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recitation_IS19_20160330_Seg01.pdf

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Setting: S19 leads a recitation section.

Participants: IS19 (boy, blue hooded sweatshirt), S1 (boy, black sweatshirt, backpack), S2 (boy, leather jacket), RA1 (gold hoop earrings)

(0:00)
XXX IS19: um
XXX ((pause))

(0:10)
XXX S1: ((approaches IS19))
XXX IS19: so this is
XXX S1: I have an exam in like an hour
XXX IS19: ok sure
XXX S1: so I’m just gonna take these and
XXX IS19: ok
XXX thank you
XXX S1: no problem
XXX IS19: good luck
XXX S1: thank you
XXX S1: ((leaves))
XXX S2: ((approaches IS19))
XXX just one question
XXX IS19: ((looks at the paper))
XXX S2: it’s constant,
XXX IS19: yes it’s constant
XXX S2: oh
XXX how is it decreasing?
XXX IS19: because it’s a (coat) in
XXX (coat dollar s) form
XXX it must be constant
XXX S2: oh
XXX cause together equals
XXX k to the y,
XXX IS19: yeah
XXX S2: uh kl to the y,
XXX IS19: yeah
XXX because you put a z in over
XXX uh before k and
XXX (z 3) and you ((indistinguishable)) to put (z)
XXX to k and l
XXX S2: mhm
XXX IS19: and uh some of the power is y
XXX and the z
XXX so there is a z (I found out) this whole thing
XXX S2: mm ok
XXX IS19: ((nodding))
XXX S2: gotcha
XXX thank you
XXX ((leaves))
XXX RA1: ((whispers to IS19)) I have a quick announcement
XXX IS19: ok sure
XXX RA1: um as you guys know
XXX from the last class
XXX when we were here
XXX we’re doing a research project,
XXX and if you didn’t sign one of our consent forms
XXX then you can sign one now.
XXX ((nodding))
XXX did everybody sign it?
XXX ok
XXX if you didn’t just let me know
XXX IS19: ok so let’s start
XXX talking about this homework now and,
XXX I’ll concentrate on problem
XXX uh 3 and 4
XXX and if we have time
XXX then I’ll discuss about the first 2 questions
XXX so first m- let me to do a quick review
XXX about how we-
XXX the procedure for how we solve this kind of
XXX uh steady state or golden rule problem
XXX so.
XXX s-
XXX so typically you will
XXX be given a aggregate production function
XXX which in (.) this form
XXX ah *sorry
XXX ((erases))
XXX so it’s
XXX f to the aggregate capital
XXX and the efficient labor
XXX and
XXX always you need to first find out what is the
XXX prefect to worker production function
XXX uh sorry
XXX it’s- ((fixes on board))
XXX and here the small y equals to the capital Y
XXX the aggregate output
XXX divided by ((writes)) the efficient labor
XXX and the small k equals to
XXX the aggregate K divided by
XXX this uh total efficient labor
XXX and (.1)
XXX then you need to find out
XXX what is the (.1) all the le-
XXX uh all the number value of a ()
XXX in the steady state
XXX and to do this,
XXX first
XXX we need to find out ((writing))
XXX what is the value of k star
XXX and we use the condition of
**delta k↑ equals to zero**

and ((writing))

as we know

the- the k equals to ((writing))

the investment

(3:00)

(minus (.1)

the break even value

which is n + g + delta times k the capital (.3)

so

and the investment is always equal to saving

and the saving equals to the saving rate

times the output

or the production function. (.3)

minus

the same thing. (.3)

and uh

this is delta k

delta k.

and since we have the condition that

delta k the changing capital is zero,

so

((pause for writing))

we will use this equation

the saving equals to the break even level

((pause for writing))

we use this equation to find what is the

capital in steady state

so this is k star here

and k star here

so this is

always the- uh the first step

to solve this problem

so to find out

what is the capital in steady state

using this equation

and i- in the second step

with the value of the (..) k star

we can find y star

the uh output for efficient worker

in steady state

using the production function

uh you have derived in- in the first part

so this part

from this equation you can get y star (.1)

and then you can get I star because

I star equals to n plus g plus (..) delta,

times k star

and this is from the up-

again this condition

with k equals to zero
because this is uh the
and because of this equation I
should always be equal to this break even value
and from this equation
we can (.)
have what is the value of (.) I star
investment in steady state
and finally we can find
consumption through the simple equation that
uh it equal to y star minus I star
we know the value of y star from step 2
and the value of I star from step 3
so from this equation we
can get the cap consumption steady state
so ((gesturing at board)) that is the-
the procedure we need to follow
to get- to solve the problem
and it is not the only way that you can do it
you can use some (.). other equation
for example for the investment

(6:00)

you can use
uh
I star equals to s times f k star
the investment equals to saving rate
but you can get the same result.
so I just ((gesturing at board))
show you (.). the procedure that I always do
to solve this problem
and this is for a steady state
and for the golden rule level
((pause for writing))
again in the same uh- in the first step
we need to find out what is the value of
capital
we notate by k star g r
and the condition we use here is
m p k the marginal product in capital
equals to (.). m plus (.). g plus (.). delta
this uh is the
population growth rate
the g is the technology growth rate
and delta is the depreciation rate.
so you should be very clear about the difference
between this condition and ((pointing))
and that one for the steady state
here you need to times the k star
but ((pointing)) in this equation
there is no k star
the right hand side only (.). include this
three parameters (.2)
so
from this equation we have got the value of k star because these three parameters are known and the mpk only depends on- uh o-on k from this ((pointing)) from this production function so from this equation we can gather value of k star in golden rule. and ((writing)) the second step is the same and using the production function, we can find the golden rule um level of uh output for efficient worker so it equals to f k star p uh golden rule so from this equation we know the value of output and the (. ) third step and the fourth (. ) step are also the same so I star and plus g plus (. ) the depreciation rate (. ) times k (. ) star in golden rule so we can get ((writing)) I star and (. ) again the consumption equals to output ((writing)) minus investment (9:01) and we have one more step here because we also need to find out what is the golden rule saving rate so (.2) at uh you can use two,- two approaches so the first condition is the consumption always equals to uh (. ) l minus the saving rate times the income over the output you know the (. ) consumption from ((pointing)) step four you know output from (. ) ((pointing)) step two and solving this equation you can get uh this golden rule saving rate or you can use
the condition that
the investment (.) equals to savings
which is the saving rate (.) times ((writing))
the output
you-you know I star
in step 3
and y star in step 2
so you can use either
these two conditions
and you can find
what is the golden rule saving rate.
so that’s the procedure (.) we generally follow
to solve this kind of problem
so now let’s look at (.) question 3
((writing))
so
for part a,
what is the prefect to worker production function
that is the- uh
small y equals to f equals to small k
so
we always derive this
uh
pref- (proficient) worker production function
from the aggregate one
so.
from the setting of this question
y equals to- the capital
y equals to k to point five
((writing)) LE
((writing)) the efficient labor
to point five
((writing)) so by definition,
the small y equals to
the capital one- the capital Y divided by L times E
and from this aggregate production function
it equals to
k to point five
LE (.) to point five
divided by LE.
and you d- do some
eh (.) you know
(signification)
so it becomes
K over LE
to the power of point five
and this K over LE
is just the small k
by definition
is the capital per effective worker.
so it equals to ((writing))
small k to point five
so the pr-production function here
is k to point five.

so that’s the result for part a (.3)
ok?

and, (.)
for part b we need to find
the steady state levels of all these four
variables
so we can do it
simply by following the procedures
first (.) we use this condition ((pointing))
to find out what is the value of
capital in steady state
so here
we have a (.) saving rate
and (.) the (formula) this production function
we have just derive it
it is ((writing)) k to point five
I write k star here because
um the capital in the steady state
which is k star satisfy this condition
so
n plus (.) g plus (.) delta the depreciation rate
times
k t- k star
and there is only one unknown in this equation
the k star
so we can solve this (.) equation
so (.) we isolate this k star into the l-
the right hand side
so
it’s s over n plus g plus delta
equals to k star to point five
so k star equals to (.) s over
n plus g plus (.) delta
the square of this whole thing.
and we plug the numbers
the values
so these four (.) parameters
into this expression
so it’s point two,
over
three percent
three percent and (.) four percent
and square
so the result is
four
((pause for reading paper))
((looks back up)) so
this uh
this equation is the only one you need
to solve this (.) k star
((pause))
so if you-

and in this um equation
means that the savings or the investment
equals to this value
this break even variable ((alt trans: level))
because it’s in the steady state
and this will implies that
the delta k equals to zero.
because in steady state,
the capital in this period
and the next- next period
is the same
so the change of the capital
um is zero
so that’s where this equation come from.
and if you-
I mean if- if you
can’t understand
where this equation come from now,
you have to remember it for the-

just for sake of the coming exam
so
yeah that’s four
for the uh capital in steady state and (.2)
for the next step,
in step two we calculate
the output in steady state
so y star equals to
we plug this number into the production function
so (..) k star to the power of point five
so it’s four to point five
so it’s two.
and in the next step,
we calculate
the value of
I star.
((writing))
so it equals to n plus g plus (.). delta times k star
we know the value of this four variables
and we can easily gather result is (.2)
point four
and for the consumption,
it equals to output minus investment
so is two minus point four
and the result is 1.6
((reading paper))
((looks back up))
so ok
any question? ((looks around)) and let me do part d first because we can refer to the procedure to solving the golden rule levels and then I will (. uh talk about part c so part d first in part d we need to find out all the golden rule levels of- of all the four variables. so again, first uh actually five variables in this case. so again, first we need to (. find what is the um capital stock in the golden rule. so. we use this condition. the (margin note for doc) in- in capital equals to the sum the summation of these three numbers so mpk equals to n plus g plus delta and with this specific production (. function form the mpk equals to point five times k to minus point five you just take derivative ((pointing)) with respect to k. and n is three percent (.2) is three percent three percent for g, and four percent here and we can get so it’s the k star pr here because it’s the uh level in- in the golden rule so we can get th- the result is 25 ((writing)) and as long as we get um the steady state and the- the level for the capital
the other things are straightforward and in the second step, we can compute the output. ((erasing)) so it equals to ((writing)) capital to the power of point five so it’s five for the output and for the investment, (writing) n plus g plus delta k star, so it’s two point five and step four, is for consumption is output minus investment is also two point five and we have one more step to calculate uh the golden rule saving rate so let me use this second one so from this equation, it’s obvious that this golden rule saving rate equals to investment divided by output and in this example is two point five over five so the answer is point five. ((moves eraser)) and it is exactly the power of this production function which is not a coincident as I have shown this result to you in last recitation so yeah that’s for part d. so this calculation just regular if you remember all this ((pointing)) procedures and the key is ((pointing)) this two conditions and if you remember this ((pointing)) two equations I mean the following computation is natural. and straightforward. so now for part c, (.1)
so
let me (. ) erase this
((pause while erasing for a while))

(21:16)
so pa-
in part c,
assume there is initial capital level
which is k one equals to three,
and we need to calculate
that variable in next period
and show it in a graph.
so (. ) in steady state
the condition is
delta k equals to zero
but in this part there is no assumption that
um we are in a steady state.
so (. ) this- ((crossing out))
this equation doesn’t hold
in this case
so
now we need to find out
what is the value for this delta k
because
the capital in next period
noted by k two
equals to k one
the capital in this period
plus delta k.
is
is delta
so in steady state
this number is zero
so this two numbers
these two values coincide with each other
but generally,
without in a steady state,
this delta is not zero.
so
this two numbers are different
and this is the
capital in the next period
and in order to find this value
we need to find out what is delta k because
k one is given
in the question
and ((writing)) as we know
delta k equals to
investment in this period
and that (is noted) as i one
minus the break even level n plus g plus
the depreciation rate
times the capital in this state
k one (.1)
((pointing))
so that is what we know about-
about delta k
the change in the capital stock.
so
we know k one
we know n g and delta
the only unknown is the investment
and
remember that the investment
always equals to the savings
and the savings
equals to the saving rate
times the income
which is f k.
and in this case
is f k one
because
the capital, in this state
is k one.
and minus
n plus g plus delta (.2)
((erasing))
times k one
so here we know the value of
all this
variables
we know s is point two,
and we know k one we know the form
of this production function
we know this three numbers,
so we just plug (. ) them
into this equation
so it’s point two,
and it’s three,

k one equals to three,
to the power of (. ) point five,
minus three percent
three percent and
four percent
times (. ) three (.1)
so the answer is-
the result is ((writing))
approx. - approximately
five percent
and then we can find the
capital in the next period
is- is k one plus ((writing))
delta k
three plus
five percent
so it’s
about three point oh five
so
that is the capital in steady state
and to show it in a graph,
((pause for drawing))
we use the
uh
we use the one f- to show the steady state
and first we draw this break even line,
so it’s n plus g plus delta times k
and this ((drawing)) curve for savings which is s times the production function
and this (.)) ((pointing)) intersection is the steady state value
so it’s k star
and the value is four because we have got the result from part d it’s four
it’s the same because all the-
the value of all the parameters s and g and delta is the same
so the steady state is four.
as we calculated in part b
and here we know that the initial capital stock is k one equals to three
so. ((pause for drawing)) it’s here and
the investment equals to the savings from here the value
at this (.) capital stock is-
this is s times f k one
so it- it is this number point two times three to one half,
and (.)) this number is break even level is this point.
is the intersection of this vertical line and when the capital stock is three
and this (.)) break even line.
so this value
is ((writing)) n plus g plus delta times k one
and the difference,
between these two values,
delta k
that we calculate
so this is (drawing) delta k
and (pointing) the capital in next period
equals to
uh
the capital in current period plus delta k

so this is k one, (writing)
and (writing)
this is (writing) delta k,
so this point is (writing)
k two
which equals to three point zero five. (.2)
and
in steady state,
the difference of this two values is zero.
right?
they coin- c- coincide
with each other
so that’s why we use the condition
delta k equals to zero
for the steady state.
and now, for
for any given value
this may not be the case
so we should
uh calculate in this way
first find out
what is this uh investment or a savings
and then we find out what is the delta k
and then we plug-
we add this delta k into the
current capital stock
and we can find the capital stock
in the next period.

((pause))
ok
any questions (class,)
((looking at board and paper))
so
now
the last part
((erasing for about 10 seconds))
((writing))
°so ((pause))
part e,
now suppose
the saving rate
um
changes from
s equal to point two,
to the golden rule saving rate.
so before this change,
the saving rate is
zero point two,
which is the value that we use in part b
to calculate all of this variables
and
now it turns to (writing)
the golden rule saving rate
which is (writing)
zero point five,
as we have calculated in
part d. (looking at paper)
and we need to find out
the immediate effect on
income per effective worker
and consumption.
and
also the long- the long run effect
of these two variables
so first let me
look at the
long run effect
(writing)
as we know in the long run,
uh: the economy will always converges into the
steady state (30:00)
so (pointing)
in order-
in order to find out what is the long run effect
we only need to compare
this two numbers
uh in the steady state
with this old uh saving rate
we have a steady state value for
uh
for the- uh for the output
or the i- or the income, and
the consumption
so.
when s equals to point two,
((writing)) y star equals to
((glancing at the board))
it’s two
and consumption is one point six
((writing))
and when ((writing))
delta saving rate is-
((erasing))
is the
golden rule one
which is zero point five,
((writing))
uh the
g-
the output is
((glancing at board))
five?
°if I remember,
((looks back at where he’s writing))
its five
and the consumption is
two point five.
because in the long run,
((pointing))
uh the economy will always converge to the
steady state
so
it is efficient for us to compare
((pointing))
this- this two numbers
and these two numbers
to figure out the long run effect
so
so it is (.2) obvious that
when-
when the saving rate increase to the
uh golden rule level
the
output will increase
and the consumption will also increase
so that is the
long run effect
both the
output per effective worker and the
consumption (.2) per effective worker will
increase
((writing))
so it’s-
so remember that
for the long run effect
you should always compare the (.2)
values in the steady state
between this two different saving rate.
((writing))
((looking at paper))
and then let me
show us the effect
immediately
so the immediate effect
((pause for writing))
so
typically when
the saving rate is different

and ((pointing))

in the- in the (current) state

when the- ((pointing))

when there is a change in the saving rate

the sto- uh

I mean the s- the

capital stock

will be the same.

and your-

the household will-

will change its consumption and investment

and in the next period

uh

the different investment will work on this capital

so the capital will begin to change

so

((writing))

I mean to illustrate in this graph,

((drawing))

so this is the break even line

and this is the (.1)

savings with the old saving rate

which is

let me de-denote it by uh

as one

and now if there is an increase in this

saving rate

right?

so

this curve will (. ) level up,