University of Chicago
Booth School of Business

Business 33840
Macroeconomics

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Week 3 – 1/26 & 1/27 (Target) QUIZ#

CLASS NOTES II

N^s – Key Equations (II.6) **Q3**

– Key Results

– Picture | N^S curve

N^s Curve and Utility (II.6) (on your own, required) **Q3**

Labor Market Equilibrium (II.7) **Q3**

Endogenous and Exogenous Variables (II.7) **Q3**

Using the Labor Market Model (II.8) **Q3**

Labor Market Examples (II.8) **Q3**

Unemployment (II.9) (on your own, required) **Q3**

Feldstein Article (II.10) (on your own, optional) **NO**

II.6 Labor Supply

As you will soon see, the decision about how much to work, i.e. how much labor to supply, is linked to the decision about how much to consume. This shouldn't be surprising since how much a person can consume depends on how much they have to spend, which depends on (among other things) how much they work.

This connection between consumption and labor supply makes it imperative to set up an "intertemporal" model of labor supply because the consumption decision is intertemporal by its very nature. To see this, note that the decision about how much to consume is tied not only to the decision about how much to work but also the decision about how much to save, which is all about postponing consumption until the future.

We will consider the simplest intertemporal model, a two-period model, and use a superscript "e" to indicate a household's expectation of a future variable. Variables without a superscript are current variables.

We will assume that the utility function households maximize is positively affected by both current and expected future consumption, negatively affected by both current and expected future labor supply, and positively affected by both current and expected future government purchases.

New Notation:

N^s = labor supply

C = real consumption

t = marginal income tax rate

D = real deductions allowed before income tax rate applies, so that real income taxes paid to government are t(Y-D).

s = sales tax rate / value added tax rate

TR = real transfers from the government to the private sector

G = real government purchases

r^e = expected (ex ante) real interest rate

H = real household wealth

MUC = marginal utility of current consumption

MDUN = marginal disutility of current working

Note: The average income tax rate is t (Y-D) / Y = t – tD/Y

The average tax rate is different from, and so long as D > 0 always lower than, the marginal tax rate.

We will assume the marginal utility of current consumption falls with increased current consumption, and that the marginal disutility of working rises with increased current labor supply.

Similar assumptions hold for the marginal utility of future consumption and marginal disutility of working in the future.

(See Figures II-5 and II-6)

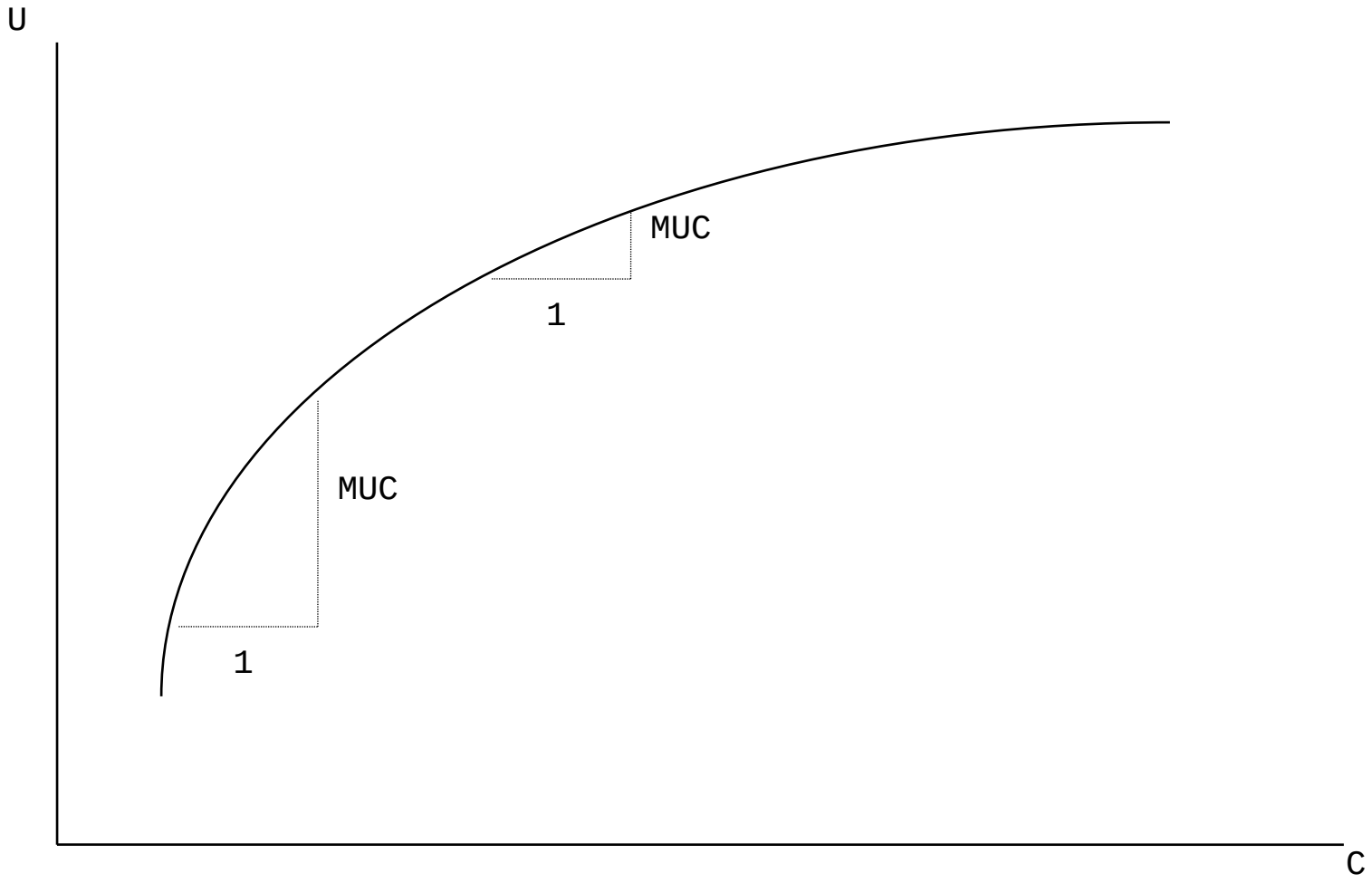


FIGURE II-5

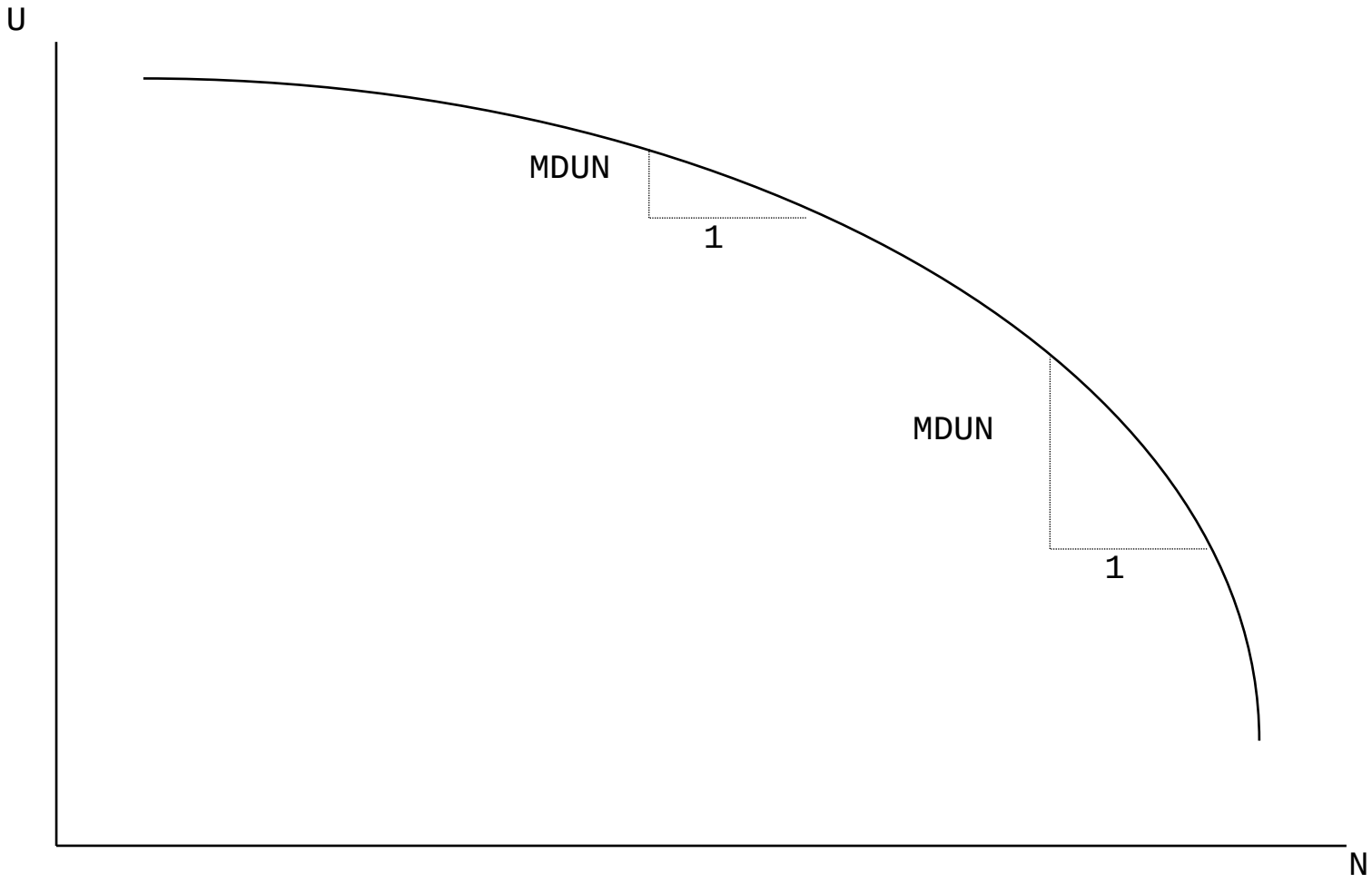


FIGURE II-6

We will assume that households' utility is separable across goods, which means that the marginal utility of consumption (both current and expected future) does not depend on labor supply or government purchases (either current or expected future). Similarly, the marginal disutility of working does not depend on consumption or government purchases.

We will assume that households have time-separable utility, which means that the marginal utility of current consumption depends only on current consumption, and not on future or past consumption. Likewise, the marginal disutility of current working depends only on current labor supply, and not on any other future or past variable.

Key Equations: **(1) $MUC\ (1-t)\ (W/P) / (1+s) = MDUN$**

(2) $MUC^e\ (1-t^e)\ (W^e/P^e) / (1+s^e) = MDUN^e$

These equations must hold if consumers maximize utility. They state that the marginal cost of supplying an additional unit of labor is set equal to the marginal benefit of supplying an additional unit of labor, both currently and in the expected future plan.

Both marginal cost and marginal benefit are measured in the same units, utility.

The marginal benefit of supplying an additional unit labor, measured in utility, can be computed as follows:

Marginal Benefit of Working	Measured in
W	pre-tax currency
$(1-t)\ W$	after-tax currency
$\frac{(1-t)\ W}{(1+s)\ P}$	after-tax goods (ATRW = after-tax real wage)
$\frac{(1-t)\ W}{(1+s)\ P}\ MUC$	utility

Thus,

If MUC (1-t) (W/P) / (1+s) > MDUN, the marginal benefit of working an extra hour now exceeds the marginal cost

utility maximization implies work more now and consume more now

more work now pushes MDUN up and more consumption now pushes MUC down

stop when MUC (1-t) (W/P) / (1+s) = MDUN

If MUC (1-t) (W/P) / (1+s) < MDUN, the marginal cost of working an extra hour now exceeds the marginal benefit

utility maximization implies work less now and consume less now

less work now pushes MDUN down and less consumption now pushes MUC up

stop when MUC (1-t) (W/P) / (1+s) = MDUN

Key Equations: **(1) $MUC\ (1-t)\ (W/P) / (1+s) = MDUN$**

(2) $MUC^e\ (1-t^e)\ (W^e/P^e) / (1+s^e) = MDUN^e$

Key Results: Twelve variables can affect current and expected future labor supply, i.e. twelve variables determine N^S and $N^{S,e}$.

They are W/P, W^e/P^e, t, t^e, s, s^e, D, D^e, TR, TR^e, r^e and H.

The last six variables can affect labor supply because they can affect how much people consume (both current and future), and therefore affect the marginal utility of consumption (both current and future).

How do these variables affect labor supply?

In order to answer this question it is necessary to use the following three results from consumption theory; these results will be derived in Class Notes III.

An increase in current real disposable income will cause a rational household to increase both C and C^e; i.e. consume some and save some of the increased current income.

An increase in expected future real disposable income will cause a rational household to increase both C and C^e; i.e. consume some of the increased expected future income now by reducing saving.

An increase in wealth will cause a rational household to increase both C and C^e; i.e. if a household wins the lottery it should consume a fraction of the increased wealth now and a fraction in the future.

It is also useful to keep the following in mind:

Changes to N^S are all

(i) Income Effect and/or

(ii) Substitution Effect

Income Effect: Buy more of what you like when you get richer (Ignore the possibility of inferior goods.)

Substitution Effect: Buy less of something when it gets more expensive

To use these effects in the labor market it is necessary to think about the demand for leisure, the opposite of work. In addition, it is essential to realize that

$\frac{(1-t)}{(1+s)}\frac{W}{P}$ = after-tax real wage = ATRW = price (in goods) of current leisure

$\frac{(1-t^e)}{(1+s^e)}\frac{W^e}{P^e}$ = expected future after-tax real wage = $ATRW^e$ = expected price (in goods) of future leisure

Finally, using the real wage as an example, we will use the following terminology to distinguish between three different types of changes:

A temporary increase in the real wage: W/P up and W^e/P^e fixed

An increase in the expected future real wage: W/P fixed and W^e/P^e up

A permanent increase in the real wage: W/P up = W^e/P^e up

The table below will be used to record and summarize our results for the effect of changes in real wages on labor supply.

Every result is derived assuming that all variables that affect N^S and $N^{S,e}$ are being held constant unless they are explicitly stated to be changing.

Key Equations: **(1) $MUC\ (1-t)\ (W/P) / (1+s) = MDUN$**

(2) $MUC^e\ (1-t^e)\ (W^e/P^e) / (1+s^e) = MDUN^e$

$\underline{N^S}$ $\underline{N^{S,e}}$

W/P up, W^e/P^e (and all else) unchanged

i.e a temporary increase in real wage

W/P (and all else) unchanged, but W^e/P^e up

i.e. an expected future increase in real wage

W/P up, W^e/P^e up (and all else unchanged)

i.e a permanent increase in real wage

A temporary increase in the real wage (higher W/P with W^e/P^e and all else fixed) leads to higher N^s and lower $N^{s,e}$.

Before the change occurs, both key equations hold.

(1) MUC (1-t) (W/P) / (1+s) = MDUN
(2) MUC^e $(1-t^e)$ (W^e/P^e) / $(1+s^e)$ = $MDUN^e$

After the change occurs, there are three changes to the key equations. Clearly W/P is up in the first equation. But there is more. At the current N^s and $N^{s,e}$ an increase in W/P means that current real disposable income rises, so that C and C^e rise. This means MUC and MUC^e fall.

(i) For $N^{s,e}$, the LHS of equation (2) is down due to a fall in MUC^e. To offset a lower MUC^e, utility maximization requires the RHS of equation (2) to fall, i.e $MDUN^e$ must fall. Thus, $N^{s,e}$ must fall.

There is an "Income Effect"; households are richer and can afford more future leisure. Expected future labor supply falls.

Intuitively, there is no need to work so hard in the future given the higher level of consumption afforded by the higher current wage. Expected future labor supply should be reduced because household are richer and can afford more future leisure.

(1) MUC (1-t) (W/P) / (1+s) = MDUN
(2) MUC^e $(1-t^e)$ (W^e/P^e) / $(1+s^e)$ = $MDUN^e$

(ii) For N^s, the LHS of equation (1) may either rise or fall, depending on whether MUC drops more or less in percentage terms than W/P rises. Thus, it is unclear whether N^s needs to rise or fall.

There is a conflict between an "Income Effect" and a "Substitution Effect".

The income effect is captured by C up and MUC down. To offset a lower MUC, utility maximization requires the RHS of equation (1) to fall. N^s must fall.

The substitution effect is captured by (1-t)(W/P)/(1+s) = ATRW up because **ATRW, the current after-tax real wage, is the price of current leisure**. To offset a higher ATRW, utility maximization requires the RHS of equation (1) to rise. N^s must rise.

Intuitively, the income effect says there is no need to work so hard currently given the higher level of consumption afforded by the higher current wage. Current labor supply should be reduced because households can afford more current leisure.

On the other hand, the substitution effect focuses on the fact that current leisure is more expensive. Thus, current leisure should be reduced and current labor supply increased. Current labor supply should be increased because a rational household buys less current leisure when that leisure becomes more expensive.

Either one of these offsetting effects could possibly be the larger effect for a rational, utility maximizing household.

So, theoretically, N^s could rise or fall, i.e. economic theory cannot predict whether a rational person should work more or less when their current pre-tax real wage increases.

Need to base our model on empirical evidence (i.e. the data). And as a result, when applying the model, these parts of the model are more likely to vary depending on the country being analyzed.

For most economies, taken as a whole, the empirical evidence suggests that the substitution effect seems to dominate the income effect for a temporary wage increase, with labor supply going up a *small* amount; N^s rises a small amount.

Key Equations: **(1) $MUC\ (1-t)\ (W/P) / (1+s) = MDUN$**

(2) $MUC^e\ (1-t^e)\ (W^e/P^e) / (1+s^e) = MDUN^e$

	N^S	$N^{S,e}$
W/P up, W^e/P^e (and all else) unchanged	**up (small)**,+**	**down***
i.e. a temporary increase in real wage		
W/P (and all else) unchanged, but W^e/P^e up		
i.e. an expected future increase in real wage		
W/P up, W^e/P^e up (and all else unchanged)		
i.e. a permanent increase in real wage		

* Income effect
** Income effect < Substitution effect
\+ based on data

Key Equations: **(1) $MUC\ (1-t)\ (W/P) / (1+s) = MDUN$**

(2) $MUC^e\ (1-t^e)\ (W^e/P^e) / (1+s^e) = MDUN^e$

	N^S	$N^{S,e}$
W/P up, W^e/P^e (and all else) unchanged	**up (small)**,+**	**down***
i.e. a temporary increase in real wage		
W/P (and all else) unchanged, W^e/P^e up	**down***	**up (small)**,+**
i.e. expected future increase in real wage		
W/P up, W^e/P^e up (and all else unchanged)		
i.e. a permanent increase in real wage		

* Income effect
** Income effect < Substitution effect
*** Income effect > Substitution effect
\+ based on data

Key Equations: **(1) $MUC\ (1-t)\ (W/P) / (1+s) = MDUN$**

(2) $MUC^e\ (1-t^e)\ (W^e/P^e) / (1+s^e) = MDUN^e$

	N^S	$N^{S,e}$
W/P up, W^e/P^e (and all else) unchanged	**up (small)**,+**	**down***
i.e. a temporary increase in real wage		
W/P (and all else) unchanged, W^e/P^e up	**down***	**up (small)**,+**
i.e. expected future increase in real wage		
W/P up, W^e/P^e up (and all else unchanged)	**down (small)***,+**	**down (small)***,+**
i.e. a permanent increase in real wage		

* Income effect
** Income effect < Substitution effect
*** Income effect > Substitution effect
\+ based on data

Details on how most of the remaining ten variables affect labor supply are easy to derive once the effects of changes in real wages are understood.

Changes in t and s affect N^S and $N^{S,e}$ exactly like changes in W/P, but in reverse

the only way W/P, t and s affect N^S and $N^{S,e}$ is through their effect on the current after-tax real wage

Changes in t^e and s^e affect N^S and $N^{S,e}$ exactly like changes in W^e/P^e, but in reverse

the only way W^e/P^e, t^e and s^e affect N^S and $N^{S,e}$ is through their effect on the expected future after-tax real wage

Hence, the following results are worth noting:

VALUE ADDED TAX RATES (CURRENT AND EXPECTED FUTURE) AFFECT LABOR SUPPLY EVEN THOUGH THEY ARE APPLIED IN THE GOODS MARKET

A PERMANENT CHANGE IN THE INCOME TAX RATE OR VALUE ADDED TAX RATE HAS A DIFFERENT EFFECT ON LABOR SUPPLY THAN DOES A TEMPORARY CHANGE

THE EFFECT OF CHANGES IN THE INCOME TAX RATE AND SALES TAX RATE ON LABOR SUPPLY IS AN EMPIRICAL ISSUE, NOT DETERMINED BY ECONOMIC THEORY.

An increase in household wealth, an increase in income tax deductions (temporary, expected in the future or permanent) and an increase in transfers (temporary, expected in the future or permanent) all lower N^s and $N^{s,e}$.

These results follow from the fact that the effect of D, D^e, TR, TR^e and H on labor supply consists solely of an income effect.

There can be no substitution effect because these variables are not part of the current or expected future after-tax real wage, the two prices that affect labor supply.

Hence, the following result is worth noting:

A CUT IN THE INCOME TAX COMING FROM INCREASED DEDUCTIONS MAY HAVE A DIFFERENT EFFECT ON LABOR SUPPLY THAN DOES AN INCOME TAX CUT COMING FROM A LOWER INCOME TAX RATE

For example, a temporary cut in the income tax rate will increase labor supply while a temporary increase in income tax deductions will lower labor supply.

WHEN ALL THE RESULTS PRESENTED HERE ARE COMBINED THEY SHOW THAT THAT IN ORDER TO ANSWER THE QUESTION, ‘WHAT WILL A TAX CUT DO TO CURRENT LABOR SUPPLY?’ ONE NEEDS TO KNOW

(i) HOW TAXES ARE BEING CUT (E.G. ARE TAX RATES CUT OR DEDUCTIONS INCREASED) AND

(ii) WHETHER THE CUT IS PERCEIVED TO BE TEMPORARY OR PERMANENT.

WITHOUT THIS INFORMATION THE QUESTION CAN NOT BE ANSWERED.

FURTHERMORE, ANY ANSWER ABOUT HOW TEMPORARY OR PERMANENT CHANGES IN TAX RATES AFFECT CURRENT LABOR SUPPLY MUST BE BASED ON EMPIRICAL EVIDENCE BECAUSE ECONOMIC THEORY CANNOT RESOLVE THE QUESTION.

All that remains is to analyze the effect of changes in the expected real interest rate on labor supply.

An increase in the expected real interest rate has no effect on N^s and $N^{s,e}$.

The model used in these notes is logically consistent in the following way: it assumes that changes in the expected real interest rate have no effect on either consumption or labor supply.

Once a model assumes that changes in the expected real interest rate do not affect consumption, such changes must logically be assumed to have no impact on the marginal utility of consumption and therefore to have no impact on labor supply.

The justification for assuming that changes in the expected real interest rate have no impact on consumption will be explained in detail in Class Notes III. However, the result shouldn't come as a complete surprise: the expected real interest is a price, the price of current consumption in terms of future consumption. Hence, a change in the expected real interest rate will have both income and substitution effects on consumption and these effects may cancel out.

In contrast to the model in these notes, the model in the book is logically inconsistent. In that model changes in the expected real interest rate are assumed to have an effect on consumption, and thereby on the marginal utility of consumption, but not on labor supply.

The authors of the book tolerate this inconsistency to keep the model simple. And so long as a change in the expected real interest rate on consumption is small, the results of their inconsistent model will be basically correct.

Labor Supply Curve:

(1) With the current real wage on the vertical axis, the labor supply curve is upward sloping

(2) An increase in the expected future real wage shifts the labor supply curve to the left

(3) A temporary increase in the current marginal income tax rate shifts the labor supply curve to the left

(4) An increase in the expected future marginal income tax rate shifts the labor supply curve right, and by more than the leftward shift described in (3) so that a permanent increase in the marginal income tax rate shifts the labor supply curve to the right

(5) A temporary increase in the current sales tax rate shifts the labor supply curve left

(6) An increase in the expected future sales tax rate shifts the labor supply curve to the right, and by more than the leftward shift described in (5) so that a permanent increase in the sales tax rate shifts the labor supply curve to the right.

(7) A temporary increase in current allowable income tax deductions or government transfers shifts the labor supply curve to the left

(8) An increase in expected future allowable income tax deductions or government transfers shifts the labor supply curve to the left, so that a permanent increase shifts the labor supply curve to the left by more than does a temporary increase

(9) An increase in wealth shifts the labor supply curve to the left

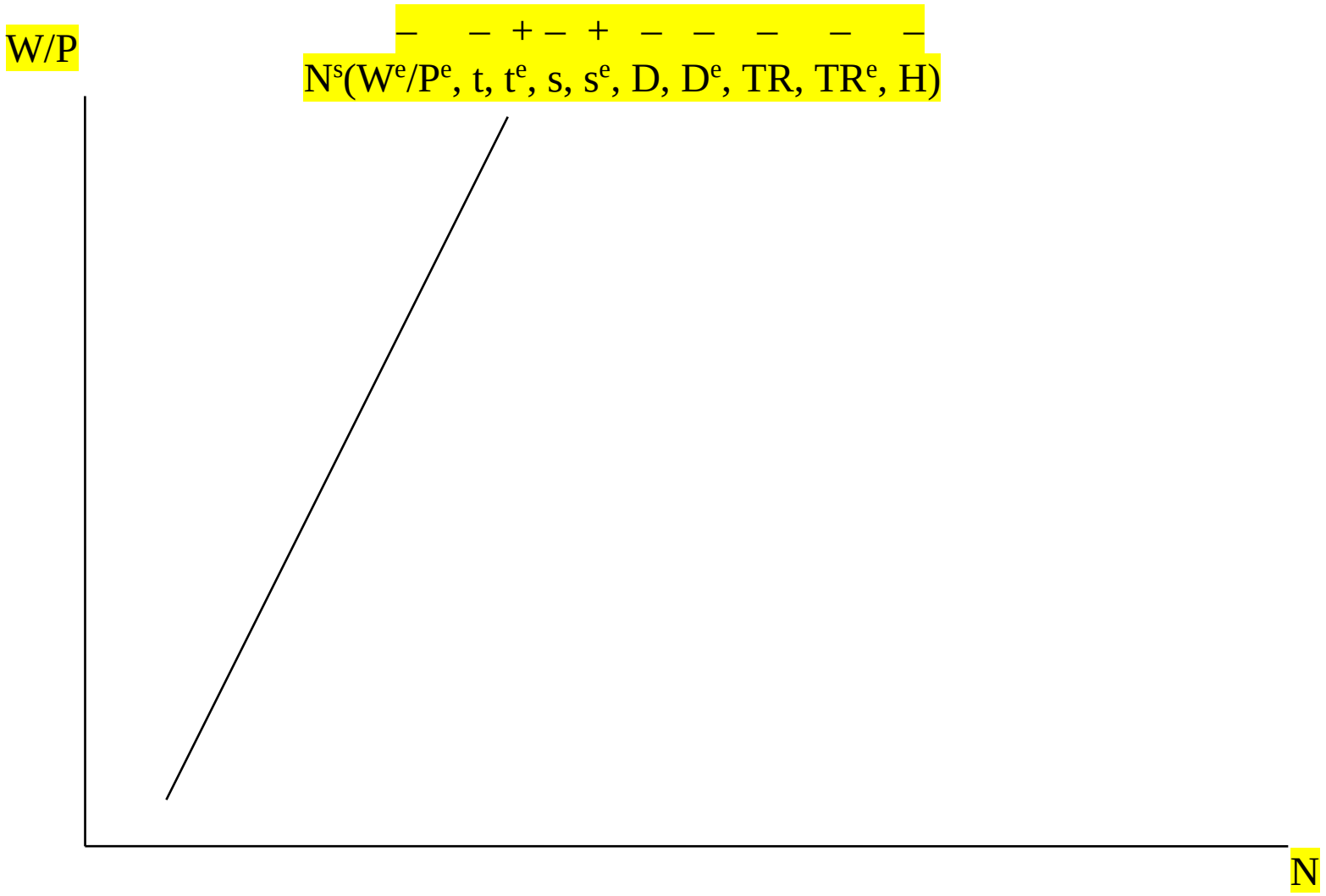


FIGURE II-7

Two final points about the labor supply curve:

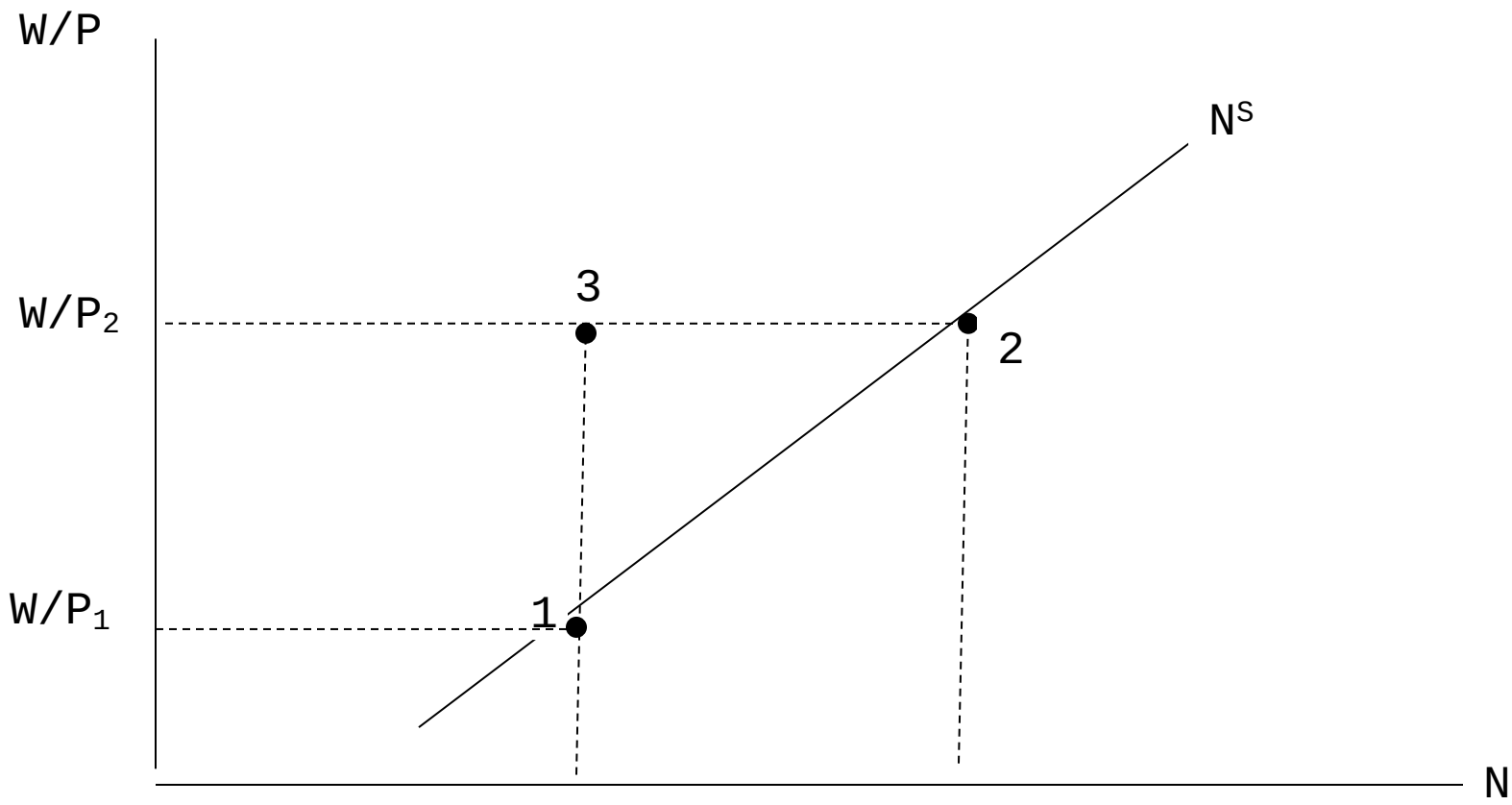
First, as one works up along the labor supply curve, utility is increased.

This may not be immediately obvious. Remember, utility is driven by consumption, leisure, and government purchases. The combination of a higher real wage with higher labor input means more income and therefore more consumption, which raises utility. But with more labor input leisure is reduced, which lowers utility. Which effect is stronger?

To answer this, break the movement up along the labor supply curve into two parts; first, directly up vertically, then directly over horizontally.

Moving up vertically clearly increases utility because leisure is fixed and with a higher real wage consumption can be higher.

Moving horizontally also increases utility. Moving horizontally to the curve HAS TO INCREASE UTILITY BECAUSE OF WHAT THE LABOR SUPPLY CURVE REPRESENTS! The labor supply curve represents the best a household can do, at a given real wage, in terms of utility. At a given real wage, utility is maximized by supplying the amount of labor represented by the curve. This is shown in the graph on the following page



Point 3 preferred to Point 1 because it has the same leisure and more consumption.

Point 2 preferred to Point 3 because Point 2 is on N^S: Point 2 is the best that can be done when $W/P = W/P_2$

Hence, Point 2 preferred to Point 1.

Second, the labor supply curve derived here is essentially the labor supply curve for an individual household. Hence, as the number of households naturally grows with increased population it is natural to expect the labor supply curve for the economy to shift to the right.

By not including population in the labor supply curve we are essentially assuming that population is constant.

II.7 Equilibrium in the Labor Market

According to the Classical model, the economy operates at the intersection of the labor demand and labor supply curves, with wages and/or prices adjusting to ensure the appropriate current pre-tax real wage.

This intersection point determines the level of employment and the current pre-tax real wage. See Figure II-8.

Employment and the pre-tax real wage are, therefore, endogenous variables for this model.

Employment and the current real wage are not the only endogenous variables for this model, however. **Any variable that depends on an endogenous variable is itself an endogenous variable.**

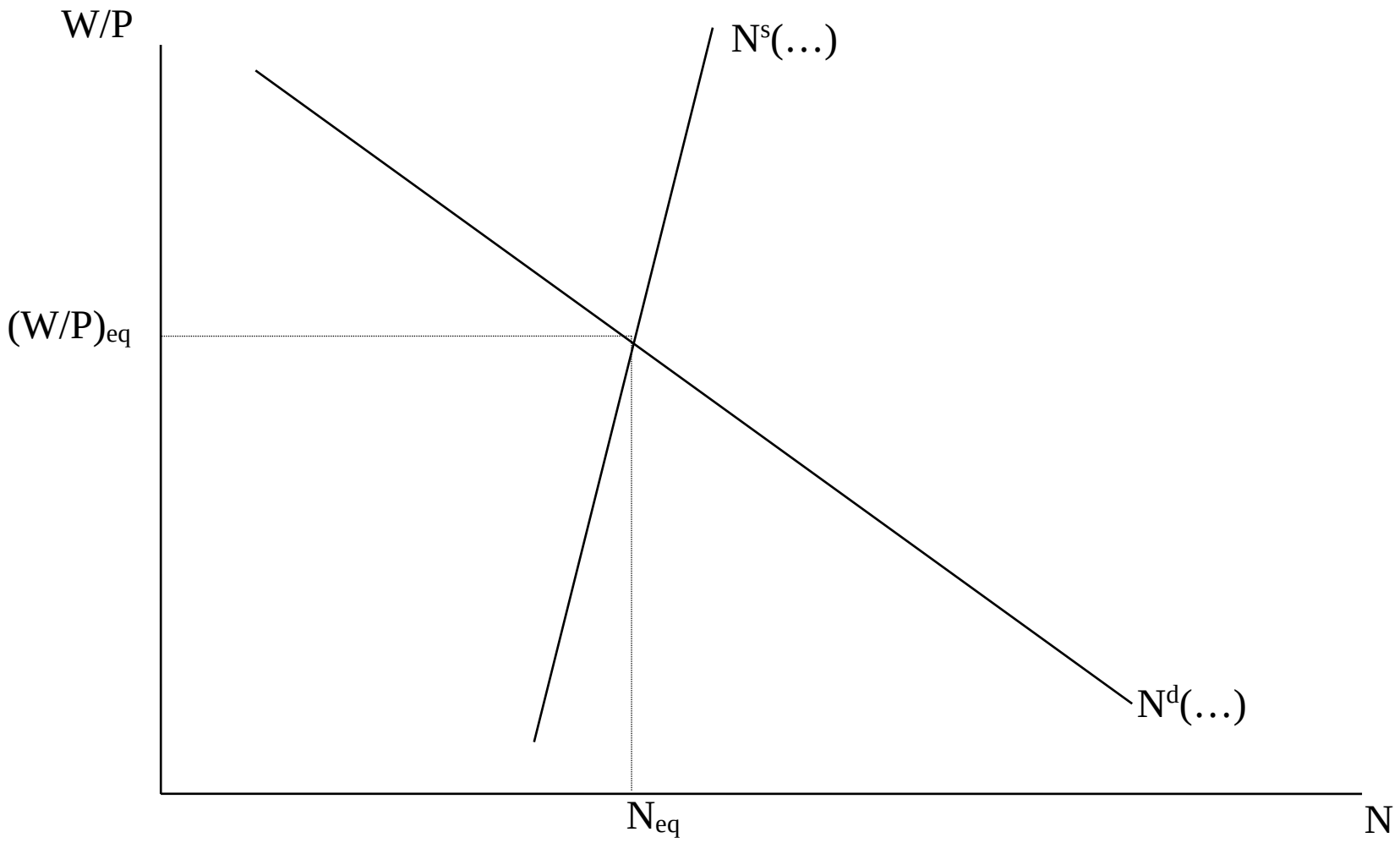


FIGURE II-8

Employment and the current real wage are not the only endogenous variables for this model, however. **Any variable that depends on an endogenous variable is itself an endogenous variable.**

Output and income are also endogenous because they move with changes in employment.

Tax revenues are endogenous because they change when income changes.

Disposable income is endogenous because it changes with movements in income and tax revenues.

The budget deficit is endogenous because it moves with changes in tax revenues.

Consumption is endogenous because it depends on disposable income

Expected future consumption is endogenous because it depends on disposable income

Private saving is endogenous because it depends on disposable income and consumption

National saving is endogenous because it depends on private saving and the budget deficit.

The after tax-real wage is endogenous because it depends on the pre-tax real wage.

Expected future labor supply is endogenous because it is determined by the same key equations that determine current labor supply

Utility is endogenous because it moves with consumption and leisure (the opposite of employment).

Not all the variables in our model are endogenous. Some are exogenous. Recall:

There is no theory about what makes an exogenous variable move.

There is a theory about does not make an exogenous variable move; changes in endogenous variables do not cause movements in exogenous variables.

How many exogenous variables are there in the model? There are almost as many as there are endogenous variables.

The model will not explain

(i) why the government sets tax rates, allowable deductions, or transfers the way it does

(ii) what makes the value of the stock market change

(iii) how people form their expectations

(iv) what causes changes in total factor productivity

(v) what changes the capital stock.

As a result, the model assumes there is no feedback from changes in any of the endogenous variables to changes in these exogenous variables.

So,

Endogenous: W/P, N, Y, TA, YD, BD, C, C^e, S^P, S^N, ATRW, $N^{s,e}$, U **13 variables**

Exogenous: A, K, t, t^e, s, s^e, D, D^e, TR, TR^e, W^e/P^e, H **12 variables**

Finally, a word of warning. Within this model the only things that can change employment, real wages, output and income are the things that shift the labor demand and labor supply curves: total factor productivity, the capital stock, current and expected future tax rates, current and expected future allowable tax deductions, current and expected future government transfers, expected future real wages, and household wealth.

As a result, the seeds of controversy have now been sown.

By not including the money supply or the level of government spending into either labor demand or labor supply, and by assuming that the labor market clears, it is guaranteed that neither changes in the money supply nor changes in government spending change employment, output or income.

If you find this prediction surprising, you are not operating with a classical economic model in mind.

II.8 Using the Labor Market Model

One way to use an economic model is to analyze what happens to a subset of the endogenous variables when one or more exogenous variables change.

For example, what happens to employment, the budget deficit and utility when there is an increase in total factor productivity?

In this class, when you use an economic model to answer such a question there are three steps you must follow, and always in the same order:

Step 1 – Use the graphs to determine what happens to the "easy" endogenous variables, i.e. the variables that appear on the axis of the graphs: **W/P and N** in the labor market model. Using the graphs involves (i) drawing the equilibrium before the change in the exogenous variable(s) takes place; (ii) labelling your curves, and then (iii) shifting the appropriate curve(s). When labelling your curves, list all exogenous variables that are changing in this particular problem and any endogenous variables that shift a curve.

Step 2 – Augment what you learn from shifting the curves with your knowledge of definitions, key equations, other equations (e.g. the production function), and other results (such as utility increases as one moves up along the supply curve) to determine what happens to the "hard" endogenous variables, i.e. the endogenous variables that do not appear on the axis of the graphs: **Y, TA, YD, BD, C, C^e, S^P, S^N, ATRW, $N^{s,e}$, U.**

Step 3 – Use words to explain the results you produced in Steps 1 and 2. This last step is called The Significant Other Test.

As the course develops, the model will get more complicated (e.g. the model will incorporate the goods market, the international bond market, and the money market) but the three steps listed above will not change.

All that will change is that the number of endogenous variable will increase, the graphs will become complicated and it may become more difficult to figure out what happens to the "hard" endogenous variables.

Example 1: Suppose there is an increase in A, total factor productivity. What happens to the real wage, employment, output, taxes, disposable income, the budget deficit, consumption and utility?

Step 1 – Use the graphs

Draw the graph of the situation before the change in total factor productivity;

Label the graph with variables that will change in this problem.

Draw the graph of the situation after the change.

Observe the results of the change in total factor productivity.

See Figures II-9 and II-10.

Higher A shifts the N^d curve to the right and has no impact on the N^s curve.

Employment and the real wage both increase.

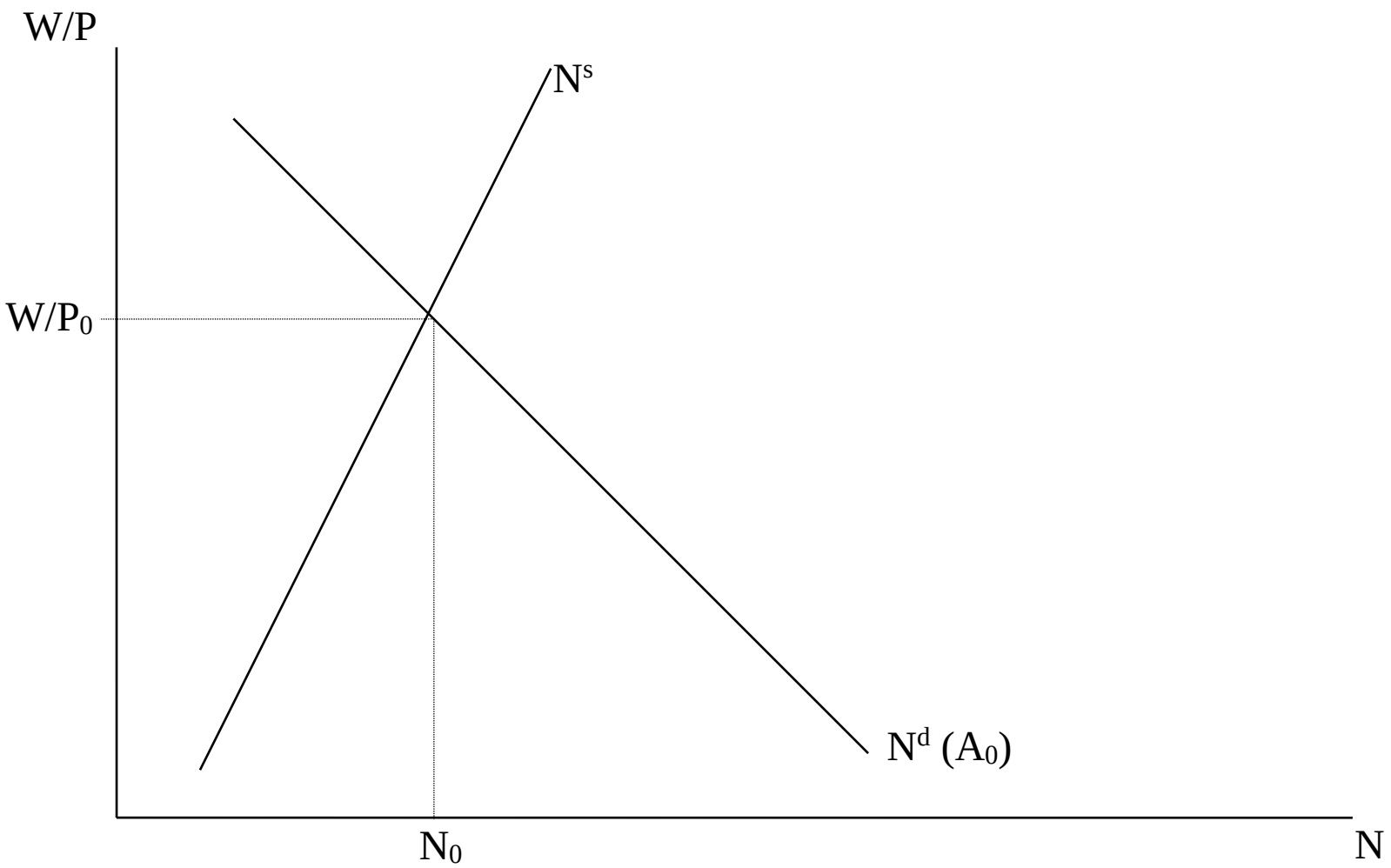


FIGURE II-9

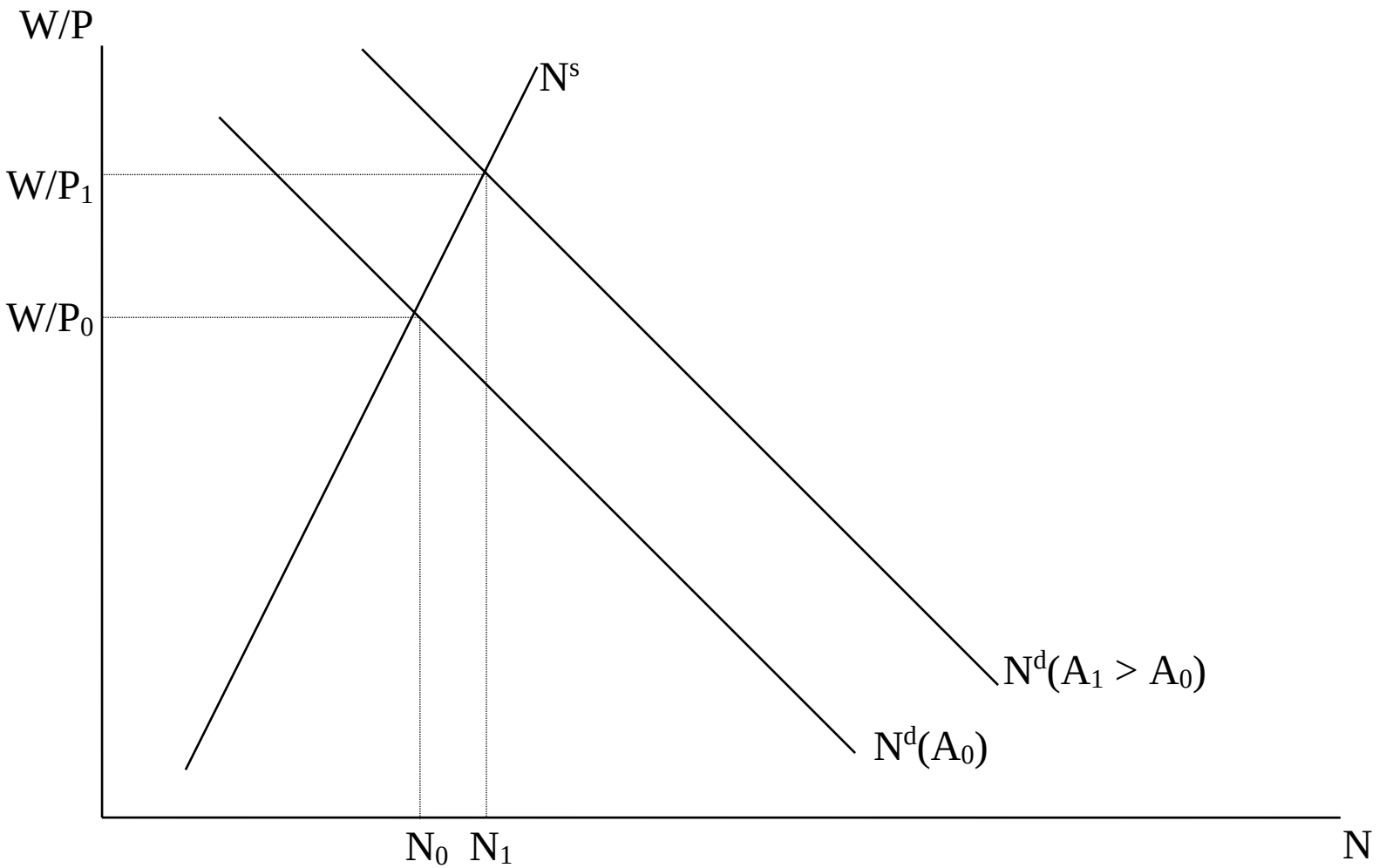


FIGURE II-10

Step 2 – Determine Additional Endogenous Variables

Using definitions, key equations, other equations (e.g. the production function), other results (utility increase as the labor demand curve shifts out along an unchanged labor supply curve)

Output ?

Income ?

Tax revenues ?

Disposable income ?

Budget deficit ?

Consumption ?

Utility ?

Output rises (higher employment, higher productivity, unchanged capital stock; the production function)

Income ?

Tax revenues ?

Disposable income ?

Budget deficit ?

Consumption ?

Utility ?

Output rises (higher employment, higher productivity, unchanged capital stock; the production function)

Income rises (output = income)

Tax revenues ?

Disposable income ?

Budget deficit ?

Consumption ?

Utility ?

Output rises (higher employment, higher productivity, unchanged capital stock; the production function)

Income rises (output = income)

Tax revenues rise (income higher, tax rates unchanged)

Disposable income ?

Budget deficit ?

Consumption ?

Utility ?

Output rises (higher employment, higher productivity, unchanged capital stock; the production function)

Income rises (output = income)

Tax revenues rise (income higher, tax rates unchanged)

Disposable income increases (income higher, tax revenues higher, and transfers are unchanged; income up more than tax revenues because unchanged tax rates are assumed < 100%)

Budget deficit ?

Consumption ?

Utility ?

Output rises (higher employment, higher productivity, unchanged capital stock; the production function)

Income rises (output = income)

Tax revenues rise (income higher, tax rates unchanged)

Disposable income increases (income higher, tax revenues higher, and transfers are unchanged; income up more than tax revenues because unchanged tax rates are assumed < 100%)

Budget deficit shrinks (tax revenues rise, no change in government spending or transfers)

Consumption ?

Utility ?

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Budget deficit shrinks (tax revenues rise, no change in government spending or transfers)

Consumption increases (disposable income rises, no change in expected future disposable income or wealth; this will be covered in next section of class notes)

Utility ?

Output rises (higher employment, higher productivity, unchanged capital stock; the production function)

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Tax revenues rise (income higher, tax rates unchanged)

Disposable income increases (income higher, tax revenues higher, and transfers are unchanged; income up more than tax revenues because unchanged tax rates are assumed < 100%)

Budget deficit shrinks (tax revenues rise, no change in government spending or transfers)

Consumption increases (disposable income rises, no change in expected future disposable income or wealth; this will be covered in next section of class notes)

Utility increases (consumption is higher and leisure is lower, so it may appear that what happens to utility is ambiguous; however, utility must rise because the labor demand curve is moving out along an unchanged labor supply curve)

Step 3 – The Significant Other Test

With a new higher level of productivity, firms can increase their profits by hiring more labor at the current real wage. Thus, firms want more labor. However, the increase in productivity does not make workers want to work more at the existing real wage. As a result, there is excess demand for labor (a shortage of labor) at the existing real wage and the real wage will be forced up. As the real wage rises labor supply is increased (we are assuming that the substitution effect dominates the income effect) and labor demand is reduced (hiring labor becomes less profitable at the higher real wage). The increase in the real wage, the resulting increase in labor supply, and the resulting decrease in labor demand all continue until demand and supply are again equal, at a higher level of employment, a higher pre-tax real wage, and increased output.

Higher output means higher pre-tax income, and with no change in tax rates (assumed to be below 100%) both households' disposable income and government tax revenues are higher. With higher tax revenues and no change in government spending or transfers, the government budget deficit is lower. Consumption is higher because people will spend part of their increased disposable income. Utility will also increase. This may seem unclear, with higher consumption increasing utility and less leisure reducing utility. But recall, workers could have chosen to work the same amount as before, earn a higher wage and have both the same leisure as before and higher consumption. But they didn't make that choice. They are willingly working more. They choose to work more because they feel the lower utility from less leisure is more than offset by the higher utility that comes from being able to consume more.

Note 1: In general, any two endogenous variables can move in the same direction or in different directions, depending on what is making those endogenous variables move.

For example, depending on what is making the real wage and employment change, there can be

(i) an increase in the real wage and a decrease in employment or

(ii) a decrease in the real wage and a decrease in employmeny

However, there are two endogenous variables that will always move in the same direction, employment and output.

You should be able to verify this on your own.

This prediction aligns well with the data.

Note 2: The current model makes no distinction between a temporary and a permanent increase in productivity because A^e does not enter the model.

This could be amended in a couple of ways.

On the labor supply side, given what we have seen about the link between A and W/P, we could model W^e/P^e as depending on A^e.

On the labor demand side, we could add hiring and firing costs to the model. This will create a reason for the rational firm to be forward looking in making current hiring decisions.

Example 2: Tax Reform

Suppose there is a permanent cut in marginal income tax rates, holding the average income tax rate at today's level of income and the average income tax rate at the expected future level of income fixed.

That is, suppose there is a decrease in both the current and expected future marginal income tax rates, while at the same time there is a decrease in deductions today and in the future by enough so that at existing real wages and employment, after-tax income is unaffected today and in the future.

What happens to employment, output, income, the pre-tax real wage, the after- tax real wage, consumption, the budget deficit and utility?

Step 1 – Use the graphs

See Figures II-11 and I-12

There is no effect on N^d curve

There is an effect on N^s curve. In fact there are 4 effects, and not all of them are working in the same direction.

Thus, it may appear that we don't know whether the labor supply curve shifts to the right or to the left.

However, some careful thought will reveal that it shifts right.

To see this N^s curve shifts right note:

(i) At current N^s, and $N^{s,e}$, there is no effect on current or expected future after-tax income. Therefore, there is no income effect on labor supply coming from this tax reform.

(ii) There is a substitution effect, however, caused by $(1-t)(W/P)/(1+s)$ and $(1-t^e)(W^e/P^e)/(1+s^e)$ rising, so that both current and expected future leisure are getting more expensive. The substitution effect says substitute away from expensive current and expected future leisure and toward working more.

(iii) N^s and $N^{s,e}$ must rise.

In equilibrium, the pre-tax real wage falls and employment rises.

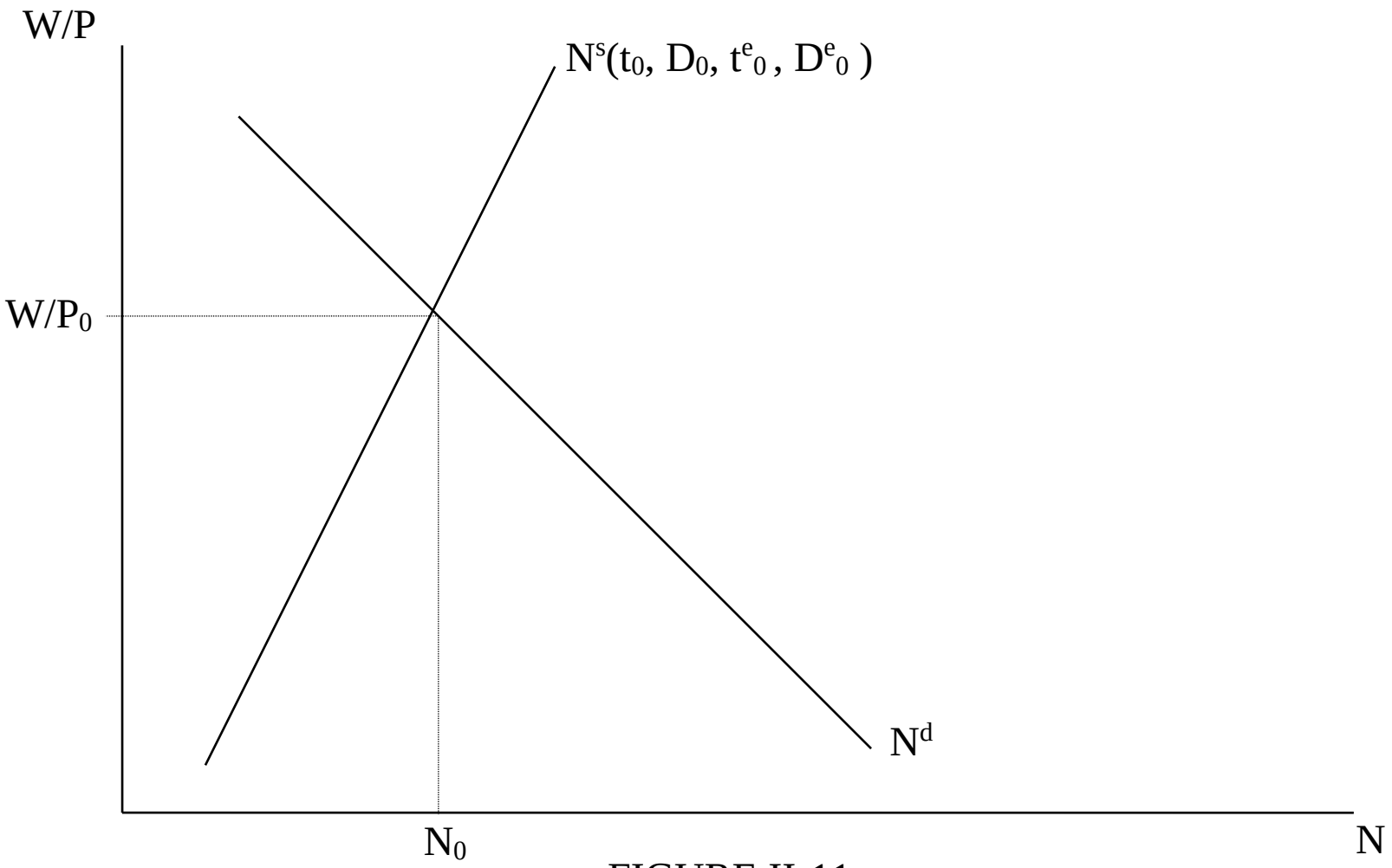

FIGURE II-11

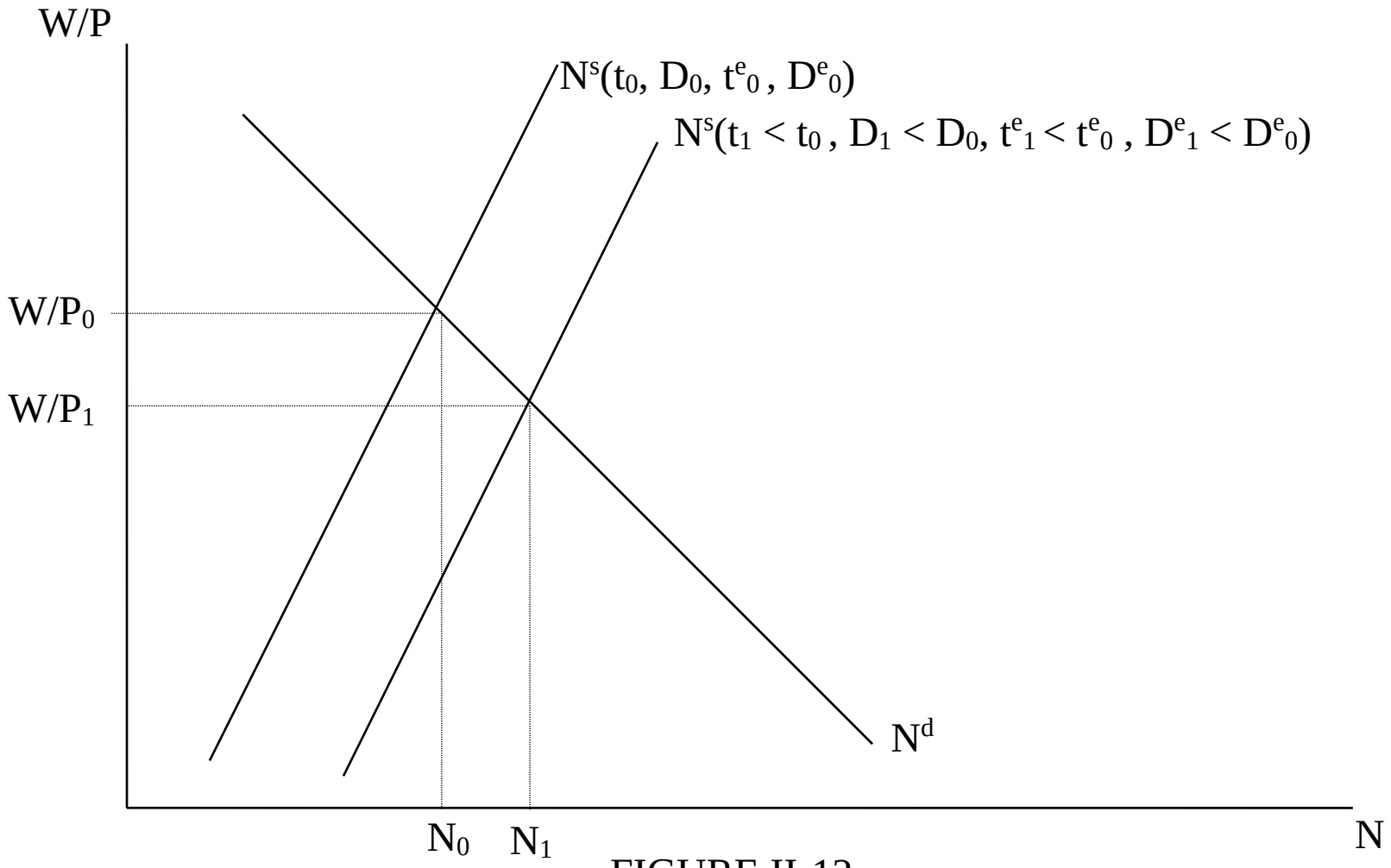

FIGURE II-12

Step 2 – Determine Additional Endogenous Variables:

Output ?

Income ?

Tax revenues ?

Disposable income ?

Budget deficit ?

Consumption ?

Utility ?

Output rises (higher employment, unchanged productivity and capital stock; the production function)

Income ?

Tax revenues ?

Disposable income ?

Budget deficit ?

Consumption ?

Utility ?

Output rises (higher employment, unchanged productivity and capital stock; the production function)

Income rises (output = income)

Warning: Do not attempt to measure what happens to income by looking at W/P and N. The product of W/P and N gives labor income, not total income (which includes both labor income and capital income). Total income equals output, which increases due to higher employment with no change in capital stock or total factor productivity. Labor income is a constant fraction of total income, which means that it must rise in this example.

Tax revenues ?

Disposable income ?

Budget deficit ?

Consumption ?

Utility ?

Output rises (higher employment, unchanged productivity and capital stock; the production function)

Income rises (output = income)

Warning: Do not attempt to measure what happens to income by looking at W/P and N. The product of W/P and N gives labor income, not total income (which includes both labor income and capital income). Total income equals output, which increases due to higher employment with no change in capital stock or total factor productivity. Labor income is a constant fraction of total income.

Tax revenues rise (even though this policy is revenue neutral at the original level of employment and output, tax revenues rise with the higher output and income)

Disposable income ?

Budget deficit ?

Consumption ?

Utility ?

Output rises (higher employment, unchanged productivity and capital stock; the production function)

Income rises (output = income)

Warning: Do not attempt to measure what happens to income by looking at W/P and N. The product of W/P and N gives labor income, not total income (which includes both labor income and capital income). Total income equals output, which increases due to higher employment with no change in capital stock or total factor productivity. Labor income is a constant fraction of total income.

Tax revenues rise (even though this policy is revenue neutral at the original level of employment and output, tax revenues rise with the higher output and income)

Disposable income increases (there is no change in disposable income at the original level of income and not all of the increased income will be taxed away)

Budget deficit ?

Consumption ?

Utility ?

Output rises (higher employment, unchanged productivity and capital stock; the production function)

Income rises (output = income)

Warning: Do not attempt to measure what happens to income by looking at W/P and N. The product of W/P and N gives labor income, not total income (which includes both labor income and capital income). Total income equals output, which increases due to higher employment with no change in capital stock or total factor productivity. Labor income is a constant fraction of total income.

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Budget deficit shrinks (tax revenues rise, no change in government spending or transfers)

Consumption ?

Utility ?

Output rises (higher employment, unchanged productivity and capital stock; the production function)

Income rises (output = income)

Warning: Do not attempt to measure what happens to income by looking at W/P and N. The product of W/P and N gives labor income, not total income (which includes both labor income and capital income). Total income equals output, which increases due to higher employment with no change in capital stock or total factor productivity. Labor income is a constant fraction of total income.

Tax revenues rise (even though this policy is revenue neutral at the original level of employment and output, tax revenues rise with the higher output and income)

Disposable income increases (there is no change in disposable income at the original level of income and not all of the increased income will be taxed away)

Budget deficit shrinks (tax revenues rise, no change in government spending or transfers)

Consumption increases (both disposable income and expected future disposable income increase; this will be covered in Class Notes III)

Utility ?

Utility increases (to see this, break down the change in utility into two parts: What happens to utility at the original equilibrium and what happens to utility in the move from the original equilibrium to the new equilibrium.

At the original equilibrium, hours worked is the same, disposable income is the same and thus households will consume the same amount; utility is unchanged.

In the move to the new equilibrium, utility increases. People willingly work more because it raises their utility. The extra labor input increases utility because even though leisure is reduced, the increase in utility derived from the new consumption made possible by more work exceeds the loss of utility from reduced leisure.)

After-tax real wage?

Utility increases (to see this, break down the change in utility into two parts: What happens to utility at the original equilibrium and what happens to utility in the move from the original equilibrium to the new equilibrium.

At the original equilibrium, hours worked is the same, disposable income is the same and thus households will consume the same amount; utility is unchanged.

In the move to the new equilibrium, utility increases. People willingly work more because it raises their utility. The extra labor input increases utility because even though leisure is reduced, the increase in utility derived from the new consumption made possible by more work exceeds the loss of utility from reduced leisure.)

The after-tax real wage increases. It may appear that what happens to the after-tax real wage is ambiguous because (1-t) is up while W/P is down. However, to see what happens to ATRW return to the key equation for labor supply: MUC * ATRW = MDUN

Compared to the original equilibrium, MUC is down due to higher consumption while MDUN is up due to increased labor supply. These two facts imply that ATRW must have risen. That means that W/P moves less in percentage terms than (1-t.)

The analysis of the previous paragraph is an example of the power of using math to evaluate important issues. The model makes both *qualitative* and *quantitative* predictions.

Step 3 – The Significant Other Test

I leave the Significant Other test for you to do on your own

Now that all three steps have been completed, consider the big picture result about tax reform: Lowering tax rates and eliminating tax breaks is a free lunch!!!!

The budget deficit is reduced and at the same time utility of households is increased.

How can this be?

Answer: This change in the tax system makes the tax system more efficient. And furthermore, this increased efficiency yields benefits that are shared by the private sector and the government.

Hence, there are two key takeaways for this example.

First, not all tax systems are equally efficient. For any given level of tax revenue, efficiency requires low t, low s, and low D instead of high t, high s, and high D: “low rates, no breaks”

This characterization of tax efficiency is correct because the marginal income tax rate and the value added/sales tax rate introduce a distortion into the economy. That distortion can be seen by looking at the condition

$$MUC * MPN = MDUN*(1+s) / (1-t),$$

a condition that holds when the real wage is at the level that equilibrates labor supply and labor demand.

To see that this condition is true, substitute the key equation for labor demand, W/P = MPN, into the key equation for current labor supply.

$$MUC * MPN = MDUN*(1+s) / (1-t),$$

If s=t=0 then in equilibrium MDUN = MUC * MPN. Equilibrium is characterized by the disutility of working an extra hour (MDUN) being set equal to utility that society can receive from working an extra hour (MUC*MPN). This is efficiency.

If s>0 or t>0 then in equilibrium MDUN < MUC * MPN. Equilibrium is characterized by the disutility of working an extra hour (MDUN) being less than the utility that society can receive from working an extra hour (MUC*MPN). In this case, society would benefit from people working more, but people do not have the proper incentive to do so. This is inefficiency.

An important distortion of the marginal income tax rate and value added/sales tax rate is to stop utility creating activity in the labor market from taking place. This is known as “deadweight loss”.

Second, when considering the effects of an increase in government purchases that is financed by an increase in the marginal income tax rate or sales tax rate, the increased utility attributable to the higher government spending must be weighed against both the reductions in utility due to lower consumption (people will have to cut consumption to pay the higher taxes) AND the loss of utility caused by the additional distortions created by the higher tax rates, i.e. the deadweight loss.

The framework of these notes is the framework applied by Marty Feldstein in his analysis of the magnitude of deadweight loss in the United States. See Martin Feldstein, **A Case for Cutting Marginal Rates**, *The Wall Street Journal*, August 9, 1996. See **Taxes Influence the Type and Number of Fringe Benefits**, *The NBER Digest,* National Bureau of Economic Research, September 1994 for confirmation of Feldstein's proposition that how people are paid in terms of benefits and wages depends on the tax system. Also, see Milton Friedman, **The Folly of Buying Health Care at the Company Store,** *The Wall Street Journal*, February 3, 1993 for relevant background info on the wages vs benefits issue and an example of the law of unintended consequences.

According to Feldstein's calculations, the distortions induced by the then existing U.S. tax system were so large that in order to claim that higher government spending financed by an income tax rate increase will raise utility it is necessary to claim that one dollar of government spending yields more utility than two dollars of consumption.

One of the reasons Feldstein's 2 to 1 ratio is so high is that he incorporates an additional distortion that is not present in our model. That distortion is caused by the fact that in the U.S. economy employees can avoid paying income tax if firms provide non-taxable benefits instead of taxable income. The resulting equilibrium results in firms providing an inefficiently high level of benefits, i.e. more deadweight loss.

Since Feldstein's analysis may be a little hard to follow, I have added some special Notes on Feldstein to the end of Class Notes II.