Macroeconomics
Exam Review

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"Once one starts thinking about the development puzzles, every other question in economics sounds second-order." - Bob Lucas

1 Lent Mock Revision Notes

1.1 IS / LM

- IS:

$$y = c^d(y - \tau_1 y - \tau_0, \frac{M+B}{P} + kq, e\frac{P^*}{P}) + i(R - \hat{P}^e, y, k) + g + x(y^*, e\frac{P^*}{P}).$$

- LM:

$$\frac{M^s}{P} = m^d[R, y, \frac{M+B}{P} + kq].$$

- Differentiating the new IS curve,

$$\begin{aligned} dy &= c^d_{y_d}[(1-\tau_1)dy - d\tau_0 - yd\tau_1] + c^d_a[\frac{dM+dB}{P} - (m+b)\frac{dP}{P} + qdk + kdq] \\ &+ c^d_s[\frac{e}{P}dP^* + \frac{P^*}{P}de - e\frac{P^*}{P^2}dP] \\ &+ i_r[dR - d\hat{P}^e] + i_y dy + i_k dk \\ &+ dg \\ &+ x_s[\frac{e}{P}dP^* + \frac{P^*}{P}de - e\frac{P^*}{P^2}dP] + x_{y^*}dy^*. \end{aligned}$$

- Total differential of the LM curve:

$$\frac{dM}{p} - m\frac{dP}{P} = m_R dR + m_y dy + m_a[\frac{dM+dB}{P} - (m+b)\frac{dP}{P} + qdk + kdq].$$

- The total differential in Matrix form:

$$\begin{bmatrix} 1 - c^d_y(1-\tau_1) - i_y & -i_r \\ m_y & m_R \end{bmatrix} \begin{bmatrix} dy \\ dR \end{bmatrix} = \tag{1}$$

$$\begin{bmatrix} 1 & -c^d_y & -yc^d_y & \frac{c^d_a}{P} & \frac{c^d_a}{P} & -i_r & \frac{-c^d_a(m+b)-s(c^d_s+x_s)}{P} & \frac{s(c^d_s+x_s)}{P^*} & \frac{s(c^d_s+x_s)}{e} & x_{y^*} \\ 0 & 0 & 0 & \frac{1-m_a}{P} & -\frac{m_a}{P} & 0 & -\frac{m-m_a(m+b)}{P} & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} dg \\ d\tau_0 \\ d\tau_1 \\ dM \\ dB \\ d\hat{P}^e \\ dP \\ dP^* \\ de \\ dy^* \end{bmatrix}. \tag{2}$$

- Fiscal Multiplier:

$$\frac{dy}{dg} = \varphi = \frac{1}{(1 - c_y(1-\tau_1) - i_y) + \frac{m_y}{m_R} i_r} = \frac{1}{\alpha + \beta} > 0.$$

- Money Multiplier:

$$\left.\frac{dy}{dM}\right|_{OMO} = \mu = \frac{i_r}{m_R} \frac{1}{P(\alpha + \beta)} > 0.$$

- Note $s = e\dfrac{P^*}{P}$.

- Aggregate Supply:

$$Keynesian\ Closed: \quad y\left(\frac{\bar{W}}{P}\right).$$

$$Classical\ Closed: \quad y\Big(k\Big).$$

$$Keynesian\ Open: \quad y\Big(P, W, k\Big) \Longrightarrow \frac{dy_k}{dP} = y'_k > 0.$$

$$Classical\ Open: \quad y\Big(k, s\Big) \Longrightarrow \frac{dy_c}{dP} = y'_c(-s/P) > 0.$$

- Labor Supply in open classical case:

$$L^s = l\left[\frac{W}{P^{1-\theta}(eP^*)^\theta}\right].$$

  Where θ is the import share of the economy.

- Mundell - Flemming:

$$\left\{\begin{array}{l|l|l|l} \bar{e} + y_k & AS + IS & \varphi > 0 & \mu = 0 \\ \bar{e} + y_c & AS + IS & \varphi > 0 & \mu = 0 \\ e + y_k & AS + LM & \varphi = 0 & \mu > 0 \\ e + y_c & AS + LM & \varphi > 0 & \mu = 0 \end{array}\right. \tag{3}$$

1.2 Shapiro-Stiglitz "Shirking Model"

- Definitions:

$$\tilde{w} \equiv \text{ Unemployment Benefit.}$$

$$\bar{e} \equiv \text{ High Effort Required.}$$

$$r \equiv \text{ Interest Rate.}$$

$$s \equiv \text{ Probability of Losing Job.}$$

$$h \equiv \text{ Probability of Finding Job.}$$

$$q \equiv \text{ Probability of Caught Shirking.}$$

- Thus the Non-Shirking Wage:

$$W_{NS} = \tilde{w} + \bar{e} + \frac{(r + \frac{s}{h})\bar{e}}{q}.$$

1.3 The Solow Model

- Growth Rates.

$$\frac{\dot{K}}{K} = \frac{\dot{Y}}{Y} = a + n.$$

$$\frac{(\dot{Y/K})}{Y/K} = 0.$$

$$\frac{\dot{K/N}}{K/N} = \frac{\dot{Y/N}}{Y/N} = a.$$

2 Final Exam Revision Notes

2.1 Dynamics

Consider the following table for transitional Dynamics:

	Jump	Phase Lines	Stable Arm	Equilibrium
Immediate Permanent	Full	–	New	New
Immediate Temporary	1/2	New	Old	Old
Annoucement Permanent	1/2	Old	New	New
Annoucement Temporary	1/2	New	Old	Old

2.2 Growth Facts

- 1) Y/K or y/k grow at a constant rate.
- 2) y and k grow at a constant rate.
- 3) $r = MP_K - \delta$ is constant.
- 4) $w = MP_L$ grows at a constant rate.
- 5) Convergence.

2.3 Multipliers

- Fiscal:
$$\frac{dy}{dg} = \frac{1}{\alpha + \beta}.$$
- Money:
$$\frac{dy}{dM} = \frac{1}{\alpha + \beta} \cdot \frac{i_r}{Pm_r}.$$
- Where:
$$\alpha = 1 - c_y^d(1 - \tau_1) - i_y.$$
$$\beta = \frac{i_r m_y}{m_R}.$$

2.4 Mundell Matrices

- Fixed Exchange Rates. LM endogenous. Endogenous variables: y,P, and M. Assume $C_a = m_a = 0$.
$$\begin{bmatrix} \alpha & \frac{s}{P}(C_s + X_s) & 0 \\ m_y & \frac{m}{P} & -\frac{1}{P} \\ 1 & -y'_k \bowtie y'_c \frac{s}{P} & 0 \end{bmatrix} \begin{bmatrix} dy \\ dP \\ dM \end{bmatrix} = \begin{bmatrix} \frac{s}{P^*}(C_s + X_s) \\ 0 \\ 0 \bowtie y'_c \frac{s}{P^*} \end{bmatrix} dP^*. \quad (4)$$

Thus,

$$\left.\frac{dy}{dP^*}\right|_{\bar{e},y_c} = 0.$$

$$\left.\frac{dy}{dP^*}\right|_{\bar{e},y_k} > 0.$$

- Flexible Exchange Rates. IS endogenous. Endogenous variables: y,P, and e. Assume $C_a = m_a = 0$.

$$\begin{bmatrix} \alpha & \frac{s}{P}(C_s + X_s) & -\frac{s}{e}(C_s + X_s) \\ m_y & \frac{m}{P} & 0 \\ 1 & -y_k' \bowtie y_c' \frac{s}{P} & 0 \bowtie -\frac{s}{e} y_c' \end{bmatrix} \begin{bmatrix} dy \\ dP \\ de \end{bmatrix} = \begin{bmatrix} \frac{s}{P^*}(C_s + X_s) \\ 0 \\ 0 \bowtie y_c' \frac{s}{P^*} \end{bmatrix} dP^*. \qquad (5)$$

Thus,

$$\left.\frac{dy}{dP^*}\right|_{e,y_c} = 0.$$

$$\left.\frac{dy}{dP^*}\right|_{e,y_k} = 0.$$

2.5 "The Table"

		Markets Clear	
		Yes - Classical	No - Keynesian
Market Imperfection	Labor Product	Friedman (Worker Mispercept) Lucas Islands	Sticky Wage (Implicit Cont, Eff. Wage) Menu Costs

Note that the classical models never assume rational expectations as all models would fail under that assumption. R.E. is strictly a Keynesian idea. Critiques of the classical models involves the Policy Ineffectiveness Proposition (PIP). Critiques of the Keynesian models involve Caplin-Spulber's analysis of menu costs under aggregation: there should be no price jerkiness if $p_i - p_i^*$ is uniformally distrbuted so at any small demand shock, some proportion of firms will just be reaching the limits of their menu costs and will reoptimize. Thus nominal demand shocks are neutral at the aggregate level, even though they are non-neutral at the microeconomic level.

2.6 Other Incidentals

- Poole's Rules. If σ^2_{IS} is high, target a fixed money supply and let interest rates absorb shocks. If σ^2_{LM} is high, target a fixed interest rate and let the money supply absorb shocks.
- Liquidity Trap: $m_R = -\infty$.
- No wealth effects (IS horizontal in P, R space):

$$c_a = m_a = 0 \Longrightarrow \frac{dM}{dP} = m = \frac{M}{P} \Rightarrow \frac{dM}{dP}\frac{P}{M} = 1.$$

- Balance Budget (BB):

$$dg = yd\tau_1 + \tau_1 dy + d\tau_0.$$

- Open Market Operations (OMO):

$$dB + dM = 0.$$

- Classical labor supply:

$$L^s\Big|_{CLOSED} = l\Big(\frac{W}{P}\Big).$$

$$L^s\Big|_{OPEN} = l\Big(\frac{W}{P^{1-\theta}ep^{*\theta}}\Big).$$

- Quantity Theory of Money:

$$M \cdot V = P \cdot Y.$$

  Neutrality of Money principal:

$$\%\Delta M = \%\Delta P.$$

  Super-Neutrality of Money principal:

$$\frac{\dot{M}}{M} = \frac{\dot{P}}{P}.$$

  So when doing dynamics, prices and money should always converge in the long run.

2.7 Brainard Model

- We have aggregate demand as follows:

$$y = ag + bM + u.$$

  Where a and b are the fiscal and money mulipliers respectively. Thus,

$$E[y] = \bar{y} = \bar{a}g + \bar{b}M.$$

- We attempt to minimize:
$$E[(y - y^*)^2].$$
- Which yields FOCs:
$$\frac{\partial E[(y-y^*)^2]}{\partial g} = 2\sigma_a^2 g + 2\sigma_{ab} M + 2\bar{a}(\bar{a}g + \bar{b}M - y^*) = 0.$$
$$\frac{\partial E[(y-y^*)^2]}{\partial M} = 2\sigma_b^2 M + 2\sigma_{ab} g + 2\bar{b}(\bar{a}g + \bar{b}M - y^*) = 0.$$
- Thus we have several cases:
$$\begin{cases} 1a & \sigma_a^2 = 0, \sigma_b^2 > 0, \sigma_{ab} = 0 & \text{Leave } M \text{ unchanged and set } g \text{ to achieve } \bar{y} = y^*. \\ 1b & \sigma_b^2 = 0, \sigma_a^2 > 0, \sigma_{ab} = 0 & \text{Leave } g \text{ unchanged and set } M \text{ to achieve } \bar{y} = y^*. \\ 2 & \sigma_a^2 > 0, \sigma_b^2 > 0, \sigma_{ab} = 0 & \text{Use both to exploit trade off between risk and objective.} \\ 3 & \sigma_a^2 > 0, \sigma_b^2 > 0, \sigma_{ab} > 0 & \text{Use of both instruments is less effective in reducing risk.} \\ 4 & \sigma_a^2 > 0, \sigma_b^2 > 0, \sigma_{ab} < 0 & \text{If perfect inverse corrlation, obtain } y^* \text{ with no risk.} \end{cases} \tag{6}$$
Note that in case 4, if the correlation is less than perfect, then the optimal policy lies somewhere inbetween cases 4 and 2.
- It is wise to err on the side of caution in policy intervention and to pursue objectives by using small amount of many instruments rather than large amounts of one. Where appropriate, use policies where risks are offsetting.

2.8 Key Articles

2.8.1 Robert Lucas - Lucas Critique

- The inference that permanent inflation will therefore induce a permanent economic high is no doubt equally ancient, yet it is only recently that this notion that undergone the mysterious tranformation from obvious fallacy to cornerstone of the theory of economic policy.
- One idea is to simply dismiss questions of the long - term behavior of the economy under alternative policies and focus instead on obtaining what is viewed as desirable behavior in the next few quarters. The hope is that the changes in θ induced by policy changes will occur slowly and that conditional forecasting based on tracking models will therefore be roughly accurate for a few periods. The hope is both false and misleading. Some policy changes induce immediate jumps in θ.
- The preference for rules versus authority in economic policy making suggested by this point of view, is not, as I hope is clear, based on any demonstrable optimality properties of rules in general. There seems to be no theoretical argument ruling out the possibility that delegating economic decision-making authority to some individual or group might not lead to superior economic performance than is attainable under some, or all, hypothetical rules.

- Syllogism: Given that the structure of an econometric model consists of optimal decision rules of economic agents, and that optimal decision rules vary systematically with changes in the structure of series relevant to the decision maker, it follows that any change in policy will systematically alter the structure of econometric models.

- The ability to forecast the consequences of arbitrary unannounced sequences of policy decisions currently claimed by the theory of economic policy appears to be beyond the capability of not only the current generation models, but also of all conceivable future models.

2.8.2 Mankiw - Menu Costs

- The act of altering a posted price is certainly costly. These costs include such items as printing new catalogs and informing salesmen of the new price. Yet these menu costs are small and, therefore, generally perceived as providing only a weak foundation for these fixed price models. However, this is flawed.

- The central postulate is that a monopoly firm must incur a small menu cost if it alters its posted price after an aggregate demand shock. I show that the firm's price adjustment decisions are suboptimal. In addition, the welfare loss can far exceed the menu cost that is its cause.

2.8.3 Hall - Life Cycle - Permanent Income Hypothesis

- Optimization of the part of consumers is shown to imply that the marginal utilty of consumption evolves according to a random walk with trend.

- The major problem in empirical research based on the hypothesis has arisen in fitting the part of the model that relates current and past observed income to expected future income.

- Whe consumers maximize expected future utility, it is shown that the conditional expectation of future marginal utility is a function of today's level of consumption alone, all other information is irrelevant. In other words, apart from a trend, marginal utility obeys a random walk.

- The strong stochastic implication of the life cycle-permanent income hypothesis is that only consumption lagged one period should have a nonzero coefficient in such a regression. This implication can be tested rigorously without any assumptions about exogeneity.

- Consumption lagged more than one period has no predictive power for current consumption. Lagged income should have no explanatory power with respect to consumption.

- Previous reseach on consumption has suggest that lagged income might be a good predictor of currrent consumption, but this hypothesis is inconsistent with the intelligent

forward-looking behaviour of consumers that forms the basic of the permanent-income theory. Of course contemporaneous income has high explanatory value. Changes in stock prices lagged by a single quarter are found to have a measurable value in predicting changes in consumption.

- Key Regression:

$$c_t = 8.2[8.3] + 1.13[0.092]c_{t-1} - 0.040[0.142]c_{t-2} + 0.030[0.142]c_{t-3} - 0.113[0.093]c_{t-4}.$$

- The pure life cycle-permanent income hypothesis–that c_t cannot be predicted by any variable dated $t-1$ or earlier other than c_{t-1} – is rejected by the data. The stock market is valuable in predicting consumption 1 quarter in the future.

- Under the pure life cycle - permanent income hypothesis, a forecast of future consumption obtained by extrapolating today's level by the historical trend is impossible to improve. The results of this paper have the strong implication that beyond the next few quartes consumption should be treated as an exogenous variable. There is no point in forecasting future income and then relating it to income since any information available today about future income is already incorporated in today's permanent income.

- Policy affects consumption only as much as it affects permanent income.

2.8.4 Dornbush Model

- The perfect foresight path is derived and it is shown that along the path, a monetary expansion causes the exchange rate to depreciate. An initial overshooting of exchange rates is shown to derive from the differential in adjustment speeds of markets.

- In the short run, a monetary expansion is shown to induce an immediate depreciation in the exchange rate and account therefore for fluctuations in the exchnage rate and the terms of trade. Second, during the adjustment process, rising prices may be accompanied by an appreciating exchange rate so that the trend behavior of exchange rates stands potentially in strong contrast with the cyclical behavior of exchange rates and prices. The third aspect of the adjustment process is a direct effect of the exchange rate on domestic inflation. In this context the exchange rate is identified as a critical channel for the transmission of monetary policy to aggregate demand for domestic output.

- If real output is fixed, a monetary expansion will, in the short run, lower interest rates and causes the exchange rate to overshoot its long run depreciation. If output, on the contrary, responds to aggregate demand, the exchange rate and interest rate changes will be dampened.

- The analyis of a monetary expansion confirms once more that Mundell-Fleming result that under conditions of capital mobility and flexible rates, a small country can conduct, in the short run, an effectice monetary policy. More imporant, the exchange rate proves a critical channel for the transmission of monetary changes to an increase in aggregate demand and output. Unlike the M-F world, extension of the analysis to the long run shows that the effects of a monetary expansion are only transitory since the inflaiton that is induced by the output expansion serves to reduce real balances and thereby return interest rates, relative prices, and real income to their initial level.

2.8.5 Kydland and Prescott - Time Inconsistency

- Only if these expectations were invariant to the future policy plan selected would optimal control theory be appropriate. In situations in which the structure is well understood, agents will surely surmise the way policy will be selected in the future. Changes in the social object function reflected in, say, a change of administration, do have an immediate effect upon agents expectations of future policies and affect their current decisions.

- If we are not to attempt to select policy optimally, how should it be selected? Out answer is, as Lucas 76 proposed, that economic theory be used to evaluate alternative policy rules and that one with good operating characteristics be selected. In a democratic society, it is probably preferable that selected rules be simple and easily understood, so it is obvious when a policymaker deviates from the policy.

2.9 Notes from Summer Macro

- Absolute Convergence - Countries with smaller capital stock but otherwise similar economic structure should grow faster. Definition:

$$\frac{\dot{y}_t}{y_t} = f(y_t), \text{ where } f' < 0.$$

- Conditional Convergence - Convergence after controlling for the variables that influence steady-state capital. Defintion:

$$\frac{\dot{y}_t}{y_t} = f(y^* - y_t), \text{ where } f' > 0.$$

- The Solow growth model cannot explain differences in y in terms of savings or population growth rates. It cannot explain them in terms of differences in k either, because income levels differ much more than capital levels do. Thus differences in y must be explained in terms of differences in A. But this is exogenous.

- The Solow model implies that growth rates can differ only in the transition to steady state. It cannot explain persistent differences. Can explain short episodes of fast growth, following a shift in the underlying steady state. These results are due to

diminishing returns to capital. Capital accumulation eventually stops because its rate of return declines as it accumulates. Endogenous growth models bypass this problem by finding reasons for non-diminishing returns to aggregate captial. For example: $f(k) = Ak$ implies $g_k = sA - (n + \delta)$.

2.9.1 The Ramsey Model

- Social planning Problem.
  Maximize:
  $$\int_0^\infty e^{-\rho t} u(c) dt.$$
  Subject to:
  $$\dot{k} = f(k) - c - (n + \delta)k.$$
  Think of $\dot{k}$ as net investment and $f(k) - c$ as savings. The whole constraint is the firm's production constraint.

- Hamiltonian with co-state variable, λ.
  $$\mathbb{H} = e^{-\rho t} u(c) + \lambda \Big[f(k) - c - (n + \delta)k \Big].$$

- Euler Conditions:
  $$\frac{\partial \mathbb{H}}{\partial c} = 0 \Longrightarrow e^{-\rho t} u'(c) - \lambda = 0.$$
  $$\frac{\partial \mathbb{H}}{\partial k} = -\dot{\lambda} \Longrightarrow \lambda[f'(k) - (n + \delta)] = -\dot{\lambda}.$$

- Differentiaing the first condition with respect to time:
  $$-\rho e^{-\rho t} u'(c) + e^{-\rho t} u''(c)\dot{c} = \dot{\lambda}.$$

- Substituting λ and $\dot{\lambda}$ into the second condition:
  $$\lambda[f'(k) - (n + \delta)] = -\dot{\lambda}.$$

  $$e^{-\rho t} u'(c)[f'(k) - (n + \delta)] = \rho e^{-\rho t} u'(c) - e^{-\rho t} u''(c)\dot{c}.$$

  Simplifying,

  $$u'(c)[f'(k) - (n + \delta)] = \rho u'(c) - u''(c)\dot{c}.$$

  $$\dot{c}u''(c) = \rho u'(c) - u'(c)[f'(k) - (n + \delta)].$$
  $$\dot{c}u''(c) = u'(c)[\rho - f'(k) + (n + \delta)].$$

$$\dot{c}u''(c) = u'(c)[-f'(k) + n + \delta + \rho].$$
$$\dot{c} = \frac{u'(c)}{u''(c)}[-f'(k) + n + \delta + \rho].$$

Note $\theta = -\frac{cu''(c)}{u'(c)}$. (The Coeffificient of Relative Risk Aversion.)

$$\dot{c} = -\frac{c}{\theta}[-f'(k) + n + \delta + \rho].$$
$$\dot{c} = \frac{c}{\theta}[f'(k) - (n + \delta + \rho)].$$
$$\frac{\dot{c}}{c} = \frac{f'(k) - (n + \delta + \rho)}{\theta}.$$

- Thus equilibrium is determined by the two equations:

$$\dot{k} = f(k) - c - (n + \delta)k.$$
$$\frac{\dot{c}}{c} = \frac{f'(k) - (n + \delta + \rho)}{\theta}.$$

- In steady state, $\dot{k} = \dot{c} = 0$. Thus,

$$c = f(k^*) - (n + \delta)k^*.$$
$$f'(k^*) = n + \delta + \rho.$$

- In k, c space, the $\dot{k} = 0$ locus is an inverted parabola. Increasing for small values of k up to some point where c is maximized (The Golden Rule) and then declining afterwards. Notice that $\dot{c} = 0$ does not depend on c so the locus of points is a vertical line at some level, k^*. The intersection of the two stationary lines gives us a capital consumption combination k^*, c^*. c^* is referred to as the "Modified Golden Rule" or the "Ramsey Solution." Consumers are more impatient in the Ramsey problem so they do not save enough to reach the Golden Rule. Since $f'(k) = r + \delta$ in competitive equilibrium, the Golden Rule requires $r = n$ or equality between the rate of return on capital and the growth rate of output.

2.9.2 Theory of Endogenous Growth

- Proposition I: An economy displays endogenous growth if one can define a set of reproducible goods which are produced with a technology that displays (at least) constant retruns in that same core of goods.

- Proposition II: Increasing returns to scale are necessary for endogenous growth only if a non-reproducible factor participates into production of the reproducible inputs.

- The Romer Model. Consider the production function:

$$Y = K^{\alpha}(AL)^{1-\alpha}.$$

Dividing by L,

$$y = K^{\alpha}A^{1-\alpha}L^{-\alpha}.$$
$$y = k^{\alpha}A^{1-\alpha}.$$

Assume that A is embodied such that $A = \lambda k$. Thus,

$$y = k^{\alpha}(\lambda k)^{1-\alpha} = \lambda^{1-\alpha}k.$$

Divide by A,

$$\tilde{y} = \frac{\lambda^{1-\alpha}k}{\lambda k} = \lambda^{-\alpha}.$$

Now consider capital accumulation:

$$\dot{K} = sY - \delta K.$$

Divide by K,

$$\frac{\dot{K}}{K} = s\frac{Y}{K} - \delta.$$
$$\frac{\dot{K}}{K} = s\frac{y}{k} - \delta.$$
$$\frac{\dot{K}}{K} = s\lambda^{1-\alpha} - \delta.$$
$$\frac{\dot{K}}{K} = s\lambda^{1-\alpha} - \delta.$$
$$\frac{\dot{\tilde{k}}}{\tilde{k}} = s\lambda^{1-\alpha} - (\delta + n + a).$$

Let $\theta = \lambda^{1-\alpha}$. Thus,

$$g = s\theta - (\delta + n + a).$$

Implications:
Non-convergence. Low income countries do not necessarily grow faster.
Growth rate depends on the savings rate.
Higher population growth, n, implies slower growth in output per capita (poverty traps).

2.10 Problem Set Shorts

- The presence of the real interest rate in determining labor supply.

$$L^s = l(W/P, r).$$

Intertemporal Labor Substitution. As r increases, the future is discounted at a higher rate so you want to earn more now. Your return on working more now and investing your income is higher. Also higher r means that mortgage payments are higher which would also encourage someone to work more now. Resulting Supply function:

$$y = F(L, k) = F[g(r, k), k] = y(r, k).$$

$$y_r = F_L g_r > 0.$$

$$y_k = F_L g_k + F_k > 0.$$

- T/F "The **new classical model** predicts that past values of monetary growth should not affect real activity." TRUE. However you could easily explain real efects with a persistance argument. Usually we assume that only supply and demand shocks can have real effects. Suppose however that yesterday's policy decisions affect tomorrow's real output levels because of persistance, or otherwise called the "Accelerator Effect." We could also look for granger causality by running the regression:

$$y_t = \alpha + \beta_1 y_{t-1} + \beta_2 m_{t-1} + \epsilon_t.$$

If we also have the suprise supply function:

$$y_t = \alpha + \beta(p_t - p_t^e) + \gamma y_{t-1},$$

β_2 would not be significant because γ captures output persistance.

- T/F "The **Lucas - Sargent - Wallace Neutrality Proposition**: anticipated fiscal policy is uneffective." TRUE. If fiscal shocks are full anticipated, they are uneffective, however, though output doesn't change levels, the composition of output will change through the crowding out effect. So as $g \uparrow$, this causes $R \uparrow$, which causes $i \downarrow$ which means that potential output, $\bar{y}$, falls. The classical view is that this happens in the long run. Keynes says we are all dead in the long run.

- T/F "**Rational Expectations** suggests that macro policy has no effects." FALSE. Need more than R.E. to get policy ineffectiveness. The observed correlation between money growth and real magnitudes is NOT inconsistent. The unexpected parts of monetary growth still cause real efects even under R.E.

- **Implicit Contracts**. The idea behind implicit contracts is that firms choose the number of workers to hire and their wages before knowing thow profitable business will be. (ie, without knowing the future state of the world.) Therefore they pay some median wage, which is usually below the workers marginal product. Workers see this

as sort of wage insurance because being risk averse, they would prefer to have one set wage all the time then to have high wages in some periods and low wages in other periods. There is an inefficiency because in the bad state of the world, firms employ too many workers. In the absense of severence payments, the implicit contracts model does NOT provide a basis for Keynesian macroeconomics. We do find a basis for real wage rigidities but not for nominal rigidities. We also get less variability in employment then with market clearly wages. Overall, implicit contracts rely on perfect information which is a poor assumption so we solve this with efficiency wages.

- T/F "If shirking workers are always detected (perfect monitoring) in the **Shapiro Stiglitz Non-Shirking model**, then this model produces NO unemployment." FALSE. With perfect monitoring, unemployment is lowered but not eliminated. No workers would shirk because they would always be caught. The residual unemployment is frictional because a proportion of workers will lose their job anyway because shit happens.

- **Bitsakakis's Ramblings** ... New Keynesian Macroeconomics relies on the observation that markets normally do not clear. We see unemployment, poverty, unutilized capital, speculative money, etc. The notion that productive efficiency should not be the first priority because we can never reach it. Instead focus on distributive justice. Key question that New Keynesians try to answer: "What is the cause of persistent unemployment above the natural rate?"

- **Taylor Expansion:**

$$f(x^* + b) = \frac{f(x^*)}{0!} + \frac{f'(x^*)b}{1!} + \frac{f''(x^*)b^2}{2!} + \cdots + \frac{f^{(n)}(x^*)b^n}{n!} + \underbrace{\frac{f^{(n+1)}(x^*)b^{n+1}}{(n+1)!}}_{R_{n+1} \equiv Residual}.$$

  Additional terms beyond f' are usually insignificant.

- **Uncovered Interest Rate Parity** (UIRP):

$$1 + i = (1 + i^*)\left[\frac{E_t[e_{t+1}]}{e_t}\right].$$

- **Covered Interest Rate Parity** (CIRP):

$$i = i^*\left[\frac{E_t[e_{t+1}] - e_t}{e_t}\right].$$

- **Hall's Random Walk Hypothesis.** Under this hypothesis, changes in consumption are relative to *unexpected* changes in lifetime wealth/income. Consider,

$$C_t = KE_t[W_t].$$

With,

$$W_t = A_{t-1} \sum_{s=t}^{T} \frac{Y_s}{(1+r)^{s-t}}.$$

Thus,

$$C_t - E_{t-1}[C_t] = K\Big(\underbrace{E_t[W_t] - E_{t-1}[W_t]}_{\text{\textit{News} about total wealth}} \Big).$$

This *News* is equivalent to:

$$C_t = \alpha + \beta C_{t-1} + \epsilon_t \Longrightarrow C_t - E(C_t) = \underbrace{\epsilon_t}_{\text{Unexpected shocks}}.$$

- T/F "The **permanent income hypothesis** tells us that temporary tax changes have no effect on consumers' expenditure. Countercyclical stabilisation policy through variations in tax rates is thus impossible." FALSE. Though permanent income will not change with a temporary tax hike, it will alter the future trade off between consumption and leisure. It will effect intertemporal labor substitution. Thus taxes change the allocation of consumption across time, though not the overall level.

- What if we interpret Hall's theory as determing permanent or planned consumption with:

  $$C_t = C_t^P + C_t^T.$$

  Suppose we consider the following $AR(1)$ process on consumption:

  $$C_t^P = a + bC_{t-1}^P + \epsilon_t.$$

  Substituting for C_t^P above,

  $$C_t = a + bC_{t-1}^P + \epsilon_t + C_t^T.$$

  Sustituting out $C_{t-1}^P = C_{t-1} - C_{t-1}^T$,

  $$C_t = a + b(C_{t-1} - C_{t-1}^T) + \epsilon_t + C_t^T.$$

  $$C_t = \underbrace{a + bC_{t-1}}_{AR(1)} - \underbrace{bC_{t-1}^T + \epsilon_t + C_t^T}_{MA(1)}.$$

  So consumption follows an $ARMA(1,1)$.

- Circumstances where consumption is not determined by the life-cycle model:

  $$C_t = cY_t + \epsilon_t.$$

  And,

  $$Y_t = a + bC_{t-1}.$$

Implies,

$$C_t = c(a + bC_{t-1}) + \epsilon_t.$$

$$C_t = ac + cbC_{t-1} + \epsilon_t.$$

Which is another $AR(1)$ process where income is not in the function. Thus, since two different sets of circumstances produce the same $AR(1)$ process, Hall's test will suffer from Observational Equivalence and have NO power.

2.11 Past Exam Shorts

2.11.1 2001

- 1. Closed Economy, fixed wages, money demand depends on the level of consumption rather than income. T/F A tax increase could lead to a rise in equilibrium output.

  TRUE. A tax rise can be expansionary if the fall in the interest rate due to the fall in money demand (as disposable income is now lower) leads to a rise in investment that more than offsets the fall in consumption. Note:

  $$M^S = m^d(c, R, a).$$

  With $c = c((1 - \tau_1)y - d\tau_0)$. Differential:

  $$\frac{dM}{P} - \frac{m}{P}dP = m_R dR + m_a(...) + m_c(c_y((1 - \tau_1)dy - yd\tau_1 - d\tau_0)).$$

  So the tax increase shifts IS to the left because of the influence disposable income. The fall in disposable income shifts the LM to the right as money demand is now lower. This drives the interest rate down spurring investment shifting IS back to the right.

- 2. Observational Equivalence. What does it imply for rational expectations.

  Observational equivalence arises where two models of the economy yield the same reduced form relationships between macroeconomic variables. This is particularly a problem with RE models because expectations formations will include all relevant economic variables. REH can none the less be tested by observations around shifts in regimes which if REH is true will generate structural instability. The parameters in the model will change as people are smart enough to know how the regime has changed and what the new model of the economy will be.

- 3. Riskier assets need not generate a risk premium. ICAP.

  Convariance with consumption outcome that matters, and not a simple measure of risk.

$$Max_{\{C_s, A_s^i\}} \;\; E_t\left[\sum_{s=t}^{T} \frac{U(C_s)}{(1+\delta)^{s-t}}\right].$$

Subject to:

$$\begin{cases} (2a) & \sum_{i=0}^{n} A_s^i \leq \sum_{i=0}^{n}(1+r_s^i)A_{s-1}^i + Y_s - C_s \quad s = t, \ldots, T \\ (2b) & \sum_{i=0}^{n} A_T^i \geq 0 \end{cases} \tag{7}$$

$$(1+\delta)U'(C_t) = E_t\left[(1+r_{t+1}^i)U'(C_{t+1})\right].$$

Yields,

$$E_t[(1+r_{t+1}^i)] - r_{t+1}^0 = -\frac{Cov(1+r_{t+1}^i, U'(C_{t+1}))}{E_t[U'(C_{t+1})]}.$$

- 4. Rich countries are rich because they save more.

  Savings only affects levels, not growth rates of income. Should present Solow model showing the shift upwards in $sf(k)$ resulting in a higher level of output, but no change in the growth rate.

- 5. Solow - increase in growth rate of population.

  Standard Solow model representation.

- 6. SOE. Perfect capital mobility. Flexible exchange rate. Increase in g. How does this affect y under fixed and flexible nominal wages.

  FALSE. Under fixed nominal wages, an increase in government expenditure has no effect on output as it is completely offset by the exchange rate appreciation. ($e \downarrow$) Under flexible nominal wages output rises to due the supply side effects of the appreciation. Real wages rise as $e \downarrow$. Labor supply and therefore AS shift to the right. Higher output. Compute mulitplier use $AS + IS$ to determine y and e.

- 7. New Keynesian models ... how do small menu costs generate large output fluctuations?

  In the region of equilibrium, small menu costs can be sufficient to discourage individual **imperfectly competitive** firms from changing their prices in response to a change in demand. Firms do not take into account the effect of their individual decision on the aggregate price level. Include model.

2.11.2 2000

- 1. Closed economy. Under what conditions is an increase in expected inflation neutral in its effect on the economy under a) fixed wages and b) flexible wages.

  Under fixed prices / wages, the real interest rate will fall unless demand for money is interest inelastic (LM vertical). Consider (y,R) space. Under flexible prices, the IS curve is flat in (P,R) space (unelss there are wealth effects in which IS is downward sloping). Thus here if IS is flat or LM is verticle, we get neutrality. One or the other is sufficient. Otherwise if there are wealth effects and the LM curve is less than perfectly inelastic, the real interest rate will fall.

- 2. Suppose i_r is more UNCERTAIN. How would this affect the relative preference for the use of monetary or fiscal policy?

  First determine how the i_r term effects the two mulitpliers. It enters in the denominator of the fiscal multiplier so a rise in i_r decreases the effectiveness of fiscal policy. It does the opposite for monetary. Thus the covariance of the multipliers negatively covary in terms of i_r. Note this might change for other elasticities in the multipliers. Thus since the effectiveness of both multiplier is becoming more uncertain, optimal policy would be to reduce the amount of both used in policy (though not be as much as if the covariance was positive), but to NOT change the relative proportion of policies used. The variance changes but NOT the mean.

- 3. Rival goods vs excludable goods.

  Rival: Physical or intrinsic property, infinitely expandible. If a good is rival when my using it makes it impossible for you to use it too. Excludable: Legal or social property; protection so that decision can be made on who can and cannot use the good. If a good is exludable, I can prevent you from using it. Chart:

	Non-Excludable	Excludable
Rival	Shopping Mall Parking Spaces	Cookies
Non-Rival	Public good (sunsets)	Commercial Software

- 4. SOE. Perfect Capital Mobility. Flexible exchange rates and fixed money stock. Suppose consumption becomes more sensitive to the level of current income. How, it at all, will this alter the effectiveness of monetary and fiscal policy under both fixed and flexible exhange rates. What about fixed and flexible wages?

  So we have an increase in c_y. Therefore consider the mulitpliers:

$$\frac{dy}{dg} = \varphi = \frac{1}{(1 - c_y(1 - \tau_1) - i_y) + \frac{m_y}{m_R} i_r} = \frac{1}{\alpha + \beta} > 0.$$

$$\left.\frac{dy}{dM}\right|_{OMO} = \mu = \frac{i_r}{m_R}\frac{1}{P(\alpha+\beta)} > 0.$$

So the relative effectiveness is given by:

$$\frac{\varphi}{\mu} = \frac{\frac{1}{\alpha+\beta}}{\frac{i_r}{m_R}\frac{1}{P(\alpha+\beta)}} = \frac{m_R P}{i_r}.$$

Thus the relative effectiveness is uneffected. Individually however, note from M/F that money is uneffective under fixed change rates and fixed or flexible wages and it is also uneffective under a flexible x-rate and flexible wages. Fiscal policy is impotent under flexible exchange rates and fixed wages, but is potent and increasing when c_y rises. (Enters negatively in the denominator of φ inside the α term.) The final case to consider is monetary policy under flexible exchange rates and fixed nominal wages. Here (case 3 of MF), monetary policy is potent. However, c_y does NOT enter the multplier in this form!! See below:
Cases I and II

$$\begin{bmatrix} \alpha^* & \frac{s}{P}(c_s + x_s) & 0 \\ m_y & \frac{m}{P} & -\frac{1}{P} \\ 1 & -y'_k \text{ or } \frac{s}{P}y'_c & 0 \end{bmatrix} \begin{bmatrix} dy \\ dP \\ dM \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} dg. \tag{8}$$

For cases III and IV:

$$\begin{bmatrix} \alpha^* & \frac{s}{P}(c_s + x_s) & \frac{P^*}{P}(x_s + c_s) \\ m_y & \frac{m}{P} & 0 \\ 1 & -y'_k \text{ or } \frac{s}{P}y'_c & 0 \text{ or } -y'_c\frac{P^*}{P} \end{bmatrix} \begin{bmatrix} dy \\ dP \\ de \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & \frac{1}{P} \\ 0 & 0 \end{bmatrix} \begin{bmatrix} dg \\ dM \end{bmatrix} \tag{9}$$

- 5. See above.

- 6. Common economic idea that underlies the analysis of: inflationary biases in monetary policy; optimal capital taxation; and the design of systems for managing intellectual property?

  Time Inconsistency. When we impose a restiction on the model, such as the commitment approach, the result is actually less efficient which is counter-intuitive. Ways to get around time inconsistancies include reputation effects, constitutional rules, etc. Other example - MP3 market. Taxation. Goverments can finance deficits with taxes on fixed factors of production. Factors like labor might be persuaded to easily substitute leisure for work if an income tax was imposed but they could impose the tax on fixed imputs like capital. However, ex-ante people will also expect this and invest less in capital which is also not a first best soluation. This creates a DWL for society.

- Solow model. Where does it fail. What does it achieve.

Achieves: constancy of factor income shares $(1/3, 2/3)$. Constancy of Y/K and therefore equal growth in y and k. Predicts convergence of incomes across countries. Something not seen in the data. Technology, the solow residual, or TFP, accounts for some 90 percent of growth in some countries so clearly and exogenous growth model is inferior. Key failure: is Solow is that the returns to capital fall over time ... see notes from summer above.

2.11.3 Other Past Shorts

- 1. Richardian Equivalence: A bond-financed change increase in taxes is neutral because consumers save proceeds from tax cut to pay for subsequent tax increase when debt is redeemed. Requires perfect capital markets and infinitely lived consumers or optimising bequests.

- Suppose consumers have intertemporally separable VNM utility function with rate of time preference δ and inta- period felicity function of the form:

$$U(C_t) = \alpha C_t - \frac{\beta}{2} C_t^2.$$

What regression would you run to test the life cycle permanent income hypothesis with these preferences.

Intertemporal optimality in consumptoin requres:

$$E_t \left[\frac{1 + r_{t+1}}{1 + \delta} \frac{\partial U}{\partial C_{t+1}} \right] = \frac{\partial U}{\partial C_t}.$$

Thus from $U(C_t)$ above,

$$U'(C_t) = \alpha - \beta C_t.$$

Assuming $r_t = r$,

$$\left(\frac{1 + r}{1 + \delta} \right) \alpha - \beta C_{t+1} = \alpha - \beta C_t + \epsilon_{t+1}.$$

Hence run:

$$C_{t+1} = a_0 + a_1 C_t + a_2 X_t + u_{t+1}.$$

With X_t as any variable in consumer's information set and then test significance of a_2.

- Unpleasant Monetarist Arthmetic. Sarget and Wallace - undermines the view that inflation is solely a monetary phenomenon, because ultimately monetary growth is a fiscal phenomenon.

- What is the relation between consumption and income in cross section and in time series?

Follow Friedman's PIH. The life cycle model explain two important stylised facts about the cross section and time series consumption income relationship. In cross section (Y_i, C_i) the relationship is rather flat. This is because we are looking across households with those at the left at the beginning and end of the life cycle while those at the right end are in the middle. In time series (Y_t, C_t) the relationship is much steeper with a roughly unitary elasticity. This is because all cohorts are continuously aging with dying cohorts being replaced by richer new cohorts, ie the cross section distribution shifts up as the economy grows over time.