Lecture VIII Economics 202A Fall 2007

1. Return logs

2. Date of Mid-term: Tuesday, October 23.

Last time we looked at efficiency wage models, and especially at Shapiro and Stiglitz, which is the most popular version of such models.

Let me briefly make one criticism.

My major criticism of those models is that I am fairly sure that in most jobs supervisors do have some fairly good notion regarding what workers do and do not do.
For example, absenteeism is directly observable.

I would think that a better model of unemployment would come from workers' concepts of the fair wage, which for some people will exceed market clearing.

Following the presidential address to the AEA, workers will think that their employers *should* pay them a fair wage.

Today I am going to discuss a problem with efficiency wage models.

A major problem with the standard efficiency wage models, such as Shapiro and Stiglitz, is that they are *real models* of unemployment. One can therefore ask the question whether they have anything to say about *cyclical fluctuations.*

Equivalently, we could ask whether these models have anything to say about the effectiveness of monetary policy.

What do I mean by saying that they are *real* models of unemployment? I mean that all the variables in these models are *real* variables.

There are no *nominal* variables.
Presumably if one added *money* to such models, it would be neutral.
In that case, for example, a 5% increase in the money supply would just change nominal wages and prices by 5 %, and all real variables would be unchanged.

Do these models then explain why a shift in *aggregate* demand, as exemplified by a shift in the *money* supply, will change any equilibrium real variables?

This, of course, is the essence of the problem posed by Robert Lucas at the very beginning of this course.

Insofar as changes in the money supply are expected, why should they cause any change in equilibrium output?
Prices* and *wages* should be proportional to the money supply with *no changes in real variables.

With efficiency wage models, and with most other models, it turns out that there is a simple and easy answer to the question why changes in money might have significant effects on equilibrium output and employment.

Because,* in a large number of models, *wage* and *price* inertia will have *little* effect on firms' profits, but *wage* and *price* inertia will have *significant* effect on *output* and *employment.

To see the innovation in the *new* models relative to the old, let us review what happens in the *old model of the standard Keynesian textbooks.*

In the simplest such model there is an IS curve and an LM curve, which together determine aggregate demand.
Aggregate supply is determined by the condition that firms hire workers up to the point where the Marginal Product of Labor is equal to the real wage.
***And* in the short-run the money wage is assumed fixed.**

Suppose *initially* the economy is at *full employment*.
Then, let there be a sudden decrease in the money supply by a fraction ϵ.

In the new equilibrium there will be *unemployed* workers.
In this new equilibrium *each* firm in this model could increase its profits by substituting *unemployed* workers for their *current employees.*
They could hire these unemployed workers at their reservation wages.

In this *old model,* if the money supply decreases by a tiny amount ϵ, there is a *potential* for profits to rise by a *large* amount for *any employer* nasty enough to follow his pecuniary interests, rather than the dictates of the model.

***Robert Lucas* would say that there were $500 bills lying on the sidewalk in such a situation. *That is,* this could *not* be a sensible equilibrium — since there are large profits to be made by its violation.**

Now let's *contrast* the *old* model of *involuntary unemployment* with *sticky* money wages with models of *involuntary* unemployment due to *efficiency wages.*

In the Keynesian model, if firms *could hire* workers at lower wages, their profits would increase by the difference in wage costs. Indeed, the profits would be

increased *at least* by the reduction in *labor costs.*

In contrast, in an efficiency wage model, firms choose the wage as part of an optimizing decision.
If we plot profits against the wage we get a nice smooth curve.

π

w* **w**

Now at this *optimum* the slope of profits with respect to the wage is 0.
And, as a result, errors *in setting wages* will have a relatively *small effect on profits.*

As a result, sticky money wage behavior in such models will be *close* to rational because the loss in profits from such *non-optimizing* behavior will be low.
As it turns out, such *non-optimizing* behavior will also be associated with a significant elasticity of employment with respect to the money supply.

With these preliminaries, let me give you a *preview* of the papers on near-rationality theory we are going to discuss today.

First,* we construct a model which, with *full maximizing* behavior, is *money neutral.

A change in the *money supply* in this model will cause no change in *real variables* if all agents fully maximize. For example, there will be no change in *real balances.*

In the long run it is *assumed* that all agents do *maximize.*
So the long run equilibrium is *money neutral.*

Now consider the short run.
In the short run, it is assumed that the money supply has changed by a fraction ϵ.
It has changed from M_0 to $M_0 (1 + \epsilon)$,

In the short-run we can try on for size the *possibility* that a fraction β of all agents keep some *nominal variable* fixed.
Such a *nominal variable* could be *prices* or *wages.*
The rest of the agents, who are in proportion $1 - \beta$, are maximizers.
We then look at the short-run equilibrium for each ϵ.

Any *non-maximizer* could, instead, be a *maximizer.*

As a *non-maximizer* her profits are π^n. (*n* for *non*-maximizer)

As a *maximizer* her profits *would be* π^m. (*m* for *maximizer*)

The short-run equilibrium is considered near-rational if

$$\pi^n / \pi^m \cong 1.$$

That is, if the profits of the *non-maximizers* are approximately equal to the profits of the *maximizers.*

What do we mean by *approximately equal?*

Let me explain:

For $\epsilon = 0$

$$\pi^n = \pi^m.$$

There is no difference between the profits of a *maximizer* and of a *non-maximizer,* since *both* have a long-run price and a long-run wage.

We can solve for the equilibrium of the system for each value of ϵ, and therefore we can *solve* for π^n and π^m for each ϵ.

We can say $\pi^n / \pi^m \cong 1$,

if

Since π^n / π^m will have the shape in this graph [DEMONSTRATE] this will occur.

This leaves one question to be *resolved*:
The agents may be near-rational in their *money illusion,* but the changes in the money supply may also have *small* effects on the economy.

In the example I shall later discuss, the elasticity of employment with respect to the money supply is *positive* for $\epsilon = 0$.

In this sense, we see that what happens to the economy *due to nonmaximizers* is an order of magnitude greater than the *private* losses in profits due to *non-maximizing decisions.*

So we have a theory why *money supply* shocks affect *real variables.*

We must have some form of *money illusion* to obtain that result.

In Lucas' and Sargent's model, people are *fooled.* But that does not seem to be a sensible solution.

Near-rationality offers an alternative explanation why a change in M will cause a change in *real activity.* This explanation takes the following form:

Real decisions might change because people have money illusion.
But people are *not* fooled.
The *losses* to any individual from *her* failure to maximize may be *small.*
But also* the effect on society as a whole, or at least *to others*, may be *significant.

You will see that such is precisely the case if some firms have sticky wages and prices in an efficiency wage model with downward sloping demand curves for firms' own products. I will be precise about it later.

First, let me give you a BARE BONES example. I am going to give you a microeconomic example first, as motivation, because I think people understand micro better than macro.

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The BARE BONES example is to show the *following principle.*

Failure to maximize by a group of people can have a *significant* effect on an *equilibrium* and on the *distribution of welfare*, even though any individual who would have engaged in *maximizing,* rather than *nonmaximizing* behavior would have gained only a *small amount.*

Here is that example.
Let this *class* be a *perfect exchange* economy.
Let there be *two* consumption goods.

A *green* consumption good, C_G, and a *red* consumption good, $C_{R.}$

Each of you has a utility function:

$$u_i\,(C_G, C_R),$$

where *i* indicates that each of you has his or her own private utility function.

Also each person has initial endowments,

$$(C^0_{Gi}, C^0_{Ri}\,)$$

given to each individual i.

Now we have an *initial* long-run equilibrium in which *all people* trade at the market-clearing price called out by an auctioneer.

Suppose that in this equilibrium everyone was maximizing.

Now suppose that there is an *increase* in the endowment of the *green* good C_G for each person, by a fraction ϵ.

Suppose ½ of the class *does not maximize*. *Instead*, it obstinately decides to consume the same amount C_G *as before.*

This failure to maximize by ½ of the class can be expected to have an effect on the price proportional to ϵ.

Why?

The standard model behaves as if everyone markets all *their initial endowment* of both commodities and *then buys back* the quantity they want at the equilibrium price.

A *decrease* in demand will *decrease* the price by something proportional to ϵ (in the normal case), which should induce additional demand for the good proportional to ϵ.

But in this case ½ the economy has suppressed their additional demand.

This has the same effect as a decrease in demand (relative to what would occur if all people were maximizing).
This decrease in demand is proportional to ½ ϵ.
The net effect of the suppression of demand is an effect on price proportional to ϵ.

[Note to self: the result is that this suppression of demand *decreases* the price of the green good relative to what it would be otherwise.]

But,* what is the *loss* to the individual agent from her *own* failure to *maximize at the given price?

That is *second order.*
It varies approximately with the *square of ϵ*.

Why?

Let me draw a picture.

Let us consider a person with a *given budget line.*

C_R

(C_G^*, C_R^*)

U^*

U^n

C_G

NOT TOO LARGE: HIGH ON BLACKBOARD

Draw in utility indifference curve U^*.

If she then chooses the optimal (C_G, C_R) combination, (C_G^*, C_R^*) she will have utility U*.

label (C_G^*, C_R^*)

Suppose this person does not optimize but still chooses a point on the budget line.

Suppose she consumed a bit too much C_G, as pictured.

MARK with X on budget line.

Her utility is then U^n.

Now in our *example* the difference between what people should choose and what they do choose,

$$C_G^m - C_G^n \cong k_0 \epsilon.$$

Now let's show that the difference between the utility of the *maximizer* and the utility of the *nonmaximizer* is:

$$\cong k_1 \epsilon^2.$$

Well, we could plot the utility of someone who chooses

(C_G, C_R) on the *budget line* as a function of her choice C_G.

U

U*

C_G^* **$C_{G.}$**

At C_G^* this utility is at a maximum, where it has a slope of 0.

We get a graph of utility as a function of C_G.

The difference in *utility* from not choosing at the maximum varies roughly with ϵ^2, as can be seen by the graph.

Also, by Taylor series expansion:

$$U(C_G) \cong U(C_G^*) + (C_G - C_G^*)\, U'(C_G^*) + \tfrac{1}{2}(C_G - C_G^*)^2\, U''(C_G^*) + \text{Remainder.}$$

Remember that

$$(C_G - C_G^*) \cong k_0\, \epsilon$$

$$\cong U(C_G^*) + \tfrac{1}{2} k_0^2\, \epsilon^2\, U''(C_G^*) + R$$

In this formal sense the loss in *utility* to the *non-maximizing* agent due to her decision *not to maximize* is second order.

But are there first-order changes in welfare?

The answer is *yes.*

At the *given prices* each *non-maximizer* could only increase her utility by an amount that varies with the *square of* ϵ.

But, because of the *collective non-maximizing behavior of ½ the class, prices change by something proportional to* ϵ.

Those of you who are *net purchasers* of the *green good* will have a first-order gain in utility because of this change in price.

And those of you who are *net sellers* of the *green commodity* will have a first-order loss in utility because of this change in the price.

Let me now state the General Principle.

Suppose that *objective functions* are second differentiable.
To remind you, the objective function is profits or utility or whatever else people are maximizing.

Then, if *objective functions* are second differentiable, failure of a Group of agents to maximize with respect to some variable will result in individual losses proportional to the *square of the departure* from maximization.

But such a failure, *in a systematic way* by a large number of agents usually results in a change in the equilibrium which is *proportional to the departure from maximization*.

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Now let's apply this to macroeconomics.

Consider an *efficiency wage* model in which firms are *monopolistic competitors* and therefore have an optimum price.

Initially the system is in long-run equilibrium.

With the money supply	**M_0**
firms are choosing the price	**p_0**
and paying the optimum wage	**w_0.**

The money supply changes to	**$M_0 (1 + \epsilon)$**
A fraction β of the firms keeps	**$\{p_0, w_0\}$**
The remaining fraction, $1 - \beta$,	
chooses the optimum price and wage	**$\{p^*, w^*\}$.**

Since the optimum price $\{p^*, w^*\}$ has changed proportional to ϵ, the distance between
$\{p_0, w_0\}$ and $\{p^*, w^*\}$ is proportional to ϵ.

Therefore the deviation in profits for the non-maximizers is proportional to the *square* of ϵ.

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Let me give the precise example.

I am going to sketch the model.

Firms are monopolistically competitive.

[NOTE to students: the bars may or may not print for you above some p's. If they do not print fill them in appropriately and you will not be confused].

The demand for each firm's product is:

$$X^D = (p/\bar{p})^{-\eta} (M/\bar{p}),$$

where p is the firm's own price;
$\bar{p}$ is the average price in the economy;
M is the money supply.

Let the firm's production function be:

$$X = (eN)^{\alpha}$$

where

X = output
e = effort
N = laborers hired.

Let effort depend on the real wage as follows:

$$e(\omega) = - a + b\, \omega^{\gamma}.$$

That is the model. Let me now sketch its solution.

Initially we are in the long run.

The firm chooses {p, w, N} to maximize profits, which are

$$\Pi = pX - wN$$

$$= p\, (p/\bar{p})^{-\eta} (M/\bar{p}) - (w/\bar{p})\, N\, \bar{p}.$$

We can invert the production function:

$N = X^{1/\alpha}\,[e\,(\omega)]^{-1}$

From this we get a profit function

$$\Pi = p\,(p/\bar{p})^{-\eta}\,(M/\bar{p}) - (p/\bar{p})^{-\eta/\alpha}\,(M/\bar{p})^{1/\alpha}\,\omega\,[e\,(\omega)]^{-1}\,\bar{p}.$$

I substituted for N [POINT] and noted that $X = (p/\bar{p})^{-\eta}\,(M/\bar{p})$. [POINT]

The model is easy to solve for the long-run solution in which all agents are maximizing.

(1) This is a simple efficiency wage model, so the firm chooses $\omega = \omega^*$, according to the Solow condition.

Then **the firm chooses p to maximize the profit function, given $\omega = \omega^*$. This yields:**

(2) $p = p(M_0, \bar{p})$.

It chooses its price given its demand, which depends on the real money supply, and also given the price that is being charged by its competitors, which is $\bar{p}$.

And in equilibrium,

(3) $p = \bar{p}$

since all firms are alike.

There are three equations for the three unknowns, p, ω and $\bar{p}$, given M_0.

ω is chosen as ω^* by the Solow condition.

And then (2) and (3) determine p and $\bar{p}$.

This is the long-run solution.

Now let's contemplate the short-run solution in which behavior is *not necessarily maximizing.*

The money supply increases from

M_0 to $M_0\,(1 + \epsilon)$.

And a fraction of firms, β, keep the same price p_0 and the same wage w_0 as

before.

Then these firms hire labor to meet the demands for their product. These are non-maximizing firms.

A fraction of firms, 1 - β, charges the maximizing price

$$p^m$$

and has the maximizing wage

$$w^m.$$

And the average price level is the geometrically weighted average of the prices of the two types of firms:

$$\bar{p} = (p^m)^{1-\beta}\,(p^n)^\beta.$$

It's now like a standard 201A homework problem to determine the new equilibrium price level $\bar{p}$, the price of the maximizers p^m, and the price of the nonmaximizers p_0.

The equilibrium is determined for each ϵ.

Now here is the result.

1. The non-maximizing behavior is *near-rational* in the sense that the non-maximizers are not losing very much by their behavior.

2. But this failure, which results only individually in small losses causes a first-order effect on employment.

We thus have a near-rational explanation as to how changes in the money supply could result in changes in employment.

The story is:

M goes up.
Some firms keep *sticky prices* and *wages.*
Other firms *maximize.*

The net result is an increase in real demand and in employment.

Do the firms that fail to maximize lose by this behavior?

Yes. They lose a little bit, but this is the short run.

In the short run it is quite unreasonable to assume that there are no small opportunities for gain by anyone.

Indeed a period in which there are at least some small gains for some people is what Marshall probably would have considered the *short run*.

But of course this part of the 202A-B sequence is about the *short run*.

So that should be OK.

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One question is whether this theory really gets it right.

I think that it is the standard thing.

This is the basic model of David's Chapter 6, although he presents it quite differently.

I think that the Romer text pretty well defines the state of *Macroeconomics,* not just because he has the office next door to mine, but because it is the standard macro text for other graduate programs as well.

But I think that you can ask the question whether this model *really* explains the effects of monetary policy on the one hand, or explains unemployment on the other hand.

I thought that I would take a few minutes to give some thoughts on what is wrong and what is right with this model.

I am going to describe four places where the model makes me uneasy.

First I should say that I am somewhat uneasy that aggregate demand here just depends upon real balances, or M/ $\bar{p}$.

That is supposed to proxy for how changes in the money supply affect aggregate demand in a more general framework.

In that more general framework the demand for money should depend upon the rate of interest and we would need both an IS *and* an LM curve to determine the level of output and employment.

I am not sure that $M/\bar{p}$ is a good proxy for the level of aggregate demand.

In that case that is a mistake of the model.

At least three other factors are left out of the model.

Keynes spent a great deal of time discussing them in *The General Theory,* but when economists came to make mathematical models of that book, they have left out because they have so far been too difficult to model.

I am going to take what I say from a book called *Animal Spirits* that Bob Shiller and I are writing.

The first factor that is left out is what Bob calls *confidence.*

There are measures of both consumer confidence and investor confidence and they play as great a role in fluctuations in demand as any of the endogenous components of the model.

In addition, linked to the penumbra of economic factors that should be associated with confidence should be issues of *accounting* and *bankruptcy.*

As we move into bad times we move into *bankrupticies* and increased evidence of malfeasance.

Cases like Enron always appear in the downturn of the business cycle, not on the upturn.

Bankruptcies are not terribly important in a minor downturn in a developed economy.

They are *very important* in *major* downturns.

They also are very important in poorer countries, especially those with high inflation.

That takes us to the *next* problem with the model.

This problem was also emphasized by Keynes.

Equilibria may be unstable.

In this model we are assuming that we are always in equilibrium.

But if equilibria tend to be unstable, then in a bad recession we may be moving away from something like *full employment* rather than toward it.

That, of course, is where bankruptcies may be particularly important.

A movement into a downturn may be accompanied by a chain of *ever more disruptive* bankruptcies.

That is also outside of the model.

Finally, considerations of *fairness* are absent from the model.

Fairness makes some presence in the model in the form of prices and wages that are not quite maximizing.

Fairness may also be the cause for its wage and price stickiness.

They are also responsible for the efficiency wages in the model.

But, if so, then exactly how *fairness* enters should be a major concern for macroeconomists.

And it should also be described much more fully and explicitly.

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However, even if all of these elements *do* enter and *should* enter a full macro model, the standard textbook framework we have may still work for the most crucial question regarding a macroeconomy.

Just because we have left many major factors out, the models we have may get the comparative statics of governmental policy right.

That crucial question is: if we get into a recession what should we do.

When Western governments got into the Great Depression in the 1930's, they did not understand what to do to get out of it.

It is quite probable that this failure by economists was a leading cause of World

War II, which caused perhaps 100,000,000 deaths.

The textbook models are probably right in their comparative statics about how a Western economy with good credit can get out of such a depression.

You can pursue monetary policy until short-term interest rates go to zero.

Then you can engage in a combination of increased government spending and decreased taxes.

In terms of the first class, the models may be fairly useful at telling us what $dY/d\overline{M}$ and $dY/d\overline{G}$ may be.

They may be far less good in telling us what the *position* of the economy may be and also why the economy moves from *good times* to *bad times*.

Especially we will want to know whether it is possible to get into some trap that neither monetary not fiscal policy can get us out of.

You might have thought that everything in macroeconomics was done.

But curiously it seems that even fundamental problems are neither well modeled nor well understood.

We may see that next time when we discuss what is happening in the current economy.