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Johar Arrieta*, David Florián*, Kristian López**
y Valeria Morales*

* Banco Central de Reserva del Perú
** Departamento de Economía, Universidad de California, Santa Cruz

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Policies for Transactional De-Dollarization: A Laboratory Study*

Johar Arrieta Vidal†[1], David Florián Hoyle‡[1], Kristian López Vargas§[2] and Valeria Morales Vásquez¶[1]

[1]Central Reserve Bank of Perú
[2]Department of Economics, University of California Santa Cruz

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Abstract

Partial currency substitution typically occurs in small economies amid economic crises, when the local currency loses some of its essential functions and a foreign currency, usually the US Dollar, is widely adopted. Interestingly, the coexistence of two currencies often persists after macroeconomic stability has been restored, which imposes challenges to the conduct of monetary policy. Central banks have responded by applying de-dollarization policies. This paper studies the effectiveness of three of them: (1) taxes on transactions in foreign currency among domestic agents, (2) storage costs on foreign currency holdings, and (3) information on the acceptance rate of the foreign currency among local agents. We extend the model in Matsuyama et al. (1993) to study the effects of these policies, both theoretically and experimentally. We contribute to the theoretical literature by characterizing a new circulation regime where agents use the foreign currency solely for international trade and settle domestic transactions exclusively in local currency. Our experimental evidence suggests that both taxes and storage costs reduce the overall acceptability of foreign currency in international and domestic transactions (around 40 percent in both cases). Information treatment does not have a significant impact relative to baseline.

Abstract

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†johar.arrieta@bcrp.gob.pe
‡david.florian@bcrp.gob.pe
§klopezva@ucsc.edu
¶valeria.morales@bcrp.gob.pe

La sustitución parcial de monedas ocurre, típicamente, en economías pequeñas en medio de crisis económicas, cuando la moneda local pierde algunas de sus funciones básicas y una moneda extranjera, generalmente el dólar estadounidense, es ampliamente adoptada. Curiosamente, la coexistencia de dos monedas a menudo persiste después de que se ha restablecido la estabilidad macroeconómica, lo que impone desafíos importantes sobre la implementación de política monetaria. Los bancos centrales han respondido aplicando políticas de desdolarización. Este documento estudia la efectividad de tres de ellas: (1) impuestos sobre las transacciones en moneda extranjera entre agentes nacionales; (2) costos de almacenamiento en tenencias de moneda extranjera; y (3) provisión de información sobre la tasa de aceptación de la moneda extranjera entre los agentes nacionales. Asimismo, se amplía el modelo en Matsuyama, Kiyotaki, Matsui (1993) para estudiar los efectos de estas políticas, tanto teórica como experimentalmente. Esta investigación contribuye a la literatura teórica al caracterizar un nuevo régimen de circulación en el que los agentes usan la moneda extranjera únicamente para el comercio internacional y realizan transacciones nacionales exclusivamente en moneda local. La evidencia experimental sugiere que tanto los impuestos como los costos de almacenamiento reducen la aceptación general de la moneda extranjera en las transacciones internacionales y nacionales (alrededor del 40 por ciento en ambos casos). Por otro lado, el tratamiento de proveer información no tiene un impacto significativo respecto a la condición base.

Keywords: Bimonetary Economy, Dollarization, Central Bank, Monetary Policy, Experiment, Money.

JEL Classification: E51, E52, E58, E59, C91, C92

1 Introduction

The coexistence of two currencies in an economy opens important challenges to central banking. Empirical evidence, mainly from emerging economies, shows that the mass adoption of alternative currencies arises when the local currency loses at least one of its functions as a result of severe fiscal and monetary disequilibria (Yeyati and Ize, 2005).

Dollarization is a process that usually presents a well-defined pattern that starts with the foreign currency being used as a reserve of value, then as a medium of exchange, and finally as a unit of account. Three concepts of dollarization emerge from this process: asset dollarization, transaction dollarization and price or invoicing dollarization. Central banks in dollarized emerging markets understand that these forms of currency substitution are interrelated. When the domestic currency loses its function as a deposit of value, agents not only change their portfolios towards dollar-denominated assets, but are also induced to use their dollar savings (deposits and cash) for durable goods transactions. Moreover, banks notice that a higher fraction of their deposits are denominated in dollars and start lending in dollars too. By the same token, firms start saving and borrowing in dollars, which ultimately leads to them setting their prices in dollars as well. The more agents get used to buying and selling goods in foreign currency, the more agents will save in such currency.

Interestingly, in many countries, the coexistence of two currencies persists even after the economy has returned to macroeconomic stability (i.e. when the local currency has recovered its fundamental attributes). This can be observed in several Latin American economies, where currency, price and financial dollarization are still prevalent but at different degrees (Yeyati and Ize, 2005; Colacelli and Blackburn, 2009). The individual decision to dollarize assets, liabilities, transactions and prices does not internalize the aggregate risks associated to currency mismatches in balance sheets and foreign currency liquidity risks. As a consequence, it may be optimal for central banks to induce agents to internalize those risks by implementing policies to discourage each form of dollarization.

Dollarization is particularly relevant to monetary policy, because it limits the role of the central bank as a lender of last resort and generates significant vulnerabilities to financial stability, as well as to the payment system as a whole. Dollarization reduces the effectiveness of monetary policy in episodes where international turbulence affects the domestic value of the foreign currency. To reduce vulnerability to external shocks, Central Banks are often interested in implementing de-dollarization policies. However, there is insufficient research and evidence on which of the available policy options are more effective.

In this paper we use laboratory experiments to study the impact of several policies on currency dollarization. In particular, our work focuses on exploring the transactional role of money in a bimonetary small open economy where a set of policies might affect the acceptance rate of foreign currency. The policies we study are: (1) taxes on transactions in foreign currency among domestic agents, (2) storage costs for the foreign currency, and (3) information on the acceptability of the foreign currency in the local economy.

Our theoretical framework, based on Matsuyama et al. (1993), is a two-country and two-currency monetary search model with indivisible tradable objects (money and consumption goods), where the circulation patterns of each currency are endogenously determined by the relative size of the two economies and the degree of trade integration. Our setting involves a small domestic economy that trades with a large foreign country. Furthermore, we focus on equilibria where the domestic currency is never accepted by the foreign economy.

We extend the model in two main directions. First, we include a government in the small open economy that deploys policies to discourage foreign currency acceptance in domestic transactions. Second, from the perspective of the small open economy, three circulation regimes for the foreign currency may emerge: (1) a national currency regime where the foreign currency is always rejected by domestic agents, (2) an international currency regime where the foreign currency is always accepted by domestic agents, and (3) an international trading currency regime where the foreign currency is accepted in international transactions but rejected in domestic transactions. The latter regime is novel and is intended to represent a small open economy with a healthy macroeconomic equilibrium but persistent currency dollarization. As in Matsuyama et al. (1993) and Jiang and Zhang (2018), our set-up excludes prices and exchange-rates from the analysis in order to focus on the policies that directly affect the acceptability decision of foreign currency in a stable economy that is already dollarized.

Our experimental results suggest that, in line with theoretical predictions, a policy that increases the storage costs of money or one that taxes specific transactions can influence currency acceptance decisions. In particular, storage costs haven a negative and significant effect on the foreign currency acceptance rate for all possible trading partners. Taxes, on the other hand, diminish foreign token acceptance for the full sample and evidence indicates a stronger rejection in domestic transactions (i.e those that involve a meeting between two locals). We interpret this result as mild evidence in favor of the international trading currency regime. Finally, information on foreign currency transactions does not seem to have an effect on the acceptance probability of foreign currency as there are no incentives to coordinate on a different regime relative to baseline. In relation to policy implementation, storage costs might be seen, in a broad sense, as reserves requirements or macroprudential policies that are usually applied by Central Banks. On the other hand, transactional taxes are applied by different policy institutions than monetary authorities since it affects international trade. Evidence on emerging economies shows that implementation would be easier in the case of macroprudential policies for independent Central Banks compared to introducing a tax on transactions in foreign currencies.

The rest of the paper is organized as follows. Section 2 presents the related literature. Section 3 presents the model and its predictions. Section 4 describes the experimental design as well as hypotheses and the laboratory procedures. Section 5 presents the results. Finally, section 6 concludes.

2 Related Literature

Two branches of literature are relevant to our work: the theoretical work on monetary search and matching models, and the research on monetary laboratory experiments.

An important body of theoretical literature in macroeconomics uses search and matching models to study the main functions of money, and, in particular, the role of money as a medium of exchange. In two seminal papers, Kiyotaki and Wright (1989, 1993) present theoretical search models focusing on the emergence of money and its welfare implications in a barter economy. In this setup, exchange is conditional to the "double coincidence" of wants between agents. Money emerges, endogenously, as a mean of payment to increase the frequency of the exchange. Interestingly, they also extend the model to analyze equilibria with multiple fiat currencies, proving that an equilibrium with universal circulation of two currencies may arise.

In line with multiple currencies, Matsuyama et al. (1993) introduced a search and matching model with two economies and two currencies. In this setting, the currencies "*compete*" to serve the medium of exchange function. The authors characterize multiple equilibria as a function of two fundamental parameters: the relative size of the economies and their trade integration degree.

On the experimental branch, a growing body of research has focused on macroeconomics and monetary policy, testing the main assumptions and predictions of a wide range of theoretical models. In important early studies, Duffy and Ochs (1999, 2002) designed experiments to evaluate the theoretical predictions of Kiyotaki and Wright (1989, 1993). Specifically, they found that an object without intrinsic value is more likely to emerge as a medium of exchange to the extent to which it lowers transaction costs. Furthermore, their work highlighted how agents' behavior interacts with policy factors that affect such costs.

More closely related to this paper, there is a newer body of experimental research about competing currencies. For example, Jiang and Zhang (2018) conduct an experiment based on the model of Matsuyama et al. (1993) to explore the drivers of different currency circulation patterns. Their results suggest that changing the relative size of the trading economies has an impact on the acceptance rates of the foreign currency. Moreover, the authors introduce government transaction policies biased towards domestic currency, which acts as a coordinating device that increases the relative preference for domestic currency. Additionally, Rietz (2019) studies the acceptance rates of a *cryptocurrency* when an official currency already circulates in the economy, following the models of Kiyotaki and Wright (1993); Soller Curtis and Waller (2000). The author's experimental results support the existence of an equilibrium with partial acceptance of the *cryptocurrency*.

There is a growing work in progress related to the effect of government intervention and monetary policy on secondary currency adoption. Based on the Lagos and Wright (2005) model with two countries and two currencies, Ding and Puzzello (2020) constructed an experimental environment to study the impact of two policies interventions on the probability that a currency emerges as an international medium of exchange. Specifically, the authors focused on the effect of relaxing restrictions on international trade and providing information on currency circulation for a small and open economy. Even though they did not find policy effects on the circulation regimes, the interventions increased the number and volume of transactions among agents.

Taken together, this body of research highlights the fact that experiments can help answer important questions on (1) which equilibrium is more likely to emerge when the models predict multiple equilibrium and (2) which policies can impact currency adoption.

3 The Model

Our theoretical predictions, as well as our experimental design, are based on the two-country, two-currency search model of Matsuyama et al. (1993). This framework is useful to explore the transactional role of money in the presence of multiple currencies. The circulation patterns of each currency are endogenously determined by two fundamental factors: the relative size of the two economies and the degree of trade integration. However, the model can be extended to include the role of a government that implements policies to deter the circulation of foreign currency.

Time is discrete and agents are infinitely lived. There are two economies: *Red* (R) and *Blue* (B); and the mass of agents in each of them has measure n_i , where $i \in \{r, b\}$. Without loss of generality, we define $n = \frac{n_r}{n_r+n_b}$ as the fraction of agents in the Red economy. All agents have an intertemporal discount factor equal to $\beta = \frac{1}{1+\delta} \in (0, 1)$, where δ is the discount rate. Economies are defined by a *matching technology* that depends on the relative size of their populations, n, and the degree of trade integration, $\rho \in [0, 1]$. This technology determines the probability, α_{ij}, that an agent from economy i meets an agent from economy j. The mapping from n, ρ to matching probabilities is summarized in Table 1.

There are three indivisible objects in the model: a consumption good and two

Table 1: Matching probabilities

	Red agent	Blue agent
Red agent	$\alpha_{rr} = 1 - \rho(1-n)$	$\alpha_{rb} = \rho(1-n)$
Blue agent	$\alpha_{br} = \rho n$	$\alpha_{bb} = 1 - \rho n$

intrinsically worthless tokens labeled by color, *Red* and *Blue*. Each agent can costlessly produce a variety of the consumption good. However, agents only consume the varieties others produce, which provides a positive utility flow, $u > 0$. After consumption, agents engage in production to restore their inventories. The absence of double coincidence of needs eliminates the existence of barter and the lack of record-keeping makes collective cooperation unsustainable. Tokens are used solely as a medium of exchange. These are useless for production and do not provide utility to their holders; that is, both currencies represent fiat money.

In each economy, i, a fraction $M_i \in (0, 1)$ of agents (buyers) is initially endowed with a unit of their home currency. The remaining fraction of agents (sellers), $1 - M_i$, is endowed with a unit of the consumption good. Henceforth, we assume that the per-capita supply of tokens remains constant. Currency exchange between agents is not allowed.

The market generates a trade opportunity whenever a buyer is matched with a seller. In that case, both agents in the pair must decide, simultaneously, whether to make the exchange. Trade occurs only when there is mutual agreement, in which case agents swap inventories and roles are reversed. That is, the buyer consumes the good, gaining utility flow $u > 0$, and engages in production immediately after, becoming a seller. Similarly, the new currency holder begins the subsequent period as a buyer. As a direct consequence of the trading rules, agents never hold more than one object at a time.

3.1 Policy Instruments

Governments might have available policy options that impact the circulation of the domestic currency by increasing the foreign currency rejection rates. The following policy instruments are available in economy i:

- τ_i^0: Lump-sum tax levied on domestic sellers for accepting foreign currency in a domestic transaction. This policy is applied when a local buyer holding foreign currency meets a local seller with a consumption good that agrees to trade.

τ_i^j: Lump-sum tax levied on domestic buyers for handing over foreign currency in a domestic transaction. In this case, the policy is applied whenever a local seller and a local buyer with foreign currency meet and agree to trade.

c_i^j: Per-period storage cost of foreign currency applied to domestic buyers. This policy is implemented whenever a buyer, holding a unit of foreign currency, was not able to trade and keep the foreign currency for an additional period.

3.2 Monetary Equilibrium

The state of the economy is completely determined by the distribution of assets among its agents, $\mathbf{m} = (m_{ij})$. In each period, there is a fraction of agents in economy i, m_{ik}, with currency $k \in \{r, b\}$; and a fraction, m_{i0}, of sellers. Since currencies are indivisible and agents can only hold one object at a time, equation (1) is always satisfied.

$$m_{ir} + m_{ib} + m_{i0} = 1 \tag{1}$$

Additionally, the total supply of currency i must equal its aggregate demand. That is, equation (2) must hold.

$$n_i M_i = n_i m_{ii} + n_j m_{ji} \tag{2}$$

Following Matsuyama et al. (1993) and Jiang and Zhang (2018), we focus on symmetric and stationary equilibria in pure strategies, where agents from the same country follow the same trading rule and the distribution of tokens remains constant over time. In this model, a token holder (buyer) who is matched with a good holder (seller) always attempts to trade. Moreover, we focus on candidate equilibria where sellers always accept the local currency. The central issue is whether sellers from economy i accept to trade and receive currency $j \neq i$. Let λ_{ij} be a dummy variable defined as $\lambda_{ij} = 1$ if sellers from country i accept the foreign currency when paired with buyers from country j, and 0 otherwise. The regimes we study are completely characterized by $\lambda = (\lambda_{rr}, \lambda_{rb}, \lambda_{br}, \lambda_{bb})$.

A currency is said to be an *international currency* if it is accepted by all sellers in both countries and a *national currency* if it is only accepted by sellers from its economy of origin. Importantly, in this paper, we introduce a particular type of currency, the ***international trading currency***, as the currency that is used for international trade, but not for local trade outside its economy of origin. Namely, we call currency i an international trading currency if it is accepted by sellers from i, irrespective of the buyer's nationality, and by sellers from $j \neq i$ *only if* it is handed over by a buyer from i.

When two agents of different nationalities are matched, $i \neq j$, the stationarity conditions of currency holdings are given by equations (3) and (4). These are built on the fact that local transactions do not alter the aggregate distribution of assets in the economy, $\mathbf{m}$. According to (3), the outflow of currency i from country j must equal the inflow of currency i to country j. Similarly, condition (4) shows that the inflow of currency j to country i must equal the outflow of currency j from country i.

$$\underbrace{m_{i0}m_{ji}}_{\text{outflow of currency } i \text{ from country } j} = \underbrace{m_{ii}m_{j0}\lambda_{ji}}_{\text{inflow of currency } i \text{ to country } j} \tag{3}$$

$$\underbrace{m_{i0}m_{jj}\lambda_{ij}}_{\text{inflow of currency } j \text{ to country } i} = \underbrace{m_{ij}m_{j0}}_{\text{outflow of currency } j \text{ from country } i} \tag{4}$$

Let V_{i0} denote the lifetime utility of a seller from economy i, and V_{ik} represent the lifetime utility of a buyer from country i who holds currency $k \in \{r, b\}$. The flow value of a seller from economy i is given by

$$\begin{aligned}\delta V_{i0} = & \underbrace{(\alpha_{ii}m_{ii} + \alpha_{ij}m_{ji})(V_{ii} - V_{i0})}_{\text{expected trade surplus when seller meets buyer with local currency}} \\ + & \underbrace{(\alpha_{ii}m_{ij}\lambda_{ii} + \alpha_{ij}m_{jj}\lambda_{ij})(V_{ij} - V_{i0})}_{\text{expected trade surplus when seller meets buyer with foreign currency}} - \underbrace{\alpha_{ii}m_{ij}\lambda_{ii}\tau_i^0}_{\text{expected tax payment of seller}} .\end{aligned} \tag{5}$$

Equation (5) consists on three terms. The first one is the probability of meeting a buyer, either local or foreign, holding local currency times the resulting trade surplus. Similarly, the second term is the probability of meeting a local or foreign buyer holding foreign currency times the corresponding trade surplus. The third is the probability of meeting a local buyer holding foreign currency times the tax levied on sellers who agree to trade. The flow value of a buyer from country i holding local currency is expressed by

$$\delta V_{ii} = \underbrace{(\alpha_{ii}m_{i0} + \alpha_{ij}m_{j0}\lambda_{ji})(u + V_{i0} - V_{ii})}_{\text{expected trade surplus of buyer with local currency in local and foreign meetings}} . \tag{6}$$

Equation (6) consists on the probability of meeting a seller, either domestic or foreign, times the associated gains from trade.

The value flow of a buyer from country i holding foreign currency can be written as

$$\delta V_{ij} = \underbrace{(\alpha_{ii} m_{i0} \lambda_{ii} + \alpha_{ij} m_{j0})(u + V_{i0} - V_{ij})}_{\text{expected trade surplus of buyer with foreign currency in local and foreign transactions}} \tag{7}$$
$$- \underbrace{\alpha_{ii} m_{i0} \lambda_{ii} \tau_i^j}_{\text{expected tax payment of buyer}} - \underbrace{(1 - \alpha_{ii} m_{i0} \lambda_{ii} - \alpha_{ij} m_{j0}) c_i^j}_{\text{expected storage cost of buyer}}$$

Equation (7) is comprised by three terms. The first one is the probability of meeting a seller, either domestic or foreign, times the resulting gains from trade. The second term is the probability of meeting a local seller times the tax levied on buyers who use foreign currency in domestic transactions. The third is the probability of holding a unit of the foreign currency for an additional period times the corresponding storage cost.

From the above expressions, it should be apparent that, in absence of policy instruments, every buyer *always* attempts to trade with a seller, local or foreign, since the value of obtaining the consumption good is higher than the value of keeping a unit of currency $k \in \{r, b\}$, $u + V_{i0} > V_{ik}$.

We focus on equilibria where taxes fail to deter buyers' willingness to use foreign currency in local transactions, $u + V_{i0} - \tau_i^j > V_{ij}$. Similarly, we focus on equilibria where storage costs encourage domestic buyers holding foreign currency to attempt to trade in order to avoid incurring in a cost of c_i^j, $u + V_{i0} > V_{ij} - c_i^j$. Whether trade occurs ultimately depends on the seller's decision. In our candidate equilibria, sellers *always* accept their domestic currency. However, the acceptance of foreign currency may vary across regimes and is endogenously determined by the following incentive compatibility constraint, written for a seller from economy i who meets a buyer from economy $k \in \{i, j\}$

$$\lambda_{ik} = \begin{cases} 1 & \text{if } V_{ij} - \tau_i^0 \mathbf{1}_{\{k=i\}} > V_{i0} \\ 0 & \text{if } V_{ij} - \tau_i^0 \mathbf{1}_{\{k=i\}} \leq V_{i0}, \end{cases} \tag{8}$$

where $\mathbf{1}_{\{.\}}$ is an indicator function. According to equation (8), a seller accepts foreign currency from a local buyer, $k = i$, if the value of holding foreign money net of tax payment, $V_{ij} - \tau_i^j$, exceeds the value of remaining a seller, V_{i0}. The same reasoning applies when the meeting involves a foreign buyer, $k = j$, except no taxes are charged to the seller if trade takes place.

3.3 Currency Regimes

A circulation regime is a symmetric and stationary equilibrium $(\mathbf{m}, \lambda, \mathbf{V})$ that satisfies conditions (3)-(8). We focus on equilibria where sellers from the *Blue* economy *always reject* the *Red* currency, $\lambda_{bb} = \lambda_{br} = 0$. Since *Red* is a *national currency* that only circulates domestically, $m_{rr} = M_r$ and $m_{br} = 0$. Table 2 summarizes the currency regimes we discuss in this paper, which differ in the extent to which *Red* sellers accept the *Blue* currency.

Table 2: Currency Regimes

Regime	Circulation pattern of *Blue* currency
N	National currency
I	International currency
C	International trading currency

For each candidate equilibrium, we solve equations (3)-(7) and verify if it is incentive-compatible according to condition (8). In every case, we assume **policy instruments are only available to the Red government**. Furthermore, we assume that the *Red* economy has a smaller population than the *Blue* country (n is low). In Figure 1, we provide the typology of equilibria under each treatment in our design, as well as the parameterization used in the experiment.

3.3.1 Regime N: *Blue* currency is *national*

In this regime, *Red* sellers **always reject** the *Blue* currency, $\lambda_{rr} = \lambda_{rb} = 0$, which in turn implies $m_{bb} = M_b$ and $m_{rb} = 0$. The flow values of agents from economy i collapse to

$$\begin{aligned}
\delta V_{i0} &= \alpha_{ii} M_i (V_{ii} - V_{i0}), \\
\delta V_{ii} &= \alpha_{ii} (1 - M_i)(u + V_{i0} - V_{ii}), \\
\delta V_{ij} &= \alpha_{ij} (1 - M_j)(u + V_{i0} - V_{ij}) - \mathbf{1}_{\{i=r\}} \left[1 - \alpha_{ij}(1 - M_j)\right] c_i^j.
\end{aligned}$$

For both economies, we verify whether the incentive compatibility constraints in (8) are satisfied. In the *Red* economy, taxing sellers τ_r^0 reduces the trade surplus they obtain when accepting foreign currency from domestic buyers, relative to the case where transactions involve a foreign counterpart. Therefore, if *Red* sellers reject the *Blue* money from *Blue* buyers, they will also reject it when offered by *Red* citizens. As a result, it is sufficient to show $V_{ij} \leq V_{i0}$, which occurs if:

$$\left[\alpha_{ii}^2 M_i(1-M_i) - (\delta+\alpha_{ii})\alpha_{ij}(1-M_j)\right] u + \mathbf{1}_{\{i=r\}}(\delta+\alpha_{ii})\left[1-\alpha_{ij}(1-M_j)\right] c_i^j > 0 \quad (9)$$

Equation (9) gives the existence conditions for Regime N in terms of the relative size of the *Red* economy, n, the degree of trade integration, ρ, and the storage cost on the *Blue* currency imposed by the *Red* government, c_r^b. Other things being equal, this policy instrument discourages the acceptance of foreign money, which translates into an increase in the set of pairs (n, ρ) that support this equilibrium.

3.3.2 Regime I: *Blue* currency is *international*

This equilibrium arises when *Red* sellers **always accept** the *Blue* currency, $\lambda_{rr} = \lambda_{rb} = 1$. Moreover, by solving equations (2) and (4), we find that the fraction of agents holding *Blue* money in the *Red* and *Blue* economy, respectively, are given by

$$\begin{aligned} m_{rb} &= \tfrac{(1-n)(1-M_r)M_b}{1-nM_r}, \\ m_{bb} &= \tfrac{(1-n)M_b}{1-nM_r}. \end{aligned}$$

For *Red* agents, flow values of simplify to

$$\begin{aligned} \delta V_{r0} &= \alpha_{rr} M_r(V_{rr} - V_{r0}) + \alpha_{rr} m_{rb}(V_{rb} - \tau_r^0 - V_{r0}) + \alpha_{rb} m_{bb}(V_{rb} - V_{r0}), \\ \delta V_{rr} &= \alpha_{rr} m_{r0}(u + V_{r0} - V_{rr}), \\ \delta V_{rb} &= \alpha_{rr} m_{r0}(u + V_{r0} - \tau_r^b - V_{rb}) + \alpha_{rb} m_{b0}(u + V_{r0} - V_{rb}) \\ &\quad - \left[\alpha_{rr}(M_r + m_{rb}) + \alpha_{rb} m_{bb}\right] c_r^b. \end{aligned}$$

Conversely, for *Blue* citizens, the value functions may be written as

$$\begin{aligned} \delta V_{b0} &= (\alpha_{bb} m_{bb} + \alpha_{br} m_{rb})(V_{bb} - V_{b0}), \\ \delta V_{bb} &= (\alpha_{bb} m_{b0} + \alpha_{br} m_{r0})(u + V_{b0} - V_{bb}), \\ \delta V_{br} &= \alpha_{br} m_{r0}(u + V_{b0} - V_{br}). \end{aligned}$$

For the *Red* economy, we verify that sellers accept the *Blue* currency from domestic buyers, $V_{rb} - \tau_r^0 > V_{r0}$, hence ensuring they will also accept it from foreign citizens. Next, we show that *Red* sellers still accept the *Red* token, which implies $V_{rr} > V_{r0}$[1].

On the other hand, we verify that *Blue* sellers always reject the *Red* currency, which requires $V_{br} \le V_{b0}$ and thus

$$\alpha_{br} m_{r0}(\delta + \alpha_{bb} m_{b0} + \alpha_{br} m_{r0}) \le \alpha_{bb} m_{b0}(\alpha_{bb} m_{bb} + \alpha_{br} m_{rb}). \tag{10}$$

According to equation (10), it should be relatively easier for *Blue* buyers to meet *Blue* rather than *Red* sellers.

3.3.3 Regime C: *Blue* currency is the *international trading currency*

This equilibrium emerges when *Red* agents reject the *Blue* token in domestic transactions, but accept it in international meetings, $\lambda_{rr} = 0$ and $\lambda_{rb} = 1$. The fraction of agents holding *Blue* currency in the *Red* and *Blue* economy, respectively, are given by

$$m_{rb} = \frac{(1-n)(1-M_r)M_b}{1-nM_r},$$

$$m_{bb} = \frac{(1-n)M_b}{1-nM_r}.$$

In the *Red* economy, value functions may be written as

$$\delta V_{r0} = \alpha_{rr} M_r (V_{rr} - V_{r0}) + \alpha_{rb} m_{bb}(V_{rb} - V_{r0}),$$

$$\delta V_{rr} = \alpha_{rr} m_{r0}(u + V_{r0} - V_{rr}),$$

$$\delta V_{rb} = \alpha_{rb} m_{b0}(u + V_{r0} - V_{rb}) - (\alpha_{rr} + \alpha_{rb} m_{bb}) c_r^b.$$

In the *Blue* economy, flow values coincide with those in *Regime I*. Therefore, equation (10) is an equilibrium condition for this regime as well. Next, we verify *Red* sellers reject the *Blue* token from local buyers, $V_{rb} - \tau_r^0 \le V_{r0}$, but accept it from foreign citizens, $V_{rb} > V_{r0}$. That is, *Red* sellers are willing to hold foreign currency as long as no tax payment, τ_r^0, is incurred upon. As a consequence, this trading rule may only arise when $\tau_r^0 > 0$. Finally, we show *Red* agents always accept the local token, $V_{rr} > V_{r0}$[2].

[1] We use Matlab to compute analytical solutions in the (n, ρ) locus. These expressions shape the circulation patterns presented in Figure 1 of Section 4.

[2] We use Matlab to compute analytical solutions in the (n, ρ) locus. These expressions shape the circulation patterns presented in Figure 1 of Section 4.

4 Experiment Design

The experimental environment closely follows the model described above, where citizens of two economies repeatedly interact with each other and with citizens of the other economy. One of the countries (*Blue*) is set to be the larger economy and the other (*Red*) represents a small open economy whose government implements policies to discourage the domestic use of foreign currency. Since we want to focus on the latter economy, we automate *Blue* citizens, whereas human participants always interact as citizens of the Red economy. Furthermore, we set the size of the *Blue* economy to twenty automated participants. Meanwhile, groups of eight human participants were assigned to the corresponding *Red* economy. From these subjects' perspective, groups of eight participants were randomly formed, which then remained together for all periods in the experimental session.

In each period, individuals participate in the same exchange game described in the theory section. Each agent holds one of three objects: a consumer good, a *Blue* token or a *Red* token. Then, each participant is randomly matched with another agent (observing the partner's origin and object) and needs to decide whether they want to attempt to exchange objects their partner. Trade attempts occur simultaneously and privately. Once both matched players submit their decisions, these are revealed and the exchange occurs only if there is a mutual willingness to trade objects. As in the model, bartering between sellers (good holders) is not allowed. Same is true for the exchange of tokens. The automated Blue agents of the foreign economy always use their optimal trading rule of only accepting Blue tokens in exchange for the consumption good and are always willing to trade when holding a token. This rule is public information for every participant.

In either country –*Red* or *Blue*– half of the agents receives their corresponding domestic currency as an initial endowment and the remaining half receives a consumption good. That is, using the model's notation: while $n_b > n_r$, we have $M_B = M_R = 0.5$. We calibrate the integration level so that: (a) there is a higher probability of meeting with another domestic agent for *Red* participants ($\alpha_{rr} = 0.75, \alpha_{rb} = 0.25$), and (b) there is almost certainty of meeting with another *Blue* agent for *Blue* bots ($\alpha_{bb} = 0.9, \alpha_{br} = 0.1$). The interaction is repeated for 50 periods ($T = 50$).[3] Moreover, each human participant starts the first period with an endowment, W, of 50 points, and the consumption utility service, u, is 10 points. The payoff for the session equals the sum all round payoffs plus

[3] We use a discount factor of $\beta = 0.98$ in calculating our theoretical equilibria. This discount factor was chosen so that, in the analogous model with random stop where probability of continuation equals β, the average number of periods was 50.

the initial endowment.

There are two additional notes related to departures of the experimental environment from the theoretical model presented above. The first one is related to the fact that we use a finite horizon ($T < \infty$) while in the model, time is infinite. On this regard, similar to what is noted in Jiang and Zhang (2018), in our environment, there exists monetary equilibria despite the finite horizon. This fact contrasts with finite time models where there is a unique or non monetary equilibrium. Also, we should note that the experimental evidence on monetary economies suggests that money emerges as a medium of exchange in most sequential games with multiple equilibria, but also in those without theoretical monetary equilibrium (Davis et al., 2019).

Second, in the model, the population of both countries is modeled as a continuum (with uncountable citizens), while in the experiment, we are naturally forced to work with finite populations in both countries. We chose the appropriate parameters so that the relevant probabilities are compatible with the discreteness of the population. Similarly, we chose population sizes that are at least as large as those in Jiang and Zhang (2018). They show through simulations that, if the sizes of the economies are sufficiently large and parameters of the environment are properly chosen, the finite-population model shares relevant equilibria with the infinite population model.

4.1 Policy Treatments

Our experiment follows a between-groups design, where each group of eight participants interacted in 50 rounds under a single condition (policy treatment). We implemented the following three policy treatments along with the baseline condition.

Baseline Condition

Each group of 8 human participants represents a *Red* economy. In each group, agents play 50 rounds of the exchange game described above, amongst themselves and with 20 automated Blue bots. The rest of the parameters are: $\alpha_{rr} = 0.75$, $\alpha_{bb} = 0.9$, $W = 50$ points, $u = 10$ points. Storage costs of either token in the *Red* economy are null, $c_r^r = c_r^b = 0$ points. Likewise, taxes on transactions are $\tau_r^0 = \tau_r^b = 0$ points.

Treatment 1: Taxes on domestic transactions with foreign currency

In this treatment we maintain the setting of the baseline condition but implement taxes to domestic transactions in foreign currency. The taxes are set to $\tau_r^0 = \tau_r^b = 1$ point.

Treatment 2: Storage costs of foreign currency
In this treatment, we maintain the setting of the baseline condition but implement asymmetric storage costs of: $c_r^r = 0$ and $c_r^b = 0.7$. That is, agents are able to freely store the local token, but must pay 0.7 points to carry over the foreign token for each additional round.

Treatment 3: Information of domestic acceptance of foreign currency
In this treatment we maintain the setting of the baseline condition but disclose information regarding transactional dollarization. Each period, human participants are revealed the fraction of exchanges that were settled in foreign currency between fellow *Red* citizens.

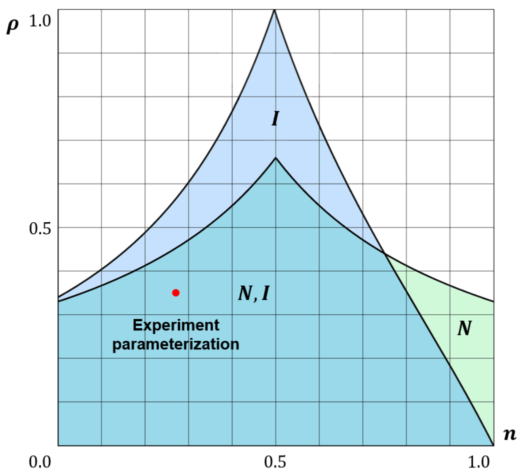
4.2 Hypotheses

In Figure 1, we present the typology of equilibria for all conditions. In particular, each panels depicts the regions of fundamentals (relative size, n, and degree of integration, ρ) that support the three different equilibrium regimes we study: international currency regime (I); national currency regime (N); and international trading currency regime (C). Panel (a) shows this typology for the baseline condition; Panels (b)-(d) show the typology for the treatments 1-3, respectively.

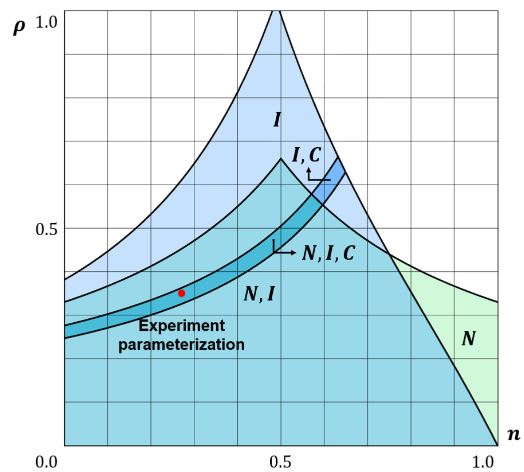
This exercise illustrates the theoretical impact of policies. Taxes barely alter the regions for regimes I and N with respect to baseline, but do introduce a small subset of I where regime C is now supported (the band in Panel b of Figure 1). On the other hand, storage costs extend the area of regime N relative to baseline, and causes a large reduction of the area of regime I, as expected. However, since storage costs are not conditional on who provided the Blue token, regime C does not emerge under this policy. As expected, the information treatment has the same prediction as baseline. That is, Panels (a) and (d) of Figure 1 are identical.

These diagrams also show the parameterization we implemented in the experiment in terms of both the degree of trade integration and the relative size of the economies (red dot). We use the same parameterization for all conditions. This parameterization supports regimes I and N in all treatments. However, only under a non-zero tax policy (treatment 2) regime C emerges as a possible equilibrium.

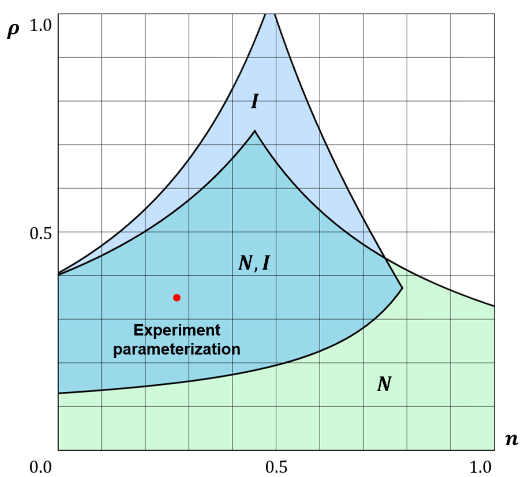
The main outcome we study is the acceptance rate of foreign currency. At the individual level, this is defined as the binary decision to accept a foreign token in exchange for the consumption good. At the economy level, this metric is defined as the percent-



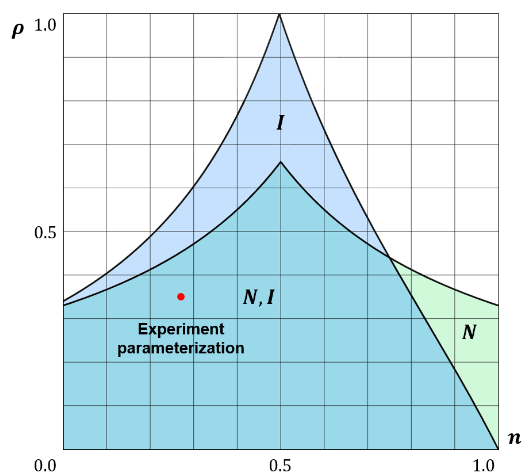
(a) Baseline Condition



(b) Taxes on trade in foreign currency



(c) Costly storage of foreign currency



(d) Info on acceptance of foreign currency

Figure 1: Typology of equilibria in all four conditions. These graphs represent the regions of fundamentals (relative size, n, and degree of integration, ρ) that support the three different equilibria we study: international circulation of Blue token (I); National circulation of Blue token (N); and conditional acceptance of Blue token (C). Panel (a) shows the typology for the baseline condition; Panels (b)-(d) show the typology for the treatments 1-3, respectively. These diagrams also show the parameterization utilized in the experiment (red dot). Notice that diagrams (a) and (d) are the same as the equilibria prediction does not differ with information display between baseline and the information treatment.

age of citizens who accept the foreign currency. Given that the focus of this paper is transactional (de)dollarization, we distinguish -when relevant- the acceptance of foreign currency in international trade (matches between *Red* and *Blue* agents) from the acceptance of foreign currency in domestic transactions (matches between two *Red* agents). Another important metric associated with efficiency and welfare in this environment, is simply the percentage of participants who decide to trade. We use the theoretical predictions of the model to form the following hypotheses about the experimental results.

> **Hypothesis I**: The introduction of taxes to domestic transactions in foreign currency will **reduce the acceptance rate of foreign currency**. Furthermore, this effect would be **based on the trade rejection of foreign currency held by locals respect to the foreign currency held by foreigners**. This effect would arise because of the fee paid when trading in foreign currency with *Red* economy individuals. Relative to baseline, more *Red* economies will move towards the international trading currency regime (*Blue* token accepted for foreign transactions and rejected between domestic agents).

> **Hypothesis II**: The introduction of asymmetric storage costs, $c_b > 0$, will diminish the acceptance rate of foreign currency, whether the partner is local or foreign. Relative to baseline, more *Red* economies will move towards the national currency regime (where *Blue* token is not accepted in the *Red* economy).

> **Hypothesis III**: The introduction of salient information on the acceptability of foreign currency in domestic transactions, helps *Red* agents to coordinate towards either regime N or I. That is, information will reduce the acceptance rate of foreign currency or will increase it. Relative to the baseline, we should observe more clear separation among economies into the two regimes.

> **Hypothesis IV**: The acceptance ratio of the consumption good remains constant throughout the control and treatment sessions. This is a rationality test for the participants, accepting the exchange is a strictly dominant strategy for buyers.

> **Hypothesis V**: The acceptance rate of local currency is higher than the acceptance ratio of the foreign currency, and remains constant through the control sessions and treatment.

4.3 Procedures

The experiment was conducted in December of 2019. We deployed online sessions using the subject pool maintained by the Experimental Economics Laboratory of the Pontifical Catholic University of Peru. This laboratory uses a standard ORSEE server Greiner (2015) to recruit human participants. We conducted a total of eight sessions with 16 participants each. In each session, we collected data for two independent groups. That totals four groups per treatment.

The session was structured as follows. Subjects received over email the corresponding URL and a code to enter the session (each session had a different URL and different IDs). Once in the session, they read the instructions page.[4] Then, participants solved incentivized control questions, and the experimenters answered any questions in private via web or via an ad hoc phone line. Then the interaction started. Each round consisted of a screen where each participant was informed about their own state, the state of their partner, and the full history of their individual transactions and previous rounds. This included the group to which the player and counterpart belonged and the object carried by each of them. After all 50 periods, subjects answered a post-interaction survey.

The experiment software was mainly developed at the LEEPS Lab of the University of California Santa Cruz using the oTree framework (Chen et al., 2016) and the server was deployed on Heroku servers. The source code can be obtained from this public repository https://github.com/elip12/dedollarization, or upon request from the authors. Appendix B contains a screenshot of the interface. The software was implemented to check whether the subject was using a desktop computer and not a mobile device (since interface was not optimized to be visualized on mobile devices).

We used the three most popular mobile payment applications in Peru (as well as direct bank deposits) as our method of payment. Payment process was initiated immediately after the session.

Participants received payments based on their performance equal to the value of their accumulated points over the 50 periods. The exchange rate in the experiment was set to be 1 PEN (Peruvian currency) for every 20 experimental points (1 point = 0.05 PEN). Participation fee was set to be 5.00 PEN.[5] The duration of a session ranged from one hour to one and a half hours, and subjects earned between 10 and 15 PEN (on average, 13 PEN approximately).

[4]The English translation of the instruction (originally in Spanish) can be found in Appendix B.

[5]Peruvian currency is called the "Sol", and its IBAN international code is "PEN". The exchange rate between PEN and the US Dollar, at the moment of the experiment, was approximately 3.38 PEN for 1 USD.

Table 3: Two tails' mean difference on foreign currency acceptance rate (foreigner - local)

	Mean Difference	z	p-value	N
Taxes [T1]	-0.0305	-0.4062	0.6852	188
Storage costs [T2]	0.1292	1.6791	0.0951	160
Information [T3]	-0.0835	-1.1144	0.2671	171

5 Results

We focus our analysis on the acceptance rate of both currencies and the consumption good. In particular, we study the acceptance pattern of foreign currency (*Blue* token).

Figure 2 shows the average acceptance rate of foreign currency in all four treatments for the complete sample of interactions. This ratio is calculated as follows. The numerator is the total number of good holders who were willing to accept the *Blue* token. The denominator is the total number of matches where trading was possible and one agent had a *Blue* token.

Using the full sample, we find that the information treatment provides foreign token acceptance rates statistically equivalent to the baseline condition (between 60% and 70%). There is also a lower acceptance for the tax and storage cost treatments, which is approximately between 40% and 45%. These treatments are statistically different than baseline and the information treatment.

Furthermore, figure 3 presents the acceptance rates detailed by the trading partner's origin. We observe that average rates are statistically similar within each treatment, except by the storage cost treatment. Also, we confirm that the information treatment is statistically equivalent to baseline and that taxes and storage costs have similar outcomes.

We observe a higher rejection of foreign currency when there are matches between two local participants in the storage costs' treatment. Therefore, we ran a formal test of the difference on the acceptance rate by the counterpart's origin for the taxes, storage costs and information treatments relative to the baseline in Table 3. The results confirm a statistically significant higher foreign currency rejection rate for the local matches in storage costs treatment.

This behavior might be in response to and overreaction to the matching probabilities between locals and the round they have to wait to incur in the cost. This finding is not present on any theoretical equilibria, as there are no differential incentives for foreign or local matches.

We also conducted a regression analysis presented in Table 4. We used the foreign

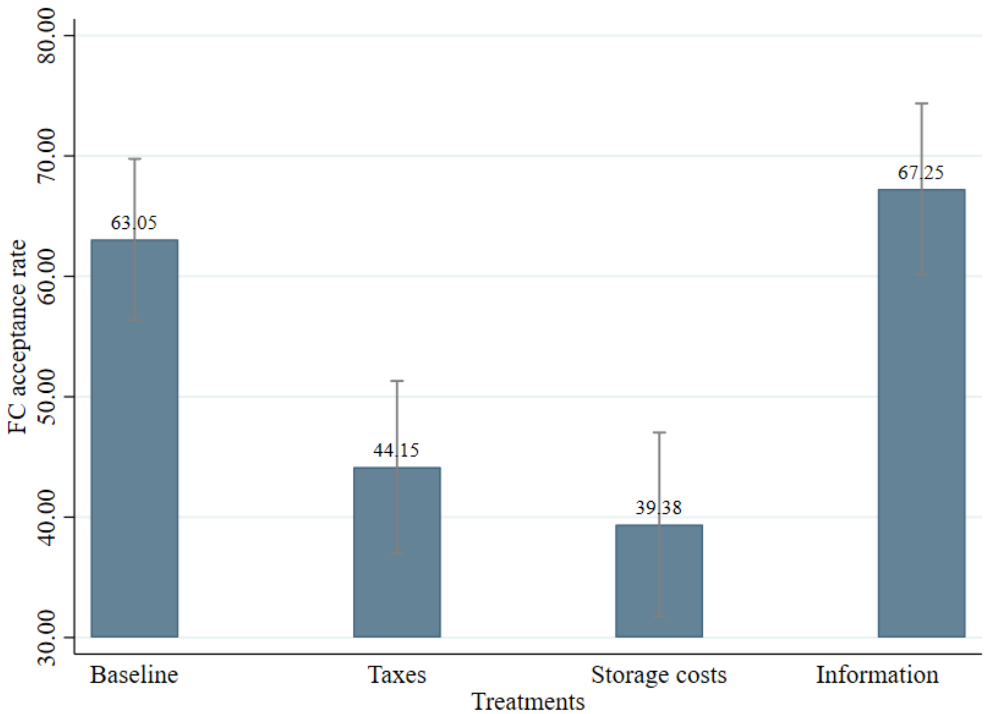


Figure 2: Foreign Currency Acceptance Rate, full sample (percentage). Whiskers on each bar depict the 95% confidence interval for the mean acceptance rate.

currency acceptance rate as the dependent variable, estimated a probit model and reported the marginal effects on the acceptance probability. We used dummy variables associated to each treatment to assess whether these have an effect on the acceptance rate of the *Blue* token relative to the baseline condition.

We included controls referring to the period of interaction (to take into account the effect of learning within each session) and for each group that made up a Red economy. We also dropped the first quarter of rounds to reduce the volatility of the initial learning process. Finally, we clustered the standard errors at the group level.

Given the few number of clusters (16), we apply the correction for the small number of clusters, the wild score bootstrapping (Cameron et al., 2008; Kline and Santos, 2012; MacKinnon and Webb, 2018; Roodman et al., 2019). This approach is suitable for nonlinear models, as it computes Lagrange Multiplier statistics with the contributions to the scores and ensures proper asymptotic behavior.

For every specification, we report the p-values computed by clustering the standard errors at the group level (in parentheses) and, also, the p-values obtained with the wild score bootstrapping correction for small number of clusters (in square brackets).

We have a caveat for the estimates, as we cannot apply the wild score bootstrap

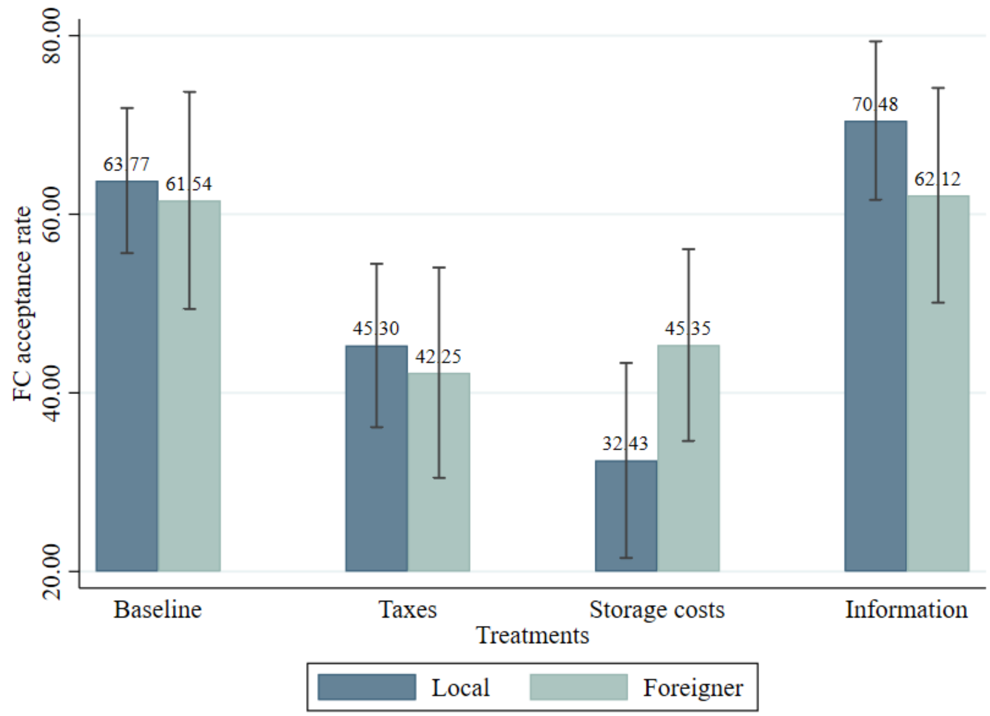


Figure 3: Foreign Currency Acceptance Rate by partner origin (percentage). Whiskers on each bar depict the 95% confidence interval for the mean acceptance rate.

to compute the marginal effects on the foreign currency acceptance. Nevertheless, we report the marginal effect found with the robust specification, as there is no major difference between the robust and the bootstrapped p-values (Porter and Serra, 2017).

Results in Table 4 highlight that taxes and storage costs have negative and significant effects on the foreign currency acceptance rate. Both treatments have a negative effect on the foreign currency acceptance rate regardless of the counterpart's nationality, which confirms Hypothesis II.

Contrarily, the information treatment does not have any significant effect on the foreign currency acceptance probability. That is, results are not statistically different from the baseline condition. The null impact reflects that information differences, on average, do not have major effects on coordinating individuals' behavior. These findings are supported by the acceptance rate per round in the Appendix C, where both treatments present similar patterns.

We extended our regression analysis to account for Hypotheses IV and V. Table 5 reports the results. As expected, the consumption good is equally accepted in all treatments; however, we find that acceptance rates are all clearly below 100%. We interpret these results as being partially consistent with Hypothesis IV. We observe

Table 4: Marginal effects on foreign currency acceptance rate (Probit)

Variables	(1) Full sample	(2) FC held by local	(3) FC held by foreigner
Taxes [T1]	-0.168**	-0.146**	-0.193*
	(0.018)	(0.053)	(0.085)
	[0.009]	[0.0351]	[0.0987]
Storage costs [T2]	-0.204**	-0.253*	-0.178**
	(0.038)	(0.078)	(0.040)
	[0.0266]	[0.0567]	[0.0374]
Information [T3]	0.0565	0.0962	-0.0063
	(0.458)	(0.352)	(0.948)
	[0.4187]	[0.2974]	[0.9471]
Controls	✓	✓	✓
N	722	434	288

p-values clustered at group level in parentheses, bootstrapped p-values in brackets
We control at a group level and the number of rounds.
*** p<0.01, ** p<0.05, * p<0.1
* indicates the bootstrapped p-values' significance level

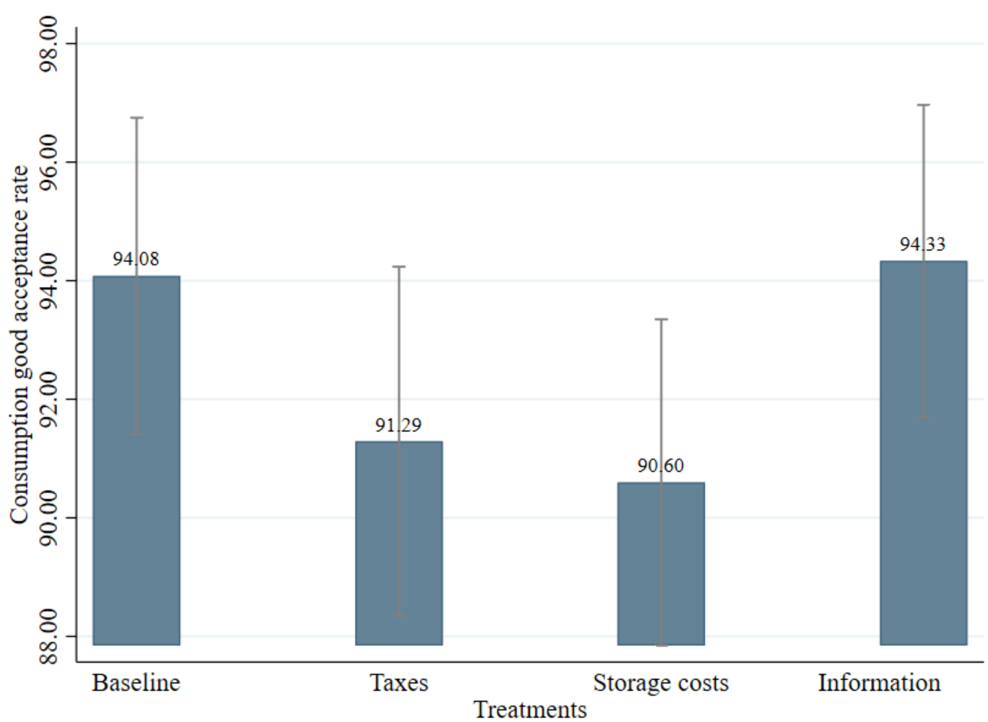


Figure 4: Consumption Good Acceptance Rate, full sample (percentage). Whiskers on each bar depict the 95% confidence interval for the mean acceptance rate.

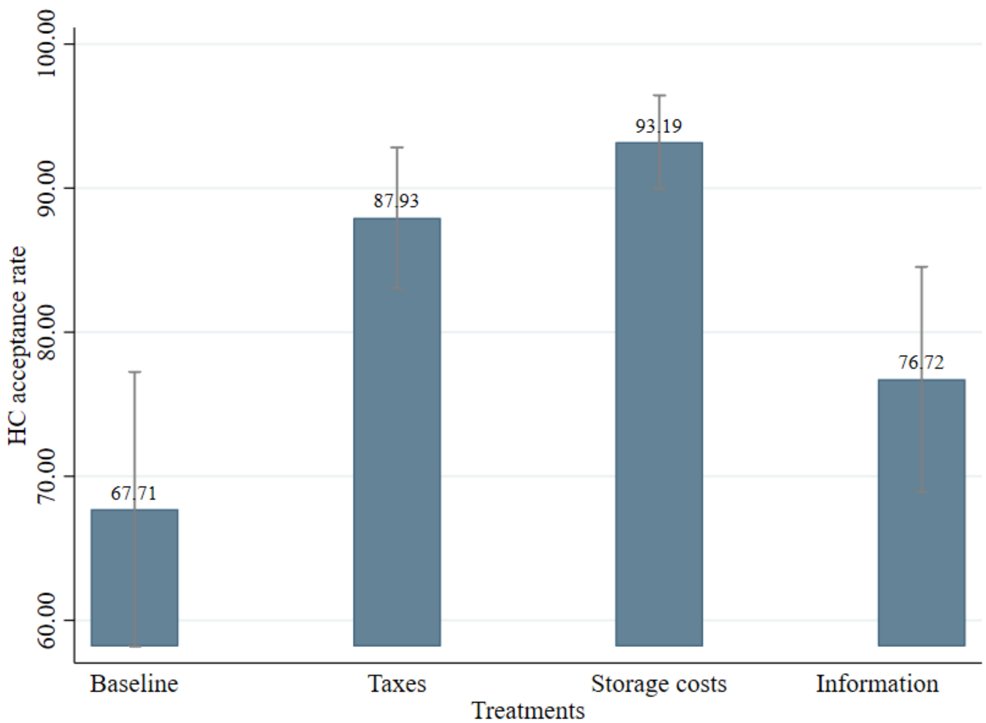


Figure 5: Home Currency Acceptance Rate, full sample (percentage). Whiskers on each bar depict the 95% confidence interval for the mean acceptance rate.

Table 5: Marginal effects on acceptance rates (Probit)

Variables	(1) Local currency	(2) Consumption good
Taxes [T1]	0.121***	-0.0582*
	(0.004)	(0.109)
	[0.0158]	[0.0917]
Storage costs [T2]	0.164***	-0.0823
	(0.000)	(0.197)
	[0.0152]	[0.3103]
Information [T3]	0.0239	-0.0256
	(0.601)	(0.504)
	[0.6039]	[0.4523]
Controls	✓	✓
N	621	1,396

p-values clustered at group level in parentheses, bootstrapped p-values in brackets
We control at a group level and the number of rounds.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$
* indicates the bootstrapped p-values' significance level

in Figure 4 that acceptance rates lay between 90% and 94% among treatments. The rejection rate might be due to initial confusion on the experiment rules.

Finally, we find that taxes and storage costs have significant and positive effects on the local currency acceptance rate. Also, Figure 4 presents the local currency acceptance rates across the treatments. Baseline and the information treatment have similar acceptance rates between 67% and 76%. On the other hand, the taxes and storage costs acceptance rates lay between 82% and 93%, respectively, which is statistically higher than baseline. Although this finding stands in sharp contrast to Hypothesis V, we believe it is highly illustrative of the behavioral substitution effects that are not present in the theoretical model or in related studies like (Jiang and Zhang, 2018).

These facts are related to the literature concerned with the role of the government on enhancing the circulation of local currency, which in our experiment would favor regime N . We must highlight that theoretical and empirical findings focus on how to establish the national currency regime instead of the international currency regime (Yeyati and Ize, 2005; Armas, 2016; Ding and Puzzello, 2020). In fact, in Eastern European and Latin American countries there are substantial efforts to reduce the circulation in a foreign currency like the US dollar or the Euro relative to the local currency circulation. These implies macroprudential and monetary policies to favor local circulation respect to foreign currency, mainly by affecting one of the money functions like store of value (Ongena et al., 2014; Epure et al., 2017; Camors et al., 2019).

In sum, both taxes and storage costs effectively deter the circulation of foreign *Blue* currency and enhance that of the local *Red* token. The information policy does not have any statistical effect on these margins.

6 Discussion

We extend the model in Matsuyama et al. (1993) to study the effectiveness of policy instruments intended to discourage transactional dollarization. This study generates relevant insights for policy-making in contexts of partial currency substitution, a rather typical phenomena in emerging markets. Paradoxically, however, currency dollarization has not been as widely documented as financial dollarization (Yeyati and Ize, 2005; Armas, 2016).

We focus on the following policies: (1) taxes on transactions in foreign currency among domestic agents; (2) storage costs for foreign currency; and (3) information on the foreign currency acceptance rate among domestic agents. We contribute to the theoretical literature by characterizing a new circulation regime that discriminates the trading partner's nationality. In this regime, domestic agents accept the foreign currency in international transactions but reject it in domestic ones.

Our experimental evidence is partly in line with our theoretical predictions: both taxes on domestic transactions settled in foreign currency and storage costs on foreign currency holdings influence currency acceptance decisions. In particular, storage costs have a negative and significant effect on the foreign currency acceptance rate regardless of the partner's origin. Taxes also diminish the foreign currency acceptance rates, but in a different magnitude according to the origin of the trading partner.

The information provision on acceptability of foreign currency in local transactions does not seem to have an effect on the acceptance rate itself. There are no apparent incentives to coordinate on a different regime than baseline.

The acceptance of home currency is enhanced by taxes and storage costs, contrary to our hypothesis stating that they would remain constant across treatments. Consumption good acceptance rate remains constant across rounds and sessions, as predicted by theory; although its acceptance is, on average, below the 100% rate predicted by the model.

In taking our insight to practice, we must highlight that there are other considerations that require attention if governments decide to tax domestic transactions or impose storage costs. Empirical results show that the latter might be implemented as reserve requirements or macroprudential policies taken by the Central Banks, while the former are decided by the Finance Ministry. Evidence on emerging economies (e.g., Argentina's taxes to transactions in dollars) show that implementation would be easier in the case of macroprudential policies for independent Central Banks. Meanwhile, transaction taxes were proposed in Europe with the Currency Transaction Tax in early 2000s, but it was not applied until Argentina implemented a tax on foreign currency transactions, mainly in dollars.

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Appendix

A Instructions for Participants

(Translated from Spanish)

Welcome. Thank you for participating in today's session. Read these instructions carefully; your decisions and those of the other participants of the experiment will determine your payment. This payment will be proportional to the points that you accumulate throughout the experiment. Upon completion, the accumulated points will be transformed into soles (S /) at 1 point conversion rate = S / 0.05. Additionally, you will be paid S / 4.00 just for participating.

Rounds and Groups The central block of this session consists of 50 rounds of the same type of interaction. At the start of the first round, random groups will be formed. Each group will have 8 participants. The groups are fixed, which means that throughout the session you will stay in the same group. Your group will be called a *Red* group. The people of your group will interact with each other and with agents of the *Blue* group, who are represented by the computer (they are bots). In the *Blue* group there are 20 agents.

Initial endowments Each participant in your group starts the first round with a 50-point endowment and one of two objects: one *Red* token or a consumer good. Half of the *Red* group members receive a *Red* token, and the remaining half will receive a consumer good. The assigned object is randomly assigned. The situation is analogous to the *Blue* group, where 10 agents receive randomly a *Blue* token and 10 receive a consumer good. The quantity of each object remains fixed throughout all rounds.

Random couples in each round At the beginning of the round, each member of the *Red* group is randomly matched with someone from their group or from the *Blue* group. The probability of pairing with someone in the *Red* group is 75% and with someone in the *Blue* group is 25%.

Exchange Decision In each round, every participant is informed of their own object, the group of his partner and the object she has. Some meetings have trade possibility and others do not. There is only exchange possibility if one has one token and the other has a consumption good. On the contrary, if both people have consumption goods, there is no exchange possibility (no barter). If the two have tokens, they cannot exchange them either. In the case of being possible to exchange, both agents must decide privately whether they want to exchange or not. Only if both agents respond positively, the token and the consumption good are exchanged. *Blue* group agents are automated (they are bots) and are always willing to exchange but never accept *Red* tokens. The object with which you end a round is the same with which you start the next.

Payments All participants start with 50 points.

In each round, receiving a token grants 0 points, regardless of whether it is *Red* or *Blue*. In contrast, receiving a consumption good from another participant gives you 10 points when you receive it. That is, the consumption good generates points only if it is obtained as a result of an exchange, regardless of which group it comes from. If you maintain the same consumption good for more than one period, you do not receive additional points.

For the Tax treatment: Using *Blue* tokens between agents of the *Red* group is taxed. If you receive a *Blue* token from another participant in the *Red* group, you will pay a 1 point tax. Similarly, if you exchange a *Blue* token for a consumption good with another participant of the *Red* group, you will pay a 1 point tax.

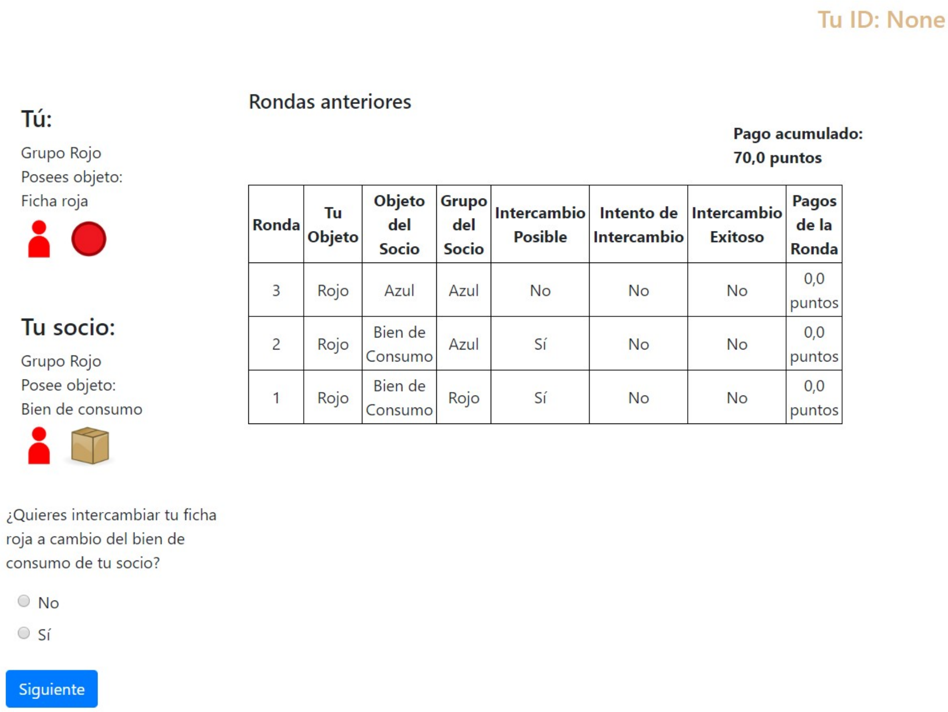
For the Storage cost treatment: If you keep a token for more than one period, you will pay a storage cost. If you keep a *Red* token, you'll pay 0 points. If you keep a *Blue* token, you will pay 0.7 points.

During all interaction rounds, you will have on your screen the information referred to the previous rounds.

For the Information treatment In particular, the acceptance rate of the *Blue* token among people on the *Red* team will be displayed.

The payment of the session is the accumulated points of the 50 rounds of interaction.

B Experiment Interface


Tu ID: None

Tú:

Grupo Rojo
Posees objeto:
Ficha roja

Tu socio:

Grupo Rojo
Posee objeto:
Bien de consumo

¿Quieres intercambiar tu ficha roja a cambio del bien de consumo de tu socio?

No
Sí

Siguiente

Rondas anteriores

Pago acumulado: 70,0 puntos

Ronda	Tu Objeto	Objeto del Socio	Grupo del Socio	Intercambio Posible	Intento de Intercambio	Intercambio Exitoso	Pagos de la Ronda
3	Rojo	Azul	Azul	No	No	No	0,0 puntos
2	Rojo	Bien de Consumo	Azul	Sí	No	No	0,0 puntos
1	Rojo	Bien de Consumo	Rojo	Sí	No	No	0,0 puntos

Figure 6: Experiment Interface

C Foreign currency acceptance rate behavior

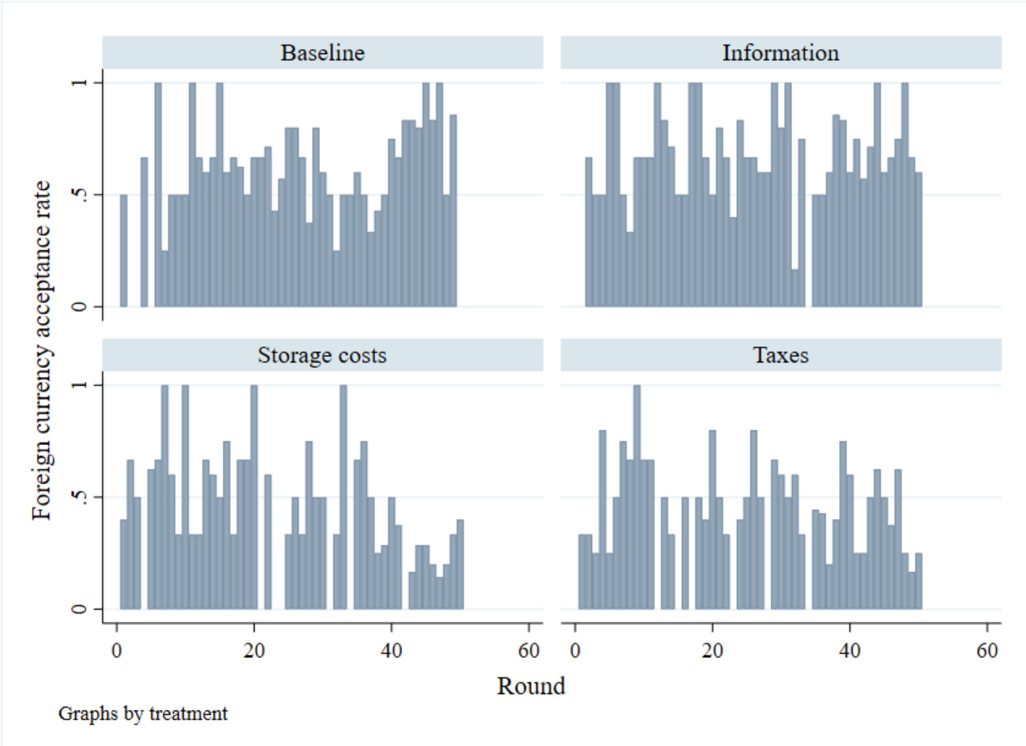


Figure 7: Foreign currency acceptance rate per round

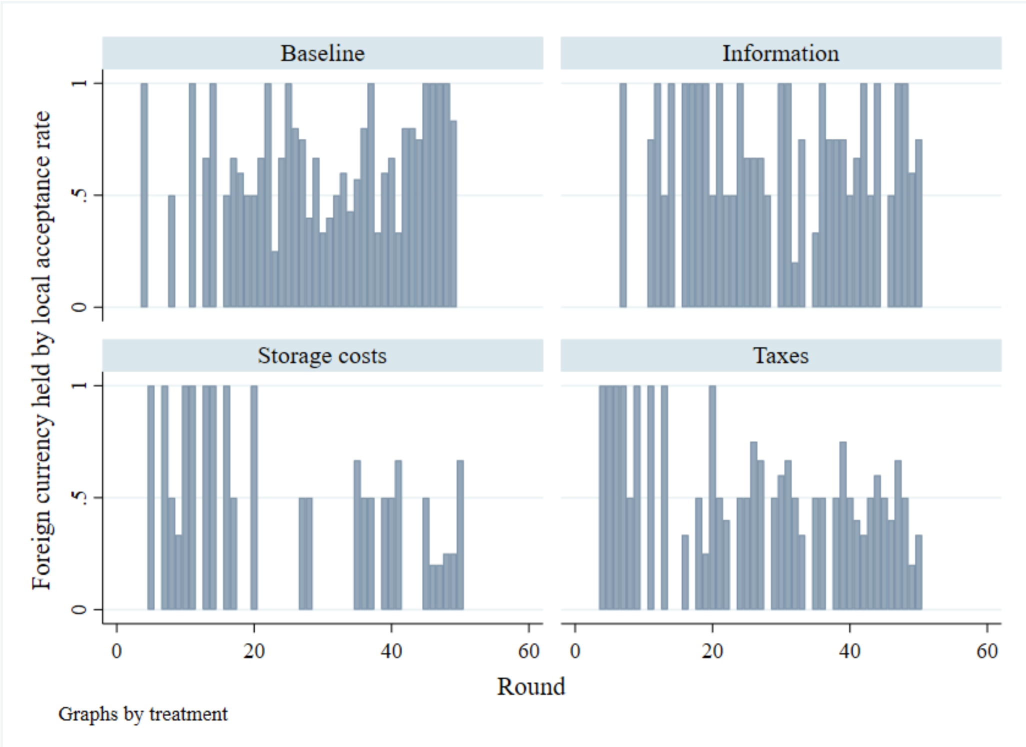


Figure 8: Foreign currency acceptance rate held by local per round

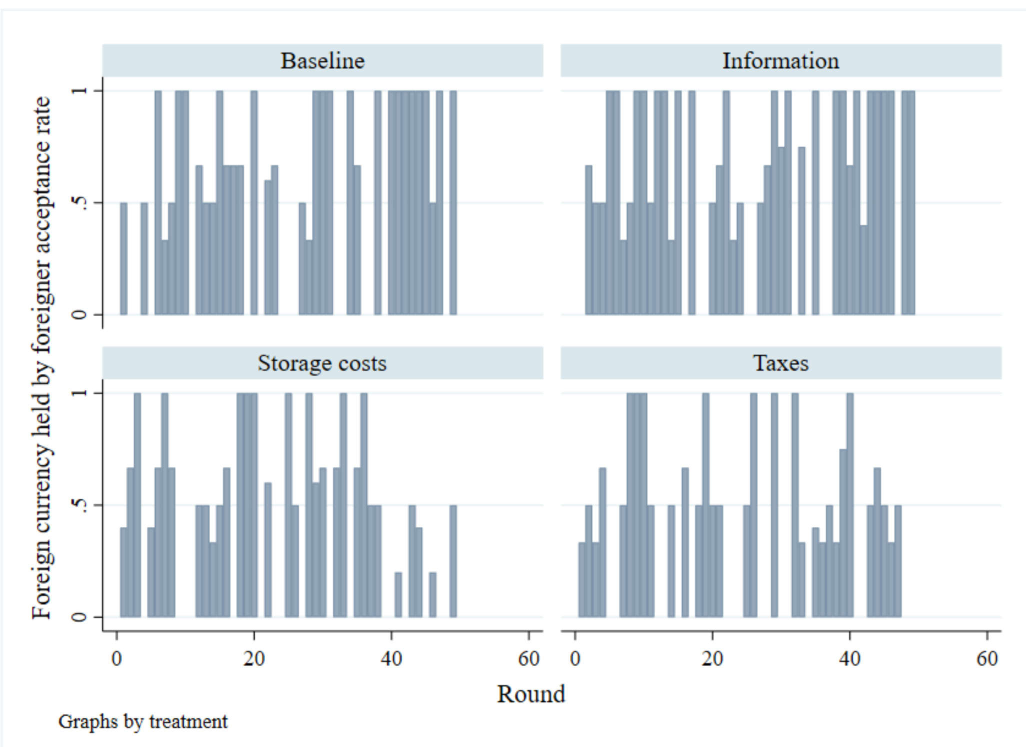


Figure 9: Foreign currency acceptance rate held by foreigner per round