Les 8èmes

« TOULOUSE LECTURES IN ECONOMICS »

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Liquidity: A New Monetarist Approach

The 2011 Toulouse Lectures

by

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PRINCETON

Liquidity – until recently arcane, or avante guarde, at best – is now *mainstream* in economics and finance.

But many current discussions leave much to be desired.

- Presumably liquidity is not just another commodity?
- Is demand for liquidity like demand for wine or labor?
- Is the supply of liquidity like the supply of labor or wine?
- Exactly what is a liquidity shock?

Monetary economists, at least the good ones, have been thinking about these issues for years.

I am delighted to have an opportunity to dicuss them here.

On the title – what is the New Monetarist Approach?

Williamson & Wright (2010) and Nosal & Rocheteau (2011) use this label for a body of work on:

- monetary theory and policy analysis
- banking, payment and settlement systems
- credit arrangements and asset markets

Key principle: economics needs solid microfoundations for institutions that facilitate the process of exchange.

This view is clearly *not* accepted in much macro or general equilibrium theory.

GE: starting with $\mathbf{x}^0$, find $\mathbf{p}^*$ such that a feasible $\mathbf{x}^*$ solves

$$\mathbf{x}_h^* = \arg\max_{\mathbf{x}_h} U^h(\mathbf{x}_h) \text{ st } \mathbf{p}^*\mathbf{x}_h \leq \mathbf{p}^*\mathbf{x}_h^0 \ \forall h$$

One simply does not ask, how do we get from $\mathbf{x}^0$ to $\mathbf{x}^*$?

> “An important and difficult question...not answered by the approach taken here: the integration of money in the theory of value.” Debreu (1959)

There is no role in frictionless theory for *any* institution – money, banking, retailers, advertising, middlemen, etc. – whose raison d’etre is facilitation of the exchange process.

Many early attempts to address this issue failed, mainly because thery were asking the wrong questions.

In macro, popular models actually used for policy analysis by central banks usually either:

(a) do not include money, banks or related institutions;

(b) or, if they do, they resort to ad hoc assumptions like:

- imposing cash-in-advance constraints;
- putting money in utility or production fns.

In light or recent events, attempts to rectify the obvious deficiencies in these models include

- putting gov't securities or commercial bank reserves in utility or production fns – yes, really.

Are such shortcuts necessarily bad?

The short answer is *yes*.

Example: The ad hoc approach can only examine recent financial events in terms of preferences or technology.

We want to examine *the exchange process* – including credit arrangements, like mortgages – and institutions whose role it is to facilitate this process.

Much interesting work has tried to take this seriously.

We think of this work as part of New Monetarist Economics.

Examples you may or may not be expecting:

- Diamond-Dybvig ... Ennis-Keister
- Bernanke-Gertler, Williamson
- Kiyotaki-Moore, Holmstrom-Tirole

What I call finance with frictions:

- Duffie, Garleneau, Pedersen, Weill, Biais, Lagos, Rocheteau

Some models I will explicitly discuss:

- Kiyotaki-Wright ... Lagos-Wright and applications
- all of which is heavily influenced by the work of Wallace

Before proceeding .... why the label "New Monetarism"?

We find much that is appealing in Old Monetarism

- monetary policy should focus on inflation (Friedman rule), and not other variables they cannot control
- relative focus on longer run issues
- preference for small and transparent models

Although we also have some basic disagreements

- the role of intermediation (e.g. narrow banking)
- explicit modeling of frictions: spatial or temporal separation, imperfect information/commitment, non-competitive pricing

We reject the "New Keynesian concensus"

- relative to us, they have little use for microfoundations
- their focus is virtually exclusively on sticky prices, which we believe is misguided, for several reasons
- they claim to incorporate modern ideas of Lucas, Prescott etc., but policy is still analyzed using essentially IS-LM models and the Phillips curve

We question their logic and provide a dissenting view.

We encourage more debate – like the healthy interactions between Old Keynesians and Old Monetarists.

Modern Monetary Theory: **The 1st Generation**

Idea: *suppose that as in search theory, and reality, agents trade with each other, not merely against budget lines.*

Objective: to show how one very simple institution, money, works to facilitate the trading process.

Apparatus:

1. a double-coincidence problem
2. limited commitment
3. imperfect monitoring or memory

Barter is difficult due to (1); credit is difficult due to (2)-(3).

Kiyotaki-Wright (93) (a baby version of Kiyotaki-Wright 89)

Time is discrete and continues forever.

A $[0, 1]$ continuum of households specialize in production and consumption of (for now) indivisible goods.

The meet randomly in pairs over time:

- each h produces some good at cost $C \geq 0$
- and consumes another good for utility $U > C$
- $\delta = prob(h$ likes what h' can produce and vice versa)
- $\sigma = prob(h$ likes what h' can produce but not vice versa)

Cooperative (credit) allocation:

$$(1-\beta)V^C = \alpha\sigma(U) + \alpha\sigma(-C) + \alpha\delta(U-C) = \alpha(\sigma+\delta)(U-C)$$

Without commitment, we have to worry about ex post IC.

Random monitoring: $\mu = prob$(deviation is detected).

Punishment: deviators are excluded from future credit, but can still barter, $(1-\beta)V^D = \alpha\delta(U-C)$.

Relevant IC is $-C + \beta V^C \geq \mu\beta V^D + (1-\mu)\beta V^C$, or

$$C \leq \frac{\mu\alpha\sigma}{r+\mu\alpha\sigma}U = \bar{C}^C.$$

Suppose we have no monitoring/memory: $\mu = 0$

Then there is no credit – the only feasible trade is barter.

Introduce *money*, an intrinsically useless, tangible, and (for now) indivisible object.

Endow M agents with $m = 1$ and $1 - M$ with $m = 0$.

$$(1-\beta)V_0 = \alpha\delta(U - C) + \alpha\sigma M \max_{\pi} \pi[-C + \beta(V_1 - V_0)]$$

$$(1-\beta)V_1 = \alpha\delta(U - C) + \alpha\sigma(1 - M)\Pi[U + \beta(V_0 - V_1)]$$

where Π others accept M and π is your best response.

Let $\Delta = \beta(V_1 - V_0)$. Then SME is a list (π, V_0, V_1) satisfying BE and BR

$$\pi = \begin{cases} 1 & \text{if } \Delta > C \\ [0,1] & \text{if } \Delta = C \\ 0 & \text{if } \Delta < C \end{cases}$$

Prop: for all parameters $\exists$ NE $\pi = 0$, and $\exists$ ME $\pi = 1$ iff

$$C \leq \frac{\alpha\sigma(1-M)}{r + \alpha\sigma(1-M)} U = \bar{C}^M$$

Prop: $\mu = 1 \Rightarrow \bar{C}^C > \bar{C}^M$ & $V^C > V^M = MV_1 + (1-M)V_0$.

Prop (Kocherlakota 98): Money is a substitute, albeit an imperfect one, for credit.

1. if ∃ ME then credit is feasible, and preferrable.
2. if μ is small, credit is impossible, but ∃ ME iff $C \leq \bar{C}^M$.

Big Idea: if agents trade with each other, and not merely against budet lines, M can be valued for its *liquidity*.

- Contrary to CIA or NK models, m is an institution that helps facilitate the process of exchange.
- Contrary to standard finance, an intrinsically worthless object m can have positive value: a bubble.

ME are tenuous, and at the same time robust:

- $\pi = 0$ is always an equil.
- $\pi = 1$ is an equil when m has bad properties (transaction or storage costs; taxation) iff they are not too bad.

Other applications of 1st Generation Models:

- endogenous commodity money (KW, AW)
- endogenous specialization (KW)
- international monetary issues (KW, MKM, Z)
- private information problems (WW)
- policy institutions (currency board, gold standard) (AW, LW)
- banking and payments issues (HHW, L).

Money and Prices: 2nd Generation Models

Shi (95) and Trejos-Wright (95) keep $m \in \{0, 1\}$ but make goods divisible, with $C = c(x)$ and $U = u(x)$.

One can determine x by:

- Rubinstein/Nash bargaining (STW)
- auctions or price posting with directed search (JKK)
- price posting with undirected search (CW)
- pure mechanism design (WZ)

For novelty, here we try Kalai's proportional bargaining sol'n (KPS).

$$u(x) + \beta(V_0 - V_1) = \theta[u(x) - c(x)]$$

Hence x solves $g(x) = \Delta$, where $\Delta = \beta(V_1 - V_0)$ and

$$g(x) = \theta c(x) + (1-\theta)u(x).$$

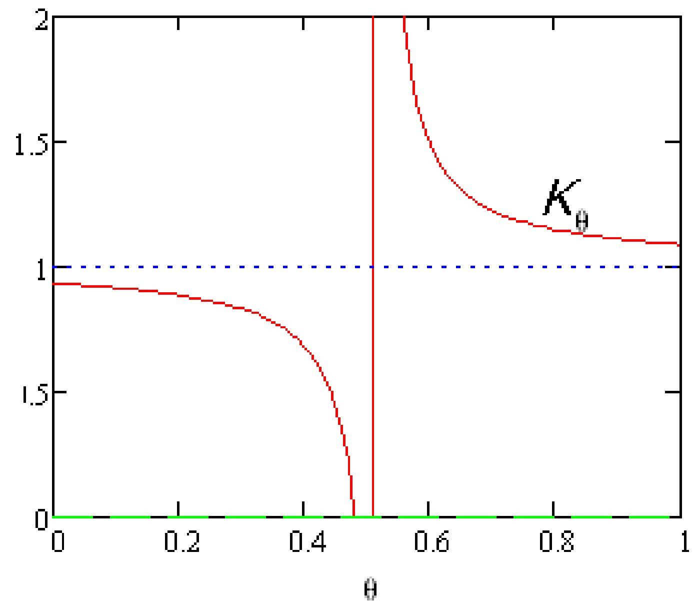
By comparision, GNS also solves $g(x) = \Delta$ but with

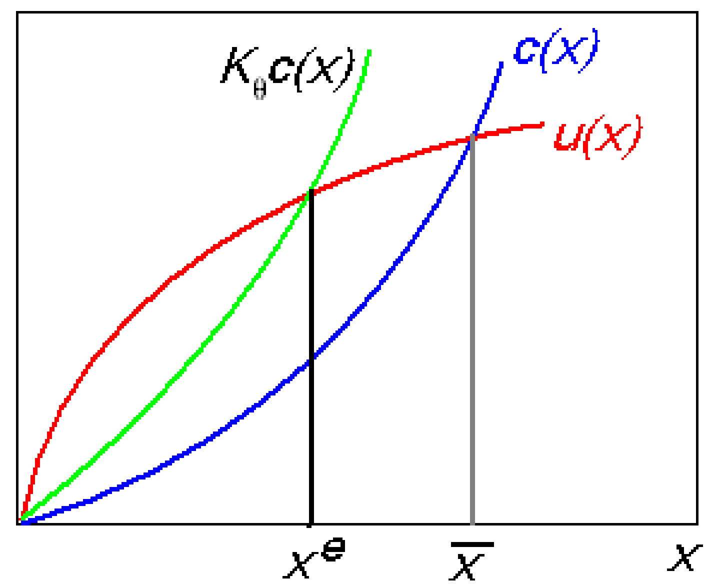
$$g(x) = \frac{\theta u'(x)}{\theta u'(x) + (1-\theta)c'(x)} c(x) + \frac{(1-\theta)c'(x)}{\theta u'(x) + (1-\theta)c'(x)} u(x).$$

These differ unless $x = x^*$ where $u'(x^*) = c'(x^*)$ – which is generically not the case in equilibrium.

KPS easily reduces to $c(x) = K_\theta c(x)$, where

$$K_\theta = \frac{\alpha\sigma(\theta - M) + \theta(1-\beta)}{\alpha\sigma\beta(\theta - M) - (1-\theta)(1-\beta)}.$$





Prop: $\exists!$ equil with $x > 0$ iff $\theta > \hat{\theta} = \frac{r + \alpha\sigma M}{r + \alpha\sigma} \in (M, 1)$.

Prop: $\frac{\partial x}{\partial \theta} > 0$, $\frac{\partial x}{\partial r} < 0$ and $\frac{\partial x}{\partial M} < 0$.

Prop: $\theta = \theta^* \Rightarrow x = x^*$, where $\theta^* > \hat{\theta}$ and $\theta^* \leq 1$ iff $r < r^*$, where

$$\theta^* = \frac{ru(x^*) + \alpha\sigma M[u(x^*) - c(x^*)]}{(r + \alpha\sigma)[u(x^*) - c(x^*)]}$$

$$r^* = \frac{\alpha\sigma(1 - M)[u(x^*) - c(x^*)]}{c(x^*)}.$$

Similar results hold with other mechanisms, but messier.

Prop: GNB with $\theta = M = 1/2$ (symmetry) $\Rightarrow x < x^*$.

Intuition:

- w/o frictions h works and consumes til $c'(x) = u'(x)$;
- w/ frictions, h works for m now and consumes later;
- to verify this, note $x \to x^*$ as $\beta \to 1$.

Optimal Policy:

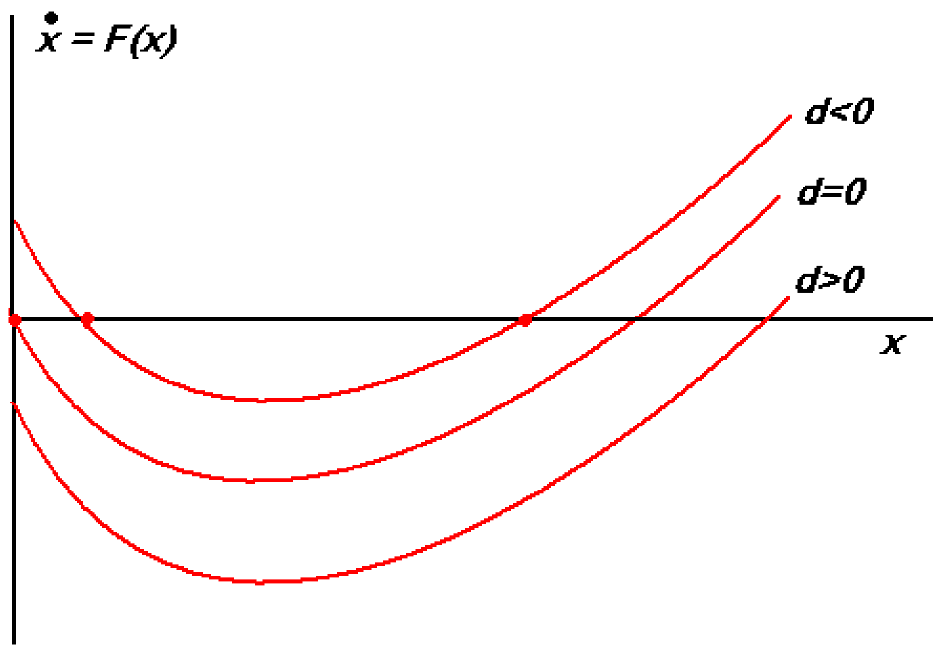
- taking x as given, $M^o = 1/2$;
- with x endogenous, $M^o < 1/2$;
- policy trade off: liquidity provision vs price distorion.

Prop: give m a flow dividend $d > 0$, or storage cost if $d < 0$.

$d = 0$: $\exists$ NE $x = 0$ & $\exists!$ ME $x > 0$.

$d < 0$: d small $\Rightarrow$ $\exists$ NE & two ME; d big $\Rightarrow$ $\nexists$ ME.

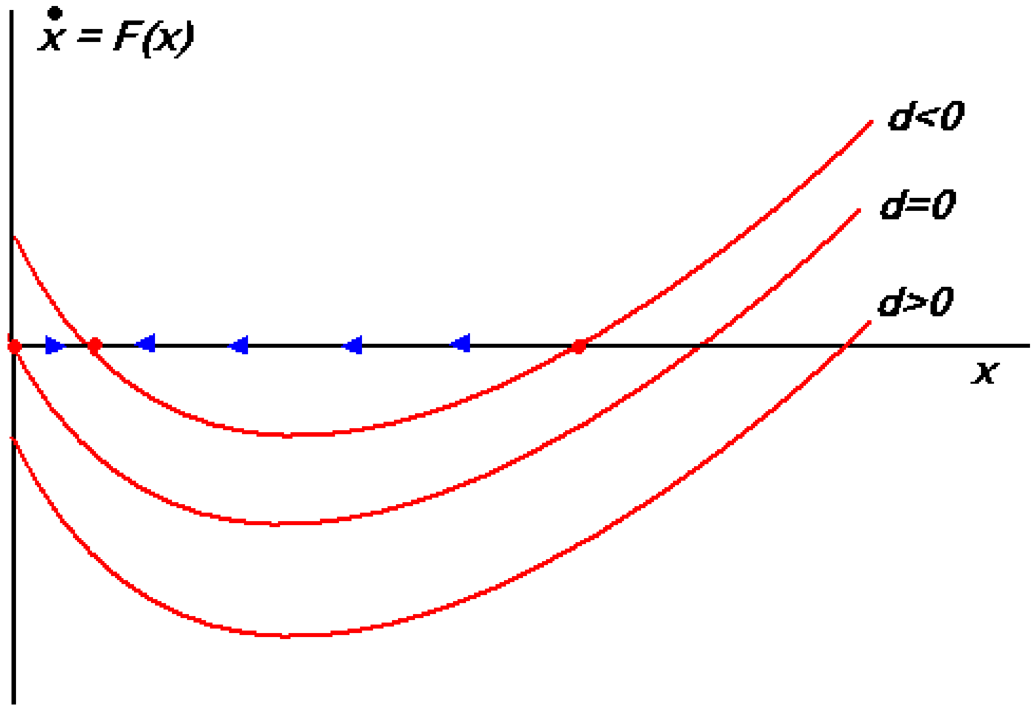
$d > 0$: $\nexists$ NE & $\exists!$ ME where m circulates iff d not too big.



Dynamics: KPB yields

$$\dot{x} = \frac{ru(x) - [(r+\alpha)\theta - \alpha M][u(x) - c(x)] - d}{\theta c'(x) + (1-\theta)u'(x)}$$

Prop: ∃ nonstationary bubble equilibria.



Other applications of 2nd Generation Models:

- more on dynamics (S, CW, E)
- specialization (S, CRW)
- money-output relation (W, KKW)
- money and credit(S)
- money and bonds (AWW)
- international monetary issues (TW)
- economic history (VWW, WZ, BTW, RW)
- denomination structure (KWZ)
- banking, payments and private money issues (CW, W)

Distributions: 3rd Generation Models

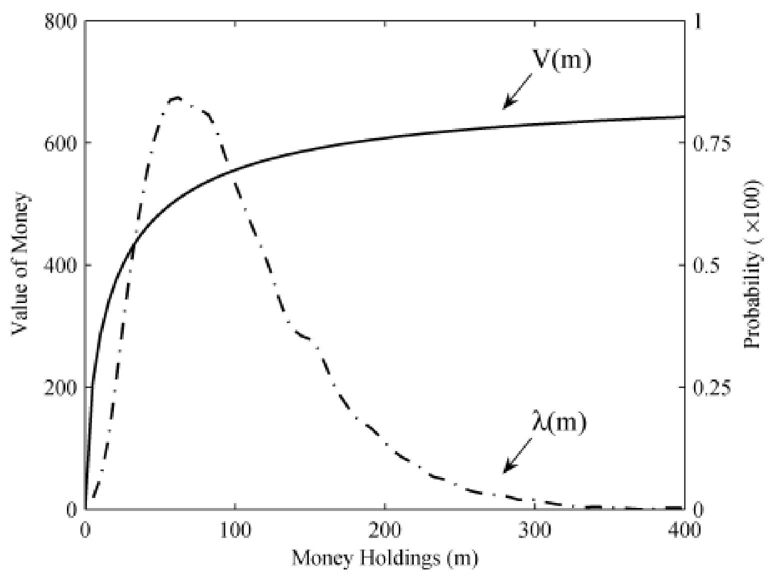
Some contibutors: Green-Zhou, Camera- Corbae, Deviatov-Wallace, Zhu, Molico, Chiu-Molico, Dressler

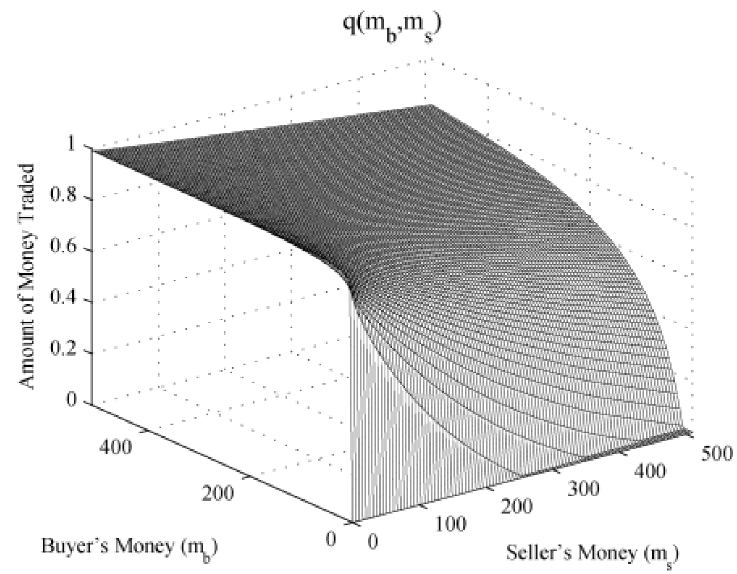
Hard part: the dist'n of money across agents, $\lambda(m)$.

$$\begin{aligned} V(m) = {} & \alpha\sigma \int \{u[x(m,\tilde{m})] + \beta V[m - d(m,\tilde{m}) + T]\}\lambda(d\tilde{m}) \\ & + \alpha\sigma \int \{-c[x(\tilde{m},m)] + \beta V[m + d(\tilde{m},m) + T]\}\lambda(d\tilde{m}) \\ & + (1 - 2\alpha\sigma)\beta V(m + T) \end{aligned}$$

where (x,d) denotes trade in mtg $(m,\tilde{m})$ and T is a transfer.

SME is a list of functions $[V(\bullet), x(\bullet), d(\bullet), F(\bullet)]$ such that: $V(m)$ solves BE; $x(m, \tilde{m})$ and $d(m, \tilde{m})$ are given by the mechanism (e.g. GNB); and $\lambda(m)$ is the implied stationary dist'n.





Proposal: Models with endogenous dist'ns are interesting in monetary economics, as they are in standard macro ... *but*

It would be nice to have a benchmark, like macro has the neoclassical growth model with homogeneous agents and complete markets.

But homogeneous agents with complete markets is a nonstarter for serious monetary theory.

Options: Shi, Menzio-Shi-Sun, Lagos-Wright

Here I do LW, since it is easy, and is realistic – in that it has elements of both search and frictionless GE theory.

The Environment

Each t has two subperiods: DM and CM, with $\mathrm{U}(x, \ell, X, L)$.

Tractability: assume U is linear in H or X.

Also, assume (for now) $x = \ell$, $X = wH$, and

$$\mathrm{U} = u(x) - c(\ell) + U(X) - AL.$$

Subsumes previous models – Molico, STW, KW.

Again we assume that h trades with h' in the DM.

But in many applications h trades with f, or f trades with f'.

CM problem:

$$W(m) = \max_{X,L,\hat{m}} \{U(X) - AL + V(\hat{m})\}$$

$$\text{st } X = wL + \phi(m - \hat{m} + T)$$

Normalize $A = w$ wlog and eliminate L:

$$W(m) = \phi m + \text{const} + \max_{\hat{m}} \{-\phi\hat{m} + V(\hat{m})\}$$

where const $= \phi T + \max_X \{U(X) - X\}$.

Prop: $W(m)$ is linear in m, with $W'(m) = \phi$; and $\hat{m} \perp m$, so that $\lambda(m)$ is degenerate.

Terms of trade:

$$S_B = u(x) + \beta W(m-d) - \beta W(m) = u(x) - \beta\phi d$$

$$S_S = -c(x) + \beta W(\tilde{m}+d) - \beta W(\tilde{m}) = \beta\phi d - c(x)$$

Let a generic mechanism g determine (x,d) as fn of (S_B, S_s) – e.g., Nash, Kalai, Walras...

Lemma: In any equilibrium, $d \leq m$ binds, and x solves $\beta\phi m = g(x)$.

Note: *this is same as second generation models*, except now $\Delta = \beta\phi m$ instead of $\Delta = \beta(V_1 - V_0)$.

Example 1: KPB implies $\beta\phi m = g(x)$ where, as above,

$$g(x) = \theta c(x) + (1-\theta)u(x).$$

Example 2: Walrasian pricing *à la* Lucas-Prescott

Buyer: $\max\{u(x) - \beta\phi d\}$ st $px = d \le m \Rightarrow px = m$

Seller: $\max\{\beta\phi d - c(x)\}$ st $px = d \Rightarrow c'(x) = \beta\phi p$

Market clearing implies $\beta\phi m = g(x)$ where this time

$$g(x) = xc'(x).$$

Many other mechanisms can be used.

Tractability: rewriting BE, replacing $V(\bullet)$ with $W(\bullet)$ on RHS, we get

$$V(m) = \alpha\sigma\int\{u[x(m,\tilde{m})] + \beta W[m - d(m,\tilde{m}) + T]\}\lambda(d\tilde{m})$$
$$+ \alpha\sigma\int\{-c[x(\tilde{m},m)] + \beta W[m + d(\tilde{m},m) + T]\}\lambda(d\tilde{m})$$
$$+ (1 - 2\alpha\sigma)\beta W(m + T)$$

Now use $d = m$, $\tilde{m} = M$, and $W(m)$ linear to write:

$$V(m) = \beta\phi m + \alpha\sigma\{u[x(m)] - \beta\phi m\} + \text{const}$$

This is quite a simplification – if not a borderline miracle.

Ignoring constants, CM problem is

$$\max_{\hat{m}}\{-\phi_t \hat{m} + \alpha\sigma u[x(\hat{m})] + (1-\alpha\sigma)\beta\phi_{t+1}\hat{m}\} \text{ st } g(x) = \beta\phi_{t+1}\hat{m}$$

FOC:

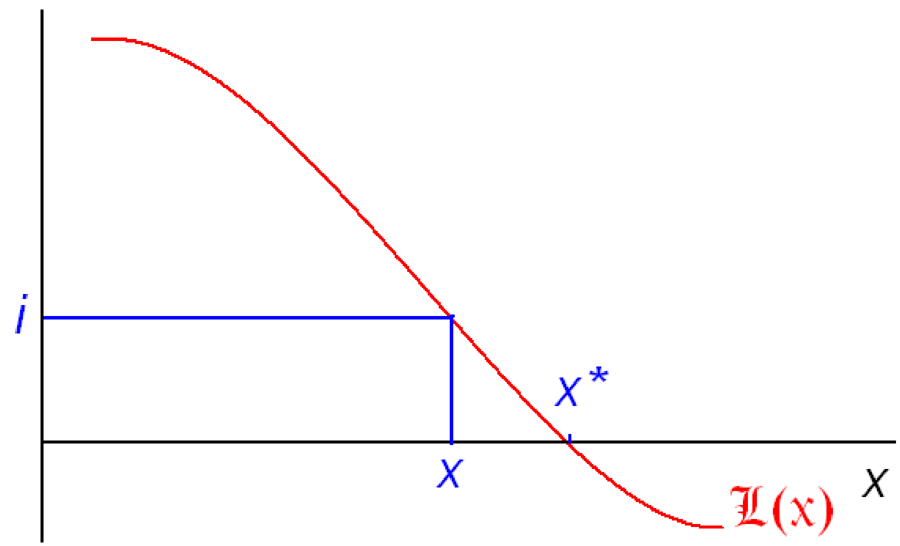
$$\phi_t = \beta\phi_{t+1}\left[\alpha\sigma\frac{u'(x)}{g'(x)} + 1 - \alpha\sigma\right].$$

Fisher eqn $1 + i = \phi_t/\phi_{t+1}\beta \Rightarrow$

$$i = \alpha\sigma\left[\frac{u'(x)}{g'(x)} - 1\right] = \alpha\sigma\mathcal{L}(x)$$

where $\mathcal{L}(x)$ is the *liquidity premium*.

Prop: For any mechanism $g \in G$, generically $\exists!$ SME $x > 0$. If $i > 0$ then $x < x^*$, and $\partial x / \partial i < 0$.



e.g. KPB $\Rightarrow \mathcal{L}(x) = \underbrace{\frac{\theta[u'(x) - c'(x)]}{\theta c'(x) + (1-\theta)u'(x)}}_{> 0 \text{ iff } x < x^*}, \mathcal{L}'(x) = \underbrace{\frac{\theta[c'(x)u''(x) - u'(x)c''(x)]}{[\theta c'(x) + (1-\theta)u'(x)]^2}}_{< 0 \forall x}$

A (New?) Model of Bargaining:

Stage 1: S proposes a deal, give me m for x.

Stage 2: B accepts or rejects, where:

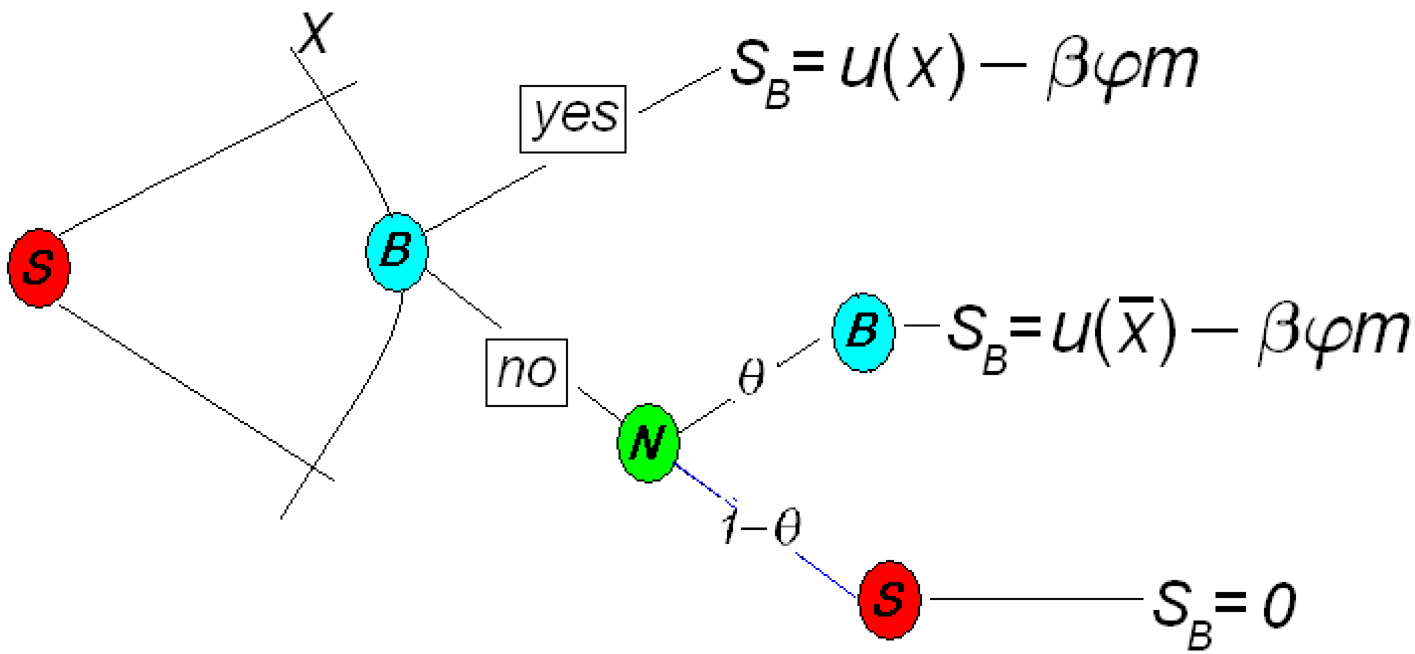
accept means the game ends;

reject means we go to stage 3.

Stage 3: Nature moves (a coin toss) with the property that:

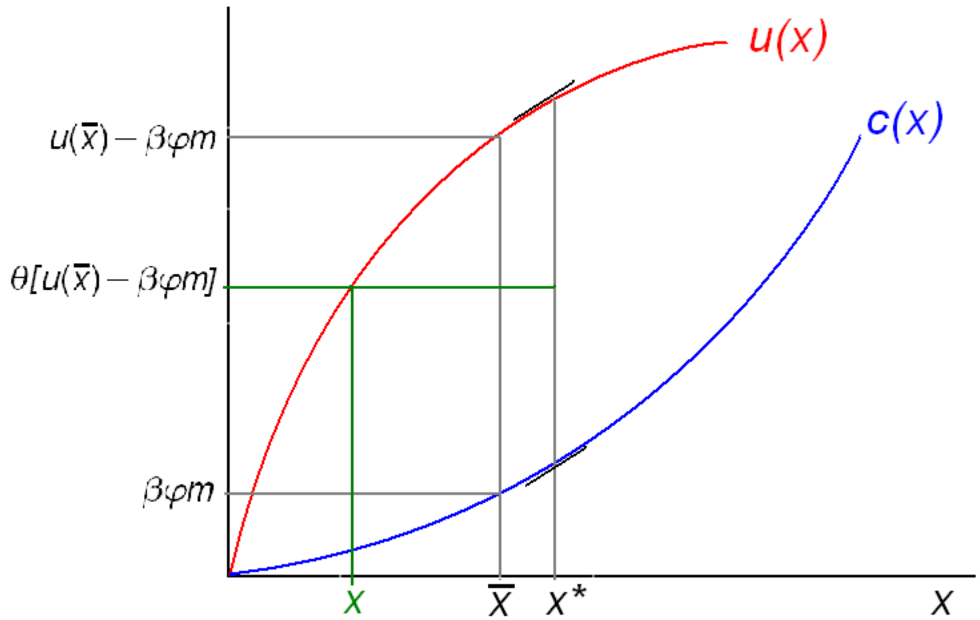
with prob θ, B makes a take-it-or-leave-it offer;

with prob $1 - \theta$, S makes B a take-it-or-leave-it offer.



Prop: ∃! SPE. The initial offer is accepted. The final offer by B satisfies $c(\bar{x}) = \beta\phi m$ and the initial offer by S satisfies

$$u(x) = \theta u(\bar{x}) + (1 - \theta)c(\bar{x}).$$

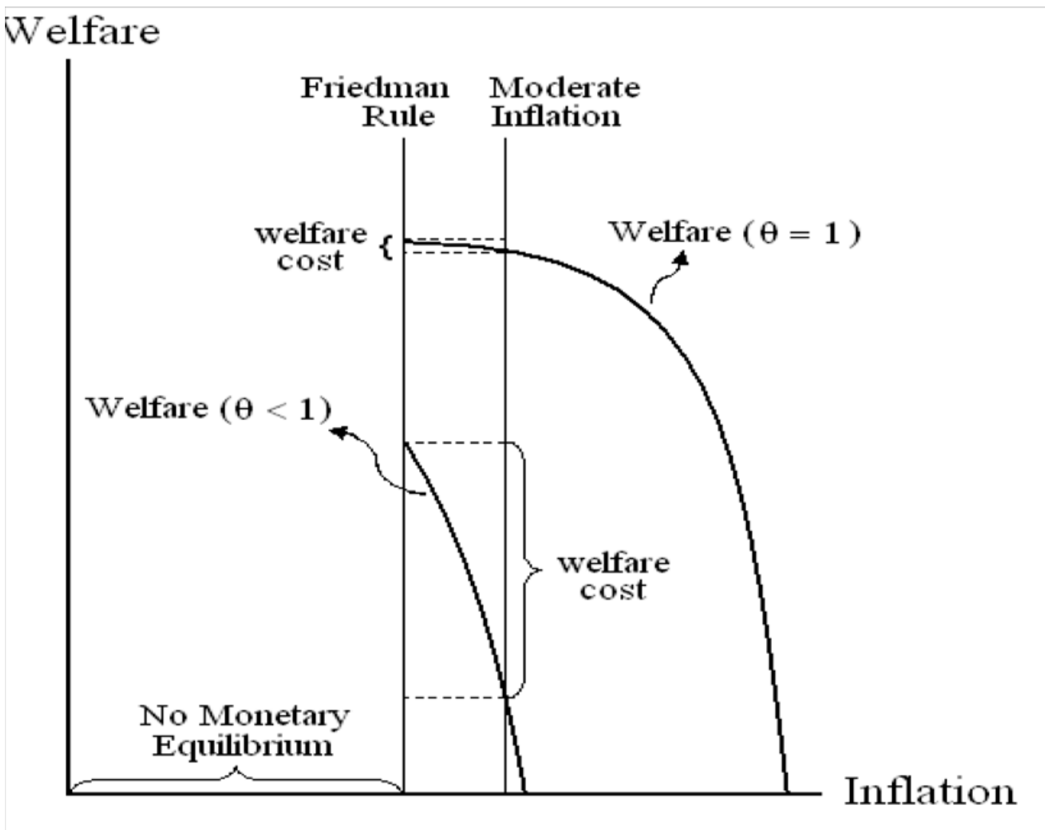


Prop: ∃! SME x, solving $u(x) = \theta u(\bar{x}) + (1-\theta)c(\bar{x})$ where

$$i = \alpha\sigma\mathcal{L}(\bar{x}) = \alpha\sigma\theta\left[\frac{u'(\bar{x})}{c'(\bar{x})} - 1\right].$$

Search, matching and bargaining frictions show up as $\alpha\sigma\theta$.

Claim: Using any bargaining (as opposed to competitive) mechanism has important welfare and policy implications.



Welfare: Taking the S & M as given, efficiency requires:

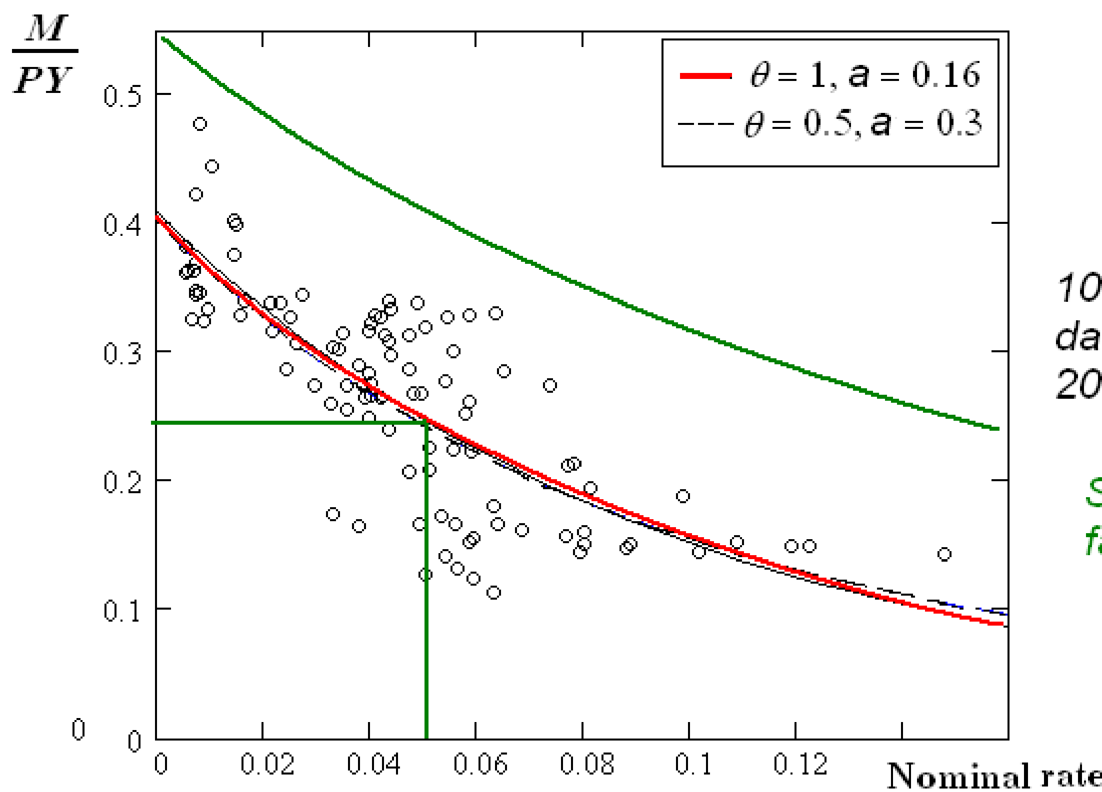
- $i = 0$ – the Friedman rule
- $\theta = 1$ – the Hosios condition.

Claim: This is *quantitatively* relevant.

- $\theta = 1$: cost of inflation like reduced-form studies $\approx 0.5\%$
- $\theta < 1$: cost of inflation closer to 5%.

Calibration: $U(X) = \log(X)$, $u(x) = Ax^{1-a}/(1-a)$ and $c(x) = x$:

- Choose β and θ to match interest rate and markup
- Choose (a, A) to match "money demand" M/PY vs i.



100 years of MD data (from Lucas 2000)

Speaks to two falacies!

fitted MD curve w/o holdup: buyer's = total surplus

fitted MD curve w/ holdup: buyers' surplus

fitted MD curve w/ holdup: social surplus

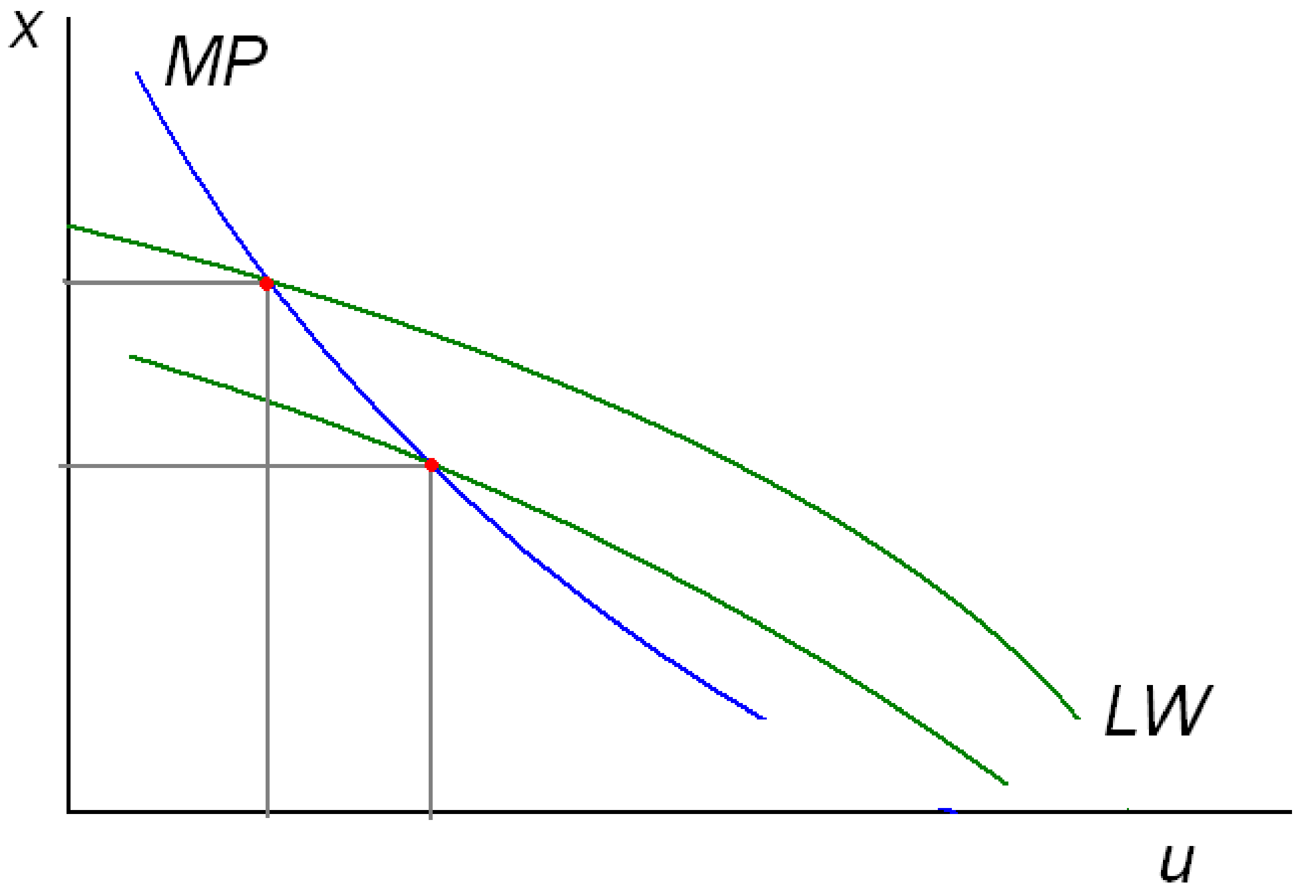
Much recent quatitative work leads us to reconsider the effects of monetary policy (see especially AS).

AWW find the effect of i on investment can be much bigger than past work suggests

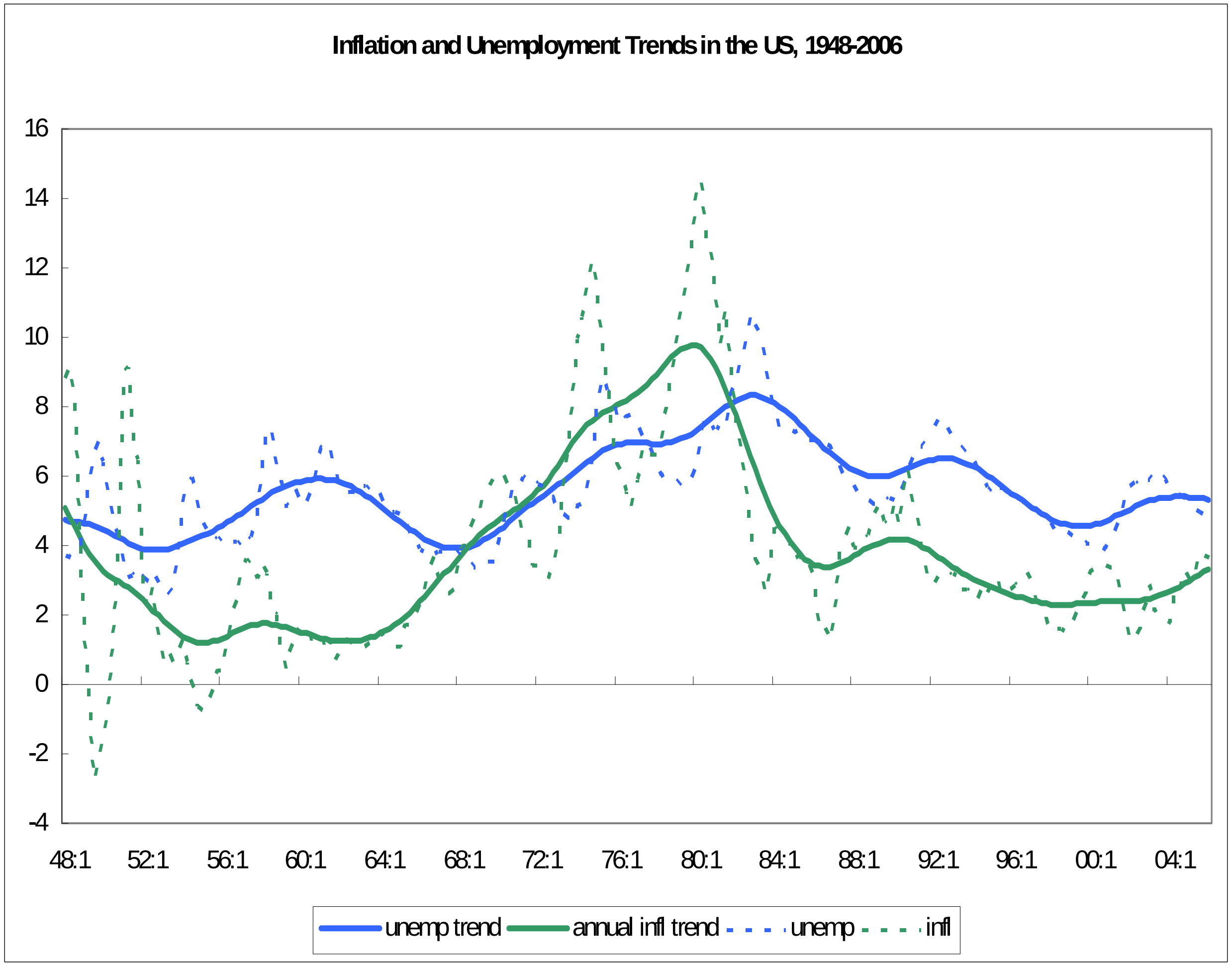
- going from 10% inflation to Freidman Rule can increase K by as much as 7% – huge!

BMW find the effect of i on unemployment can also be big – but not like Keynesians think.

- theory predicts in medium-to-long run higher $i \Rightarrow$ higher u.
- changes in i account for about 1/2 of the ups and downs in u during 70s and 80s.

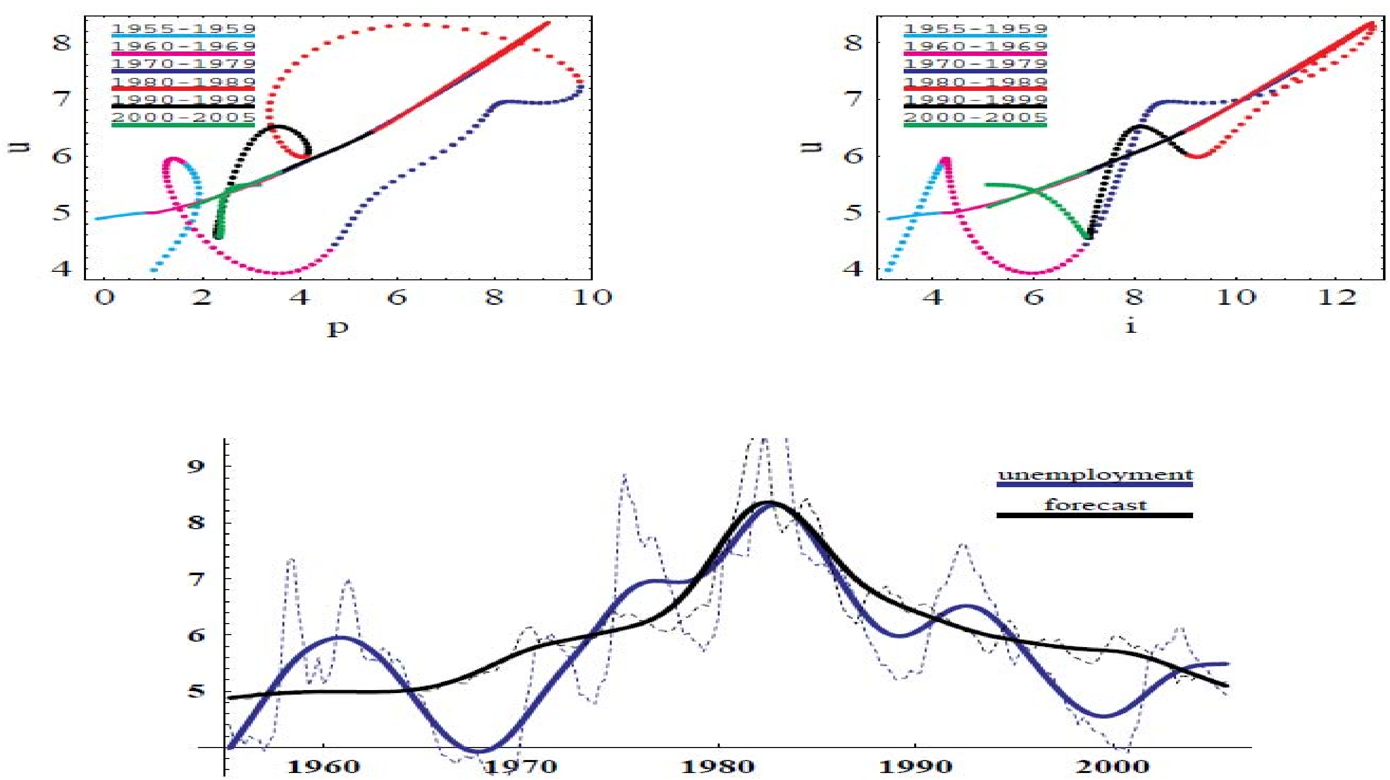


BMW model: increasing i lowers value of money and increases unemployment.



See BMW-charts.pdf for more evidence on QT, FE, PC and MD including other countries.

Figure 6.8: BF high elasticity 1600



Generalized Model: Asset Pricing:

$$y(\mathbf{a}) = \sum_{j=1}^{n}(\delta_j + \phi_j)a_j$$

where $\mathbf{a} \in R_+^n$ is your portfolio. Then

$$W(y) = \max_{X,L,\hat{\mathbf{a}}}\{U(X) - L + \beta V(\hat{\mathbf{a}})\} \text{ st } X = L + y - \sum_j \phi_j \hat{a}_j + T$$

$$= y + \text{const} + \max_{\hat{\mathbf{a}}}\{-\boldsymbol{\phi} \cdot \mathbf{a} + \beta V(\hat{\mathbf{a}})\}$$

Prop: $W'(y) = 1$ and $\hat{\mathbf{a}} \perp \mathbf{a}$.

Differential Liquidity (information)

$\rho_S = prob$(type S mtg where seller accepts only $a_j \in S$)

Liquid wealth in a type S mtg

$$y_S(\mathbf{a}) = \sum_{j \in S} (\delta_j + \phi_j) a_j.$$

$$y_S(\mathbf{a}) \geq y^* \Rightarrow p_S(\mathbf{a}) = y^* \;\&\; x_S(\mathbf{a}) = x^*$$

$$y_S(\mathbf{a}) < y^* \Rightarrow p_S(\mathbf{a}) = y_S(\mathbf{a}) \;\&\; x_S(\mathbf{a}) = g^{-1} \circ y_S(\mathbf{a}) < x^*$$

Agents are *satiated in liquidity* when $\mathcal{L}[x_S(\mathbf{a})] = 0$, i.e. $x_S(\mathbf{a}) = x^*$, for all S.

Asset-pricing equations:

$$\phi_j(t) = \beta[\delta_j + \phi_j(t+1)]\left\{1 + \alpha\sigma \sum_{S \in \mathrm{P}_j} \rho_S \mathcal{L}[q_S(\mathbf{A})]\right\}, j = 1, \ldots n$$

Equil is a nonnegative and bounded sequence $\{\boldsymbol{\phi}_t\}_{t=0}^{\infty}$ satisfying this DE.

If agents are satiated in liquidity, or if $\alpha\sigma = 0$, then we have $\phi_j = \beta\delta_j/(1-\beta) = \phi_j^*$ – the *fundamental price*.

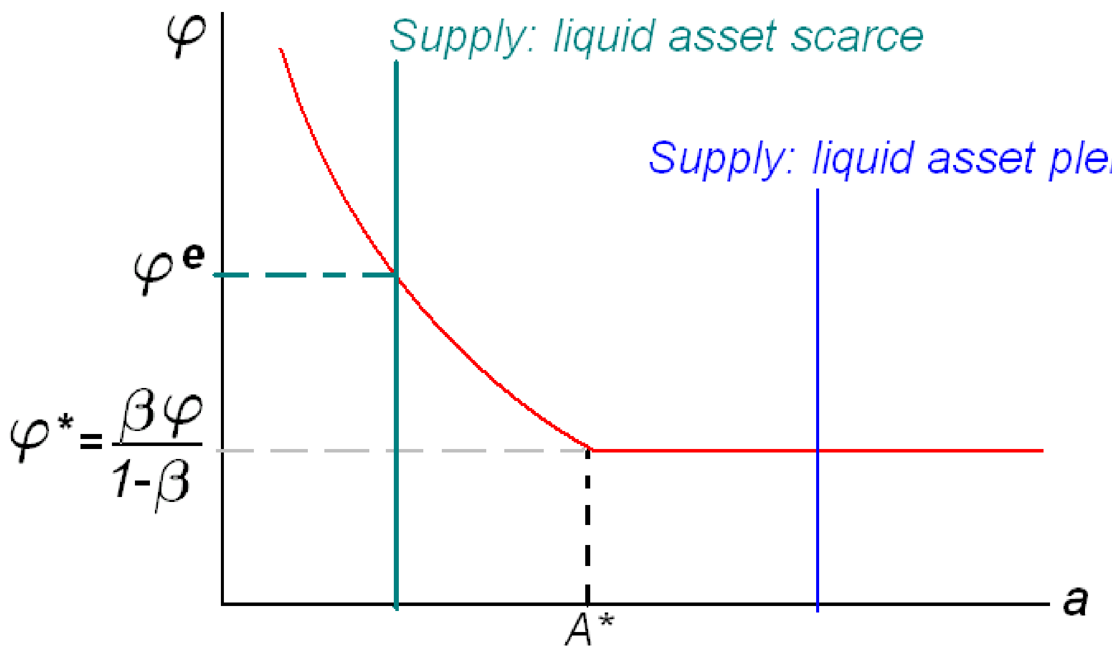
If agents are not satiated in liquidity then $\phi_j > \phi_j{}^*$ for some j.

DE implicitly defines the demand for a given ϕ.

Prop: Demand is continuous, with kink at $A^* = y^*/(\delta + \phi)$.

$A > A^* \Rightarrow \exists!$ equil with $\varphi = \varphi^*$ and $x = x^*$

$A < A^* \Rightarrow \exists!$ equil with $\varphi = \varphi^e > \phi^*$ and $x < x^*$



$\varphi^e - \varphi^*$ ***is a liquidity premium***

Applications (see conference next week for details)

Multiple Assets

Policy implications:

- inflation irrelevant for real return on illiquid assets (Fisher);
- inflation decreases the real return on liquid assets iff liquidity is scarce;
- inflation lowers consumption and utility even for agents that never use money.

Endogenous Information

- multiple equilibria and effects of monetary policy;
- hysteresis in dollarization and exchange rates.

Q: Is Kiyotaki right to think there is more to Kiyotaki-Moore than Kiyotaki-Wright?

KM: let d be debt, settled using numeraire in CM X wlog.

$$W(a,d) = \max_{X,L,\hat{a}} \{U(X) - L + V(\hat{a})\} \text{ st } X = L + \phi(a - \hat{a}) - d$$

$$V(\hat{a}) = \beta W(\hat{a},0) + \alpha\sigma[u(x) - \beta d] + \text{const}$$

Impose debt limit $D = D(a)$ – e.g. KM use $D = \chi a$:

- unconstrained trade: $x = x^*$ and $d = d^* = g(x^*)$
- if $d^* > D(a)$ then $d = D(a)$ and x solves $g(x) = D(a)$

Note that in KM-style models, along the equil path assets do not change hands.

- all DM trade uses credit with a playing the role of collateral;
- in CM, debtor settles obligations in numeraire;
- only if buyer defaults – which never happens in equil – does the lender seize a.

By contrast, in KW-style models, assets are transferred and there is finality in each DM trade.

Does this matter for anything? No.

Should it be controversial? Not really.

A recent David Andofatto blog:

On the surface, these two methods of payment look rather different. The first [read Kiyotaki-Wright] entails immediate settlement, while the second [read Kiyotaki-Moore] entails delayed settlement. To the extent that the asset in question circulates widely as a device used for immediate settlement it is called money (in this case, backed money). To the extent it is used in support of debt, it is called collateral. But while the monetary and credit transactions just described look different on the surface, they are equivalent in the sense that capital is used to facilitate transactions that might not otherwise have taken place.

Other differences seem superficial:

- KM models usually have producers trading; KW models usually have consumers trading;
- KM models use Walrasian pricing; KW models study a wide variety of mechanisms;
- KM models use preference or tech. shocks to generate gains from trade; KW models usually use random matching;
- KM models have only credit frictions; KW models also have search, matching, bargaining frictions.

The comparison between KM and KW is quite stark in our benchmark alternating-market environment.

What is the relation in general?

Appilcation: House Prices

- Reinhart and Rogoff (2009): recent financial developments allowed consumers "to turn their previously illiquid housing assets into ATM machines."
- Ferguson (2007): it "allowed borrowers to treat their homes as cash machines."

Use KM interpretation, $D = D(k)$ with k = housing capital

$$W(k,d) = \max_{X,L,\hat{k}} \left\{ U(X,k) - L + V(\hat{k}) \right\} \text{ st } X = L + pk(1-\delta) - p\hat{k} - d$$

$$V(\hat{k}) = \beta W(\hat{k},0) + \alpha\sigma[u(x) - \beta d] + \text{const}$$

Here k enters U fn and budget eqn – most assets like m do not – although one can also use HP theory.

Housing price (or house pricing) eqn:

$$\underbrace{rp_t}_{} = \underbrace{U_2(x_{t+1}, k_{t+1})}_{} + \underbrace{(1-\delta)p_{t+1} - p_t}_{} + \underbrace{\alpha\sigma p_{t+1} D'(ph)\mathcal{L}(p_{t+1}k_{t+1})}_{}$$

flow price = flow utility + capital gain + liquidity premium

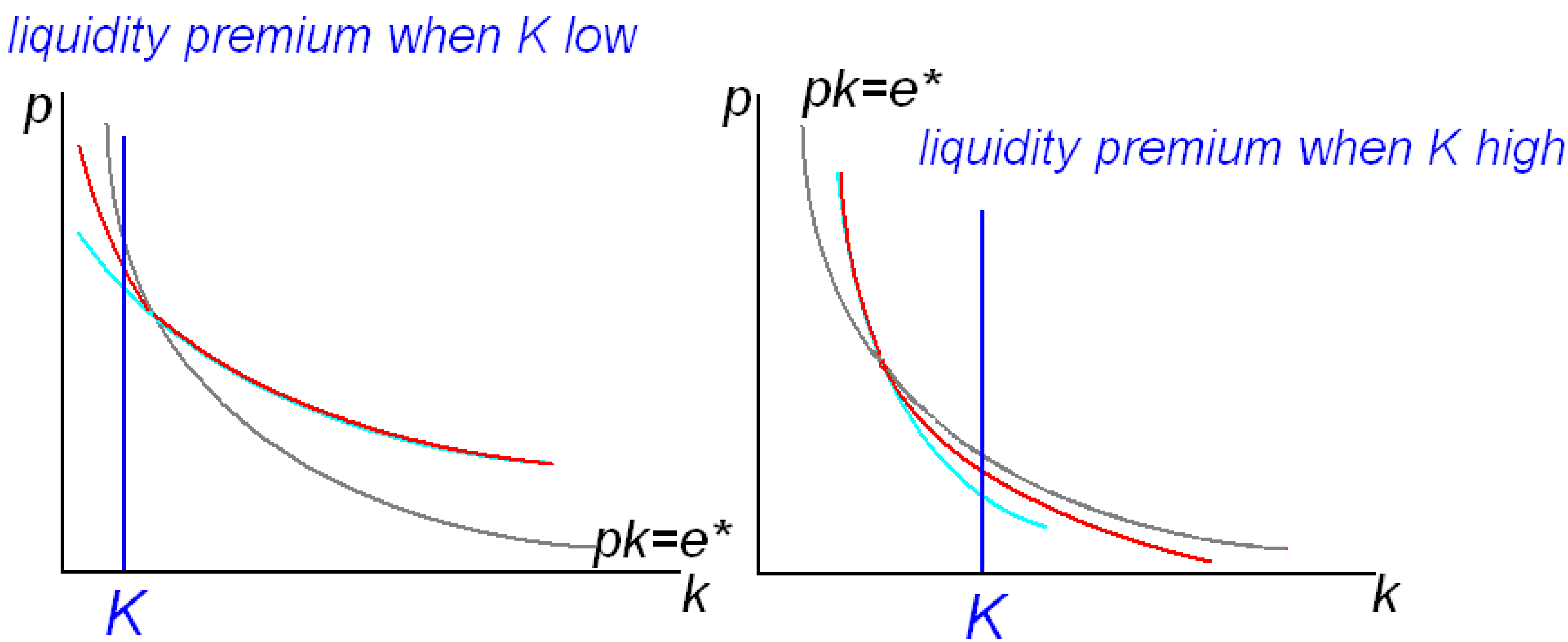
where as always $\mathcal{L}(ph) = \dfrac{u'(x)}{g'(x)} - 1 > 0$ iff $x < x^*$.

In steady state: $(r+\delta)p = U_2[X(k), k] + \alpha p \mathcal{L}(pk)$.

Approach 1: set $k = K$ and solve for p (fixed supply);

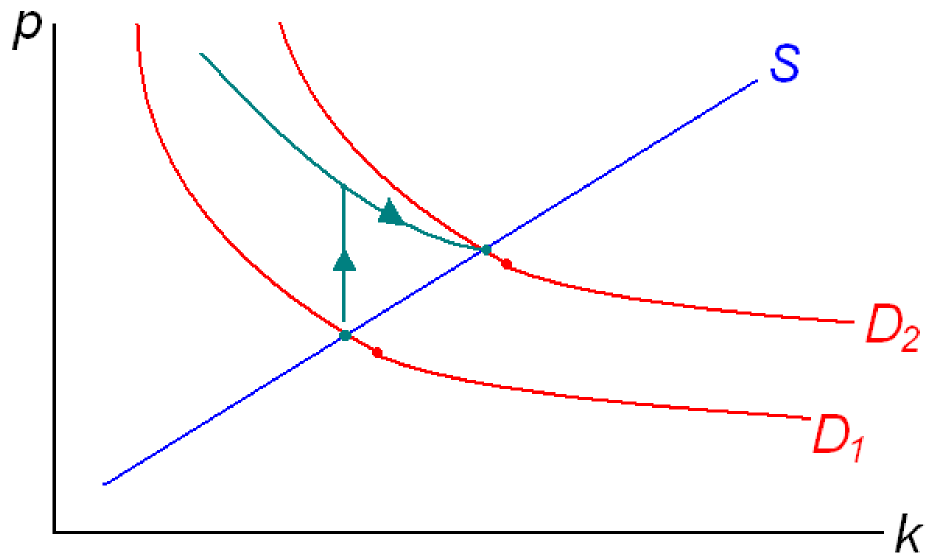
Approach 2: set $p = \gamma'(\Delta k)$ and solve for k (endog supply).

Note that $x < x^*$ – i.e. $\mathscr{L}(pk) > 0$ – depends on pk not k.

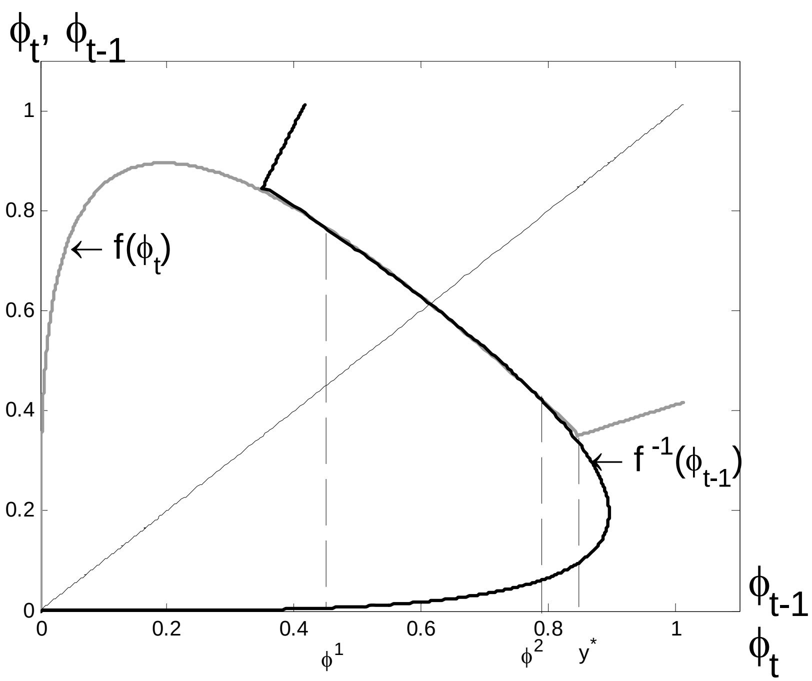


standard demand curve and demand with liquidity premium

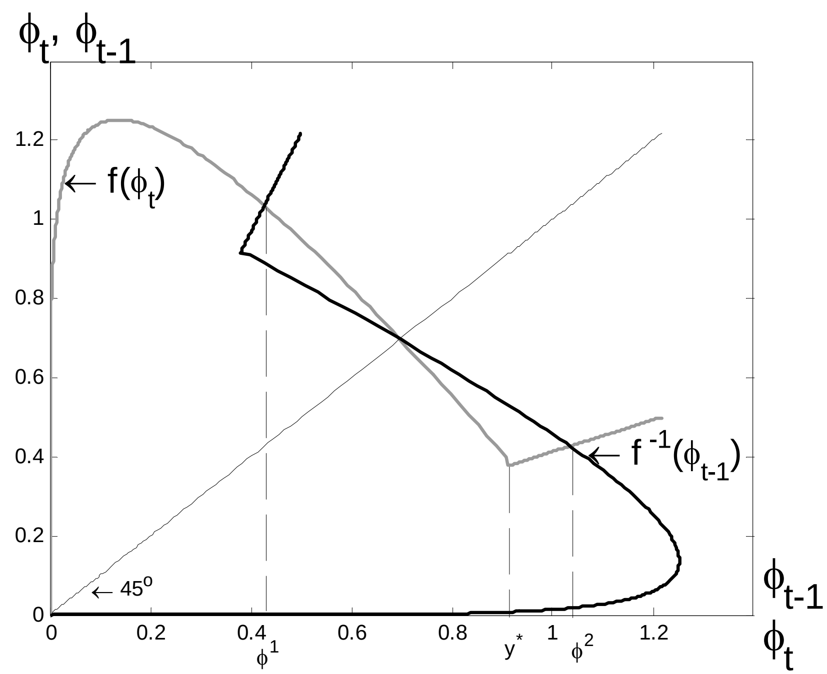
Increase in D due to financial innovation: perfect foresight dynamics when ss is a saddle path



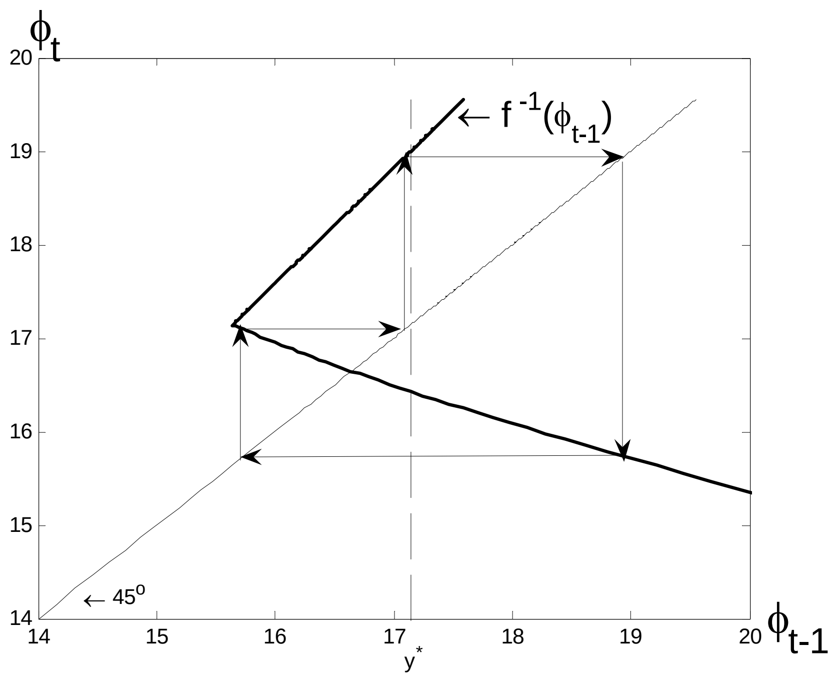
But more exotic dynamics are also possible!



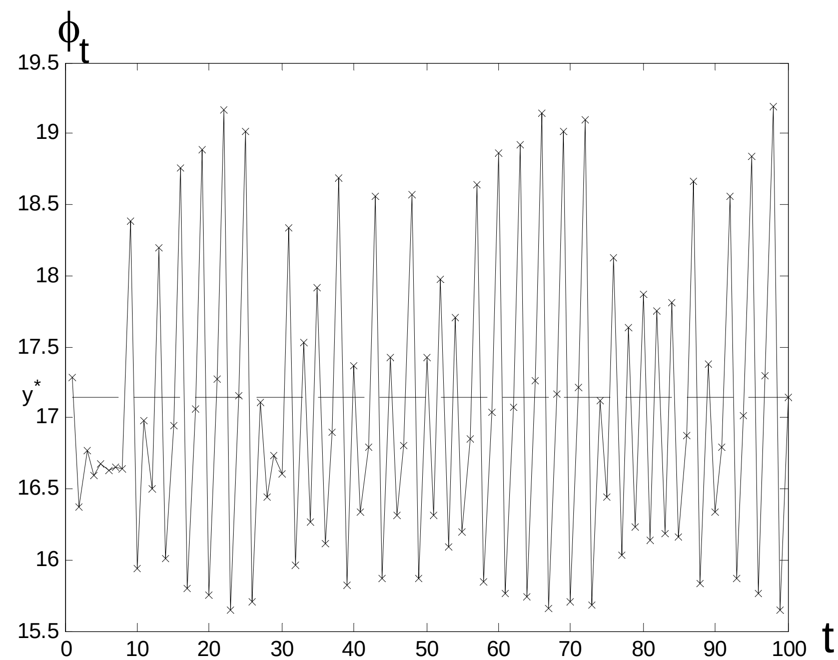
Two-cycle (Nash)



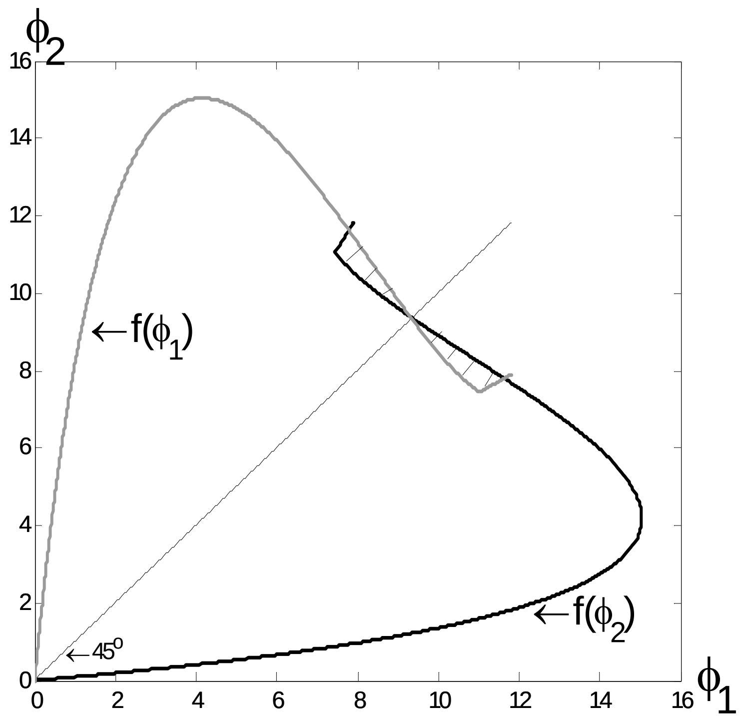
Two-cycle (Walras)

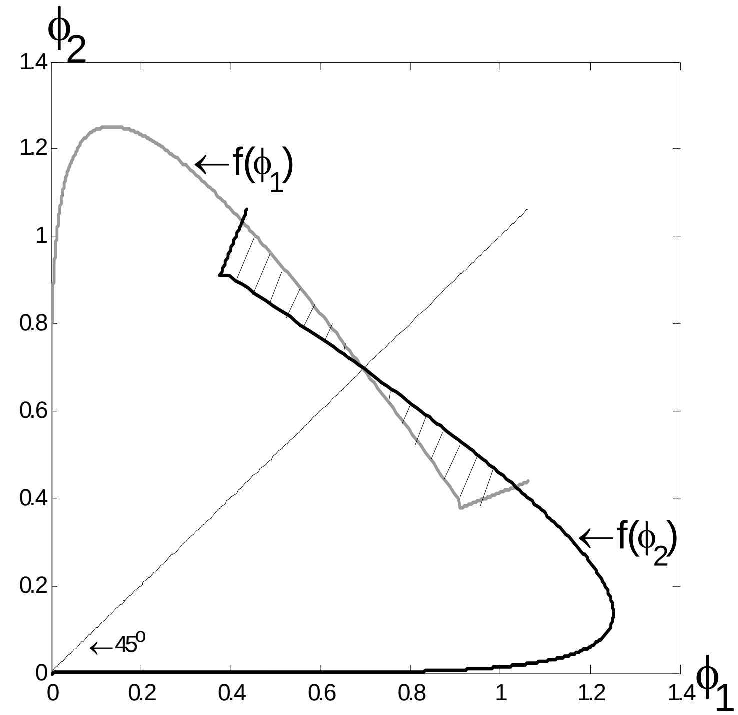


A three-period cycle



Chaotic dynamics





Sunspot equil (Nash pricing)

Sunspot equil (Walras)

Many other applications. To pick the most interesting – sticky prices!