

PERFECT AND IMPERFECT COMPETITION MODELS OF LABOUR AND GOODS MARKETS — TUTORIAL 4

1. WE CAN USE A LAGRANGIAN TO SOLVE AN INFINITE-HORIZON REPRESENTATIVE CONSUMER MODEL. LET $U = \sum_{t=0}^{\infty} [\ln(C_t) - f(L_t)] \beta^t$ WHERE C_t IS CONSUMPTION IN PERIOD t , L_t IS LABOUR SUPPLY AND β IS THE DISCOUNT FACTOR. THE BUDGET CONSTRAINT COULD ~~BE~~

BE SPECIFIED AS $\sum_{t=0}^{\infty} \left[\left(\frac{1}{1+r} \right) C_t \right] \leq \sum_{t=0}^{\infty} \left[\left(\frac{1}{1+r} \right) W_t L_t \right]$

BUT THE PROBLEM IS THAT THIS ONLY WORKS IF r IS THE SAME IN EVERY PERIOD. IF r_t IS DIFFERENT IN EACH PERIOD THEN IT IS EASIER TO SPECIFY A

BUDGET CONSTRAINT $W_t L_t + (1+r_t) A_t \geq C_t + A_{t+1}$ IN EACH PERIOD. HENCE THE LAGRANGIAN BECOMES: (A_t IS ASSETS IN PERIOD t)

$$\mathcal{L} = \sum_{t=0}^{\infty} \left[\beta^t (\ln(C_t) - f(L_t)) \right] - \sum_{t=0}^{\infty} \left[\lambda_t (C_t + A_{t+1} - W_t L_t - (1+r_t) A_t) \right]$$

THE FOCs CAN THEN BE USED TO DERIVE THE INTRATEMPORAL LABOUR SUPPLY AND INTER-TEMPORAL CONSUMPTION AND LABOUR EULER EQUATIONS:

$$\frac{\partial \mathcal{L}}{\partial C_j} = (\beta^j) \left(\frac{1}{C_j} \right) - \lambda_j = 0 \quad \frac{\partial \mathcal{L}}{\partial L_j} = \beta^j \left(-\frac{\partial f}{\partial L_j} \right) + \lambda_j \cdot W_j = 0$$

$$\frac{\partial \mathcal{L}}{\partial C_{j+1}} = (\beta^{j+1}) \left(\frac{1}{C_{j+1}} \right) - \lambda_{j+1} = 0$$

$$\frac{\partial \mathcal{L}}{\partial A_{j+1}} = -\lambda_j + (1+r_j) \lambda_{j+1} = 0$$

$$\Rightarrow \lambda_{j+1} = \left(\frac{1}{1+r_j} \right) \lambda_j$$

COMBINING FOR C_j AND C_{j+1} WE GET

$$\beta^{j+1} \left(\frac{1}{C_{j+1}} \right) = \lambda_{j+1} = \left(\frac{1}{1+r_j} \right) (1) = \left(\frac{1}{1+r_j} \right) (\beta^j \left(\frac{1}{C_j} \right))$$

$$\Rightarrow \beta(1+r_j) = \frac{C_{j+1}}{C_j} \Rightarrow C_j = \frac{C_{j+1}}{\beta(1+r_j)}$$

THIS IS THE STANDARD CONSUMPTION EULER EQUATION WHERE IF r_j RISES C_j FALLS DUE TO INCREASED SAVING.

WE ARE MORE INTERESTED IN THE INTRATEMPORAL LABOUR SUPPLY HOWEVER. COMBINING THE FOCs ON CONSUMPTION AND LABOUR IN PERIOD j , WE GET:

$$\beta^j \frac{\partial F}{\partial L_j} = \beta^j \frac{w_j}{C_j} \Rightarrow w_j = C_j \left(\frac{\partial F}{\partial L_j} \right)$$

THE MOST LIKELY FUNCTIONAL FORM FOR THE COST OF LABOUR $F(L_j)$ FUNCTION WOULD BE EITHER COBB-DOUGLAS OR ISOELASTIC:

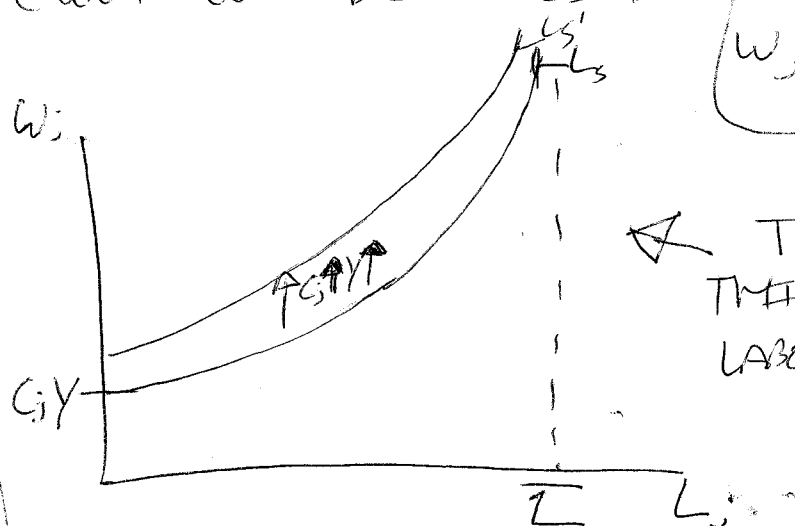
COBB-DOUGLAS: $U = \ln(C_t) + \gamma \ln(\bar{L} - L_t)$ (WHERE \bar{L} IS LEISURE ENDOWMENT AND $\bar{L} - L_t$ IS LEISURE)

$$\Rightarrow F(L_j) = ~~-\gamma \ln(\bar{L} - L_j)~~ - \gamma \ln(\bar{L} - L_j)$$

$$\Rightarrow \frac{\partial F}{\partial L_j} = (-1)(-\gamma) \left(\frac{1}{\bar{L} - L_j} \right) = \frac{\gamma}{\bar{L} - L_j}$$

SO THE INTRATEMPORAL LABOUR SUPPLY EQUATION BECOMES:

$$w_j = \frac{C_j \gamma}{\bar{L} - L_j}$$



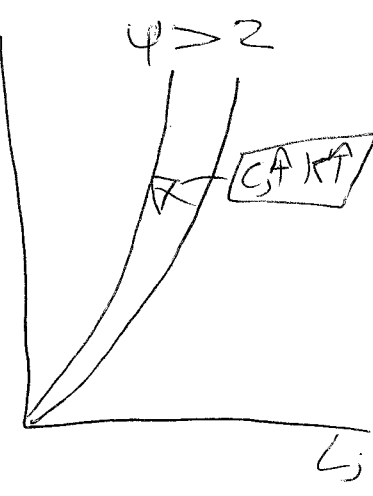
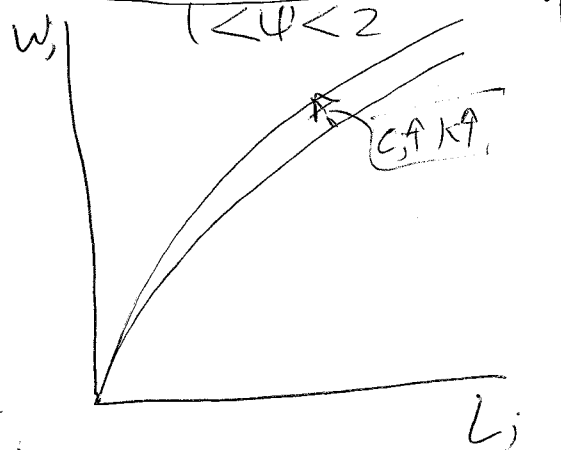
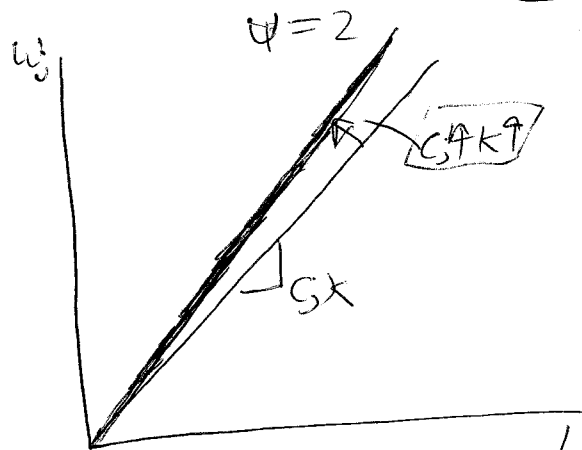
THIS LOOKS LIKE THIS. IF C_j OR γ RISES, LABOUR SUPPLY "SHIFTS" INWARDS/UPWARDS.

FOR AN ISOELASTIC LABOUR SUPPLY FUNCTION

$$f(L_i) = \frac{K}{\psi} (L_i)^\psi \Rightarrow f'(L_i) = K (L_i)^{\psi-1}$$

SO THE INTRATEMPORAL LABOUR SUPPLY EQUATION BECOMES:

$$(w_i = C_i) K (L_i)^{\psi-1}$$



K IS A PARAMETER WHICH INCREASES THE MARGINAL PRODUCT / COST OF LABOUR AND HENCE REDUCES LABOUR SUPPLY, CETERIS PARIBUS. AN INCREASE IN C_i MEANS HIGHER LIFETIME INCOME AND HENCE REDUCED LABOUR SUPPLY, CETERIS PARIBUS.

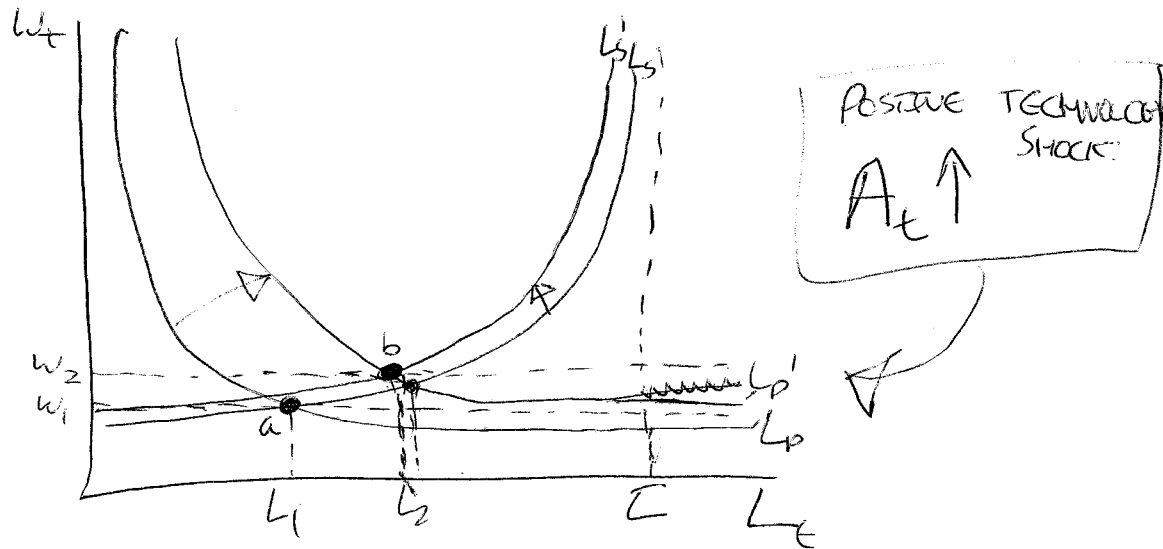
THIS TYPE OF INTERTEMPORAL LABOUR / CONSUMPTION MODEL ENABLES US TO EXPLAIN THE PROPAGATION MECHANISM FOR THE RBC TECHNOLOGY-SHOCK-DRIVEN BUSINESS CYCLE. IF WE ALSO ASSUME A COBB-DOUGLASS TECHNOLOGY:

$y_t = A_t K_t^\alpha L_t^{1-\alpha}$ SO THE LABOUR DEMAND CURVE IS THEN SIMPLY THE MPL:

$$L_t = \frac{\partial y}{\partial L} = A_t (1-\alpha) \left(\frac{K_t}{L_t} \right)^\alpha$$

ALSO, THE INTEREST RATE WILL BE $r_t = \frac{\partial y}{\partial K} - \delta$ (WHERE δ IS THE CAPITAL DEPRECIATION RATE) $\Rightarrow r_t = A_t \alpha \left(\frac{L_t}{K_t} \right)^{1-\alpha} - \delta$

WHEN A POSITIVE TECHNOLOGY SHOCK HAPPENS, THE MPL CURVE MOVES OUT. IF LABOUR SUPPLY IS QUITE ELASTIC THEN L_t RISES A LOT, w_t A BIT AND SO r_t ALSO RISES A LOT (SINCE THE INCREASE IN L_t REINFORCES THE INCREASE IN A_t) THIS HAS THE EFFECT OF DAMPENING THE INCREASE IN C_t , SO THE LABOUR SUPPLY ^{CURVE} ONLY MOVES UP A LITTLE BIT:



THIS CAN ONLY FIT THE EMPIRICAL EVIDENCE THAT REAL WAGE IS SLIGHTLY PROCYCLICAL, REAL INTEREST RATE STRONGLY PROCYCLICAL AND LABOUR SUPPLY / OUTPUT STRONGLY PROCYCLICAL IF THE LABOUR SUPPLY CURVE IS QUITE FLAT / ELASTIC.

SINCE CONSUMPTION IS SMOOTHED, THE INCREASED OUTPUT FROM THE "TAKEN A WHOLE THE SUN SHINES" EFFECT THEN MEANS THAT INVESTMENT AND FUTURE CAPITAL STOCK INCREASE:

$$Y = C + I + G$$

↑ ↑ ↑

$$K_t = I_{t-1} - \delta K_{t-1}$$

CAPITAL ACCUMULATION
IDENTITY

2. "THE EXISTENCE OF INVOLUNTARY UNEMPLOYMENT DEPENDS UPON THE PRESENCE OF IMPERFECT COMPETITION IN THE LABOUR MARKET, BUT ITS LEVEL MAY ALSO DEPEND ON IMPERFECT COMPETITION IN THE GOODS MARKET." EXPLAIN THIS STATEMENT.

THE NEW KEYNESIAN IMPERFECT COMPETITION MODEL OF THE LABOUR MARKET ENABLES THE INTERACTION BETWEEN THE GOODS MARKET AND THE LABOUR MARKET TO BE ANALYSED. THE PRICE SETTING (PS) CURVE IS DERIVED FROM FIRMS' PRICE-SETTING POWER IN IMPERFECT

MONOPOLISTIC COMPETITION. CONSIDER A GOODS MARKET SPLIT INTO N SECTORS, WITH AN OVERALL LEVEL OF AGGREGATE DEMAND A AND AN ISOLATED DEMAND FUNCTION SUCH THAT ~~THE DEMAND FUNCTION~~ $x_i(p_i) = A p_i^{-\epsilon}$.

HENCE PROFIT FOR THE MONOPOLY FIRM IN SECTOR i WILL BE $\pi_i = x_i(p_i)(p_i - c_i) = A p_i^{-\epsilon}(p_i - c_i)$

WHERE $c_i = \frac{w_i}{\alpha_i}$ IS THE MARGINAL COST OF PRODUCTION IN SECTOR i , AS THE RATIO OF NOMINAL WAGE TO THE MPL α_i . THUS PROFIT CAN BE SIMPLIFIED TO:

$$\pi_i = A p_i^{1-\epsilon} - A p_i^{-\epsilon} \left(\frac{w_i}{\alpha_i} \right)$$

TO MAXIMIZE: $\frac{d\pi_i}{dp_i} = (1-\epsilon)A p_i^{-\epsilon} - (-\epsilon)A p_i^{-\epsilon-1} \left(\frac{w_i}{\alpha_i} \right) = 0$

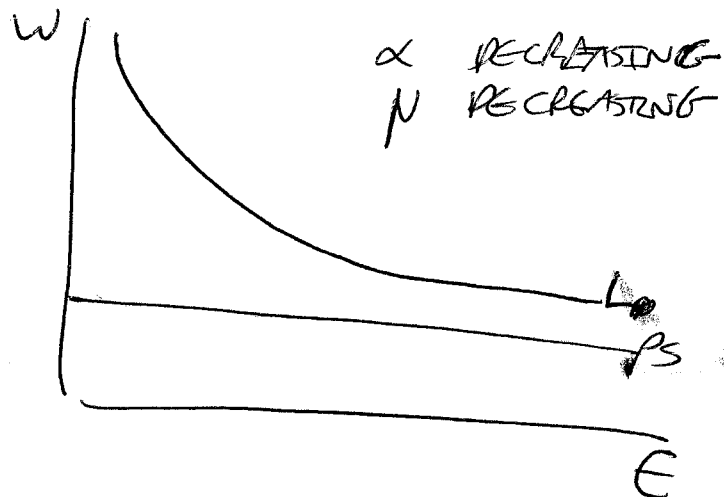
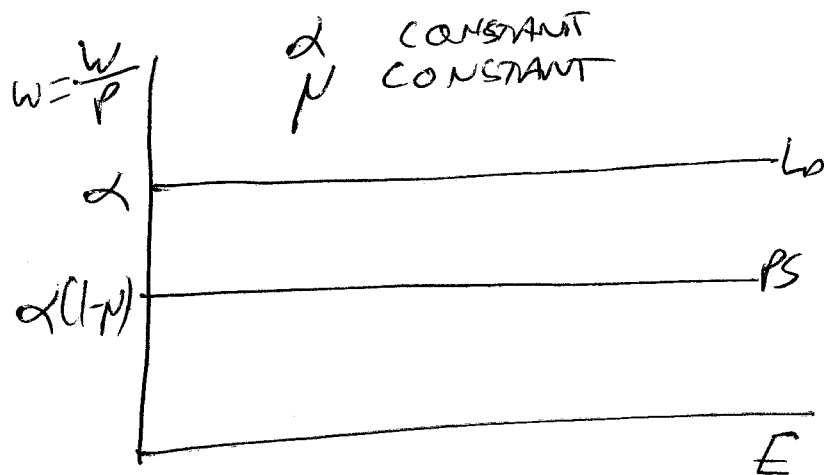
$$\Rightarrow p_i^{-\epsilon} = \left(\frac{\epsilon}{\epsilon-1} \right) \left(\frac{w_i}{\alpha_i} \right) p_i^{-\epsilon-1} \Rightarrow \frac{w_i}{\alpha_i} = \alpha_i \left(\frac{\epsilon-1}{\epsilon} \right) p_i$$

NOTE: ϵ IS THE ABSOLUTE ELASTICITY OF DEMAND SO THAT $\epsilon_D = -\epsilon$ AND $|\epsilon_D| = \epsilon$. THE REAL

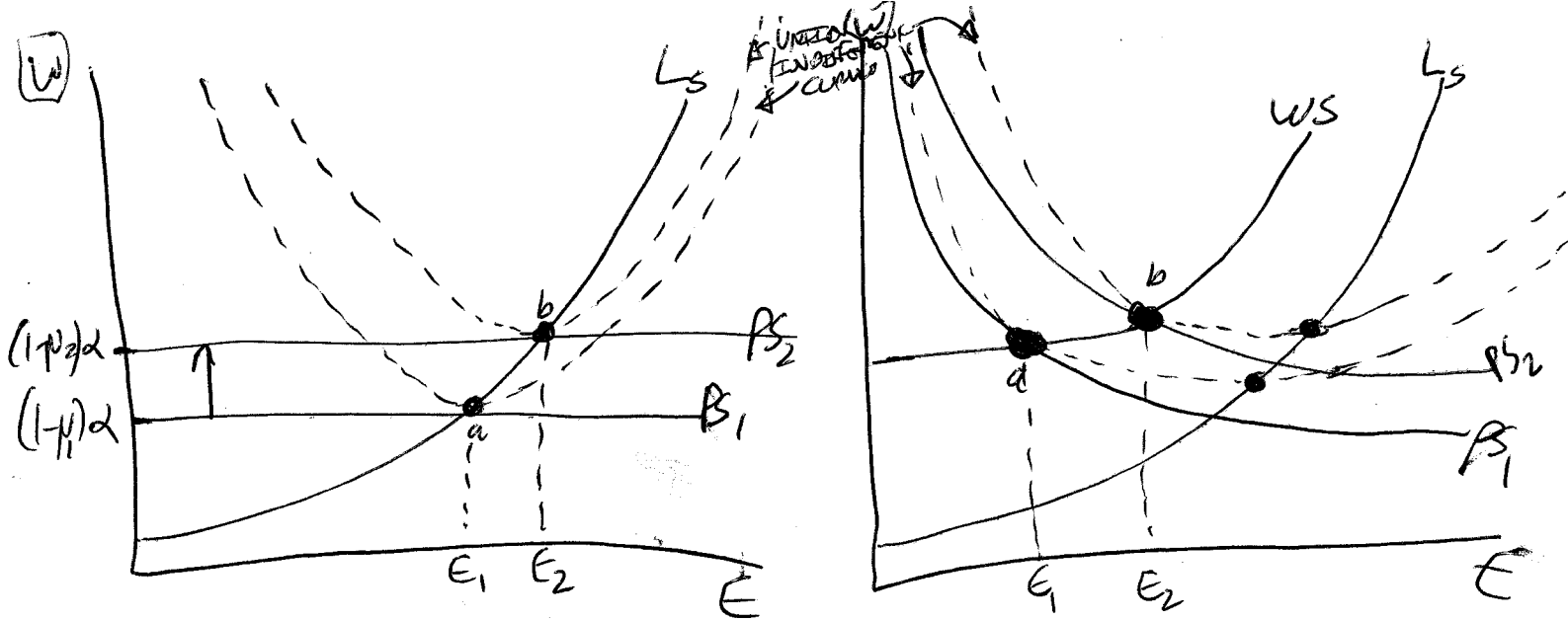
WAGE RATE IN SECTOR i WILL BE $w_i = \frac{w_i}{P}$ WHERE ~~THE PRICE~~ P IS THE AGGREGATE PRICE AND w_i

LEVEL BUT, ASSUMING α_i IS THE SAME IN ALL SECTORS, p_i WILL BE THE SAME IN ALL SECTORS AND SO $w_i = \alpha \left(\frac{\epsilon-1}{\epsilon} \right) = \alpha \left(1 - \frac{1}{\epsilon} \right)$

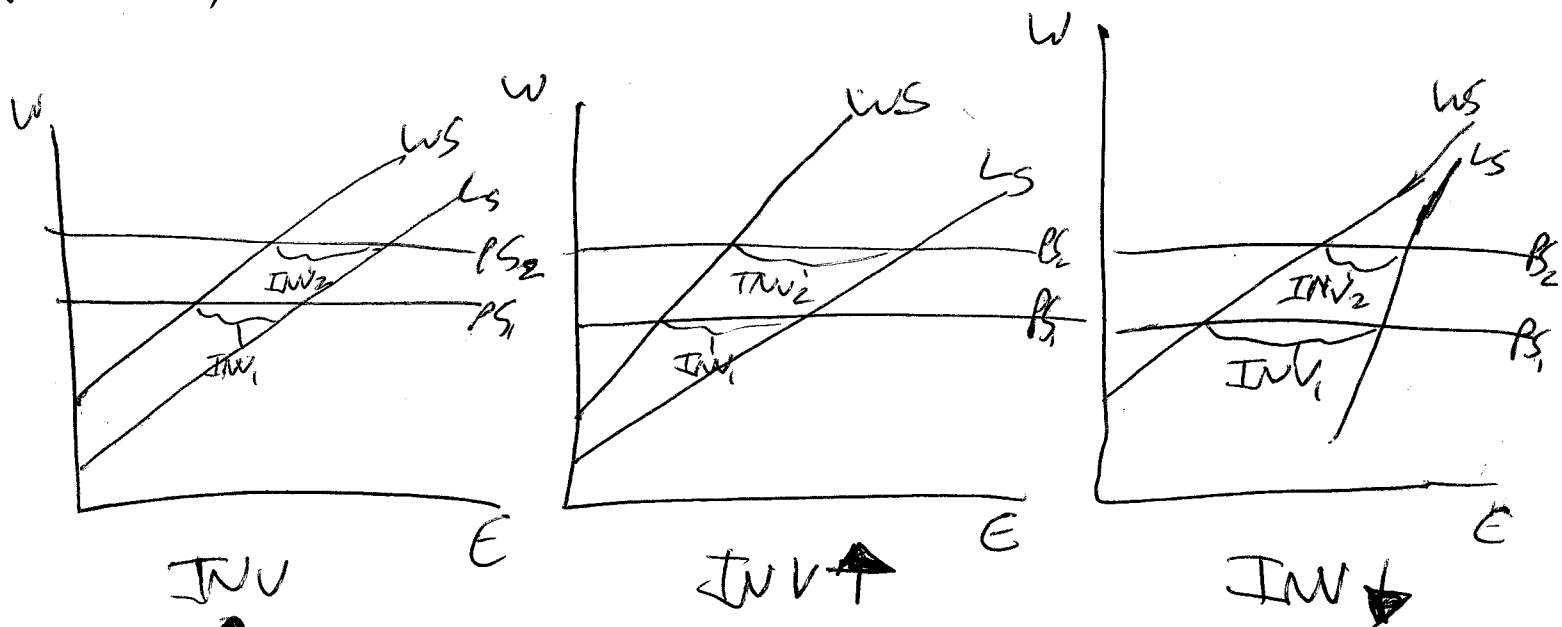
So, $w_i = \alpha(1-n)$ WHERE $n = \frac{1}{\epsilon}$ IS THE MARK-UP. EMPIRICAL EVIDENCE SUGGESTS THAT THE REAL WAGE IS FAIRLY STABLE OVER THE ECONOMIC CYCLE SO WE SHALL, AS A SIMPLIFYING ASSUMPTION, ASSUME THAT α IS CONSTANT, (MORE REALISTICALLY, WE WOULD ALSO GET A FLAT PS CURVE WITH A DECREASING α BUT ALSO A DECREASING n):



THE WAGG SETTING (WS) CURVE IS DERIVED FROM EITHER UNION WAGE BARGAINING OR EFFICIENCY WAGES. WE SHALL TAKE THE UNION CASE AND MODEL UNION BEHAVIOUR USING ~~THE~~ UNION INDIFFERENCE CURVES: TAKING FIRST THE CASE OF A SINGLE UNIFIED ECONOMY-WIDE MONOPOLY UNION THEN, WITH A FLAT PS CURVE THE LABOUR SUPPLY IS THE SAME AS UNDER ~~PERFECT~~ COMPETITIVE LABOUR SUPPLY BUT, WITH A ^{CONSTANT} DOWNWARDS-SLOPING PS CURVE THE WS_n LIES ABOVE THE L_s CURVE. THE FIRST RESULT OCCURS BECAUSE INTUITIVELY IF THE PS CURVE IS FLAT THEN THE MONOPOLY UNION HAS NOTHING TO GAIN BY RESTRICTING LABOUR SUPPLY. SINCE REAL WAGES ARE FIXED.



THE TWO DIAGRAMS ABOVE ILLUSTRATE THE EFFECT OF AN INCREASE IN PRODUCT MARKET COMPETITION ON THE LEVEL OF EQUILIBRIUM EMPLOYMENT. IN THE FLAT PS CASE, EMPLOYMENT IS ~~NOT~~ DETERMINED BY THE COMPETITIVE LABOUR SUPPLY CURVE AND SO INVOLUNTARY UNEMPLOYMENT IS ALWAYS ZERO. IN THE CASE OF A DOWNWARD-SLOPING PS CURVE THEN IF THE HORIZONTAL GAP BETWEEN LS AND WS IS DIMINISHING WITH HIGHER W THEN GREATER PRODUCT MARKET COMPETITION WILL, BY REDUCING μ AND SHIFTING PS OUTWARDS, DECREASE INVOLUNTARY UNEMPLOYMENT. IN GENERAL HOWEVER, THIS RESULT IS AMBIGUOUS.



CALMFOR - PRITTELL MODEL

EVEN IF P IS FLAT, W COULD BE ABOVE L IF THERE IS DECENTRALISED UNION BARGAINING.
SUPPOSE THAT THERE IS A MONOPOLY UNION IN EACH SECTOR RATHER THAN FOR THE ENTIRE ECONOMY. THE FIRST ORDER CONDITION FOR PROFIT MAXIMISATION ^{IMPLIES:} ~~$(1-\epsilon)x_i - (1-\epsilon)x_i p_i \left(\frac{w_i}{p_i} \right) = 0$~~

SINCE α_i IS A CONSTANT (BY ASSUMPTION) THEN THIS CAN BE FURTHER REARRANGED AS:

$$(1-\epsilon)(\epsilon \alpha_i) + \epsilon \epsilon_i \alpha_i \frac{w_i}{p_i} \left(\frac{1}{\alpha_i} \right) = 0$$

~~Now, since $w_i = \frac{W_i}{P}$ we can rearrange the equation as:~~

$$W_i = \alpha_i \left(\frac{\epsilon-1}{\epsilon} \right) P_i \Rightarrow W_i = \frac{W_i}{P} = \alpha_i \left(\frac{\epsilon-1}{\epsilon} \right) \left(\frac{P_i}{P} \right)$$

Now, $x_i = A P_i^{-\epsilon} \Rightarrow P_i = \left(\frac{A}{x_i} \right)^{1/\epsilon}$. So, combining:

$$W_i = \alpha_i \left(\frac{\epsilon-1}{\epsilon} \right) \left(\frac{A}{x_i} \right)^{1/\epsilon} \left(\frac{1}{P} \right)$$

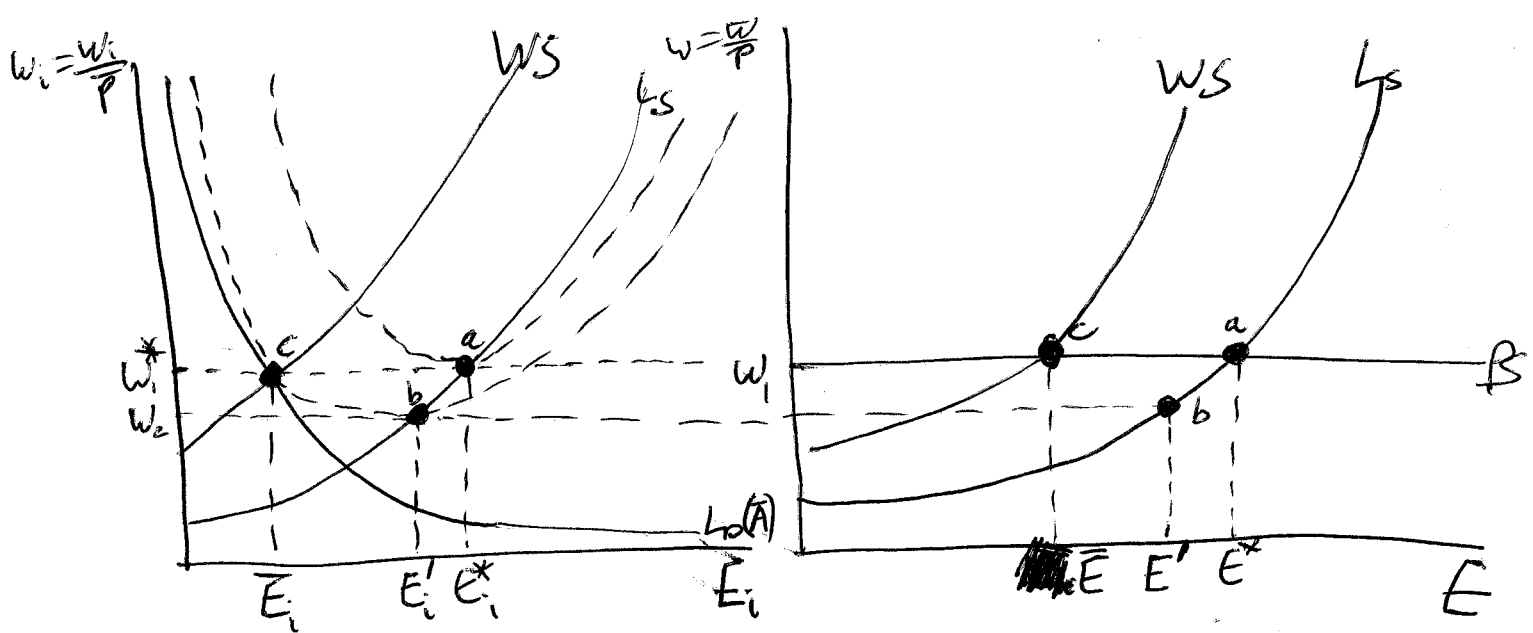
α_i , $E_i = \frac{x_i}{\alpha_i}$ THEN $x_i = E_i \alpha_i$, so we

THEN GET:

$$W_i = \alpha_i^{1/\epsilon} E_i^{-1/\epsilon} \left(\frac{\epsilon-1}{\epsilon} \right) A^{1/\epsilon} P^{-1}$$

HENCE WE CAN SEE THAT THE SECTORAL LABOUR DEMAND CURVE IS DOWNWARDS-SLOPING EVEN THOUGH THE P CURVE IS FLAT ECONOMY-WIDE.

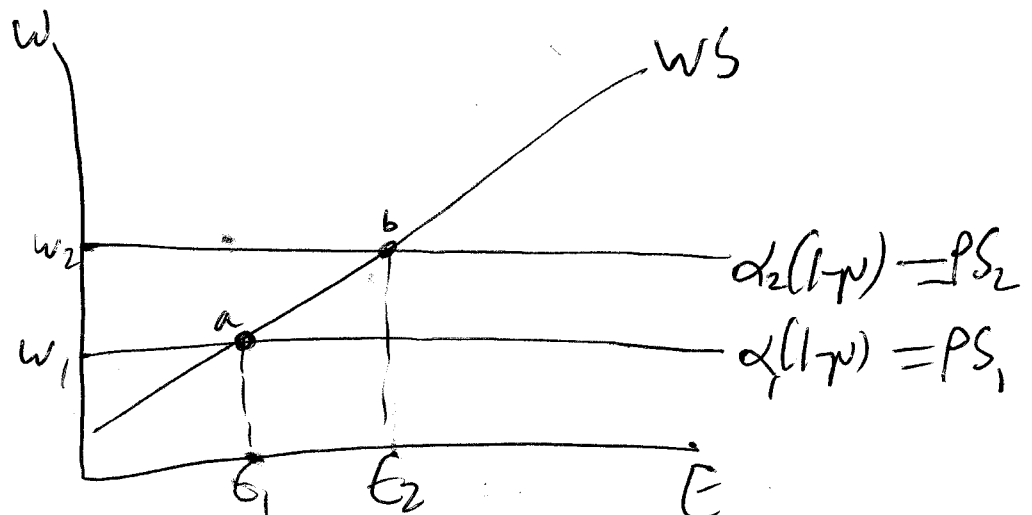
ALSO NOTE THAT AN INCREASE IN AGGREGATE DEMAND A "SHIFT S" THE SECTORAL LABOUR DEMAND CURVE OUTWARDS.



THIS DIAGRAM SHOWS HOW A DOWNWARDS-SLOPING LABOUR DEMAND CURVE AT THE SECTORAL LEVEL GENERATES, VIA UNION INDIFFERENCE CURVES, AN ECONOMY-WIDE WS CURVE WHICH LIES ABOVE L_s . HENCE WE GET INVOLUNTARY UNEMPLOYMENT AND AN INSUFFICIENTLY LOW LEVEL OF EQUILIBRIUM EMPLOYMENT AT E INSTEAD OF E^* .

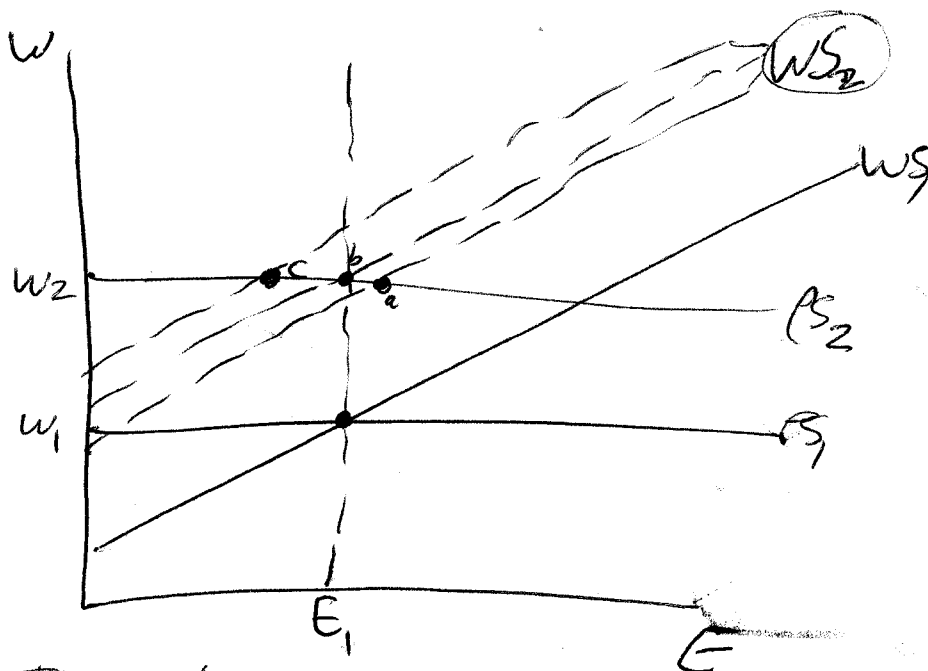
3. IN IMPERFECTLY COMPETING GOODS AND LABOUR MARKETS, WHAT IS THE IMPACT OF A PRODUCTIVITY INCREASE ON EMPLOYMENT AND REAL WAGES?

WITH NO CHANGE IN WS:



SO EMPLOYMENT RISES, REAL WAGE RISES AND UNEMPLOYMENT FALLS.

WITH INCREASE IN WAGE DEMANDS / ASPIRATIONS:



COULD GO TO a, b OR c SO EFFECT ON EMPLOYMENT IS NOW AMBIGUOUS

HOW MUCH OF THE DISAGREEMENT BETWEEN KEYNESIAN AND RBC THEORY HAS TO DO WITH DIFFERING VIEWS ABOUT WHAT SHOCKS HIT THE ECONOMY RATHER THAN HOW THE ECONOMY REACTS?

WE HAVE ALREADY MODELLED THE LABOUR MARKET PROPAGATION MECHANISM FOR RBC SUPPLY SHOCKS. HOWEVER, LET US SUMMARISE THE MAIN AREAS OF DISAGREEMENT BETWEEN KEYNESIAN AND RBC THEORY:

	RBC	KEYNESIAN
(1) LABOUR MARKET	PERFECTLY COMPETITIVE NO INVOLUNTARY UNEMPLOYMENT	IMPERFECTLY COMPETITIVE
(2) PRICE FLEXIBILITY	PRICES FULLY FLEXIBLE \Rightarrow SHORT RUN MONEY NEUTRALITY	STICKY PRICES / ONLY MONEY NEUTRAL IN THE MEDIUM RUN
(3) CONSUMPTION	DRIVEN BY INTERTEMPORAL OPTIMIZATION OF REPRESENTATIVE CONSUMER WITH PERFECT MARKETS ^{INTER-TEMPORAL} EXPECTATIONS	DRIVEN BY KEYNESIAN CONSUMPTION FUNCTION BASED UPON CREDIT CONSTRAINTS, ADAPTING EXPECTATIONS AND OTHER MARKET IMPERFECTIONS
(4) INVESTMENT (AND OR NET EXPORTS IN OPEN ECONOMY)	ENDOGENOUSLY DETERMINED BY CONSUMPTION AND SUPPLY SIDE	EXOGENOUSLY DRIVEN BY DEMAND / CONFIDENCE SHOCKS