QUEEN'S UNIVERSITY AT KINGSTON
DEPARTMENT OF ECONOMICS
ECONOMICS 332—Economic History of North America Since 1865
Fall 2011/2012
Midterm Exam

Time: 60 minutes

Instructions: Answer any two of the following three questions. Questions are of equal value. Use diagrams where appropriate. Be sure to fully label diagrams, and be sure to explain the meaning of all diagrams used.

1. Staples model and resource exploitation
   (a) Explain the staples model as a theory of adjustment to a disequilibrium in commodity and factor markets, and outline the sources of economic growth predicted by the model.
      - Old world (Europe) - large; new world (Canada, North America) - small
      - exogenous shock: discovery of high quality resource (staple) or decline in transport cost rendering new world resource competitive with old world source
      - initiates disequilibrium: K, L migrate from old world to new to exploit resource and earn disequilibrium r and w; new world exports resource to old world
      - new world producers face perfectly elastic demand as expansion of output from small country does not affect world supply
      - Market adjustment:
        - when w and r in new world fall from disequilibrium levels to equal w and r in old world, factor migration stops
        - new world stock of resource too small to affect world price
      - welfare:
        - owners of resource stock in new world gain rents (if property rights can be enforced)
        - owners of resource stock in old world lose, but because new world resource stock small, losses are small.
        - world price of resource unaffected if new world is small, so no impact on world consumers
        - new world experiences extensive growth: expansion of stocks of K,L and expansion of aggregate output, all intensive growth accrues as rents to resource owners (if any)
   (b) Apply the staples model to the cases of the virtual extinction of the North American buffalo and to the expansion of wheat production on the Canadian Prairie. Explain in each case how the staples model applies and identify where the benefits accrued.

- prior to 1870
  - buffalo hide has no value to old world–inability to tan hide and use as leather, and is not traded
  - buffalo had high value to native Americans who exploited the resource at sustainable equilibrium (see diagram)
- exogenous shock: technological change – method developed to tan buffalo hide to use as leather, demand for buffalo hides shifts up
  - price of buffalo hide set on international market: perfectly elastic demand at international price p'
  - large buffalo herd = high quality stock of leather
  - return to hunting effort remains high for those with sufficient skills, so w in buffalo hunt higher than in alternative employment
  - exploitation of resource: hunting of buffalo for hides: migration of L to west from east to hunt buffalo
  - with perfectly elastic demand, world price unaffected by pace of resource exploitation, and with no enforceable property rights, buffalo stocks driven down to virtual extinction
    - at non-trade price p stock size equilibrates at A at S=S*
    - at international price (p') and without private property rights, stock size falls to S=S', and then falls farther towards 0.
  - see model for illustration of shift in equilibrium
  - gains from exploitation: with no enforceable property rights, only gains are disequilibrium returns to hunting. No rents to owners as no enforceable property rights hence no long run gains and stock goes extinct

2. Chambers and Gordon use the staples model to test the impact of the Canadian Wheat Boom on Canadian economic growth. Explain their test fully. Relate it to the staples model. Discuss the modification to their estimate in Lewis.

   (a) Chambers and Gordon's method (see diagram–required)
   - Staples model: all gains from resource exploitation in equilibrium accrue to owners of resource, so calculate value of prairie farm rents to measure gains from wheat boom
   - defines wheat boom as beginning in 1901 and ending with restoration of equilibrium in 1911 – to match available data.
   - need model because over course of wheat boom wages rise in rest of economy–gadgets
   - use 2-sector model: wheat and gadgets
   - in model, wheat boom raises value of marginal product of labour in wheat
   - but cannot just measure rents to farmers in 1901 (BCR) and rents

in 1911 (AFH), as wages have risen
- gains to owners of prairie farms would be area ADR - BCR had there been no change in gadgets
- increase in value of marginal product of labour in gadgets due to exogenous technological change, so wages rise
- need counterfactual measure of rents to farmers without wheat boom (1901 prairie labour demand) but with wage-increasing technological change in gadgets
- hold wages at 1911, then compare counterfactual prairie rents without wheat boom (BEH) to rents in 1911 (AFH): yields gain of AFEB to wheat boom
- quantifying area AFEB results in relatively small share of growth in Canadian per capita income from 1901–1911 coming from wheat boom

(b) Lewis extension (see diagram–required)
- C&G assume perfectly elastic demand for labour in gadgets
- Lewis argues that in absence of a wheat boom to employ 200,000 workers, gadget employment would be expanded
- expanded gadget employment increases gadget output beyond gadget consumption in 1911
- gadget market clearing would require lower gadget prices, hence lower wages of workers in gadgets
- wage set by employment in wheat sector without wheat boom (point A for wage of w')
- gains to wheat boom include rents in wheat of DCBAE, and of gains to wage income of wFGw'
- estimates of gains to wheat boom by Lewis are about double of C&G's original estimates.

3. We discussed railway 'building ahead of demand' and the subsidization of the Canadian Pacific Railroad.

(a) How important was rail line construction for prairie settlement?
- Data point: CPR completed in 1885, but prairie settlement accelerated in 1896, one decade later, so why the delay?
- Norrie suggests that prairie settlement determined by pace of diffusion of dry-farming techniques
  - new region of settlement with uncertainty about how to grow crops
  - experimentation and diffusion of best practice techniques takes time
  - Evidence: differing response of settlers to wheat prices before and after 1896 suggests role for diffusion of dry-farming technique

- Lewis includes rail branch line construction as more important determinant of pace of prairie settlement
  - motive for settlement is profit from wheat farming
    - π = Revenue from wheat sales - Cost
    - Cost = cost of growing wheat + cost of transporting wheat to market
    - dry-farming techniques lower cost of growing wheat
    - expansion of rail branch line network expands the feasible margin of production by increasing the proportion of prairie lands with potential to grow wheat suitable for settlement (see diagram)
    - for given rail network, feasible region of settlement is some distance x from rail loading platform, beyond which cost of transport too high
    - dry-farming - increases yield of land so increases distance x of feasible region (in diagram lowers yield, y, needed for farming to be profitable at fixed distance x from loading platform)
    - expansion of rail network shifts up distribution of farms within distance x of feasible region
    - Lewis tests for effect of dry-farming and rail network expansion by constructing counterfactuals
      - effect of dry-farming: hold rail network at 1911 level and shows expansion of feasible region from 1898–1911 due to increases in yields
      - effect of rail network expansion: hold yields at 1911 level and shows expansion of feasible region from 1898–1911 due to rail branch line construction
      - concludes that rail network expansion increased feasible region from 60% to 90% of feasible region, or 50% increase; while increases in yields due to dry-farming techniques increased feasible region from 75% to 90%, or a 20% increase only.

(b) Did it matter whether the government subsidized the C.P.R. using cash or land?
- railway profits from moving freight, which requires settled population of farmers
- population will settle prairies if farming profitable, which includes availability of transportation to move grains to market
- gov't goal to settle prairies, but neither railway nor settlers will make first move alone, so gov't gives railway subsidy of land grant
- land grant important because it alters incentives of C.P.R. to build

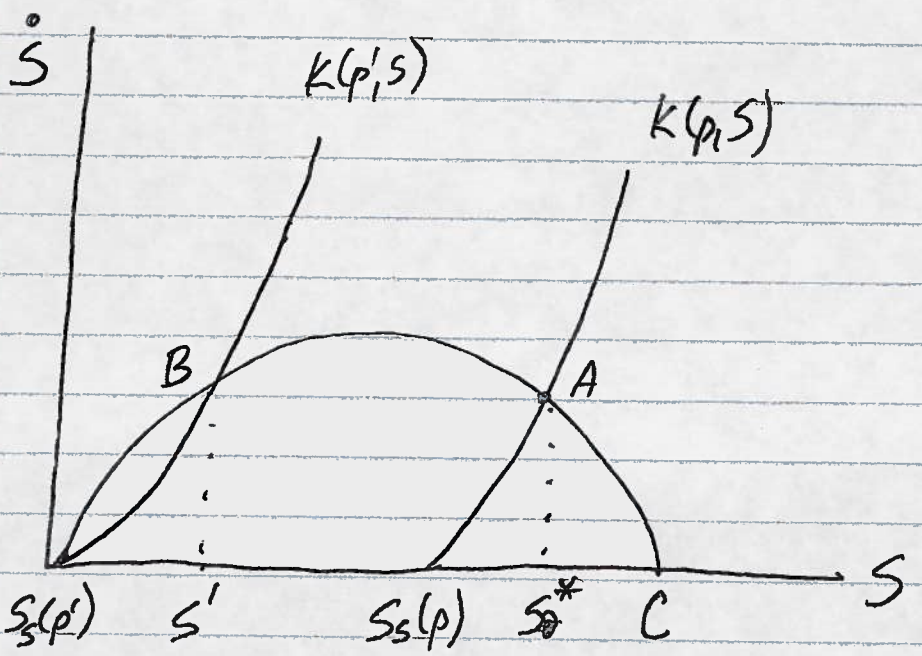
rail branch lines
  - rail is monopolist and sets freight rate where MR=MC
  - with rail service only, sets p^{rail} from MR^{rail}
  - with rail service and land sales, sets $p^{rail+land}$, lower than p^{rail}
  - lower freight rate makes more land profitable to farm, and more settlers are attracted
  - so, effect of land subsidy by making C.P.R. land owner provides them with incentive to charge lower freight rate than they would if monopoly seller of freight service alone
  - evidence in profitability of rail branch line when constructed
    * monopolist should build branch line when revenues generated from freight service and land sales equal annual capitalized cost of rail line construction
    * Lewis points to evidence from 2 of 4 rail branch lines built in crop district 1 in Saskatchewan
    * 2 of 4 lines built as predicted (earliest line is built too late, while last line built much too soon, but by then the C.P.R. was no longer monopolist)

(c) And if the government's goal was settling the Prairies, was subsidization of the C.P.R. necessary or unnecessary, excessive or the appropriate value?
- rail line profitable to investors when NPV ≥ 0
- Mercer calculates rate of return of the annual net cash flows over the first 20 years of the C.P.R.'s operation
- he estimates the revenue stream under various possible subsidy schemes
  - land
  - cash
  - donation of previously built rail line
- Mercer calculates the annual stream of revenues and expenses, adds a terminal value adjustment (so he doesn't have to run annual streams into perpetuity)
- to determine if subsidy necessary, he runs several scenarios. in each scenario he calculates annual revenues: without subsidy, with only one subsidy, with all subsidies.
- only when all subsidies are included does the rate of return (8.8%) exceed the opportunity cost of capital (6.75%)
- Mercer then calculates the value of subsidy needed to generate a NPV = 0, $20million, or just slightly less than all cash given to the C.P.R. by the government
- Mercer concludes: subsidy necessary but excessive
- Emery and McKenzie suggest that the excess subsidy may not be

excess once risk is considered

- Mercer looks at realized earnings, but investors decided on project based on risk-return tradeoff
- Emery and McKenzie estimate level of risk needed to have disuaded investors at the time from investing in C.P.R., where risk is measured as potential volatility of revenue stream, and suggest the risk level was not too high, suggesting that perhaps the C.P.R. was not over-subsidized after all.

Q1



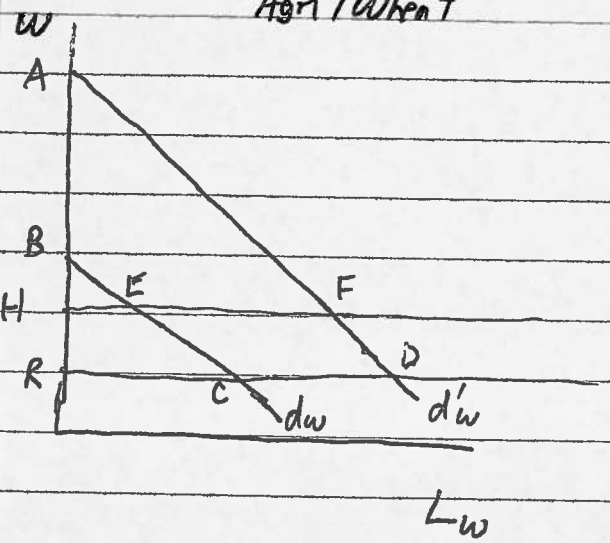
S: stock size C: max stock size
Ṡ: dS/dt
p: buffalo hide price before 1870
p' - - - after 1870
p' > p

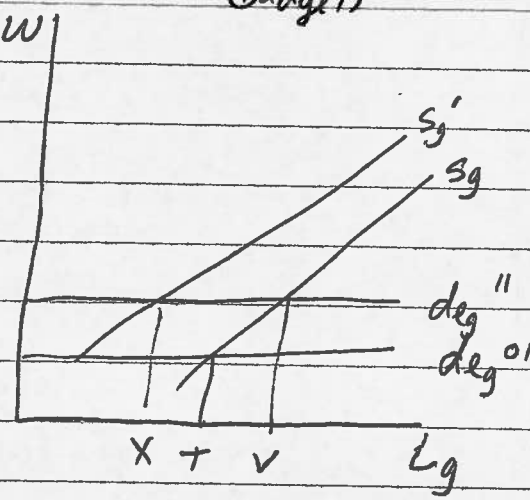
K(p,S) is harvest (kill) function
return to hunting
$h = \alpha S(t)$, α = skill of hunter distributed evenly from $[\underline{\alpha}, \bar{\alpha}]$

so revenue $= ph = p\alpha S(t)$
reservation wage = w ← wage in alternate employment
so $p\alpha^* S(t) = w$
where α^* is minimum skill needed

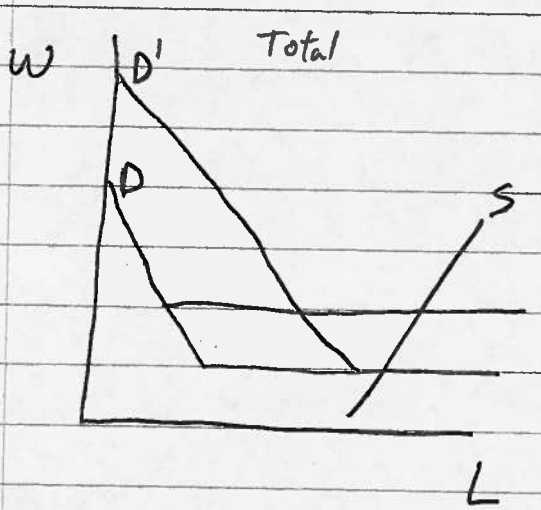
Before 1870: natives hunted to steady state A with stock S^*
[at stock size $S_S(p)$, no hunting takes place]
After 1870, price rises to p'
Kill function shifts to $K(p',S)$
move to point B with stock size S'
- increase in hunting, decline in stock

Q2 C&G





optimal



S_g : supply of labour to gadgets wheat - no wheat boom

S_g' : supply of labour to gadgets with wheat boom

d_w : demand for labour in wheat - no wheat boom

d_w' : demand - - - - wheat boom

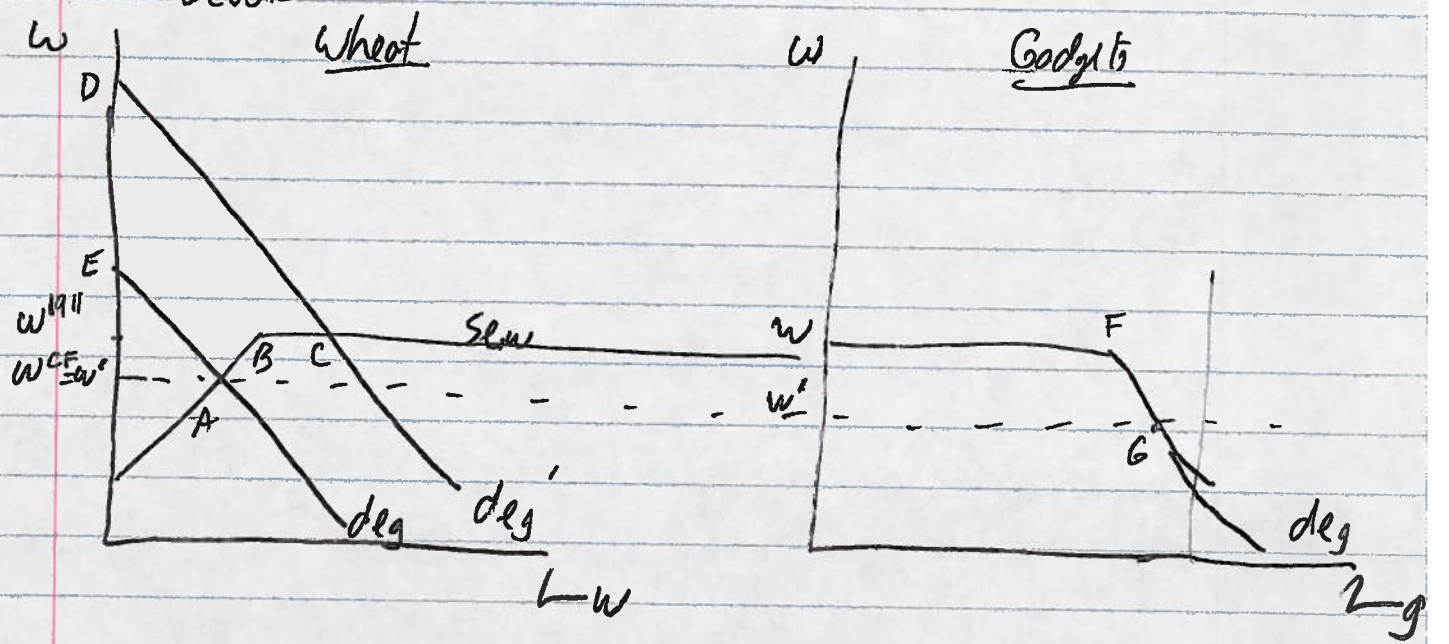
Area BRC : rents to wheat - no wheat boom, 1901

AFH : rents - - - 1911

BEH : counterfactual rents - no wheat boom

AFH − BEH = AFEB - rents due to wheat boom

Q2: Lewis



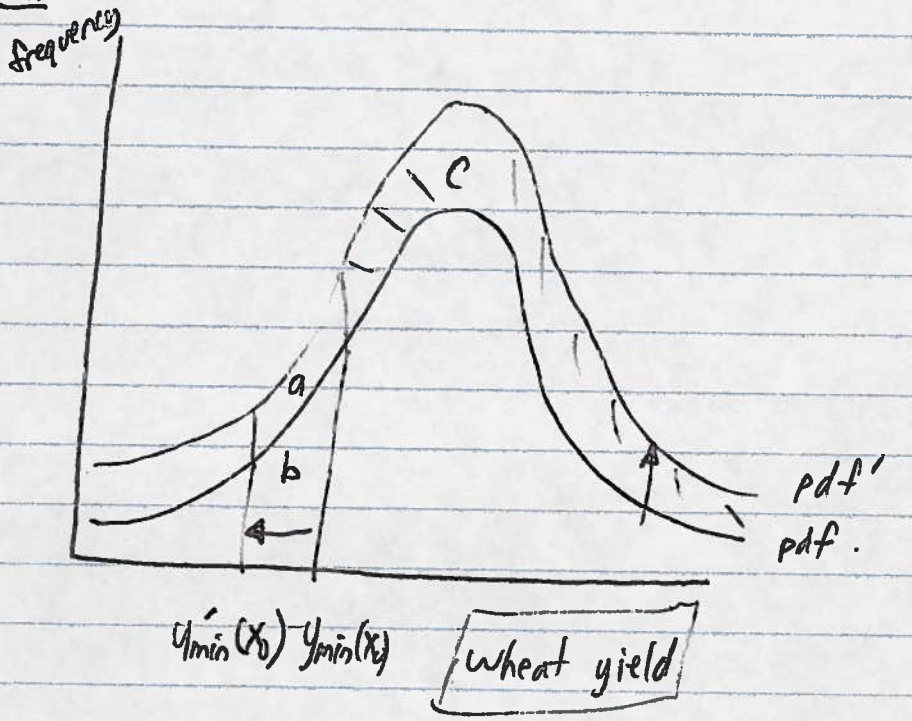
d_{eg}: no longer perfectly elastic
- at point F, gadget output = total Canadian gadget consumption
- from F, increase in employment in gadgets requires falling gadget prices to generate increased consumption
- falling prices = declining VMPL in gadgets, hence declining wages

$Sl_{e,w}$ · kinks down to left of B due to effects above
- as labour absorbed into wheat, attracts labour from gadgets, reducing gadget output, raising gadget prices, raising wages

counterfactual (no wheat boom) wage equilibrium:
occurs at A → w'
actual 1911 wage: w
So gains to wheat boom
Wheat: DCBAE → slightly larger rents
gadgets: WFGW' → higher wages due to demand for

Q3

Rail



$y_{min}(X_0)$: X_0 : distance from rail loading platform

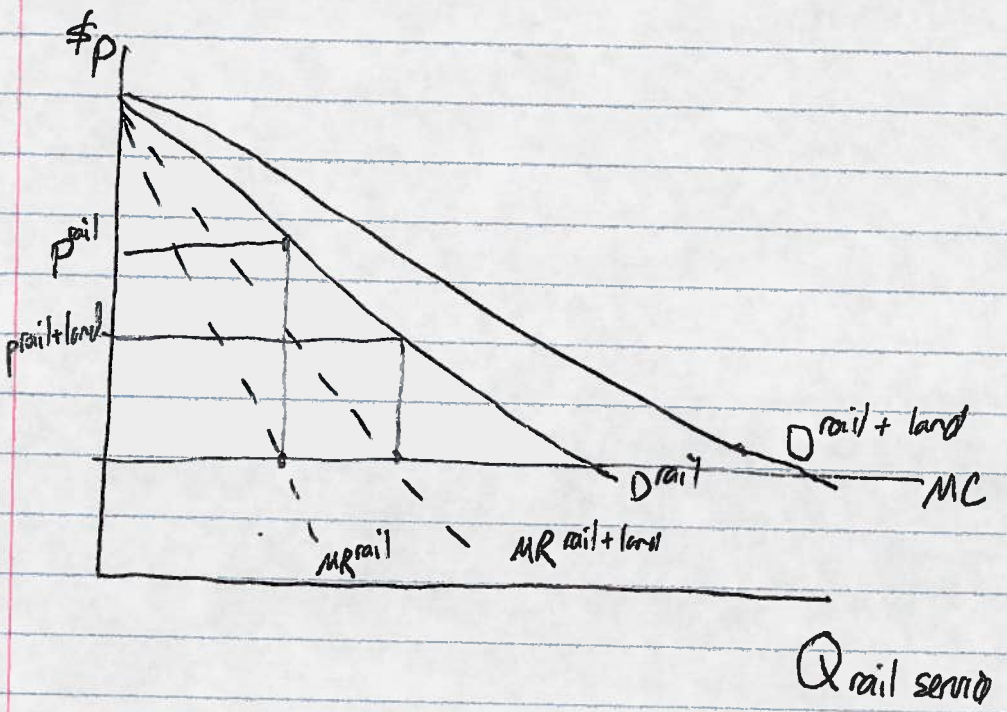
$y_{min}(X_0)$: yield needed to set costs = revenue at distance X_0

- effect of dry-farming techniques
  - shift $y_{min}(X_0)$ to left increasing area feasible to grow wheat

- effect of rail branch line network expansion
  - increase the number of farms at distance X_0, so shift up the distribution from pdf to pdf'

- effect of dry farming : area a+b
  effect of rail expansion : area a+c

Q3


$P
P^rail
P^rail+land
D^rail + land
D^rail
MC
MR^rail
MR^rail+land
Q rail service