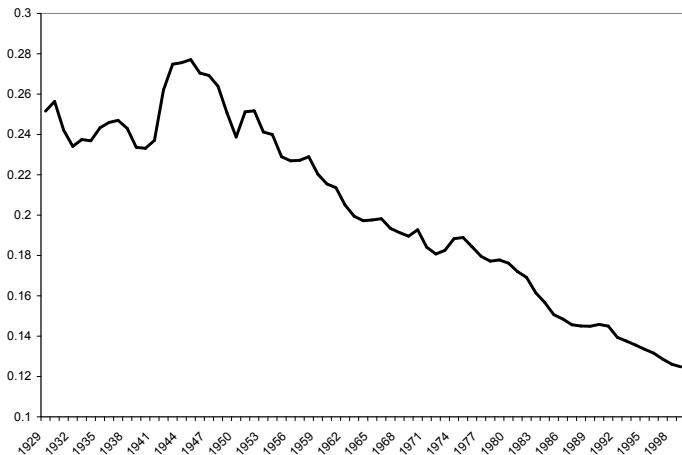# Regions, Frictions, and Migrations in a Model of Structural Transformation

Trevor Tombe
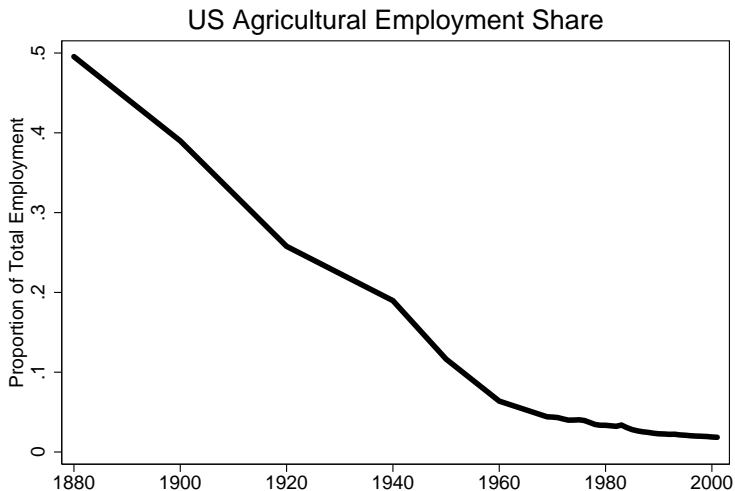
CEA 2010 - Quebec City

May 28, 2010

Structural Change: Food Expenditure Share

Structural Change: Employment

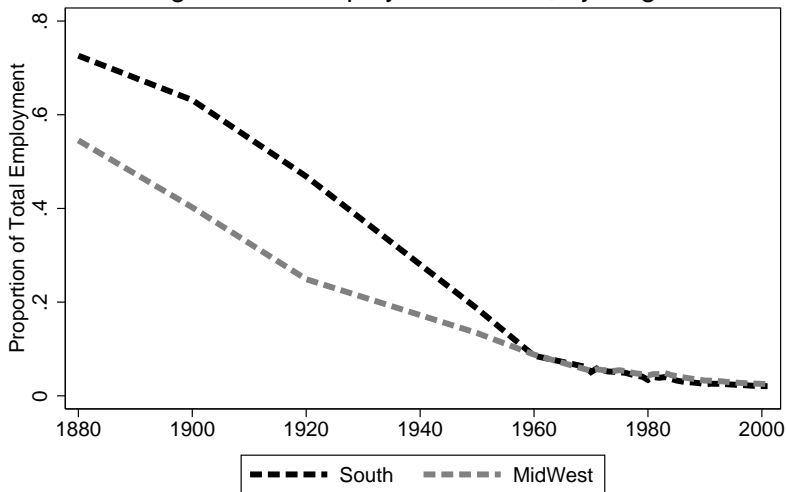## US Agricultural Employment Share

Source: Lee et al. (1957), 1880–1920; Caselli and Coleman (2001), 1940–60; BEA, 1969–2001

Regions Defined

Structural Change: Employment

Agricultural Employment Share, by Region

Source: Lee et al. (1957), 1880–1920; Caselli and Coleman (2001), 1940–60; BEA, 1969–2001

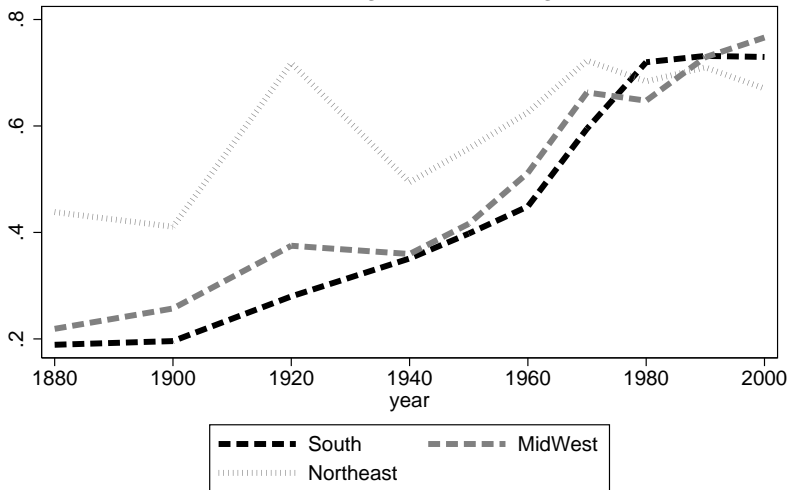# Rising Agricultural Wages

Relative Agricultural Wages
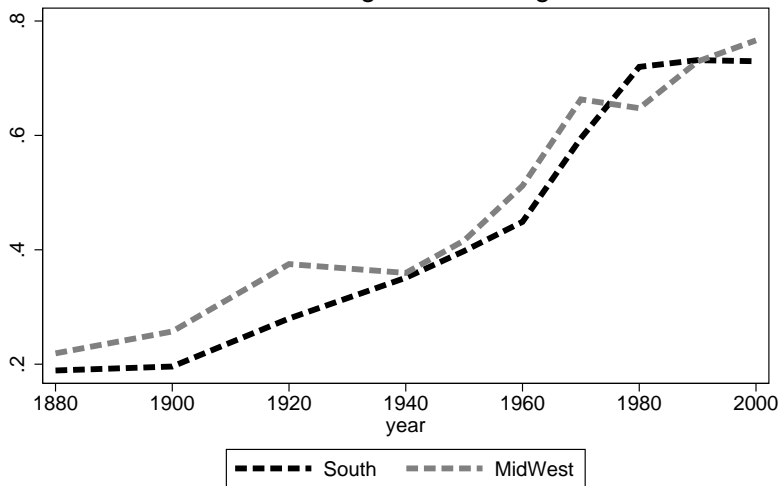
Source: Lee et al. (1957), 1880–1920; Caselli and Coleman (2001), 1940–90; IPUMS Census, 2000

Rising Agricultural Wages

Relative Agricultural Wages

Source: Lee et al. (1957), 1880–1920; Caselli and Coleman (2001), 1940–90; IPUMS Census, 2000

Motivation

Can structural change drive convergence between regions?

- Caselli and Coleman (2001) investigate Northeastern and Southern US States

Intuition: improved ability of workers to acquire nonagricultural skills will

- Increase agricultural wages
- Increase employment share in the higher paying nonagricultural sector
- Increase relative earnings in the previously agriculture-intensive (poorer) region

However, generates counterfactual migration patterns and is difficult to match experiences of other regions

Regional Convergence Patterns

Average Income Relative to Northeast
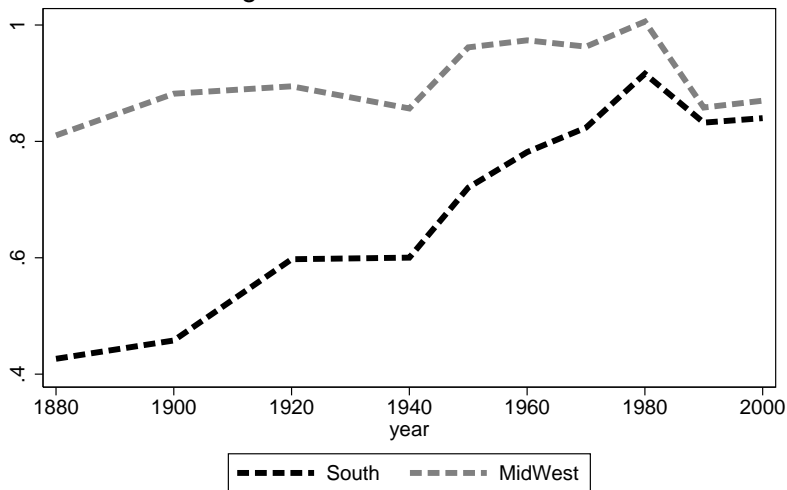
Source: Lee et al. (1957), 1880–1920; Caselli and Coleman (2001), 1940–90; IPUMS Census, 2000

"Peripheral" Migration

Employment Relative to Northeast
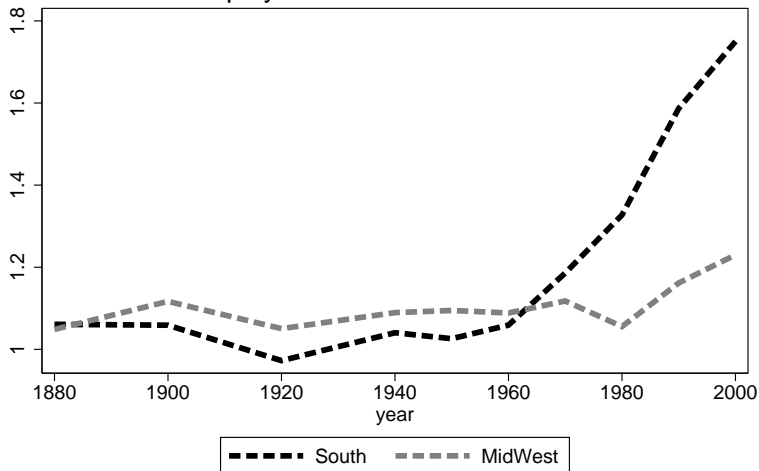
Source: Lee et al. (1957), 1880–1920; Caselli and Coleman (2001), 1940–90; IPUMS Census, 2000

Motivation

Migration patterns:

- Improved ability to leave farm employment will lead to out-migration from the agriculture-intensive region
- Data, however, suggests exactly the opposite

Other regions: Midwestern versus Northeastern US states

- Relative sectoral wages in Midwest similar to South
- Majority of employment in agriculture, as in South
- However, far less convergence than North-South

Motvation - Takeaway Message

My approach:

- General equilibrium equilibrium model of structural transformation
- Calibrated to match US regional data between 1880 and 1990
- Incorporate between region transportation costs, between region migration costs, and between sector (within region) labour switching costs

Findings:

- Migration barriers magnify income convergence effect of labour market improvements found by Caselli and Coleman (2001)
- Transportation cost improvements offsets convergence effect, and explain the Midwestern experience

Technology

Production: for each region $i \in \{p, c\}$ and sector $s \in \{f, m\}$

$$
\begin{aligned}
Y_s^i &= A_s^i N_s^{i\,\alpha_s} L_s^{i\,1-\alpha_s} \\
\max_{Y,L,N} \Pi_s^i &= P_s^i Y_s^i - w_s^i L_s^i - r_s^i N_s^i
\end{aligned}
$$

Transportation: for all $i, j = p, c$, $i \neq j$, and $s \in \{f, m\}$

$$
\begin{aligned}
\max_{D_s^i, B_s^i} \pi_t &= P_f^i D_f^i + P_m^i D_m^i - p_f^j B_f^j - p_m^j B_m^j \\
D_s^i &= \Delta B_s^j
\end{aligned}
$$

$$
\Rightarrow \Delta_t P_m^p = P_m^c \text{ and } P_f^c = 1/\Delta_t
$$

Preferences

Households: Nonhomothetic preferences

$$\max_{\{c_f^i, c_m^i, L_f^i, L_m^i\}} \left(\tau \log(c_f^i - \bar{a}) + (1 - \tau) \log(c_m^i)\right)$$

$$\text{s.t. } P_f^i c_f^i + P_m^i c_m^i \leq L_f^i w_f^i + L_m^i w_m^i$$

Migration: Costs proportional to utility

$$c_m^{p\,\tau} c_f^{p\,1-\tau} = \mu c_m^{c\,\tau} c_f^{c\,1-\tau}$$

Training: Time cost to *maintain* nonagricultural skills

$$(1 - \xi) w_m^p \geq w_f^p$$

Calibration of Model Parameters

Table: Common Time-Invariant Parameters

Parameter	Description	Target	Value
α	Nonlabour Income Share	Literature	0.4
τ	Agricultural goods' preference weight	Literature	0.01

Table: Productivity Parameter, A_s^i, Data: 1880-1990

Statistic	Agriculture	Nonagriculture
Employment Growth	-1.01%	2.38%
Producer Price Growth	1.24%	2.41%
Nominal GDP Growth	2.14%	5.79%
Real GDP Growth	0.91%	3.39%
A	1.51%	**1.96**%

Calibration of Model Parameters

Table: Region-Specific and Time-Varying Model Parameters

Parameter	Description	Target	MW-NE		S-NE	
Directly Calibrated Using Observable Data			1880	1990	1880	1990
Δ_t^i	Between-region transportation cost	Price differentials	0.70	0.90	0.95	0.99
ξ_t^i	Sectoral switching cost	Wage differentials	0.78	0.27	0.81	0.28
Jointly Calibrated Using Model Output			1880	1990	1880	1990
$\overline{a}^i$	Subsistence level for food	Consumption shares	0.13		0.21	
Ω^i	MW/S immobile factor share	Regional incomes	0.38		0.33	
μ_t^i	Ease of between-region migration	Regional employment	0.58	0.78	0.37	0.82
			Initial	Growth	Initial	Growth
$A_{f,t}^P$	MW/S agricultural productivity	Normalization	1.00	2.91%	1.00	3.97%
$A_{m,t}^{P'}$	} Nonagricultural productivity	Sectoral Employment	0.98	1.97%	0.97	2.22%
$A_{m,t}^C$		& Regional Incomes	1.01	1.95%	1.03	1.93%

Calibration Performance vs. Data

Table: Midwest-Norhteast

Observed Outcome in	1880		1990	
Peripheral Region	Data	Model	Data	Model
Relative Employment Size	1.05	1.05*	1.16	1.16*
Agricultural Employment Share	0.55	0.55*	0.03	0.04
Relative Income	0.81	0.81*	0.86	0.86*

Note: Asterisks denotes targets

Table: South-Northeast

Observed Outcome in	1880		1990	
Peripheral Region	Data	Model	Data	Model
Relative Employment Size	1.06	1.06*	1.59	1.59*
Agricultural Employment Share	0.73	0.73*	0.03	0.03
Relative Income	0.43	0.43*	0.83	0.83*

Note: Asterisks denotes targets

Isolating the Effect of Labour Market Improvements

$\left(1 - \frac{w_a}{w_m}\right) \downarrow$ by $\frac{2}{3}$ but all else unchanged.

		Reduce Labour Market	
		Friction by Two-Thirds	
	1880 Benchmark	Model with	Model with
Observed Outcome	Model Values	Migration	No Migration
Midwestern Region			
Relative Employment Size	1.05	2.20	1.05
Agricultural Labour Share	0.55	0.31	0.39
Relative Income	0.81	**0.80**	**1.06**
Relative Utility	0.58	0.58	0.81
Southern Region			
Relative Employment Size	1.06	2.85	1.06
Agricultural Labour Share	0.73	0.44	0.55
Relative Income	0.43	**0.46**	**0.67**
Relative Utility	0.37	0.37	0.58

Convergence offset by in-migration.

Isolating the Effect of Transportation Cost Reductions

$\Delta^{-1} \downarrow$ by $\frac{2}{3}$ but all else unchanged.

Observed Outcome	1880 Benchmark Model Values	Reduce Transportation Costs by Two-Thirds	
		Model with Migration	Model with No Migration
Midwestern Region			
Relative Employment Size	1.05	1.02	1.05
Agricultural Labour Share	0.55	0.51	0.50
Relative Income	0.81	**0.66**	**0.65**
Relative Utility	0.58	0.58	0.57
Southern Region			
Relative Employment Size	1.06	1.07	1.06
Agricultural Labour Share	0.73	0.72	0.72
Relative Income	0.43	**0.42**	**0.42**
Relative Utility	0.37	0.37	0.37

Lower transport costs offset convergence in both cases.

Concluding Remarks

- Labour market frictions explain less when migration permitted
- Migration cost reductions may be more important than regional labour market improvements
- Transport cost reductions offset convergence gains from structural change
- Migration costs important

Results: South-Northeast

Evidence for higher Southern productivity growth than Midwest or Northeast, from BEA (only post-1960s, not earlier). Using $\gamma_{A_m} = \gamma_{Y_m} - (1 - \alpha_m)\gamma_{L_m}$ get 7.75% for South versus 6.75% for North and 6.5% for Midwest:

Growth in Am, by Region, 1969–1997