14.02 FINAL EXAM REVIEW

THE STATIC MODEL

AGGREGATE SUPPLY

PF THE PRODUCTION FUNCTION
\[ y = A^*N = A^*L^*(1-u) \] as \( u = U/L \) and \( N + U = L \)
Each unit of output requires \((1/A)\) units of labor
Since cost of labor is \( W \) the marginal cost of production (MC) is \( W/A \)

THE LABOR MARKET

WS Wage-Setting (“Labor Supply”)
\[ W = P^*(1 + z - \alpha^*u) \]
Price-expectations important for wage-setting as workers care about real wages
More unemployment benefits \((z)\) increase the benefits of not working, raising wage demands for working
More unemployment \((u)\) reduces the bargaining power of workers as they become easier to replace, reducing wage demands
Shifts in WS curve: what happens to wage demands holding the unemployment rate constant?

PS Price-Setting (“Labor Demand”)
\[ P = (1+\mu)^*MC = (1+\mu)^*W/A \]
\[ W = A^*P/(1+\mu) \]
Shifts in PS curve: what happens to wages holding the unemployment rate constant?

Equilibrium
Long-run: Natural rate of unemployment
Price expectations correct
Determined ONLY by the markup, technology, unemployment, and \( \alpha \)
Short-run: Price expectations incorrect
Adjustment to long-run depends on how price expectations change
Adaptive price expectations \((P_t^e = P_{t-1} \Leftrightarrow \Pi_t^e = 0)\)
Two types of unemployment: structural through the natural rate and business-cycle through expectations being wrong.

SUPPLY
Simply labor-market equilibrium combined with the production function to map equilibrium unemployment rate into output through \( y = A^*L^*(1-u) \)
Natural level of output \((y_n)\) simply consistent with natural rate of unemployment \((u_n)\)
Intuition is that in order to produce more output, must reduce unemployment rate by PF, which increases wages (in amount depending on \( \alpha \)) by WS, which increase prices by PS.
Slope of the AS curve depends on \( \alpha \); IS-LM analysis presumes \( \alpha = 0 \) \( \Leftrightarrow \) AS horizontal.
Shifts in AS curve: What happens to the equilibrium unemployment rate in WS-PS space holding prices constant? Use PF to map \( \Delta u \) into \( \Delta Y \): \( P^*, \mu, z \) are ONLY shifters.
Note all but \( \Delta P^e \) also change \( u_n \) and thus \( y_n \).
AGGREGATE DEMAND

IS
THE GOODS MARKET
Slope \( (dr/dy) \) is simply \( 1/[m_g \cdot \delta ZZ/\delta r] \) where \( m_g \) is multiplier and \( ZZ \) is goods demand
Shifts in IS curve: What happens to the equilibrium goods market output holding interest rates constant? Includes: \( T, G, E, Y^*, c_0, i_0, \ldots \)
With flexible exchange rates and perfect capital markets, substitute uncovered interest parity into \( NX(\varepsilon) = NX(E_e/[1+i – i^*]) \). Higher domestic interest rates require an appreciation, which reduces NX so demand is now MORE sensitive to changes in interest rates ☞ open economy/perfect capital markets IS curve flatter than closed economy.

LM
THE MONEY MARKET
Slope \( (dr/dy) \) is simply \(-1*[(\delta m_d/\delta y)/(\delta m_d/\delta i)]\)
Shifts in LM curve: what happens to the equilibrium money market interest rate holding output constant? Includes \( M^s, P \)
Credibly fixed exchange rates require \( i = i^* \), so \( M^s \) must keep interest rates constant and there is no scope for an independent monetary policy.

OPEN ECONOMY IS-LM POLICY
You should understand monetary and fiscal policy under three exchange rate regimes:
Fixed, flexible & perfect capital markets, flexible and imperfect capital markets

DEMAND
Simply equilibrium output from IS-LM
Intuition is higher prices increase money demand by increasing nominal income and the transactions motive for holding money, increasing interest rates and thus reducing investment. LM shifts back due to higher prices, move along IS.
In the open economy ALSO get shift back in IS as higher prices cause a real appreciation, reducing NX and reducing output from IS-LM further so open economy AD curve flatter than closed.
Shifters: simply what happens to equilibrium output in IS-LM holding prices constant?

POLICY EVALUATION WITH COMPARATIVE STATICS

DEMAND SHOCKS
Do NOT affect \( y_n \) or \( u_n \)

Short-Run (First Period)
A single shift of the IS or LM curve (through changes in \( G, T, E, M^s, \ldots \))
Changes equilibrium \( y^d \) from IS-LM holding prices constant
Shifts AD right or left by change in \( y^d \) at old price level
Changes prices to clear AS-AD
Price changes feedback effect on LM curve, mitigating change in output
Equilibrium \( y^d \) in IS-LM read from AS-AD with new AD curve
PS shifts due to price changes, changing the unemployment rate

Short-Run (Second Period)
AS shifts as price expectations change; In particular, AS curve must cross \( y_n \) at last period’s price because natural output occurs only when price expectations correct and expectations are adaptive AD does NOT shift anymore
The AS shift changes prices again in the same direction with feedback effect on LM curve and PS curve. Output is closer to \( y_n \) and unemployment is closer to \( u_n \).
This shift in prices will change expectations again next period.

Long-run
Price expectations are eventually correct where AS crosses AD at \( y_n \).
All demand shocks are neutral (do not affect \( y \) or \( u \)) in the long-run
IS shocks can have compositional effects on demand through long-run effects on interest rates
SUPPLY SHOCKS
Do NOT affect AD but do change \( y_n \) and \( u_n \)

Short-run (First Period)
A single shift in \( y_n \) and \( u_n \) (through changes in \( A, z, \mu \))
Also must have shift in AS curve; in particular, new AS curve must cross new \( y_n \) at the old price level for the same reason as above.
Prices change to clear AS-AD and output moves toward new \( y_n \)
Price changes feedback effect on LM curve, mitigating change in output
Equilibrium \( y^* \) in IS-LM read from AS-AD with new AD curve
PS shifts due to price changes, changing the unemployment rate towards new \( u_n \)

Short-Run (Second Period)
AS shifts as price expectations change; In particular, AS curve must cross the new \( y_n \) at last period’s price because natural output occurs only when price expectations correct and expectations are adaptive
The AS shift changes prices again in the same direction with feedback effect on LM curve and PS curve. Output is closer to the new \( y_n \) and unemployment is closer to the new \( u_n \).
This shift in prices will change expectations again next period.

Long-run
Price expectations are eventually correct where AS crosses AD at the new \( y_n \).
Supply shocks are NOT neutral, affecting both \( y \) and \( u \) in the long-run

INFLATION AND THE DYNAMIC MODEL

THE (MODIFIED) PHILLIPS CURVE \( \Pi_t = \Pi_t^* - \alpha*(u_t-u_n) \n\)
Derived using price-setting and wage-setting conditions
Simply a dynamic equation for Aggregate Supply == Labor Market Equilibrium
Adaptive expectations for prices imply expected inflation is zero
Intuition for the curve as follows:
Initially unemployment is at natural rate, inflation is positive and real wages constant. Lower unemployment is created by higher than expected inflation (demand shocks). Increases nominal wage growth as workers bargaining power increases. Increases inflation due to the constant markup of prices over wages. Increases wage growth next period through adaptive expectations for inflation. Increases inflation due to the constant markup…
Inflation is costly because it affects income distribution, creates distortions and increases uncertainty
See attached graphics for AS-AD motivation

OKUN’S LAW \( \Delta u_t = -\beta*(g_y^*-g_y^*) \)
Simply dynamic form of linear production function
\( y_t = A_t^*N_t = A_t^*L_t^*(1-u_t) \) where \( g_y^* = g_A + g_L \)
Output can only grow faster than long-run growth if unemployment is falling
DYNAMIC AGGREGATE DEMAND
\[ g_{yt} = g_{mt} - \Pi_t \iff \Pi_t = g_{mt} - g_{yt} \]
\[ \gamma^d_t = \gamma^r(M_t/P_t) \]
Assume demand depends ONLY on the real money supply
Inflation is always and everywhere a monetary phenomenon
Intuition in AS-AD space is \( y_n \) shifts right by trend output growth while AD shifts right by money growth. When money growth is faster, prices increase every period, creating inflation.

DISINFLATION
Can reduce inflation only through slower money growth
If inflationary expectations are slow to adjust then excess unemployment in short-run
Intuition in AS-AD space is the long-run AS shifts right due to trend growth AND expected inflation; slower money growth slows shift in AD but slowing of AS takes time
See attached graphics for AS-AD motivation
Slope of aggregate supply == sensitivity of wage demands to unemployment rate crucial
As wage demands more sensitive, small change in unemployment moves wages and prices a lot so the “sacrifice” to reduce inflation is small
A credible disinflation program (convincing workers to revise inflationary expectations downward) could avoid these short-run costs
Pre-existing wage contracts which reflect “old expectations” could prevent from changes in these expectations to matter
Increasing indexation of wages to prices makes the AS curve steeper by making it easier to change prices without changing the unemployment rate by “effectively” increasing \( \alpha \).
\[ \Pi^t = \Pi^*_{t} + \lambda^*\Pi_t \Rightarrow \Delta \Pi_t = -\alpha/(1-\lambda^*)*(u_t-u_n) \]

THE ROLE FOR MONETARY POLICY IN THE SHORT-RUN
Twin objectives of price stability (low inflation) and full employment (u = u_n)
In the long-run: can only affect inflation
In the short-run: exploit trade-offs between unemployment rate and changes in inflation to moderate shocks to supply and demand

The US Situation
Surely u < u_n and FED increased interest rates three times in last year