Capitalist Culture and the Business Cycle: Notes Toward A Model

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Introduction

The current crisis has exposed the woeful state of mainstream macroeconomics. In Krugman's (2009) infamous characterization, macroeconomics is in the midst of its own Dark Ages, a period remarkable less for the low stock of common knowledge than for the loss, even destruction, of accumulated knowledge.

One important example is the disappearance of Goodwin's (1951) model of endogenous business cycles from the canon. There are any number of reasons for this, not least of which is the mainstream preference for linear(ized) models that preclude the existence of "turbulence."

Outside the mainstream, of course, there is a small but vibrant literature on endogenous cycles. This paper is a modest contribution to that literature, one that reflects the influence of evolutionary game theoretic methods. Its core is an almost trivial formalization of the contested exchange (Bowles and Gintis, 1993) between capitalist and worker in which the actions of each are, in some measure, a reflection of behavioral norms or "culture." These norms constitute an important, if sometimes overlooked, element of the social structure of accumlation.

In concert, the matches of capitalists and workers produce an *autonomous extraction cycle* in which the proportions of wokers who "acquiesce" and capitalists who commit (more) resources to extraction exhibit periodic fluctuations that are independent of the level of employment. The movements in output and therefore income that result are then connected, via the standard multiplier mechanism, to movements in the (un)employment rate.

The surprise, perhaps, is that this "toy model" will prove to be consistent with a number of stylized facts about business cycles, in particular the observed correlations of productivity, real wages and (perhaps) supervisory labor with output.

The Extraction Cycle

Contested exchange is represented as a variant of the Inspection Game (Fudenberg and Tirole, 1991) in which individual capitalists confront N workers.

Capitalists either commit resources of S_1 to the extraction problem under the standard mode of production or $S_2 \geq S_1$ under an "extractive mode."

These additional resources $\Delta S = S_2 - S_1$ include, but are not limited to, "organizational capital" (Hounshell's (1984) lines of production or Thompson's (1967) clocks) and use of "guard labor" (Bowles and Jayadev, 2004).

Workers can choose to acquiese or contest the exchange. If workers acquiese, each supplies effective labor of e_2 and produces output of v_2, but if they contest, then each supplies effective labor of $e_1 < e_2$ and produces output of $v_1 < v_2$.

Last, suppose that each worker receives w_2 whenever s/he acquiesces or she contests *and* the capitalist is committed to the standard or traditional mode, and w_1 otherwise.

The normal form of the game is:

		Capitalist's Choice of Regime	
		Extractive	Standard
Workers	Acquisce	$N(w_2 - e_2), N(v_2 - w_2) - S_2$	$N(w_2 - e_2), N(v_2 - w_2) - S_1$
	Contest	$N(w_1 - e_1), N(v_1 - w_1) - S_2$	$N(w_2 - e_1), N(v_1 - w_2) - S_1$

I shall also assume that (i) $v_i > w_i > e_i$, $i = 1, 2$, (ii) $\Delta v > \Delta w > \Delta e$, where $\Delta x = x_2 - x_1$ and (iii) $N(v_2 - w_2) > S_2$ and $N\Delta w > \Delta S$. Most are natural in the context, but some ensure that payoffs are strictly positive, a practical but not fudnamental feature. Under these restrictions, the game has a unique Nash equilibrium in mixed strategies, in which the capitalist chooses the extractive mode with likelihood $p_E = (\Delta e / \Delta w)$ and workers acquiesce with likelihood $p_A = (N\Delta w - \Delta S)/N\Delta w$.

A different, more dynamic, approach is adopted here. Suppose that each of the M capitalists is matched with MN workers at the start of production periods of length δ, where M is "large." Each capitalist's choice of mode of production reflects the current culture and, as a result, exhibits persistence.

In particular, suppose that a proportion $\alpha^C \delta$ of capitalists reconsider their choice at the end of the period and, as in Schlag (1998), "sample" another capitalist. If the sampled capitalist receives more profits, the sampler "imitates" the sampled - that is, adopts his/her mode of production - with likelihood proportional to the difference, where the factor of proportionality is ρ^C.

"Cultural inertia" is reflected in both the "review rate" $\alpha^C \delta$ and ρ^C : as the production period becomes shorter, the proportion who reconsider shrinks and, furthermore, a difference in profits isn't sufficent to ensure a switch.

The behavior of each N-set of workers is assumed to follow a similar pattern, with parameters α^C and ρ^W.

It is then not difficult to show that the evolution of proportions of capitalists who choose the extractive mode $p_E(t)$ and workers who acquiesce $p_A(t)$ will follow:

$$\begin{aligned} p_E(t+\delta) - p_E(t) &= \alpha^C \delta \rho^C p_E(t)(1 - p_E(t))[\Pi_E^C(t) - \Pi_S^C(t)] \\ p_A(t+\delta) - p_A(t) &= \alpha^W \delta \rho^W p_A(t)(1 - p_A(t))[\Pi_A^W(t) - \Pi_C^W(t)] \end{aligned}$$

where $\Pi_j^i(t)$ is the mean payoff to members of group i with behavior j in period t.

Dividing both sides by δ and letting $\delta \Longrightarrow 0$ produces:

$$\begin{aligned} \frac{dp_E}{dt} &= \alpha^C \rho^C p_E(t)(1 - p_E(t))[\Pi_E^C(t) - \Pi_S^C(t)] \\ \frac{dp_A}{dt} &= \alpha^W \rho^W p_A(t)(1 - p_A(t))[\Pi_A^W(t) - \Pi_C^W(t)] \end{aligned}$$

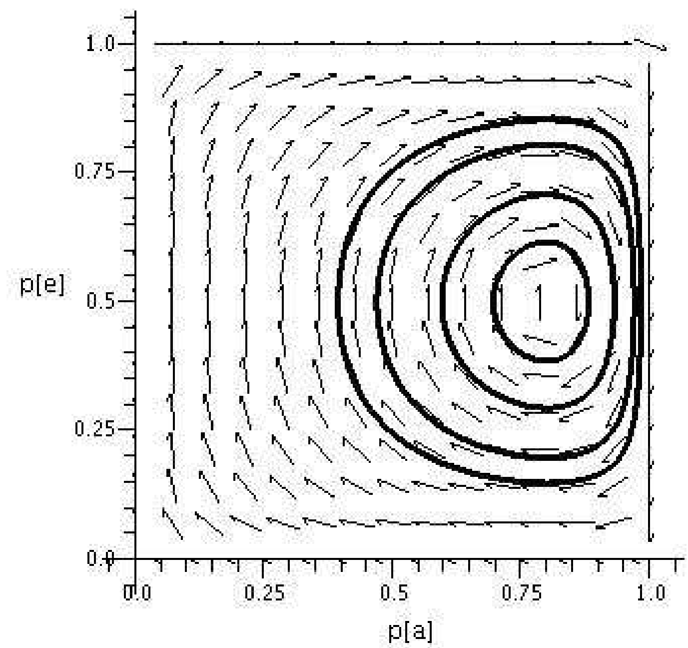
which is an example of a *multi-population replicator dynamic.*

> Aside: In the one population case, the parameters α and ρ affect the velocities of proportions but not their evolution. This is not the case here, however: differences in cultural transmission will influence behavior.

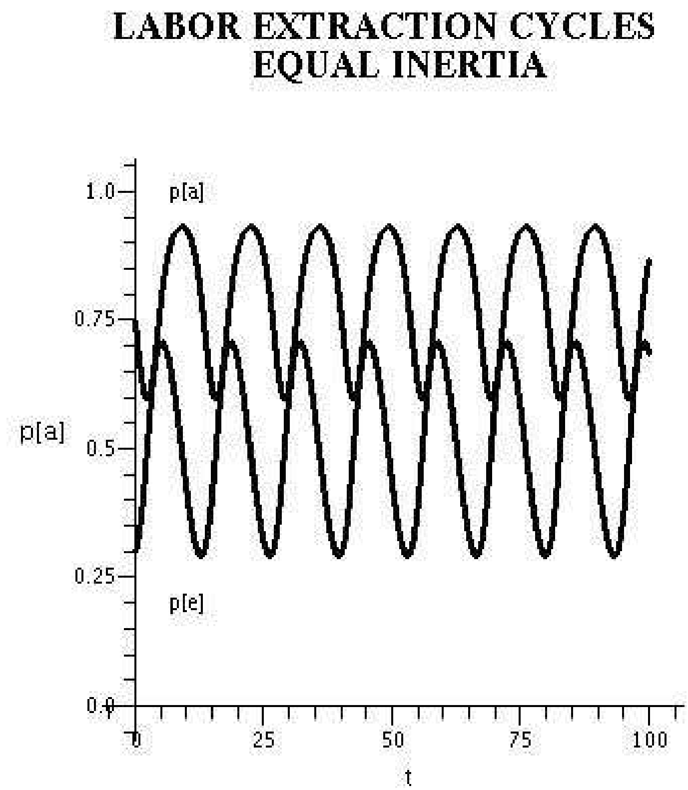
It is then not difficult to show the solution paths will be closed, clockwise orbits around the proportions associated with the mixed Nash equilibrium. Each of these paths is an example of an *autonomous extraction cycle.*

Under the parametrization $N=5, v_2=90, v_1=75, w_2=60, w_1=40, e_2=30, e_1=20, S_2=50, S_1=30, \alpha^W=\alpha^C=0.50$ and $\rho^W=\rho^C=0.05$, where v, w, e and S are chosen to be more or less consistent with annualized (in thousands of dollars) US data, and in which "cultural inertia" is the same for capitalists and workers, the direction field and representative orbits are:

LABOR EXTRACTION CYCLES
EQUAL INERTIA



The associated time paths for one set of initial conditions are:



The most important feature of these dynamics is the existence of a regular business cycle - output will rise with the proportion of workers who acquiesce, and vice versa - that is decoupled from employment (MN is fixed).

The relationship between the proportion of capitalists who choose the more extractive mode and output is more subtle, and will be revisited.

On the basis of these particular paths, however, it seems that "guard labor," for example, should lead output. Capitalists seem to become more extractive *before* output turns in a recession, and become more "lax" *before* output peaks.

From Extraction Cycles To Business Cycles

It's reasonable, however, to require that as output fluctuates, so, too, must the demand for labor. To this end, consider a modification of the previous game in which there is some likelihood $(1 - n(t))$ that the match between capitalist and N workers is abandoned for want of effective demand, and that both receive 0 from an abandoned match.

Within the framework of this model $n(t)$ can also be viewed the employment rate at time t and $1 - n(t)$ the unemployment rate.

The implicit assumption that the there are no sunk costs associated with either mode of production - but, in particular, the more extractive one - is not innocuous, but affords a welcome simplification. If capitalists and workers are risk neutral, the evolution of behaviors can be modeled as a consequence of the modified expected value game:

		Capitalist's Choice of Regime	
		Extractive	Standard
Workers	Acquisce	$n(t)N(w_2{-}e_2), n(t)[N(v_2{-}w_2) - S_2]$	$n(t)N(w_2{-}e_2), n(t)[N(v_2{-}w_2) - S_1]$
	Contest	$n(t)N(w_1{-}e_1), n(t)[N(v_1{-}w_1) - S_2]$	$n(t)N(w_2{-}e_1), n(t)[N(v_1{-}w_2) - S_1]$

Under these conditions, the laws of motion for the proportions of extractive capitalists and acquiescent workers become:

$$\begin{aligned}\frac{dp_E}{dt} &= \alpha^C \rho^C n(t) p_E(t)(1-p_E(t))[\Pi_E^C(t) - \Pi_S^C(t)] \\ \frac{dp_A}{dt} &= \alpha^W \rho^W n(t) p_A(t)(1-p_A(t))[\Pi_A^W(t) - \Pi_C^W(t)]\end{aligned}$$

But how is the evolution of $n(t)$ determined? The reduced form solution adopted here assumes that, consistent with the operation of an expenditure multiplier, the fluctuations in output and income associated with the extraction cycle will induce fluctuations in employment.

Under the simplest possible specification, the rate of change of total employment, equal here to $n(t)MN$, will be proportional to the rate of change of total output, denoted $Y(t)$,where the factor of proportionality is denoted β:

$$\frac{d(n(t)MN)}{dt} = MN\frac{dn(t)}{dt} = \beta\frac{dY(t)}{dt}$$

Since output $Y(t)$ is also equal to $n(t)MN\widehat{v}(t)$, where $\widehat{v}(t) = p_A(t)v_2 + (1-p_A(t))v_1$ is mean output per worker - that is, the product of mean output per worker and the number of "non-abandoned" workers - the rate of change of output must also follow:

$$\frac{dY(t)}{dt} = NM\left(\widehat{v}(t)\frac{dn(t)}{dt} + n(t)\frac{d\widehat{v}(t)}{dt}\right)$$

where $d\widehat{v}(t)/dt = (\Delta v)(dp_A(t)/dt)$.

It follows, therefore, that:

$$MN\frac{dn(t)}{dt} = NM\beta\left(\widehat{v}(t)\frac{dn(t)}{dt} + n(t)\frac{d\widehat{v}(t)}{dt}\right)$$

or, after simplification, the law of motion:

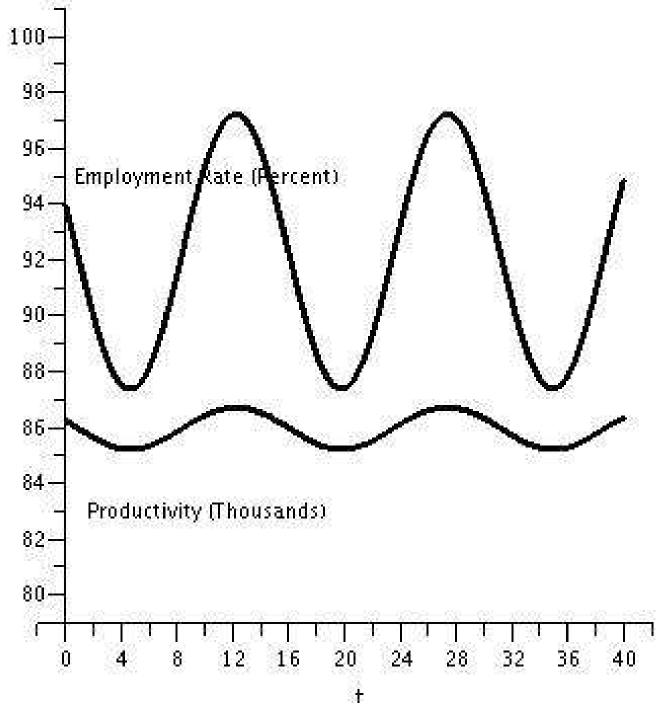
$$\frac{dn(t)}{dt} = \frac{\beta\Delta v\frac{dp_A(t)}{dt}}{1-\beta\widehat{v}(t)}n(t)$$

The system described by the laws of motion for $p_A(t)$, $p_E(t)$ and $n(t)$ has some noteworthy features but one of the most important comes as no surprise: "capitalist culture" induces an autonomous extraction cycle whose effects on output and income are now amplified through the multiplier. There is still a closed solution path associated with each set of initial conditions.

To illustrate some of the model's properties, consider a set of initial conditions close to the proportions associated with the mixed NE, $p_A(0) = 0.80, p_E(0) = 0.45, n(0) = 0.94$, and fix one of the last parameters, β, at 0.01.

Start with the relationship between the employment rate $n(t)$ and the implied behavior of labor productivity $\widehat{v}(t) = p_A(t)v_2 + (1 - p_A(t))v_1$.

EMPLOYMENT AND LABOR PRODUCTIVITY



Within this framework, labor productivity is mildly procyclical, consistent with the data for most advanced capitalist economies (DeLong and Waldmann 1997, for example).

> Aside: Standard (that is, neo-classical) explanations include job hoarding, returns to scale and technological shocks (Basu 1996), but there is reason to be skeptical about each.

The closest mainstream antecedent of this model is Chatterji and Sparks (1991), who focus on agency problems.

Conventional explanations of this anomalous pattern suffer from two flaws: the "causal arrow" points in just one direction and there is no persuasive explanation for cyclical patterns in output.

Goodwin's (1951,1967) research offers a welcome alternative - and an obvious inspiration for the model outlined here - but the current focus on the "stylized facts" of the business cycle is novel.

In this case, the cyclicality of productivity is more the cause than the effect of cyclicality of employment, as the conflict between capitalists and workers produces fluctuations in the proportion of workers who acquiesce.

What does the model predict will happen to the average wage of employed workers, $\widehat{w}(t)$, defined here as:

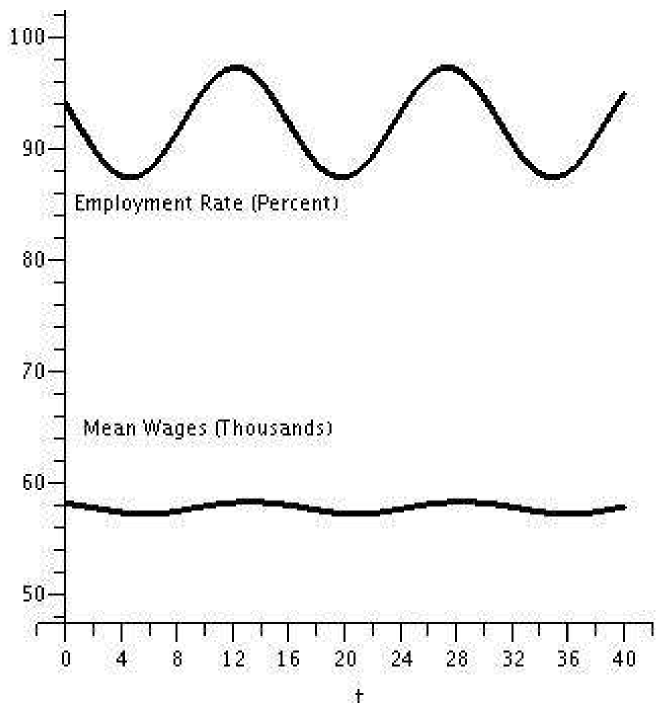
$$\begin{aligned}\widehat{w}(t) &= [p_A(t) + (1 - p_A(t))(1 - p_E(t))]w_2 \\ &\quad - p_E(t)(1 - p_A(t))w_1 \\ &= w_2 - p_E(t)(1 - p_A(t))\Delta w\end{aligned}$$

which implies that:

$$\frac{d\widehat{w}(t)}{dt} = \left[p_E(t)\frac{dp_A(t)}{dt} - (1 - p_A(t))\frac{dp_E(t)}{dt}\right]\Delta w$$

It isn't obvious from this expression whether $d\widehat{w}(t)/dt$ will have the same sign as $dp_A(t)/dt$, and therefore move in the same direction as labor productivity, which follows $d\widehat{v}(t)/dt = (dp_A(t)/dt)\Delta v$, which in turn tracks employment.

EMPLOYMENT AND AVERAGE WAGES

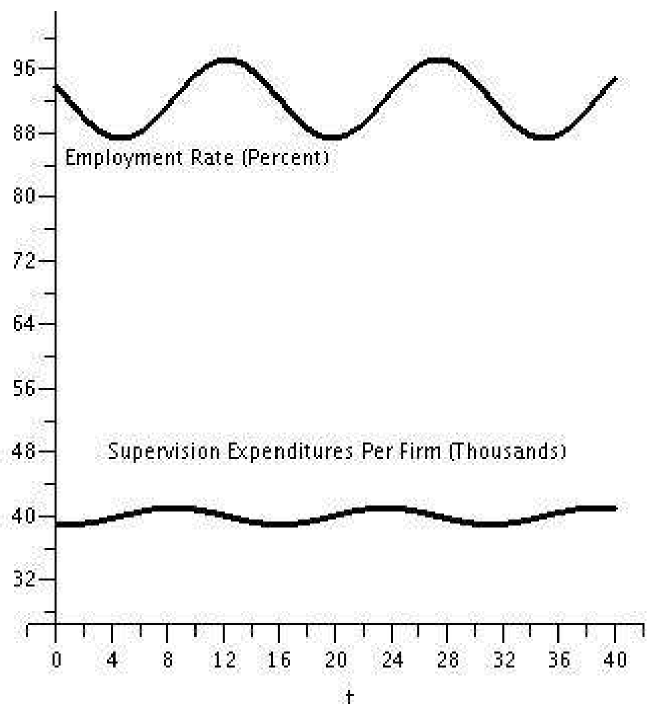


Under the maintained parametrization, it appears that average wages are *mildly procyclical*, and follow productivity and employment. That is, average wages rise during expansions, but do not start to increase until the expansion is underway and continue to rise until the peak has passed.

This is consistent with another stylized fact about business cycles (Solon et al, 1994), especially their Anglo-American incarnations (Liu, 2003).

What is the predicted relationship between the employment rate $n(t)$ and average capitalist expenditures on extraction, $\widehat{S}(t)$, measured as $p_E(t)S_2(t) + (1 - p_E(t))S_1(t)$?

EMPLOYMENT AND SUPERVISION COSTS



Since $n(t)$ mirrors $p_A(t)$ and $\widehat{S}(t)$ reflects the influence of $p_E(t)$,the relationship is the same, modulo scale, as that between $p_A(t)$ and $p_E(t)$ described earlier.

With this in mind, it seems that, to borrow Gordon's (1990) term, the intensity of supervision reaches its peak when output and employment are low - to be preicse, soon after the trough - and falls as output expands, but continues to fall for a short time after output crests, and so on.

Is this consistent with the data? It's not clear. There is a mainstream literature on "non-production workers," but not all of these oversee the extraction process. Bowles and Jayadev's (2004) "guard labor" is almost ideal, but their focus is not on its cyclical properties.

Gordon (1990) finds that his constructed measure of supervisory intensity rises and fall with the cost of job loss, which implies countercyclicality. This is "cleaner" than the model's prediction but not inconsistent with it.

Conclusion