Lecture XXXI: Effects of Subsidies on Input Markets and Input Subsidies

Charles B. Moss [1]

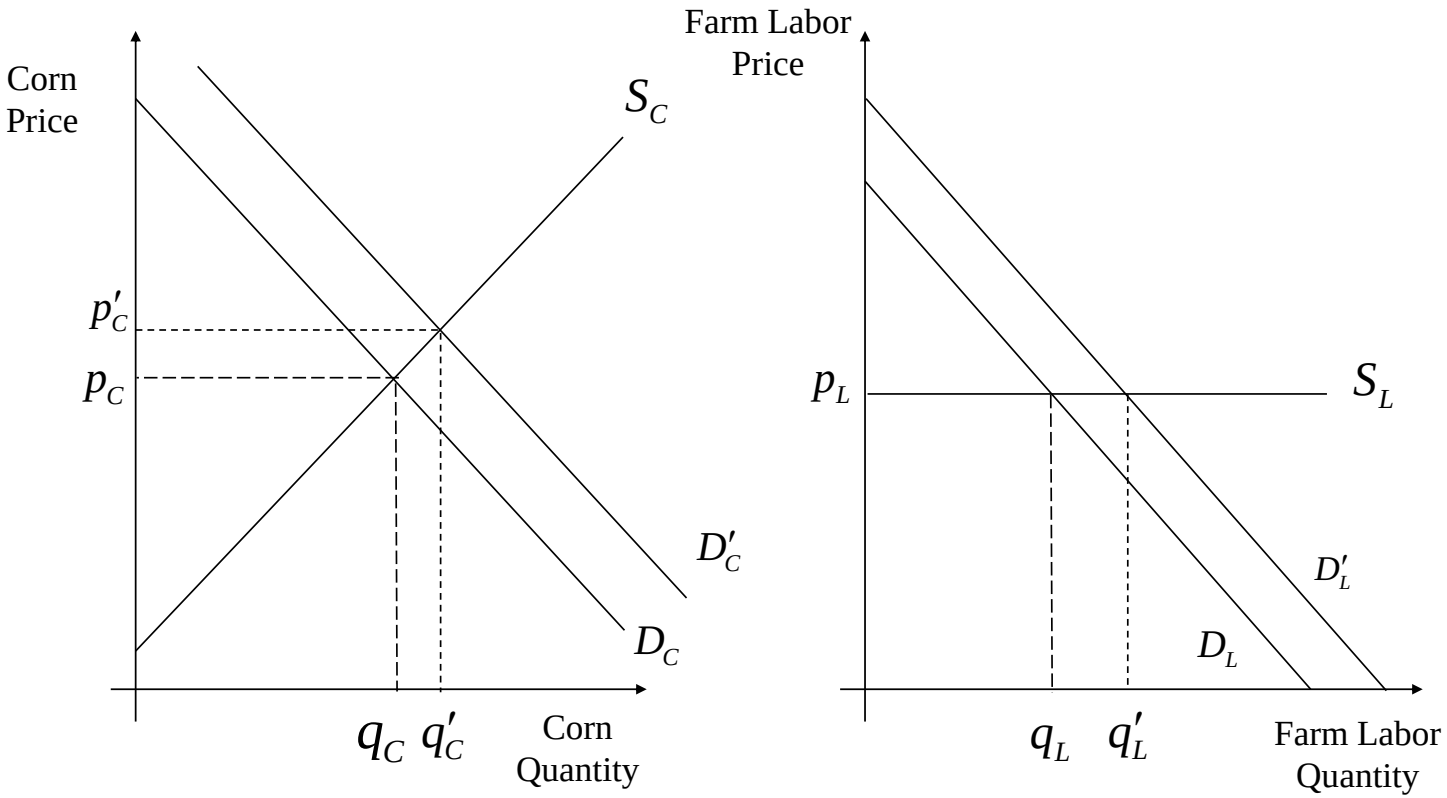
[1] University of Florida

November 29, 2018

Effect of Agricultural Policy on Input Use

- "The old-timers say that cotton has paid more bills than any crop in southwestern Oklahoma, but as long as you have cotton you will always have more bills to pay" – Varney Eual Moss (1919 – 2008)
- "The owners of factors of production, such as labor and land, derive 'economic rent' from the services provided by these factors for which there is a positive market demand. Economic rent has a symmetrical change in the individual's welfare when the set of prices facing him are altered or the constraints on him are altered. " – Just, Hueth, and Schmitz 2004:183.

Effect of Subsidy on Input Use



Derived Demand

- We typically refer to the demand for inputs as a "derived demand" curve – it is the demand derived or based on the production of another good.
- Just a little bit of calculus - suppose that the production function for corn ($f(N)$) is

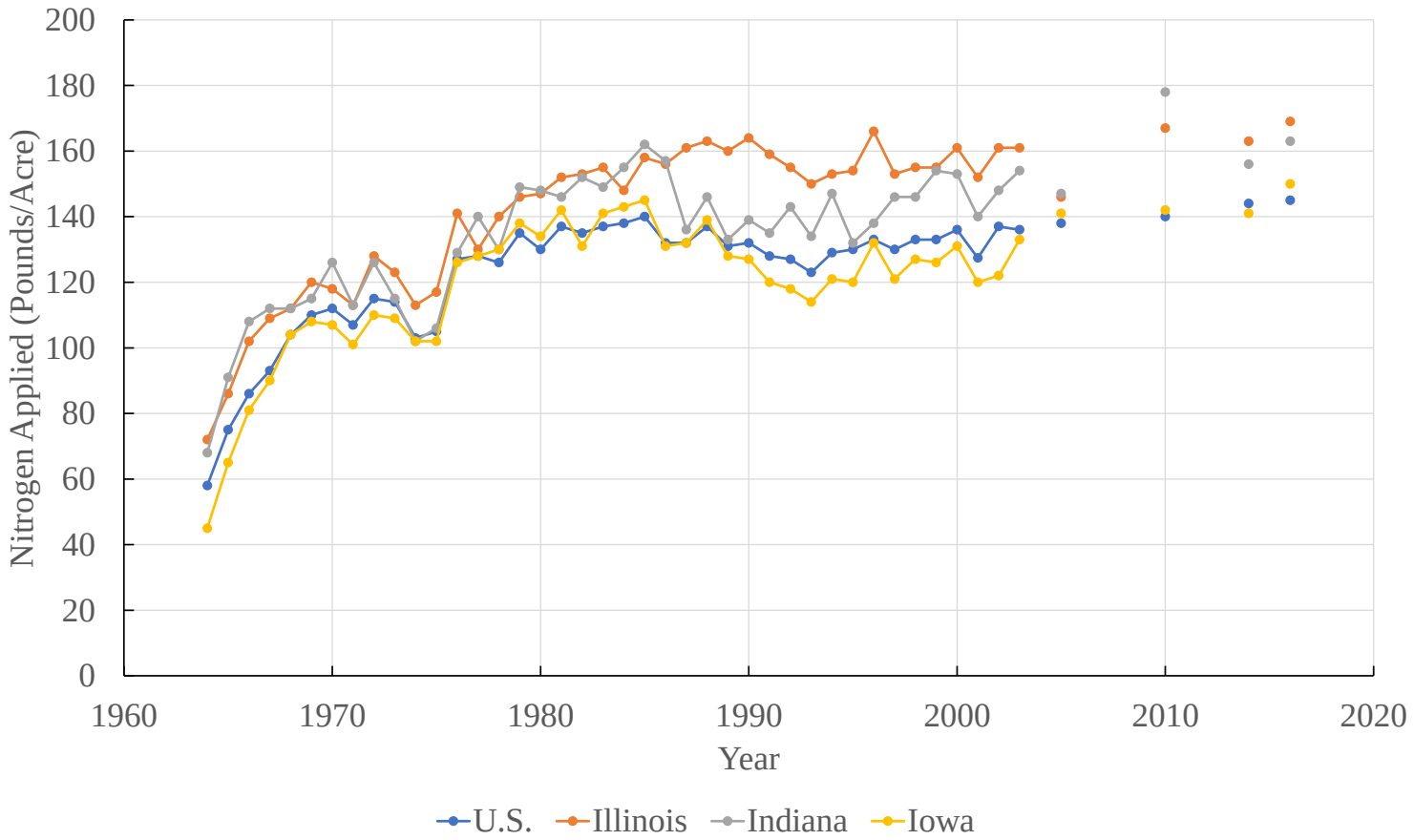
$$f(N) = -202.575 + 4.3475N - 0.014053N^2 \tag{1}$$

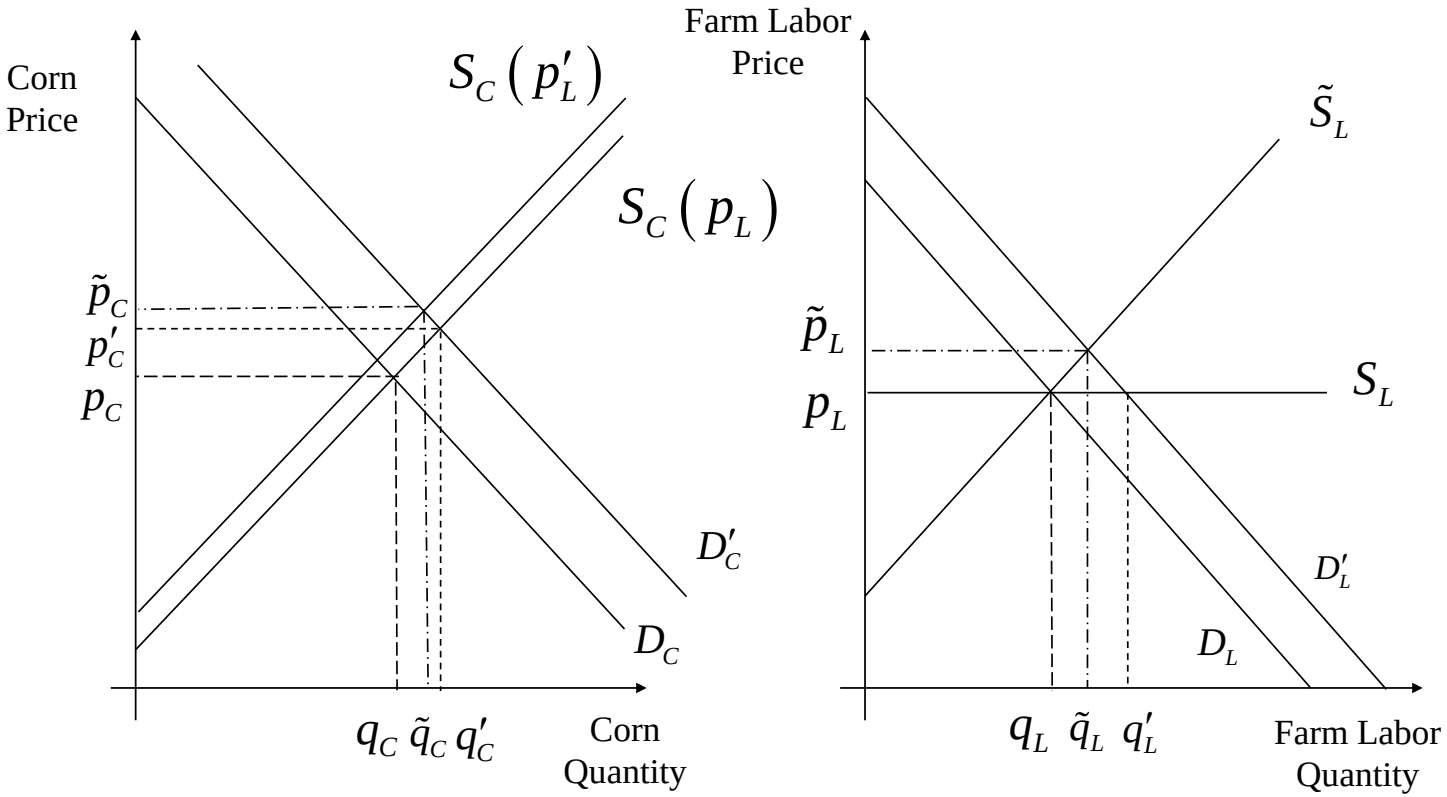
where N is the pounds of nitrogen applied per acre.

- We derive the demand for nitrogen based on profit maximization

$$\max_N p_y f(N) - w_N N \Rightarrow \begin{cases} \frac{\partial f(N)}{\partial N} = 4.3775 - 0.028106N = \frac{w_N}{p_y} \\ N^*(w_N, p_y) = 155.70 - 35.58\frac{w_N}{p_y} \end{cases} \tag{2}$$

Nitrogen Use on Corn over Time




Corn Price
$S_C(p'_L)$
$S_C(p_L)$
$\tilde{p}_C$
p'_C
p_C
D'_C
D_C
q_C $\tilde{q}_C$ q'_C
Corn Quantity
Farm Labor Price
$\tilde{S}_L$
$\tilde{p}_L$
p_L
S_L
D'_L
D_L
q_L $\tilde{q}_L$ q'_L
Farm Labor Quantity

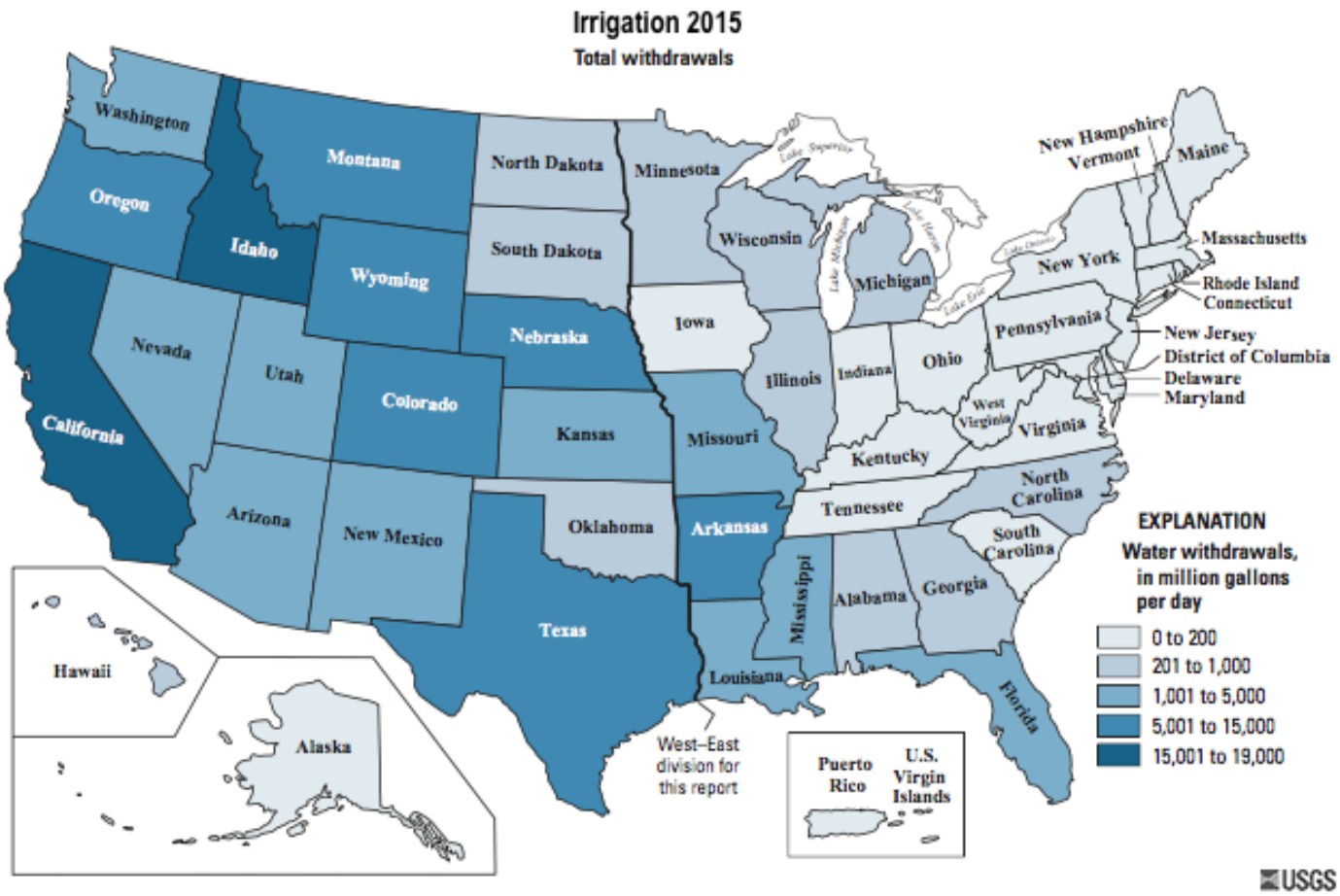
Input Policies – Taxes and Subsidies

- Traditionally, government has been "subsidized" agriculture by subsidizing water.
  - In Texas, 79.4 per cent of the groundwater is used for irrigation, 13.5 per cent is used for municipal water supplies, 3.6 per cent is used for manufacturing, 1.4 per cent for mining, 1.2 per cent for livestock, and 0.9 per cent for power (McGinley 2009).
  - In California, agriculture uses 75 to 80 per cent of the state's water (Sunding 2000).
  - In Florida, agriculture uses 62 per cent of the surface water and 42 per cent of the groundwater (Marella 1992).

Cost of Irrigation

Cost Category	Acres Incurring Cost: Level (Million $)	Acres Incurring Cost: Share (%)	State-Level Cost Range ($/acre)	National Average Cost ($/acre)	Total National Cost (million $)
Energy Expense for Pumping Groundwater	32.34	61.5	7-176	39.50	1,277.54
Energy Expense for Lifting or Pressuring Surface Water	10.56	20.1	10-82	26.39	278.72
Water Purchased from Off–Farm Sources	13.87	26.4	5-86	41.73	578.73
Maintainance	40.01	76.1	4-80	12.29	491.77
Total Variable Cost					2,622.37
Average Variable Cost					49.87
Capital Investment Expenses Incurred in 2003	26.67	50.7	16-187	42.18	1,125.13

Irrigation Withdrawals



Credit Market Subsidies - Cooperative Lenders

- The largest group of cooperative lenders has been the Farm Credit System which was established under the auspices of the Federal Farm Loan Act of 1916.

Cooperatives

- A cooperative is a company (typically organized as a corporation) that is owned by its clients.
  - In the great plains, farmers would form a company (cooperative) to operate a grain elevator.
  - They could incorporate by selling a small number of shares and borrowing the remaining capital through debt (sometimes from the Bank for Cooperatives – a subset of the Farm Credit System).
  - The cooperative would hire management and operate the business – sell fertilizer and seed to farmers and purchase their output for shipment over the railroads.
  - The common stock (i.e., shares) and proceeds from the operation are distributed based on the amount of business that farmers conduct with the cooperative.

Farm Credit System

- The Farm Credit System was a federally chartered cooperative.
- Organization
  - Originally the Farm Credit System was a source of long-term – farm ownership loans.
  - It eventually contained three components – the Federal Land Banks (which provided long term capital), the Federal Intermediate Credit Bank (which provided short and intermediate term credit), and the Bank for Cooperatives.
  - The U.S. was divided into twelve districts, each of which had one of each component.
  - In addition there was a national Bank for Cooperatives that could lend across regions.
  - Local lending was carried out by local associations - the Federal Land Bank Associations and Production Credit Associations.

- The Farm Credit System raised money by selling bonds in government enterprise market.
- Several limitations of commercial banking combined to provide impetus for the Farm Credit System.
  - Commercial banks were limited to making real estate loans of less than five years.
  - Limits on the amount of money that could be loaned to an individual borrower (for example limitations on the percent of owner's equity [common stock plus retained earnings] that could be loaned to an individual borrower) put significant limitations on the availability of capital for agriculture in some locations.

- The seeds for the future difficulties of the Farm Credit System were sown in its establishment.
  - The Farm Credit System is a **Government Sponsored Enterprise** (GSE).
  - The goal of these enterprises is typically to meet some policy objective (in this case providing for the capital needs of the farm sector) while meeting all its costs.
  - Being a cooperative, the goal was only to accumulate the amount of capital required to secure the bonds. Providing adequate security of the bonds would keep the cost of capital to the farmers as low as possible.
  - However, the capital markets often thought that as a GSE, the government would provide resources if the bonds were ever at risk of default (this became known as the implicit government guarantee).

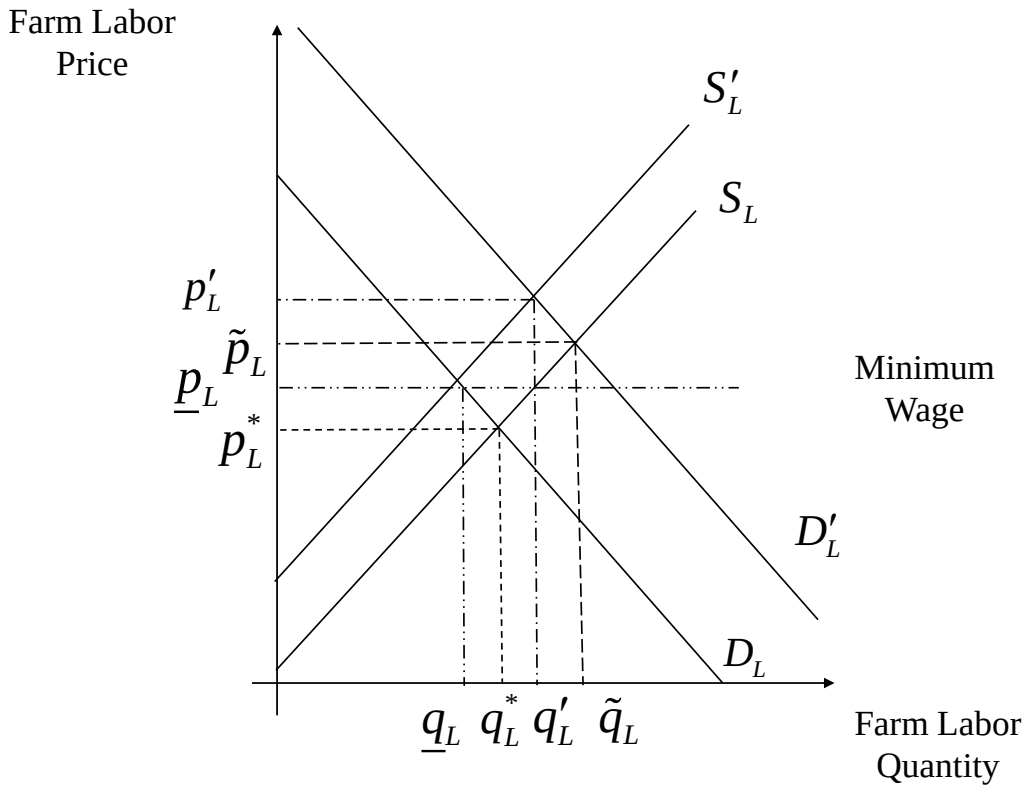
Government Entities

- The dominate government entity lending in agriculture has been the Farmer Service Agency - Farm Loan Programs (from 1946 through the 1990s this was typically refered to as the Farmers Home Administration).
- The FSA operates in two ways:
  - The FSA does make direct loans.
  - The FSA also provides loans to farmers by guaranteeing loans – the bank makes the loan, but the FSA guarantees 80 % of the value of the loan if the farmer defaults.

Share of Real Estate Lending by Lender

Year	Farm Credit System	Farm Service Agency	Commercial Banks	Life Insurance Companies	Individuals and Others	CCC Storage & Drying Loans
1960	19.65	5.52	11.99	23.45	38.98	0.42
1965	19.91	6.95	11.95	22.94	38.07	0.18
1970	23.38	7.96	12.24	18.50	37.38	0.54
1975	32.10	6.74	12.52	13.57	34.69	0.39
1980	37.03	8.32	8.71	13.30	30.93	1.71
1985	42.13	9.81	10.72	11.26	25.75	0.33
1990	34.69	10.22	21.80	12.98	20.30	0.00
1995	31.34	6.38	28.10	11.47	22.72	0.00
2000	35.05	4.03	35.12	13.05	12.75	0.00
2005	39.30	2.34	36.18	10.79	11.15	0.24
2006	40.21	2.20	37.16	11.11	9.06	0.26
2007	41.53	2.02	37.17	11.32	7.68	0.28
2008	42.85	1.72	37.55	11.13	6.64	0.11
2009	43.55	1.78	38.14	10.26	5.91	0.36
2010	45.27	2.05	38.06	9.37	5.09	0.16

Labor Markets



An Econometric Model

- Differential supply model

$$\bar{f}_{it}\Delta \ln\left(x_{it}\right) = \gamma_t \sum_{r=1}^{m} \theta_i^r \bar{g}_r \Delta \ln\left(y_{rt}\right) + \sum_{j=1}^{n} \pi_{ij} \Delta \ln\left(w_{jt}\right) \tag{3}$$

$$\zeta_{ir} = \frac{\theta_i^r \gamma_t \bar{g}_{rt}}{\bar{f}_{it}}\ ,\ \zeta_{ij}^* = \frac{\pi_{ij}}{\bar{f}_{it}}$$

Labor Output and Price Elasticities

State	ζ_{HL}	ζ_{HC}	ζ_{HR}	ζ_{OL}	ζ_{OC}	ζ_{OR}
Alabama	-0.86530	-0.15536	0.02961	-0.53597	0.23681	0.07612
Florida	-1.48765	0.37991	-0.11831	1.27655	0.29032	0.40047
Georgia	-0.75888	0.40703	-0.29238	-0.07330	-0.04688	0.81854

State	ζ^*_{HH}	ζ^*_{HO}	ζ^*_{OH}	ζ^*_{OO}
Alabama	-2.39040	1.78763	0.60616	-0.77211
Florida	-1.25073	0.82874	1.67366	-1.33002
Georgia	-1.28145	0.65999	0.28560	-0.04720