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journal homepage: www.elsevier.com/locate/jeboCompeting currencies in the laboratory[☆]Janet Hua Jiang^a, Cathy Zhang^{b,*}^a Bank of Canada, 234 Wellington Street Ottawa, ON K1A 0G9, Canada^b Department of Economics, Krannert School of Management, Purdue University, 100 South Grant Street, West Lafayette, IN 47907, USA

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ABSTRACT

We investigate competition between two currencies as a result of decentralized interactions between human subjects. We design a laboratory experiment based on a simple two-country, two-currency search model to study factors that affect circulation patterns and equilibrium selection. Experimental results indicate foreign currency acceptance rates decrease with relative country size but are not significantly affected by the degree of integration. Subjects tend to always accept both currencies even though rejecting either currency is consistent with equilibrium. Introducing government transaction policies biased towards domestic currency significantly reduces the acceptability of foreign currency. These findings suggest government policies can serve as a coordination device when multiple currencies are available.

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1. Introduction

Government-issued money, or *national currency*, is the most widely used currency in most modern economies and has an important role as a generally accepted medium of exchange. Historically, the first known paper currencies were issued by local governments and tended not to circulate beyond a region's borders. Only thereafter did the secondary use of paper currencies from other localities' become more common and often times at a lesser scale (Ferguson (2009)). While only one or a few *international currencies* tend to widely circulate at given point in time, their general acceptance raises the question of whether another currency can substitute or crowd out the use a national currency. More recently, the dominance of national currencies has received renewed interest among policymakers as privately issued cryptocurrencies, such as bitcoin, have started being used alongside government-issued money. What determines *which* currency out of many potential candidates emerges as a universally accepted payment? And how are circulation patterns affected by government policy?

In this paper, we investigate competition between multiple currencies using experimental methods and examine how various features of the economy affect their roles in exchange. The starting point of our analysis is the two-country, two-currency search model of Matsuyama et al. (1993), where domestic and foreign currency compete and can circulate as

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media of exchange. Search theoretic models are particularly well suited for studying the use of multiple currencies since these models endogenously generate different payment regimes, without having to restrict which currencies private citizens can accept. For that reason, we adopt a version of Matsuyama et al. (1993) in the laboratory to study the circulation pattern of the two currencies and investigate how they are affected by economic integration, relative country size, and government policies favoring domestic currency.

In the two-country, two-currency model, a country is defined by the fact that agents are more likely to encounter compatriots than foreigners. Asymmetric matching probabilities across countries are governed by country size and the degree of economic integration, which captures how frequently an individual meets with foreigners. For instance, an increase in economic integration can be interpreted as a reduction in trade costs or barriers that raise the probability of meeting a foreigner. Each country issues its own currency, which is modeled as a token object that yields no value if consumed and cannot be used for production. Trade between agents entails an exchange of goods for either home or foreign currency.

Since the circulation of token objects is driven by both fundamentals and beliefs regarding what other agents do, there are multiple equilibria that differ in the areas of circulation of the two currencies. One equilibrium features only local circulation of currencies. In another equilibrium, one currency is internationally accepted while the other remains local. Finally, there is also an equilibrium where both currencies are everywhere accepted. Whether there are zero, one, or two international currencies depends on the fundamentals of the economy, such as country size and degree of economic integration, as well as expectations regarding what other agents do. While the multiplicity of equilibria poses predictive challenges for the theory, our experimental approach can help discern which equilibrium is selected in the laboratory.¹ Equilibrium selection is therefore an important reason we go to the laboratory.

There are several other advantages of using an experimental approach to study multiple currencies. First, there is lack of micro-level data on the circulation of multiple currencies, which makes empirical studies using field data sparse.² Second, experimental methods give clean control of the environment and allow us to isolate the factors that drive acceptance decisions. Third, we directly observe currency acceptability and can incentivize subjects in the laboratory. Field data often rely on surveys susceptible to errors due to insufficient incentives for truthful or careful reporting, misunderstandings about the survey questions, etc. Finally, it is possible to conduct policy experiments and counterfactuals in the laboratory that are not feasible to implement in practice.

In our benchmark experiment, we implement a simple version of the model in the laboratory and investigate whether agents who have access to two intrinsically worthless tokens coordinate on an equilibrium with zero, one, or two currencies everywhere accepted. Our design allows us to explore how the degree of economic integration and relative group size matter for currency circulation and equilibrium selection. In the model, these two parameters affect the matching process and hence the likelihood that individuals expect to meet foreigners relative to compatriots.

We introduce three treatments as part of the benchmark design. The baseline treatment features symmetric country sizes and a high level of integration, the second has a lower level of integration and keeps country sizes symmetric, and the third has different country sizes. Results indicate the degree of integration has no significant effect on currency circulation. With asymmetric country sizes, subjects from the larger country show stronger home bias and reject foreign currency more frequently compared with subjects in the baseline treatment. In all three treatments, the experimental economies are close to the unified currency regime with low rejection rates for both home and foreign tokens.

We next extend our design to incorporate government transaction policies biased towards domestic currency. This captures the role of government policies and legal tender laws that aim to increase the acceptance of local money. The basic idea is that by simply accepting a particular currency in its own trades, governments may induce private agents to do the same. We find the presence of government agents coordinates subjects towards rejecting foreign tokens more frequently. The foreign token rejection rate increases on average from 7% in the baseline treatment to 57% with government transaction policies. On the other hand, home token rejection rates remain similar to the baseline treatments without government. These results suggest government policies biased towards domestic currency can act as a coordination device, consistent with the role of government transaction policies in practice.

The rest of the paper proceeds as follows. Section 2 discusses related literature and our contribution. Section 3 describes the theoretical framework used for the experiments. Section 4 describes the experimental design and provides a broader discussion on some modeling and design choices. Section 5 reports the main results and discusses robustness. Section 6 concludes.

2. Related literature

This paper contributes to a growing experimental literature on monetary and payments economics. Here we mention only a few of the most relevant studies; for a more comprehensive survey, see Duffy (1998, 2016). The earliest studies on the role of money as medium of exchange in search models are Brown (1996) and Duffy and Ochs (1999). These studies construct experimental tests of the commodity money model of Kiyotaki and Wright (1989). Duffy and Ochs (2002) consider the

¹ A different approach to equilibrium selection is the evolutionary approach to study how agents coordinate on an equilibrium; see Matsuyama et al. (1993) and Wright (1995) in the context of monetary search models.

² An exception is Colacelli and Blackburn (2009), which provides a micro-level analysis of the circulation of secondary currencies using survey data from Argentina.

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