Discussion of “The Aggregate Demand for Treasury Debt” by Arvind Krishnamurthy and Annette Vissing-Jorgensen

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Summary of the Paper

- Start with the reduced-form utility function

$$u\left[c_t + v\left(\frac{\theta_t^A}{GDP_t}, \xi_t\right)\right]$$

c_t: endowment, θ_t^A: "convenience assets"

- "Convenience function" satisfies $v'(.) > 0$ (with satiation) and $v''(.) < 0$.
- Derive asset-pricing conditions comparing treasuries with
  - corporate bonds with / without default
  - long-term bonds
  - assets of differing safety and liquidity
- Key implication : $log(Debt/GDP)$ should affect various interest rate spreads **negatively**.
- Result : It does!
- Important implications regarding what "risk-free" rate is.

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- Where is the convenience function coming from? Alternatives?
- Are the empirical results robust with respect to variations?
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Convenience Function

- Easier to interpret as

$$E \sum_{t=0}^{\infty} \beta^t u(c_t)$$

$$\text{subject to } c_t + cost\left(\frac{\theta_t^A}{GDP_t}, \xi_t\right) = y_t$$

$$\text{or } c_t = y_t + v\left(\frac{\theta_t^A}{GDP_t}, \xi_t\right)$$

- Direct analogy to transaction-cost models of money

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Simple Example of Their Result

$$E\sum_{t=0}^{\infty}\beta^t u\left[c_t + v\left(\frac{b_t}{p_t y_t},\xi_t\right)\right]$$

$$p_t c_t + b_t + a_t = p_t y_t + R^b_{t-1}b_{t-1} + (1-\lambda)R^c_{t-1}a_{t-1}$$

- **Euler Equations**

$$u'(t) = \frac{u'(t)v'(t)}{y_t} + \beta R^b_t E_t\left[\frac{u'(t+1)}{\pi_{t+1}}\right]$$

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- **Note equation (7) of the paper**

$$\frac{P^T_t}{Q_t}u'(C_t) = \frac{P^T_t}{Q_t}u'(C_t)v'\left(\frac{\theta^A_t}{GDP_t}\right) + \beta E_t\left[\frac{P^T_{t+1}}{Q_{t+1}}u'(C_{t+1})\right]$$

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- Combining the Euler Equations

$$(1-\lambda)\left[1-\frac{v'(t)}{y_t}\right]=\frac{R_t^b}{R_t^c}$$

- Taking logs

$$i_t^c - i_t^b = \frac{v'\left(\frac{b_t}{p_t y_t},\xi_t\right)}{y_t}+\lambda$$

- Since $v''(.)<0$, the implication is

$$\frac{\partial(i_t^c - i_t^b)}{\partial(b_t/p_t y_t)}<0$$

- Default risk also increases the spread.

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- Micro-foundations matter!
- Isn't it more reasonable to assume v is a function of $\left(\frac{b_t}{p_t c_t}\right)$?

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  - Note that this will bring in many more terms in the FOCs.
  - The ultimate result will probably still go through. (not as pretty)

- Would it make sense to have an analogy to a money-in-the-utility function? (more on this later)

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Money

- As the authors also emphasize, money should have the same liquidity and safety properties, in addition to its medium of exchange property.
- Expand $v(.)$ to include money, e.g. $\left(\frac{b_t + m_t}{p_t GDP_t}\right)$
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Empirical Results 1 : Add Money

Focus on Table I, Panel A (Aaa-Treasury), Column 1

	Benchmark	M1S	M2S-M1S	M2S
Period	1927-2009	1931-2007	1961-2007	1961-2007
$log(B/GDP)$	-0.69 *(0.00)*	-0.80 *(0.00)*	-1.21 *(0.00)*	-1.44 *(0.00)*
$log(M/GDP)$	-	0.03 *(0.84)*	0.17 *(0.76)*	-1.07 *(0.22)*
R^2	0.80	0.82	0.76	0.76
N	83	77	47	47
Method	OLS	OLS	OLS	OLS

Notes: All regressions have the Aaa-Treasury spread as the dependent variable and are estimated via OLS, allowing for AR(2) in residuals. Newey-West standard errors. p-values in parentheses.

Empirical Results 2 : Spread of Bonds and Money

- Money is **also** valued for its medium of exchange role : $w(m/p)$ in the utility function. (and remove it from $v(.)$.)
- Euler equations

$$u'(t) = \frac{u'(t)v'(t)}{y_t} + \beta R_t^b E_t \left[\frac{u'(t+1)}{\pi_{t+1}} \right]$$

$$u'(t) = w'(t) + \beta E_t \left[\frac{u'(t+1)}{\pi_{t+1}} \right]$$

- Spread between interest rates of treasuries and money (zero)

$$i_t^b \approx -v'(b) + w'(m)$$

- $Treas_t = cons \underset{(0.00)}{-5.56} \times \frac{m}{py} \underset{(0.57)}{-0.43} \times \frac{b}{py}$
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Empirical Results 3 : Use B/P instead of B/PY

	Benchmark	M1S	M2S-M1S	M2S
Period	1930-2009	1930-2007	1960-2007	1961-2007
$log(B/P)$	-0.03 *(0.80)*	-0.73 *(0.02)*	-1.04 *(0.00)*	-1.23 *(0.00)*
$log(M/P)$	-	1.08 *(0.02)*	1.26 *(0.00)*	1.54 *(0.00)*
R^2	0.00	0.16	0.48	0.49
N	80	78	48	48
Method	FMOLS	FMOLS	FMOLS	FMOLS

Notes: All regressions have the Aaa-Treasury spread as the dependent variable and are estimated via FMOLS (fully-modified OLS) to capture the cointegration. Newey-West standard errors. p-values in parentheses.

Summary So Far

- It is clear that B/PY is priced.
- If it was **only** due to liquidity / safety they provide, then M/PY should have been priced as well.
  - Aside: Is it clear that corporate bonds are less liquid?
- It is not!
- It seems B/PY is priced for a reason that is **not** shared by money.
  - Collateral in financial transactions
  - Fed's balance sheet
- Need a structural model to sort these out.
- Using B/P in the convenience function seems equally reasonable. It doesn't yield the same empirical results.

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Money Demand Regressions - 1

	M1S	M1S	M2S-M1S	M2S-M1S	M2S	M2S
i^b	-0.09	-0.07	0.03	0.02	0.00	-0.00
	(0.00)	*(0.00)*	*(0.00)*	*(0.01)*	*(0.55)*	*(0.29)*
$log(y)$	0.83	0.80	0.91	0.94	0.87	0.88
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*
$log(B/PY)$	-	0.26	-	-0.26	-	-0.12
		(0.00)		*(0.00)*		*(0.01)*
R^2	0.96	0.98	0.96	0.97	0.99	0.99
N	75	75	46	47	46	46

Notes: All regressions have natural logarithm of a measure of real money balances as the dependent variable and are estimated via FMOLS (fully-modified OLS) to capture the cointegration relationship. Newey-West standard errors. p-values in parentheses.

Money Demand Regressions - 2 (M1S, before and after 1970)

	Before	Before	After	After
i^b	-0.21	-0.08	-0.06	-0.05
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
$log(y)$	0.98	0.81	0.93	1.00
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
$log(B/PY)$	-	0.28	-	-0.14
		(0.00)		*(0.09)*
R^2	0.96	0.99	0.97	0.98
N	40	40	35	35

Notes: All regressions have a natural logarithm of real M1S as the dependent variable and are estimated via FMOLS (fully-modified OLS) to capture the cointegration relationship. Newey-West standard errors. p-values in parentheses.

Conclusions

- Very interesting paper.
- Document an interesting fact.
  - The stock of debt is priced.
- It is not clear that it is the liquidity property of treasuries that is priced.
- We need more structural work (a model that distinguishes various other roles of treasuries).
- Treasuries seem like
  - complements of very liquid part of money supply. (M1S)
  - substitutes of less liquid part of money supply. (M2S minus M1S)
- Adding stock of treasuries help stability of money demand over time.