Take Home # 1 REVIEW

Part A: General Results

Part B: The Model (Classical Model of Labor Market)

Part C: Test Taking

Part A: General Results

$\%\Delta(X*Y) = \%\Delta X + \%\Delta Y$

$\%\Delta(X/Y) = \%\Delta X - \%\Delta Y$

$\%\Delta X^{\alpha} = \alpha\, \%\Delta X$

Output = Income (Two versions of each: GNP & GDP)

GDP: output produced and income earned in a country

GNP: output produced and income earned using domestic factors of production

GNP = GDP – Factor Payments to Foreigners + Factor Payments from Abroad

= GDP + NFP

Output & Income = Spending

GDP = Domestic Spending – Imports + Exports

= C + I + G + Exports – Imports

= C + I + G + NX

Disposable Income

YD = GNP + TRGP - TA

GNP is not a measure of welfare. GNP is positively correlated with welfare, but economists prefer to link utility to current and future values of (i) private consumption; (ii) leisure; and (iii) government consumption.

Labor's Share of Income Has Remained Remarkably Constant over Time

This is the motivation for the Cobb-Douglas Production Function

This may be changing very recently, with Labor's Share declining

$$BD = G + TRGP + TRGF - TA$$

$$G = G^C + G^I$$

$$S^P = YD - C - TRPF$$

$$S^G = TA - G^C - TRGP - TRGF$$

$$S^N = S^P + S^G$$

$$= GNP - C - G^C - TRPF - TRGF$$

If $G = G^C$

$$BD = G + TRGP + TRGF - TA = - S^G$$

If $G = G^C$ and $TRPF = TRGF = 0$

$$S^N = GNP - C - G$$

Nominal means measured in currency

Real means measured in goods

Nominal GDP is constructed using current prices and current quantities

Real GDP is constructed using base period prices and current quantities

Real GDP is a fixed-weight index, i.e. %Δ Real GDP = weighted average of the growth rates of the quantities of individual goods weighted by the share of those goods in base period GDP, meaning these weights don't change over time. Fixed-weight indices can be inaccurate if the structure of the economy changes over time.

Chain-Weighted GDP is a variable-weight index measure of real GDP growth. Variable-weight indices reflect changes in the structure of the economy and are preferred to fixed weight indices for measuring growth rates.

In most countries, high growth industries are, on average, industries with falling relative prices.

This makes chain-weighted real GNP growth lower than typical real GNP growth after the base year, while the reverse is true before the base year.

Looking at whether prices and quantities move together or in opposite directions tells us whether supply or demand factors are more important in a market.

GDP Deflator = Nominal GDP / Real GDP =>

Real GDP = Nominal GDP / GDP Deflator

Deflators exist for all components of GDP,

e.g. there is a Consumption Deflator & an Investment Deflator

GDP Deflator is like an average price level for the entire economy

%ΔGDP Deflator = inflation; this is a variable-weight index (inflation rates of individual goods are weighted by the share of those goods in current year real GDP) which is desirable. In the U.S., the Fed's target inflation is stated in terms of the PCE, i.e. the %ΔConsumption Deflator.

%ΔCPI = inflation; this is a fixed-weight index (inflation rates of individual goods are weighted by the share of those goods in base year real GDP). %ΔCPI is less accurate than %ΔDeflator; it overstates inflation because consumers tend to substitute away from high inflation goods whose relative price is rising.

For all assets the relationship between the expected real return, expected nominal return and expected inflation is given by:

$r^e = i^e - \pi^e \iff i^e = r^e + \pi^e$

for a default-free one-period bond $i^e = i$

r^e on a risk-free bond is the relative price of consumption today in terms of consumption tomorrow

π^e is not the relative price of consumption today in terms of consumption tomorrow

Part B: The Model (Classical Model of Labor Market)

Basic Assumptions (the world described by the model):

All households are the same. Households sell labor to firms. Households also own the firms, so they receive all the pre-tax income created in the economy, not just the labor income, and from this income they pay taxes. Households use their disposable income to pay for their consumption and save. Households maximize utility over a two-period planning horizon. Households get utility from current and expected future leisure, current and expected future private consumption, and current and expected future government spending. Households have increasing marginal disutility of work and have decreasing marginal utility of consumption. They have time separable utility. Their utility is also separable across goods.

All firms are the same. Firms are perfectly competitive in both the labor and goods markets. Firms hire labor and use it to produce output using a fixed capital stock and a Cobb-Douglas production function. Firms maximize after-tax profits.

There are income taxes, value added/sales taxes and a corporate profits tax. There is a single marginal income tax rate, and there are deductions from income before applying this marginal rate. Thus, the marginal income tax rate and the average income tax rate are not the same.

Households do not necessarily believe that future sales tax rate, income tax rate and income tax deductions will be the same as they are currently.

The government does not employ workers or produce goods; it uses tax revenue to purchase goods and make transfers. The government does not have to run a balanced budget; it issues government debt when it runs a budget deficit and repays government debt when it runs a budget surplus. The debt is viewed as risk-free in nominal terms; there is no probability of default.

Households base their consumption on three factors: current disposable income, expected future disposable income and wealth.

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 wealth now and a fraction in the future. An increase in consumption with an unchanged level of income means a lower amount of saving.

There are perfect capital markets. That is, households can always borrow to pay for future consumption so long as their consumption plans are consistent with their budget constraint.

Key Equations: All are interpretable as marginal benefit = marginal cost

N^d: MPN = W/P

N^s, $N^{s,e}$: MUC * ATRW = MDUN; ATRW = (W/P) * (1-t)/(1+s) is the price of current leisure

MUC^e *$ATRW^e$ = $MDUN^e$ $ATRW^e = (W/P)^e * (1-t^e)/(1+s^e)$ is the price of future leisure

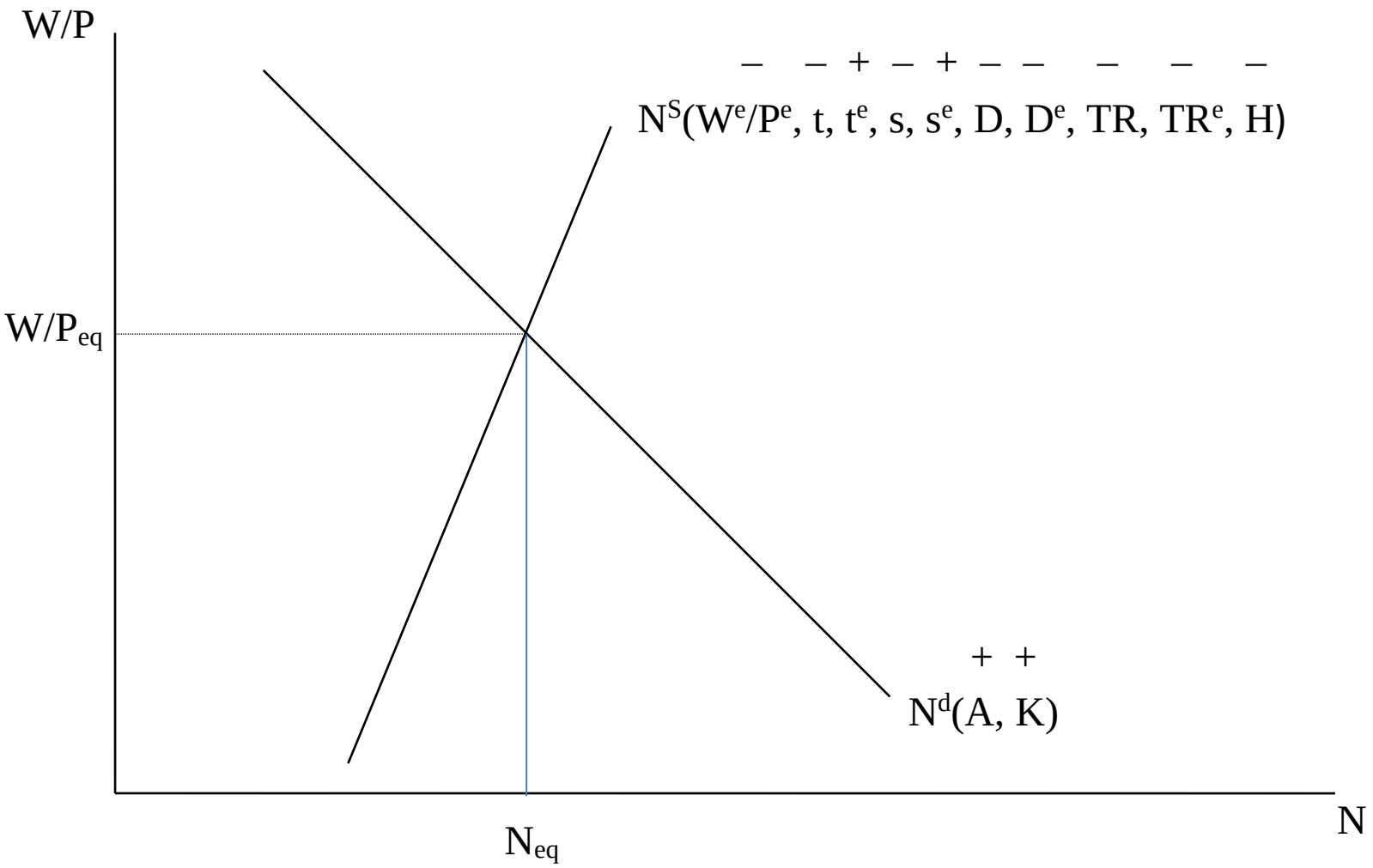
Market Behavior:

The Classical Model assumes that the pre-tax real wage, W/P, clears the labor market.

Graphical Representation of Classical Model:

The graph on the following page shows the Labor Market

Labor Market:



Additional assumptions needed to derive curves:

Due to offsetting income and substitution effects, the basic assumptions combined with economic theory cannot determine if an increase in W/P increases or decreases labor supply. The same is true for an increase in the income tax rate and sales tax rate. (Recall, because it is the after-tax real wage that determines labor supply, the effect of changes in the income tax rate and the value added tax rate have exactly the opposite effect on labor supply as does a change in the real wage.)

In lieu of results from economic theory, economists base their models on empirical evidence, i.e. on data.

Empirical evidence suggests that the labor supply curve is upward sloping. A temporary increase in the real wage, i.e. an increase in W/P holding W^e/P^e fixed, increases labor supply because the substitution effect is stronger than the income effect.

Likewise, a temporary increase in the income tax rate or sales tax rate lowers labor supply.

Empirical evidence suggest that a permanent increase in the real wage, i.e. an equal increase in W/P and W^e/P^e, will lower labor supply because the stronger income effect outweighs the unchanged substitution effect.

Likewise, a permanent increase in the income tax rate or sales tax rate raises labor supply.

Types of Variables:

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**

A model explains how endogenous variables are determined; it explains how changes in exogenous variables cause endogenous variables to change.

A variable that depends on an endogenous variable is endogenous.

A model does not specify what causes an exogenous variable to move, but it does specify what does not cause an exogenous variable to move: an endogenous variable does not cause an exogenous variable to move.

Analyzing the Impact of "Shocks"

How Do Changes in Exogenous Variables Cause Changes in Endogenous Variables

The Recipe for Success

(Steps 0 through 4 below breakdown Steps 1 and 2 from Class Notes II)

0) Draw the initial equilibrium for the labor market and label the curves appropriately by including both (i) any exogenous variables that change in this particular problem and (ii) all endogenous variables that shift a curve. Currently there are no endogenous variables that shift a curve.
1) Determine if the shock shifts the N^d curve
2) Determine if the shock shifts the N^s curve
3) Combine 1) and 2) to find what happens to W/P, N, and Y

4) To determine the remaining endogenous variables requires more than the graphs. Additional information that can be used includes definitions, the key equations, other equations (e.g. the production function and the fact that output equals spending) or other means (e.g. utility increases as the economy moves up along the labor supply curve and the change in utility can be broken down into what happens at the original equilibrium plus what happens as the economy moves to the new equilibrium).

   This additional information can also be used to determine the relative magnitudes of changes in endogenous variables.

After the above the 4 steps are completed, it is time to pass the **Significant Other Test**, i.e. use words to explain the results of the model to an intelligent person who has not had any formal training in economics.

Miscellaneous but Important, Results:

1) There is no fixed relationship between endogenous variables, except N and Y. For the rest, the relationship depends on which exogenous variable caused the endogenous variables to move.

   For example,

   higher employment can be associated with higher real wages or lower real wages;

   higher consumption can be associated with higher or lower disposable income.

   It follows that the pattern of endogenous variables is an indication of what exogenous variables are responsible for the endogenous variables changing. This can be useful when "solving the model backwards", i.e. examining the behavior of the endogenous variables in order to determine what caused the economy the change.

2) Labor supply is all income and substitution effects. It is the inverse of the demand for leisure.

Some Tax Policy Results:

1) Income tax rates and value added tax rates work differently in the labor market than do income tax deductions. Deductions have only income effects. Income tax rates and value added tax rates have both income and substitution effects because they affect the price of leisure, i.e. the after-tax real wage.

   Income tax deductions do not affect the price of leisure because they are irrelevant when considering the cost of buying an additional unit of leisure, i.e. the cost of working one less hour. And this is because income tax deductions in our model are fixed regardless of whether a household works less hour or not.

   If income tax deductions were tied to the level of income, e.g. if every extra unit of income reduced deductions by a fraction d, then d would show up in the after-tax real wage. In particular, ATRW would be $\frac{1-t-td}{1+s}\frac{W}{P} = \frac{1-t(1+d)}{1+s}\frac{W}{P}$.

Phasing out deductions with income works just like the income tax rate. Which means such a policy creates the same deadweight loss and loss of "tax efficiency" as having a positive income tax rate or positive sales tax rate. (See result 3 below.)

Phasing pout transfers with higher income would create yet another distortion in the economy.

2) The sales tax rate distorts decisions made in labor market, even though it is applied in the goods market. The reason for this is simple: people work so that they can consume. Thus, both what happens in the goods market and what happens in the labor market affects labor supply decisions.

3) An efficient tax system has low income tax rates, low value added tax rates, and no deductions. For any amount of tax revenue to be raised, it is most efficient to keep the tax base as big as possible so that tax rates can be set as low as possible. This is because there is a deadweight loss associated with marginal tax rates.

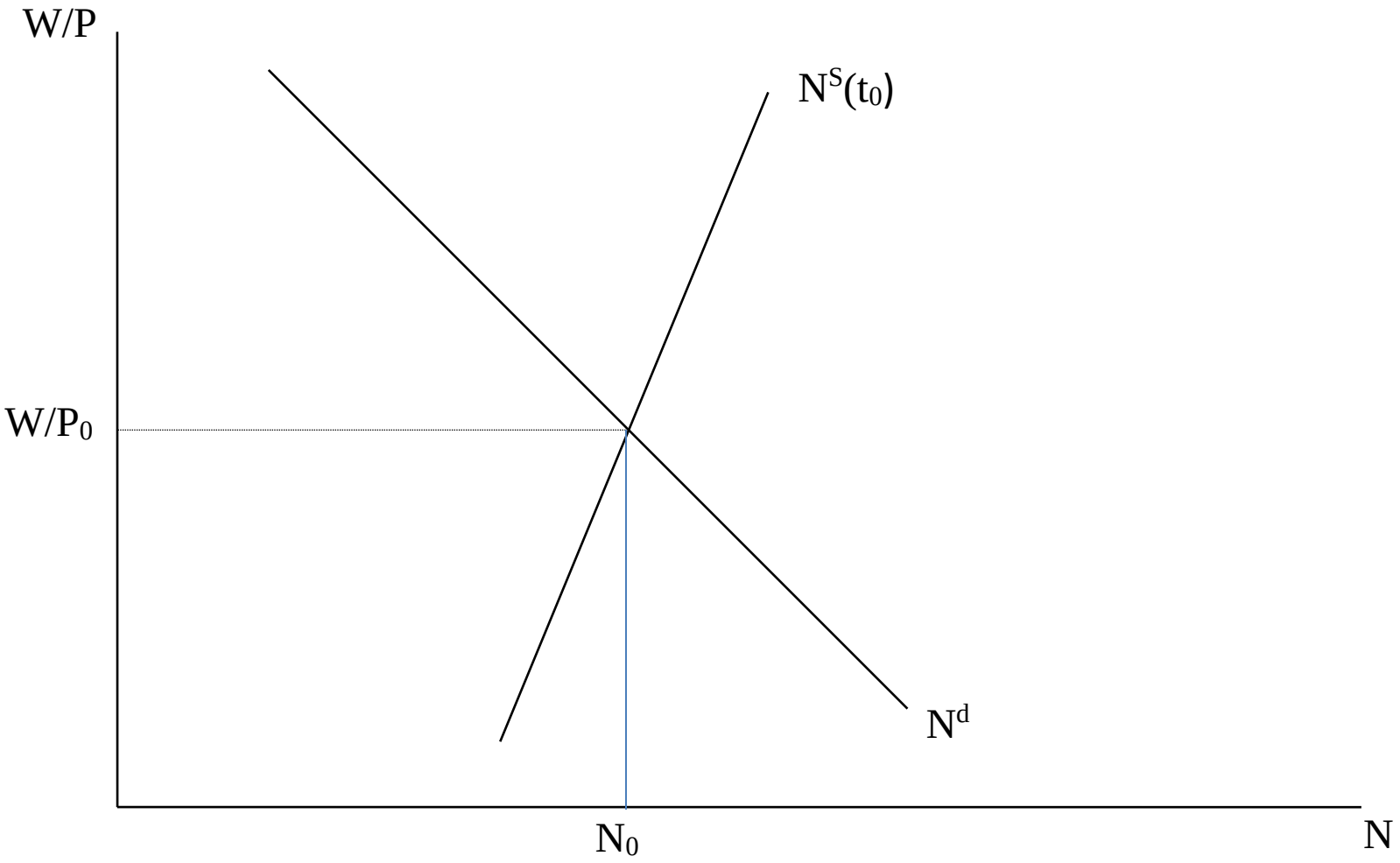
   When the labor market clears MUC * MPN = MDUN * (1+s)/(1-t).

   With s=0 and t=0, MUC * MPN = MDUN and the marginal benefit to society of working equals the marginal cost to society; this is the socially optimal level of employment and output.

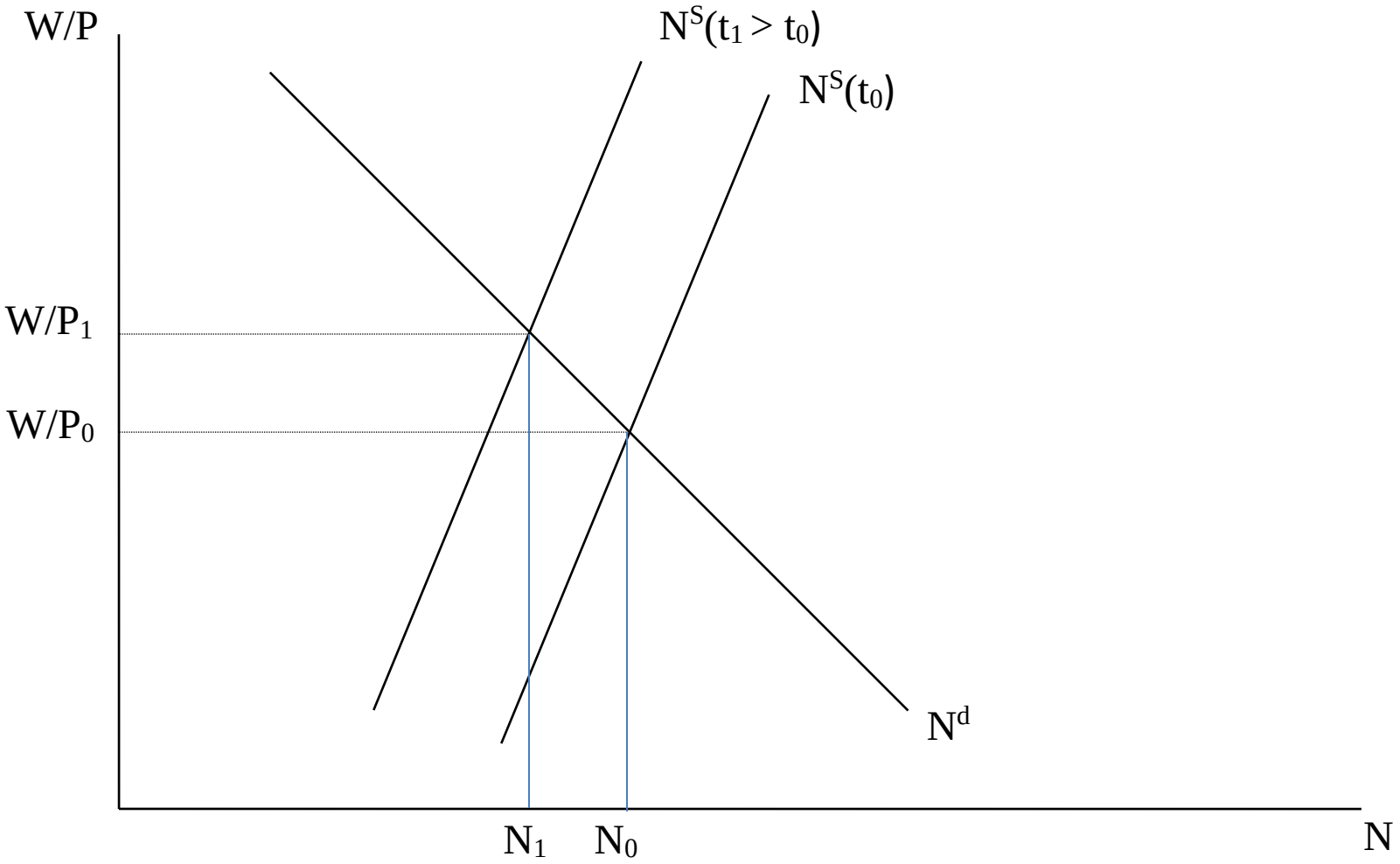
   With s>0 and t>0, MUC * MPN > MDUN and the level of employment and output is too low; if people worked more then utility for society would rise.

An Example: Analyze the effect of a temporary increase in the income tax rate

0) Draw original equilibrium in labor market, label curves



1) No shift of N^d **2)** N^s shifts left **3)** W/P up, N down, Y down



4) Other endogenous variables

TA: ambiguous

t is up but Y is down

YD: down

Y down and t up

BD: ambiguous

what happens to TA is ambiguous

C: down

YD down (with YD^e and H unchanged) means C is down

C^e: down

YD down (with YD^e and H unchanged) means C^e is down

S^P: down

YD down (with YD^e and H unchanged) means C is down less than YD

save less now because C^e down

S^N: ambiguous

What happens to BD is ambiguous

ATRW: down

may appear ambiguous because W/P up, $\frac{1-t}{1+s}$ is down

however, MUC * ATRW = MDUN

MDUN is down because N is down

MUC is up because C is down

So ATRW is down

$N^{s,e}$: up

$$MUC^{e} * \frac{W^{e}}{P^{e}} \frac{1-t^{e}}{1+s^{e}} = MDUN^{e}$$

MUC^{e} is up because C^{e} is down

$\frac{W^{e}}{P^{e}} \frac{1-t^{e}}{1+s^{e}}$ is unchanged

=> $MDUN^{e}$ is up => $N^{s,e}$ up

Note: Is it possible that $N^{s,e}$ up raises YD^{e} enough to invalidate the result above that C and C^{e} are down?

No.

If C^{e} were not down it would not be optimal for $N^{s,e}$ to increase.

And if C^{e} is down then C must be down.

U: down

May appear ambiguous because while C & C^e are down (which lowers utility) and $N^{s,e}$ is up (which lowers utility), N is down (which increases utility).

However, it can be shown that utility unambiguously falls.

To see this, let $C_*$and C_*^e be the optimal amounts of current and expected future consumption that could be purchased if (i) the tax rate was t_0; and (ii) current and expected future labor supply were N_1 and N_1^e.

Then $U(C_0, C_0^e, N_0, N_0^e; t_0) > U(C_*, C_*^e, N_1, N_1^e; t_0) > U(C_1, C_1^e, N_1, N_1^e; t_1)$

Where, moving left to right, (i) the first inequality is true by virtue of C_0, C_0^e, N_0 and N_0^e being the optimal plan when the income tax rate is t_0; and (ii) the second inequality is true because with a higher tax rate and the same amount of current and expected future labor supply, the utility value of current and expected future consumption must be lower.

Part C: Test Taking

1. The majority of the points on the exam will be questions from Part B

2. Read the question carefully. Make sure you answer what is asked but don't spend time answering what is not asked.

   Do not confuse the description of the article that serves as the basis for the question with the actual question being asked. The questions being asked are identified with a), b), … etc.

For example, here is a question from a previous midterm:

The October 25, 2016 issue of *The Wall Street Journal* contained an editorial entitled "A Vote for Trump Is a Vote for Growth" in which the authors write, "This raises the question: Why have interest rates gone down over the last eight years as the Obama-Clinton regime has doubled our national debt from $10 trillion to nearly $20 trillion."

a) According to the model developed in class, a model where there is no risk of the government defaulting on its debt, would we expect the expected real interest rate to be more closely connected to the size of government budget deficit or to the amount of government debt? Explain. (10 points)

b) Give an example of a "shock" (i.e. a change in one or more exogenous variables) that could, theoretically, cause the government budget deficit to rise and at the same time cause the expected real interest rate to fall. Explain your answer using the graphical analysis of the model developed in class. (20 points)

Do not comment on the statement in the paragraph before the text in a) and b) except to answer the questions embedded in a) and b).

3. When the question states (as most do), *"According to the economic model developed in class,"* make sure you base your answer on the model developed in class; do not answer based on your personal experience or your personal view of the world.

4. If you write something correct and irrelevant, you get zero points. If you write something incorrect, you lose points whether it is relevant or not.

5. If you get the right answer but do not *completely and correctly* justify your reasoning, you will not get full credit. For example, consider a problem where C rises and N rises, you are asked what happens to U, and the correct answer is that U rises because the increased utility from higher C is more important than the decreased utility from higher N. If you answer C rises so U rises, you will not get full credit. This is the right answer, but the justification is not complete. The justification only becomes *complete and correct* when discussion of N is also included.

6. My answers to old exam questions can be more thorough than what I expect from you; the exam plus my answers are intended to help you learn material.

7. Although my answers to old exam questions don't have graphs, you need to include them. The graphs are omitted from my answers, and replaced with words that describe the graphs, in order to conserve space.

8. When the exam asks you to use graphs and words to explain your answer that means (i) use graphs to show what the correct answer is for "easy" endogenous variables; (ii) use information like definitions, key equations, or the most famous equation in macro to determine what the correct answer is for "hard" exogenous variables; and (iii) pass the significant other test - use words to provide intuition about why that is the answer.

9. Questions are written to distinguish between four types of students:

D) Understand some, but not all, of what was covered in class and lecture notes.

C) Understand what was covered in class and lecture notes, but are unable to analyze anything not previously explained.

B) Understand what was covered in class and lecture notes, plus can do simple things that have not been previously explained.

A) Understand what was covered in class and lecture notes, plus can do complicated things that have not been previously explained.

10. From your point of view, it is helpful to distinguish between:

a) questions that test your knowledge about definitions or a piece of the overall model

b) questions that test about your ability to apply the entire model to the real word

Furthermore, questions about the applying the entire model can be

b1) questions that test your ability to change exogenous variables and determine the change in endogenous variables.

solve the model forward

use the Recipe for Success

b2) questions that test your ability to diagnose what changes in exogenous variables caused a particular observed pattern in endogenous variables.

solve the model backward

no uniform approach, like solving for hard endogenous variables in the Recipe for Success, need to consider all the tools in your toolbox.

b3) questions that test your ability to extend the model beyond what has been covered in class and the notes.

11. When in doubt about what a question is asking, ask the professor for clarification before you answer.