Private Money and the Central Banking

Eric Englebert and Dr. Yan Li
University of Wisconsin-Eau Claire, Economics Department

Introduction

- The use of private money (i.e. store value cards) has been growing rapidly due to the quick growth in technological development over the past couple decades.
- The issuance and redemption of private money is difficult to track, causing the measurement of liquidity to be inaccurate.
- This creates problems for the central bank to conduct monetary policy.

Objective and Contribution

- Find a model that examines how multiple means of payment coexist in transactions. Specifically we will revise the conventional money multiplier by introducing private money.
- Once a model has been found we then have a better understanding of how private money affects the monetary base and central banking along with the amount of liquidity in the economy.

Introduction to Private Money

- Private money is different from the government created fiat money. Private money is instead issued by private entities working as a form of borrowing for the issuers.
- Private money dates back to the 1800's in the U.S. Bank notes are the earliest forms of private money.
- Private money is generally classified as open-loop or closed-loop. Closed-loop cards are known as merchant gift cards that can only be accepted by a single merchant (the issuer) and can have a fixed amount the purchaser chooses. Open-loop cards carry the amount the card holder prepays and these cards may be accepted anywhere the same logo is used. Open-loop cards are closely related to debit cards except they do not require an underlying bank account.
- Other forms of private money include: electronic cash, gift cards, phone cards, network money, EBT, etc.

Benefits of Private Money

- Issuing private money is an efficient form of borrowing for merchants (the issuers).
- Issuers can control restrictions, terms, conditions, fees, and flexibility.
- Advancement in technology over the years have eased the clearing of private money.
- Increased anonymity and freedom for users
- Private money allows the unbanked, under-banked, or those with poor credit history to conduct electronic shopping and payment.
- Other benefits: carrying fewer amounts of cash, digital record or transactions, convenience of transferring funds.

Conventional Money Multiplier

- A Tool used to predict the maximum increase in the money supply in response to a given increase in the excess reserves.
- How much the money supply changes is measured as:

$$Money\_Multiplier = \frac{1}{\gamma}$$

Where γ denotes the reserve requirement

Coexistence of Private & Fiat Money

- Assume an endowment economy which implies the country's production rate is determined by endowments (land, labor, capital) each period.
- The value of fiat money (M_t) and the value of private money (M_s) are measured by price (P) multiplying by the quantity (Q).

$$(P_{ft})(Q_{ft}) = M_{ft}$$

- The nominal value of deposits is the price of fiat goods (P_{ft}) multiplied by the value of real deposits (H_{ft}).

$$(P_{ft})(H_{ft}) = \text{Value of Deposits}$$

- Now we can find a new model that derives the new, revised money multiplier. The supply of money for this endowed economy is the stock of currency (M_{1t}) plus the nominal value of deposits.

$$M_{1t} = (1 + \frac{H_{ft}}{Q_{ft}})(M_{ft})$$

- We now have redefined the money multiplier as:

$$(1 + \frac{H_{ft}}{Q_{ft}})$$

- Now that we have redefined the money multiplier as well as M1, we can incorporate the new reserve requirement back into the money supply equation. This equation now includes both fiat and private money.

$$M_{1t} = \left(1 + (\frac{\gamma_h}{\gamma_q})(\frac{H_t}{Q_t})\right)(M_{ft})$$

where $\frac{\gamma_h}{\gamma_q} = \frac{\Delta H_t}{\Delta Q_t}$

The Model Implications

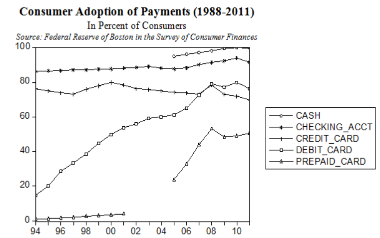
- We want to examine the effects of private money on liquidity when the nominal value of real deposits (H_{ft}) or quantity of fiat goods (Q_{ft}) changes.
- If both the value of deposits (H_{ft}) and the quantity of fiat goods (Q_{ft}) fall, then there are three cases:

$$\Delta H_{ft} > \Delta Q_{ft} \rightarrow \Delta M_{1t} > 0$$

$$\Delta H_{ft} < \Delta Q_{ft} \rightarrow \Delta M_{1t} < 0$$

$$\Delta H_{ft} = \Delta Q_{ft} \rightarrow \Delta M_{1t} = 0$$

Data / Forecasting Results



Dependent Variable: PREPAID1
Method: Least Squares
Date: 10/28/12 Time: 19:39
Sample(adjusted): 1996 2001
Included observations: 6 after adjusting endpoints
Convergence achieved after 8 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.633269	0.059425	10.65664	0.0596
T	0.313902	0.029542	10.62547	0.0597
T2	0.014151	0.003236	4.372358	0.1431
AR(1)	-1.000000	1.051315	-0.951190	0.5159
AR(2)	-0.789474	0.799931	-0.986928	0.5042

R-squared	0.999467	Mean dependent var	2.833333
Adjusted R-squared	0.997337	S.D. dependent var	0.889194
S.E. of regression	0.045883	Akaike info criterion	-3.450531
Sum squared resid	0.002105	Schwarz criterion	-3.624064
Log likelihood	15.35159	F-statistic	469.2083
Durbin-Watson stat	3.065789	Prob(F-statistic)	0.034609

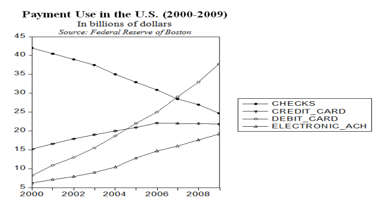
$$Prepaid\_Cards1 = .6332(C) + .3139(T) + .0142(T_2) - 1.00(Y_{t-1}) - .7895(Y_{t-2})$$

Dependent Variable: PREPAID2
Method: Least Squares
Date: 10/28/12 Time: 19:59
Sample(adjusted): 2006 2011
Included observations: 6 after adjusting endpoints
Convergence not achieved after 500 iterations
Backcast: 2005

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.292621	32.41707	0.286658	0.8223
T	16.10252	15.09134	1.067004	0.4794
T2	-1.524301	1.632218	-0.933883	0.5218
AR(1)	-0.392031	1.605206	-0.244225	0.8475
MA(1)	-0.997492	1.61E-05	-62023.22	0.0000

R-squared	0.941724	Mean dependent var	46.35000
Adjusted R-squared	0.708621	S.D. dependent var	7.243411
S.E. of regression	3.909961	Akaike info criterion	5.439839
Sum squared resid	15.28780	Schwarz criterion	5.266305
Log likelihood	-11.31952	F-statistic	4.039942
Durbin-Watson stat	2.336538	Prob(F-statistic)	0.355072

$$Prepaid\_Cards2 = 9.293(C) + 16.103(T) - 1.524(T_2) - .392(Y_{t-1}) - .9975(\varepsilon_{t-1})$$

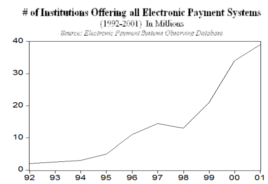


Dependent Variable: LOGELECTRONIC
Method: Least Squares
Date: 10/28/12 Time: 19:01
Sample(adjusted): 2001 2009
Included observations: 9 after adjusting endpoints
Convergence achieved after 93 iterations
Backcast: 2000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.393311	0.087833	4.477942	0.0065
T	0.052293	0.005417	9.653942	0.0002
AR(1)	0.489257	0.454629	1.076167	0.3310
MA(1)	0.997042	0.332706	2.996763	0.0302

R-squared	0.994156	Mean dependent var	1.080847
Adjusted R-squared	0.990649	S.D. dependent var	0.157263
S.E. of regression	0.015207	Akaike info criterion	-5.232959
Sum squared resid	0.001156	Schwarz criterion	-5.145304
Log likelihood	27.54832	F-statistic	283.5050
Durbin-Watson stat	1.858362	Prob(F-statistic)	0.000005

$$\log(electronic) = .3933(C) + .0523(T) + .4893(Y_{t-1}) + .997(\varepsilon_{t-1})$$



Dependent Variable: LOGNOFINST
Method: Least Squares
Date: 01/04/13 Time: 12:02
Sample(adjusted): 1993 2002
Included observations: 10 after adjusting endpoints
Convergence achieved after 191 iterations
Backcast: OFF (Roots of MA process too large)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.211629	0.708683	0.298623	0.7753
T	0.104005	0.143094	0.726832	0.4947
AR(1)	0.739288	0.807294	0.915761	0.3951
MA(1)	3.919452	1.669399	2.347823	0.0572

R-squared	0.990241	Mean dependent var	1.061425
Adjusted R-squared	0.985362	S.D. dependent var	0.414040
S.E. of regression	0.050093	Akaike info criterion	-2.860685
Sum squared resid	0.015056	Schwarz criterion	-2.739651
Log likelihood	18.30342	F-statistic	202.9490
Durbin-Watson stat	1.663235	Prob(F-statistic)	0.000002

$$\log(\#of\_institutions) = .2116(C) + .104(T) + .7393(Y_{t-1}) + 3.919(\varepsilon_{t-1})$$

Conclusions

- Technology and other recent innovations are allowing the use of private money to grow at incredible speeds and also weakening the powers of the Central bank to conduct monetary policy.
- We have updated a conventional model to incorporate both the private and fiat money into the money measurement and money multiplier. This may allow us to identify the possible monetary implications of private money on liquidity and the central banking power.
- Forecasts were overall accurate and able to obtain the highest adjusted R^2 value, lowest AIC and SIC values, and random residual plots.
- Static forecasting was the appropriate choice for all data models.
- As time and technology progress, we can expect to see further increases in the use of private money. A new model of the money supply that incorporates private money is needed now more than ever.

Selected References

Friedman, M. (1960). A Program for Monetary Stability. New York: Fordham University Press.

Lucas, R. (1990) Liquidity and Interest Rates. Journal of Economic Theory, 50: 237-264.

Williamson, S.D. (2004). Limited Participation, Private Money, and Credit in a Spatial Model of Money. Economic Theory, 24: 857-876.