance \leq 2km$	0.750***	-0.044	0.587***	0.018	2.237***	2.604***
	(0.139)	(0.164)	(0.093)	(0.131)	(0.346)	(0.431)
# Obs	6,997	6,997	6,997	6,997	6,997	6,091

Table IA15. Token velocity and share responses by merchant type

This table reports the heterogeneous token velocity and share responses to exposure to the redemption network by merchant type: cafe in Column (1), a retail shop in Column (2), bar in Column (3), restaurant in Column (4), and service shop in Column (5). $Velocity_{from\_users}$ is defined as $\frac{BTZ\_from\_User_{i,t}}{Disposable\_Holding_{i,t}}$. $Velocity_{to\_users}$ is defined as $\frac{BTZ\_to\_User_{i,t}}{Disposable\_Holding_{i,t}}$. $Velocity_{Redeem}$ is defined as $\frac{BTZ\_to\_Merchant_{i,t}}{Disposable\_Holding_{i,t}}$. $Velocity_{from\_BUNZ}$ is defined as $\frac{BTZ\_from\_BUNZ_{i,t}}{Disposable\_Holding_{i,t}}$. In Panel D, the dependent variable is the total BTZ amount received from other users divided by the total BTZ amount received. In Panel E, the dependent variable is the total BTZ amount redeemed at merchants divided by the total BTZ amount spent by users. Robust standard errors are reported in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	Panel A: Dependent variable: $Velocity_{from\_users}$				
	(1) Cafe	(2) Retail	(3) Bar	(4) Restaurant	(5) Service
Exposure	0.847***	0.562***	0.400***	1.100***	0.696***
	(0.143)	(0.142)	(0.135)	(0.156)	(0.147)
	Panel B: Dependent variable: $Velocity_{to\_users}$				
Exposure	-0.137	-0.547***	-0.498***	0.326*	-0.047
	(0.169)	(0.160)	(0.156)	(0.180)	(0.167)
	Panel C: Dependent variable: $Velocity_{redeem}$				
Exposure	0.708***	0.772***	0.670***	0.479***	0.537***
	(0.096)	(0.110)	(0.094)	(0.098)	(0.101)
	Panel D: Dependent variable: $Velocity_{from\_BUNZ}$				
Exposure	-0.006	-0.134	-0.230*	0.161	0.063
	(0.136)	(0.138)	(0.121)	(0.135)	(0.144)
	Panel E: Dependent variable: $Share_{from\_users}$				
Exposure	2.353***	2.085***	1.669***	2.533***	1.525***
	(0.342)	(0.353)	(0.344)	(0.339)	(0.351)
# Obs	6,997	6,997	6,997	6,997	6,997
	Panel F: Dependent variable: $Share_{redeem}$				
Exposure	3.033***	3.941***	3.515***	1.622***	2.070***
	(0.442)	(0.476)	(0.442)	(0.439)	(0.448)
# Obs	6,091	6,091	6,091	6,091	6,091

Table IA16. DID analysis on buying transactions

This table reports the effect of the redemption network collapse on selling transactions, including the log number of buying transactions in Column (1), the log amount of BTZ sent by users in Column (2), and dummy variable that equals to 100 if the users buy 1 item in Column (3). Panel A report the results of DID analysis. Panels B and C report the regression results before and after the redemption network collapse, respectively. The individual and monthly fixed effects are included in Panel A. The month-fixed effects are included in Panels B and C. Robust standard deviations are two-way clustered at individual and month levels and reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	Panel A: DID analysis		
	(1)	(2)	(3)
	$Trade\_LogNum_{to\_users}$	$BTZ\_LogAmount_{to\_users}$	$Trade\_Dummy_{to\_users}$
Exposure × *Post*	-0.003	-0.021	-0.175
	(0.004)	(0.021)	(0.272)
Individual FE	YES	YES	YES
Month FE	YES	YES	YES
# Obs	178,587	178,587	178,587
	Panel B: Before the collapse of redemption network		
Exposure	0.005	0.026	0.248
	(0.004)	(0.024)	(0.306)
Month FE	YES	YES	YES
# Obs	85,481	85,481	85,481
	Panel C: After the collapse of redemption network		
Exposure	0.001	0.006	0.084
	(0.002)	(0.013)	(0.177)
Month FE	YES	YES	YES
# Obs	93,106	93,106	93,106

Table IA17. Robustness: DID analysis on BTZ transactions

This table reports the effect of the redemption network on BTZ transactions before and after the redemption collapse, including the log total number of selling transactions in Column (1), buying transactions in Column (2), transactions between users in Column (3), the log total amount of BTZ involved in selling transactions in Column (4), buying transactions in Column (5) and transactions between users in Column (6). Panels A and B report the cross-sectional regression results before and after the redemption network collapse. Robust standard deviations are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	(1)	(2)	(3)	(4)	(5)	(6)
	$Trade\_LogNum_{from\_users}$	$Trade\_LogNum_{to\_users}$	$Trade\_LogNum_{all}$	$BTZ\_LogAmount_{from\_users}$	$BTZ\_LogAmount_{to\_users}$	$BTZ\_LogAmount_{all}$
	Panel A: Before the collapse of redemption network					
Exposure	0.070***	0.003	0.048***	0.239***	-0.018	0.140***
	(0.014)	(0.013)	(0.015)	(0.048)	(0.047)	(0.044)
	Panel A: After the collapse of redemption network					
Exposure	0.004	0.006	0.008	0.001	0.007	0.030
	(0.009)	(0.009)	(0.011)	(0.043)	(0.044)	(0.048)
# Obs	7,162	7,162	7,162	7,162	7,162	7,162

A Proofs

Proof of existence of σ

Here we show that, for any given $M, W \in [0,1]$, there exists σ such that if $\sigma_i = \sigma$ for all agents i, then money supply and expected individual money holdings are time-invariant.

The relevant two conditions are given by (3) and (4). It follows then that it suffices to show that there exists σ such that $I(\sigma) = 0$, where

$$I(\sigma) := \int_N m_i(\sigma)\rho_i di - \int_N (1 - m_i(\sigma))\sigma di$$

and

$$m_i(\sigma) := \frac{\alpha x(1-y)\pi_i M + \sigma}{\alpha x(1-y)(\pi_i M + W) + \rho_i + \sigma}.$$

Since $\rho_i \sim \Phi(\rho)$ and $\pi_i = 1$ iff $\rho_i \geq t_i - \alpha x(1-y)W$, where $t_i = \frac{c_i(r_i+\sigma)}{u_i - c_i}$ follows distribution $G_\sigma(t)$. Recall our assumptions on Ψ, the joint distribution of (u_i, c_i, r_i). We assume that $S = \sup\{\frac{u_i - c_i}{c_i} : (u_i, c_i, r_i) \in \text{supp}(\Psi)\} < \infty$, and $u_i > c_i$ for all i. Therefore, $\text{supp}(G_\sigma) \subset [\frac{\sigma}{S}, \infty)$.

We rewrite $I(\sigma)$ as the following,

$$I(\sigma) = \int_0^\infty \left(\int_{t-\alpha x(1-y)W}^{\overline{\rho}} \frac{\alpha x(1-y)(M\rho - W\sigma)}{\alpha x(1-y)(M+W) + \rho + \sigma} d\Phi(\rho) + \int_{\underline{\rho}}^{t-\alpha x(1-y)W} \frac{-\alpha x(1-y)W\sigma}{\alpha x(1-y)W + \rho + \sigma} d\Phi(\rho) \right) dG_\sigma(t). \tag{10}$$

Note that $I(0) > 0$. Next, note that for sufficiently large $\overline{\sigma}$, we have that $\frac{\sigma}{S} - \alpha x(1-y)W > \overline{\rho}$ (i.e. no one accepts money), which implies that $I(\overline{\sigma}) < 0$. More formally,

$$\begin{aligned} I(\overline{\sigma}) <& \int_0^{\overline{\rho}+\alpha x(1-y)W} \left(\int_{t-\alpha x(1-y)W}^{\overline{\rho}} \frac{\alpha x(1-y)(M\rho - W\overline{\sigma})}{\alpha x(1-y)(M+W) + \rho + \overline{\sigma}} d\Phi(\rho) \right) dG_{\overline{\sigma}}(t) \\ &+ \int_{\overline{\rho}+\alpha x(1-y)W}^{\infty} \left(\int_{\underline{\rho}}^{t-\alpha x(1-y)W} \frac{-\alpha x(1-y)W\overline{\sigma}}{\alpha x(1-y)W + \rho + \overline{\sigma}} d\Phi(\rho) \right) dG_{\overline{\sigma}}(t) \\ =& 0 - E_\rho \left[\frac{\alpha x(1-y)W}{\alpha x(1-y)W + \rho + \overline{\sigma}} \right] G_{\overline{\sigma}}(\overline{\rho} + \alpha x(1-y)W) < 0 \end{aligned} \tag{11}$$

By the continuity of I, we have that there exists $\sigma^* \in (0, \overline{\sigma})$ such that $I(\sigma^*) = 0$.

Proof of Proposition 1

Recall that in any equilibrium, $\pi_i = 1$ if and only if $\rho_i \geq t_i - \alpha x(1-y)W$. Since $W = \int_N \pi_i(1 - m_i)di$, we can write

$$W = \int_0^{+\infty} \int_{t-\alpha x(1-y)W}^{\overline{\rho}} (1 - m(W, \rho))\, d\Phi(\rho) dG(t) \tag{12}$$

with

$$m(W,\rho) = \frac{\alpha x(1-y)M + \sigma}{\alpha x(1-y)(M+W) + \sigma + \rho}.$$

The existence of an equilibrium is equivalent to the existence of the fixed point of function $H(W)$, defined as

$$H(W) := \int_0^{+\infty} \int_{t-\alpha x(1-y)W}^{\overline{\rho}} (1 - m(W,\rho))\, d\Phi(\rho) dG(t).$$

Observe that $m(W,\rho) \in [0,1]$, so $H : [0,1] \to [0,1]$. In addition,

$$\begin{aligned} \frac{\partial H}{\partial W} &= \int_0^{+\infty} \frac{\partial}{\partial W}\left(\int_{t-\alpha x(1-y)W}^{\overline{\rho}} (1 - m(W,\rho))\, d\Phi(\rho) \right) dG(t) \\ &= \int_0^{+\infty} \alpha x(1-y)\,(1 - m(W, t - \alpha x(1-y)W))\, dG(t) > 0, \end{aligned} \tag{13}$$

where the first equation holds due to dominated convergence theorem, since for any $W \geq 0$, $H(W) \leq 1 - m(0,\overline{\rho}) < \infty$. Therefore, $H(W)$ is monotonically increasing in W. By Tarsky's Fixed Point Theorem, H must have at least one fixed point in $[0,1]$.

Suppose that $\overline{\rho} \leq \underline{t}$, then $H(0) = 0$, so there exists a non-monetary equilibrium.

Suppose that $\overline{\rho} > \underline{t}$, then $H(0) > \int_{\underline{t}}^{\overline{\rho}} (1 - m(0,t))\,(\overline{\rho} - t) dG(t) > 0$, hence $W = 0$ is not a fixed point of $H(W)$, therefore there is no non-monetary equilibrium.

Proof of Prediction 2

(1) As shown in Equation 9, $E[\pi_i|\rho_i = \rho] = G(\rho + \alpha x(1-y)W)$, which increases in ρ.

(2) Note that $E[S_i|\rho_i = \rho] = \alpha x(1-y)ME[\pi_i(1-m_i)|\rho_i = \rho]$, and

$$\begin{aligned} E[\pi_i(1-m_i)|\rho_i = \rho] &= \int_{\underline{t}}^{\rho+\alpha x(1-y)W} (1 - m(\rho)) dG(t) \\ &= \frac{\alpha x(1-y)W + \rho}{\alpha x(1-y)(M+W) + \rho + \sigma} G(\rho + \alpha x(1-y)W), \end{aligned} \tag{14}$$

which increases in ρ.

(3) Note that $E[P_i|\rho_i = \rho] = \alpha x(1-y)WE[m_i|\rho_i = \rho]$, and

$$\begin{aligned} E[m_i|\rho_i = \rho] &= \int_{\underline{t}}^{\rho+\alpha x(1-y)W} \frac{\alpha x(1-y)M + \sigma}{\alpha x(1-y)(M+W) + \rho + \sigma} dG + \int_{\rho+\alpha x(1-y)W}^{+\infty} \frac{\sigma}{\alpha x(1-y)W + \rho + \sigma} dG \\ &= \frac{(\alpha x(1-y)M + \sigma)\, G(\rho + \alpha x(1-y)W)}{\alpha x(1-y)(M+W) + \rho + \sigma} + \frac{\sigma(1 - G(\rho + \alpha x(1-y)W))}{\alpha x(1-y)W + \rho + \sigma}, \end{aligned} \tag{15}$$

which is non-monotonic in ρ depending on the distribution G.