Volume Title: NBER Macroeconomics Annual 2013, Volume 28

Volume Author/Editor: Jonathan A. Parker and Michael Woodford, editors

Volume Publisher: University of Chicago Press

Volume ISBN: 978-0-226-16540-0 (cloth); 978-0-226-16540-0 (paper); 978-0-226-16554-7 (eISBN)

ISSN: 0889-3365

Volume URL: http://www.nber.org/books/park13-1

Conference Date: April 12–13, 2013

Publication Date: April 2014

Chapter Title: Comment on "Pledgability and Liquidity: A New Monetarist Model of Financial and Macroeconomic Activity"

Chapter Author(s): Jean Tirole

Chapter URL: http://www.nber.org/chapters/c12928

Chapter pages in book: (p. 279 – 286)

Comment

Jean Tirole, *Toulouse School of Economics*

The paper by Venky Venkateswaran and Randall Wright (henceforth VW) brings an interesting contribution to the growing literature on the role of liquidity for asset pricing and real allocations. It develops an elegant model, building on some of the existing monetary economics literature. It then obtains extensive comparative statics results and finally proceeds to calibrate the model. It is a tour de force, and delivers a number of new insights.

I will discuss the key assumptions and indicate a few alleys for subsequent research. Having limited expertise in calibration, I will content myself with a few remarks on the part of the paper devoted to it. Overall, this is a very rich paper.

The model is a consumer-centric model of liquidity, unlike, say, the kind of firm/bank centric model that Bengt Holmström and I analyzed in the late 1990s. Its basic structure is a Lagos-Wright (2005) model of monetary exchange. In this very tractable paradigm, frictionless centralized markets (CM) alternate with imperfect decentralized ones (DM).

- In the DM, each agent has probability σ of being a buyer and probability σ of being a seller; buyers and sellers are matched pairwise and then bargain over the quantity q of some good to be manufactured and traded, and over the split of the joint surplus $u(q) - c(q)$.
  - Regardless of the selected quantity, Kalai bargaining obtains, in that the price ensures that the buyer receives a fixed share θ of the joint surplus $u(q) - c(q)$, and the seller receives share $1 - \theta$ of that joint surplus.
  - Bargaining and trade are constrained by the buyer's wealth and pledgeability thereof: If the buyer has too little pledgeable wealth, the

978-0-226-16540-0/2014/2013-0403$10.00

seller will not accept to produce at the socially efficient level q^* given by $u'(q^*) = c'(q^*)$, because the buyer is unable to offer proper compensation. More precisely, "debt" corresponds to the level of assets that the buyer can credibly pledge; the buyer cannot take on a real[1] debt level d exceeding some ceiling D (more on the determination of D in the following). Because feasible debt levels affect the transfer that the buyer can offer to the seller, the quantity is either q^* (if the buyer has a high D) or a level q lower than q^*, and computed such that the buyer receive a fraction θ of the gains from trade (if the buyer has a low D).

- The CM is a set of frictionless Arrow-Debreu markets in which the goods to be traded are labor (l) and another consumption good (x).
  - Various assets (real bonds, Lucas trees, capital, money, and housing) can also be traded; these assets will serve as collateral for their owners in the next decentralized markets if they take on the role of buyer. There is no bubble: asset prices are equal to the present discounted value of the asset's dividends (where "dividends" include the liquidity services associated with the facilitation of trade and appropriated by the asset's owner).
  - As is usual in this type of model, utilities in the CM are quasi-linear (in labor here), implying that past wealth/debt is irrelevant for the continuation equilibrium. Thus, each CM period starts with a clean slate, unlike the DM periods in which the buyers' wealth plays a central role in the ability to exchange.

Pledgeability Assumptions

Let us return to the determination of the debt capacity D. VW assumes that in the DM:

- There is no unsecured debt: all debt must be backed by assets held by the buyer. [2] Moreover, all debt is short-term (more precisely, contracted in the DM and settled in the subsequent CM); this assumption rules out the possibility for the authorities to use inflation to let the economy escape a recession by allowing nominal-claims borrowers to deleverage (on the other hand, the paper's focus is on steady states). Like most theoretical macroeconomic models, this model does not look at maturity transformation, and so does not distinguish between liquidity ratios (LCR, say) and solvency ratios (CAR, say).

• The buyer can pledge a fraction of the value that the individual assets fetch in the CM: $D_j(a_j) \leq a_j$ for an asset of value a_j in the CM; thus asset j-related indebtedness d_j must satisfy $d_j \leq D_j(a_j)$.

• Furthermore, there is no deadweight loss involved in pledging the assets—the only inefficiency stems from imperfect pledgeability. If the buyer owns an asset of value 1 (= a_j in this example), and the pledgeability parameter is .6, then the buyer gives/promises .6 (= $D_j(a_j)$) to the seller and keeps .4 (= $a_j - D_j(a_j)$) to herself.

These postulates rest on several implicit assumptions:

• *No asymmetric information*. If constrained, the buyer pledges to the seller all the assets she owns. This, of course, is in sharp contrast with the large, mostly recent literature on market freezes, and misses some of the insights gleaned in this literature on the efficiency of market recovery (through waiting for news, active price discovery, or jumpstarting by government intervention, or a combination of the three). On the other hand, the absence of adverse selection considerably simplifies the analysis and seems a reasonable assumption to make for the purpose of the paper.

• *Absence of deadweight loss*. This again is mostly for convenience, although foundations can be found for it. For example, Lester, Postlewaite, and Wright's recognizability model (REStud 2012)[3] delivers (a stochastic version of) this hypothesis. Or, for assets exchanged in the primary market[4] and subject to moral hazard by their holders, a simple two-effort-levels version of the moral hazard model also delivers an absence of welfare loss.

Of course, the authors realize that this assumption need not be fulfilled. First, other forms of moral hazard would normally lead to undereffort. Second, as we noted, adverse selection also would generate a deadweight loss. Third, so would costly collateral pledging (à la Bester AER 1985) or costly state verification (à la Townsend JET 1979 or Gale-Hellwig REStud 1985). For example, to use Bester's idea, even leaving aside the transaction costs associated with seizing and reselling the house, pledging one's family house involves a deadweight loss to the extent that the house is worth more to the owner than to the bank that will seize it in bad times.

As I said, the absence of deadweight loss again can be justified by convenience. I suspect that the presence of deadweight losses would imply that the buyer would not always transact to the hilt, unlike in

VW, and that the demand for money would be larger. But this would be unlikely to alter the paper's main positive messages. It might be interesting to look at how normative/welfare conclusions might be affected by the presence of welfare losses in the debt market.

• *Additivity.* Despite the fact that the buyer pledges all her assets to the same party (the seller), the buyer pledges her wealth asset by asset, rather than the portfolio composed of all her assets. Yet, as Diamond (REStud 1984) has shown, cross-pledging increases pledgeability unless assets in the portfolio are perfectly correlated. Once more, this is a fine assumption for the purpose of the analysis, although it may be a bit stretched when one comes to calibration. Consider, for instance, the firm-/bank-centric version of the model; despite the recent "asset income run," in which individual lenders have been more and more insistent that specific assets on the asset side of the borrower's balance sheet be earmarked to them in case of bankruptcy, much of the balance sheet of firms and banks is still cross-pledged.

The DM/CM Parable

The DM/CM model is very elegant and tractable. It might be worth thinking about some extensions (this remark is broader than VW and applies to the literature using the DM/CM paradigm). The model assumes that there are no friction in the asset markets in the CM, and (potentially substantial) frictions in the DM.

One understands well why in a bilateral commercial transaction, the seller may have very sketchy knowledge about the quality of assets on the buyer's balance sheet or about the buyer's overall balance sheet; the question is why the experts/intermediaries/market makers who make the CM function well cannot intermediate in the DM, and enable the same amount of asset pledgeability as in the DM. Examples include the importer's bank providing a letter of credit to the exporter or exporter's bank in an international transaction. Or in the consumer- centric version of the liquidity paradigm, the buyer can pay in a bilateral commercial transaction with an IOU (check or credit card payment) on her bank.

Endogenizing intermediation (which is already implicit in the CM) consistently in the CM and DM seems an important venue of research for this literature. This line of research would bring more than just theoretical insights. It might also contribute to a calibration of pledgeability frictions at the microeconomic level.

Theoretical Insights

Liquidity Premia

Because assets allow the realization of gains from trade, they carry a *premium* over and above the level that would result from the agents' rate of time preference. Namely prices are multiplied by a factor $[1 + \sigma D_j'(a_j) L(q)]$ where

- $L(q) = [u'(q) - z'(q)]/z'(q)$ is strictly positive as long as the buyer's wealth is too meager to enable the realization of all gains from trade (i.e., as long as $q < q^*$).
- $z(q) = \theta c(q) + (1 - \theta)u(q)$ is a bargaining-power weighted combination of utility and cost.

Price kernels embodying liquidity premia can also be found in firm-centric models of liquidity, such as the LAPM (Holmström-Tirole's [JoF 2001] and chapter 4 in 2011 *Inside and Outside Liquidity* book); Dow-Gorton-Krishnamurthy (AER 2005, with a nice emphasis on the term structure in a free cash-flow environment); or more recently Caballero-Farhi 2013's working paper on the safe asset mechanism.

Fiat Money

A particularly interesting exercise in the VW model is its study of the *price of money*. As we said, bubbles are ruled out and so money has a positive price only if it facilitates transactions, or put differently, if assets are in short supply; that is, $q < q^*$. The return i on illiquid nominal bonds is given by the benefit for the buyer:

$$i = \sigma L(q).$$

Money is assumed to be fully pledgeable ($D_j'(a_j) = 1$). Notice that each agent is a buyer with probability σ; and that $L(q)$ is increasing with the buyer's bargaining power θ (indeed, $L(q) = 0$ if $\theta = 0$).

The Friedman rule commands that the market be replete with liquid instruments and so there is no hindrance to trade:[5]

$$i = 0.$$

VW then study the impact of the return i on illiquid nominal bonds. An increase in i increases the cost of carrying real balances and reduces trade in the DM. And through a Mundell effect, it raises demand for the

other assets. Intuitively, and interestingly, real returns are independent of inflation for illiquid assets (nonpledgeable assets), but depend on (increase with) inflation for (imperfectly or perfectly) pledgeable assets.

VW also study a variant of their model, in which capital is taxed. In that case, in order to reestablish a level playing field among assets, the Friedman rule must be modified and so optimally $i > 0$.

Welfare

These remarks naturally lead to a discussion of the *welfare aspects* of liquidity hoarding. Diamond (JPE 1982) and Diamond-Maskin (BJE 1979) had pointed out that when trade takes place in a noncompetitive DM, decisions facilitating trade involve an externality. These pre-DM decisions are often taken to be search intensities in the literature, but they can be pretty much any variable that affect the ability to trade.

In a search context, the Hosios rule states that for efficiency to obtain, the surplus must be divided so as to compensate properly (at the margin) for search—search is suboptimal, but incentives to search are balanced in the least distortionary way because both parties' search intensities facilitate trade.[6]

In the VW hoarding context, only the buyer's wealth matters and so the externality is solely on the seller, whose surplus is not internalized (if $q < q^*$ and $\theta < 1$ in the VW model). Optimally, $\theta = 1$ eliminates all externalities.

To enhance the connection with the policy debates, future work might introduce the various other externalities related to liquidity management and that have received substantial attention lately: fire sales, counterparty risk, or collective moral hazard (the idea that a widespread maturity mismatch forces the central bank and the treasury to bail out financial institutions).

Calibration

The paper calibrates the model to match 1954 to 2000 US data, adding to the original model labor and capital taxes. I won't provide many comments on this part, due to my shortage of expertise in the area; this is of course somewhat unfair to the paper, which devotes a substantial amount of work to the issue; but I leave it to more expert scholars to assess this part of the paper. My main questions here concern:

• The sensitivity of the results to the choice of a particular ratio $[z(q)/q]/c'(q) = 1.30$. In principle this ratio can take on a wide range of values (greater or smaller than 1). This ratio has a big impact on the liquidity premium. Because the DM/CM, consumer-centric model is a parable (as are all models, but perhaps more so in this instance), it is not easy to have direct intuition concerning this parameter.

• The pledgeability hypotheses (e.g., in the baseline calibration 0.45 for T-bills, 0.17 for capital, 0.06 for housing). It would be worth obtaining more direct evidence on these parameters.

• Finally, embodying such calibration in an international context would be useful in view of the role that the worldwide shortage of stores of values played prior to the subprime crisis.[7]

Endnotes

For acknowledgments, sources of research support, and disclosure of the author's material financial relationships, if any, please see http://www.nber.org/chapters/c12928.ack.

1. In the VW paper, the levels are normalized by the wage prevailing in the CM, since utilities are taken to be quasi-linear in labor supplied in the CM market.
2. Or at least no endogenously determined unsecured debt.
3. The party accepting the asset (the seller in VW) either knows what it is worth, or does not know and then can be tendered a fake claim by the owner of the assets (the buyer in VW), who always knows what they are worth; recognizability is assumed common knowledge in Lester et al.
4. Although one can think of situations (for instance, involving a large monitor) in which cash flows depend on ownership structures, moral hazard is usually less relevant in secondary markets, which mostly involve trading in preexisting cash-flow rights.
5. Contrast this fundamentalist view with the analysis of bubbles on real activity: on the one hand, bubbles augment the volume of stores of value and promote growth through a liquidity effect; on the other hand, bubbles compete with real investment to attract savings, generating a crowding-out effect. But bubbles unambiguously raise interest rates. For more on the dynamics of bubbly economies, see, for example, Emmanuel Farhi and Jean Tirole, "Bubbly Liquidity," *Review of Economic Studies*, 79 (2012): 678–706, and Tomohiro Hirano, Masaru Inaba, and Noriyuki Yanagawa, "Asset Bubbles and Bailouts," WP University of Tokyo (2013). Here there is no crowding-out effect because consumers, not capital-investing firms, are the agents needing liquidity.
6. For an extensive discussion of efficiency in search models, see, for example, Aleksander Berentsen, Guillaume Rocheteau, and Shouyong Shi, "Friedman Meets Hosios: Efficiency in Search Models of Money," *Economic Journal* 117 (2007): 174–95. These externalities justify deviations from the Friedman rule, for example, $i > 0$ when the buyer has relatively low surplus from exchange. Here the externality is one-sided and so, the Friedman rule is not altered: the acquisition of liquid assets should be encouraged.
7. See, in particular, Ricardo Caballero, Emmanuel Farhi, and Pierre-Olivier Gourinchas, "An Equilibrium Model of 'Global Imbalances' and Low Interest Rates," *American Economic Review* 98 (1, 2008): 358–93.

References

Bester, H. 1985. "Screening vs. Rationing in Credit Markets with Imperfect Information," 75(4): 850–55.
Caballero, R., and E. Farhi. 2013. "A Model of the Safe Asset Mechanism (SAM): Safety Traps and Economic Policy," NBER Working Paper No. 18737.
Diamond , D. 1984. "Financial Intermediation and Delegated Monitoring," *Review of Economic Studies*, 51(3): 393–416.
Diamond, P. 1982. "Aggregate Demand Management in Search Equilibrium," *Journal of Political Economy*, 90(5): 881–94.
Diamond, P., and E. Maskin. 1979. "An Equilibrium Analysis of Search and Breach of Contract, I: Steady States," *Bell Journal of Economics*, 10(1): 282–316.
Dow, J., Gorton, G., and A. Krishnamurthy. 2005. "Equilibrium Investment and Asset Prices under Imperfect Corporate Control," *American Economic Review*, 95(3): 659–81.
Farhi, E., and J. Tirole. 2012. "Bubbly Liquidity," *Review of Economic Studies*, 79: 678–706.
Gale, D., and M. Hellwig. 1985. "Incentive-Compatible Debt Contracts: The One-Period Problem," *Review of Economic Studies*, 52(4): 647–65.
Holmström, B., and J. Tirole. 2001. "LAPM: A Liquidity-Based Asset Pricing Model," *Journal of Finance*, 56(5): 1837–67.
Holmström, B., and J. Tirole. 2011. *Inside and Outside Liquidity*, chapter 4, MIT Press.
Lester, B., Postlewaite, A., and R. Wright. 2012. "Information, Liquidity, Asset Prices, and Monetary Policy," *Review of Economic Studies*, 79 (3): 1208–38.
Townsend, R. 1979. "Optimal Contracts and Competitive Markets with Costly State Verification," *Journal of Economic Theory*, 21(2): 265–93.