On the Role of Policy Interventions in Structural Change and Economic Development: The Case of Japan's Postwar

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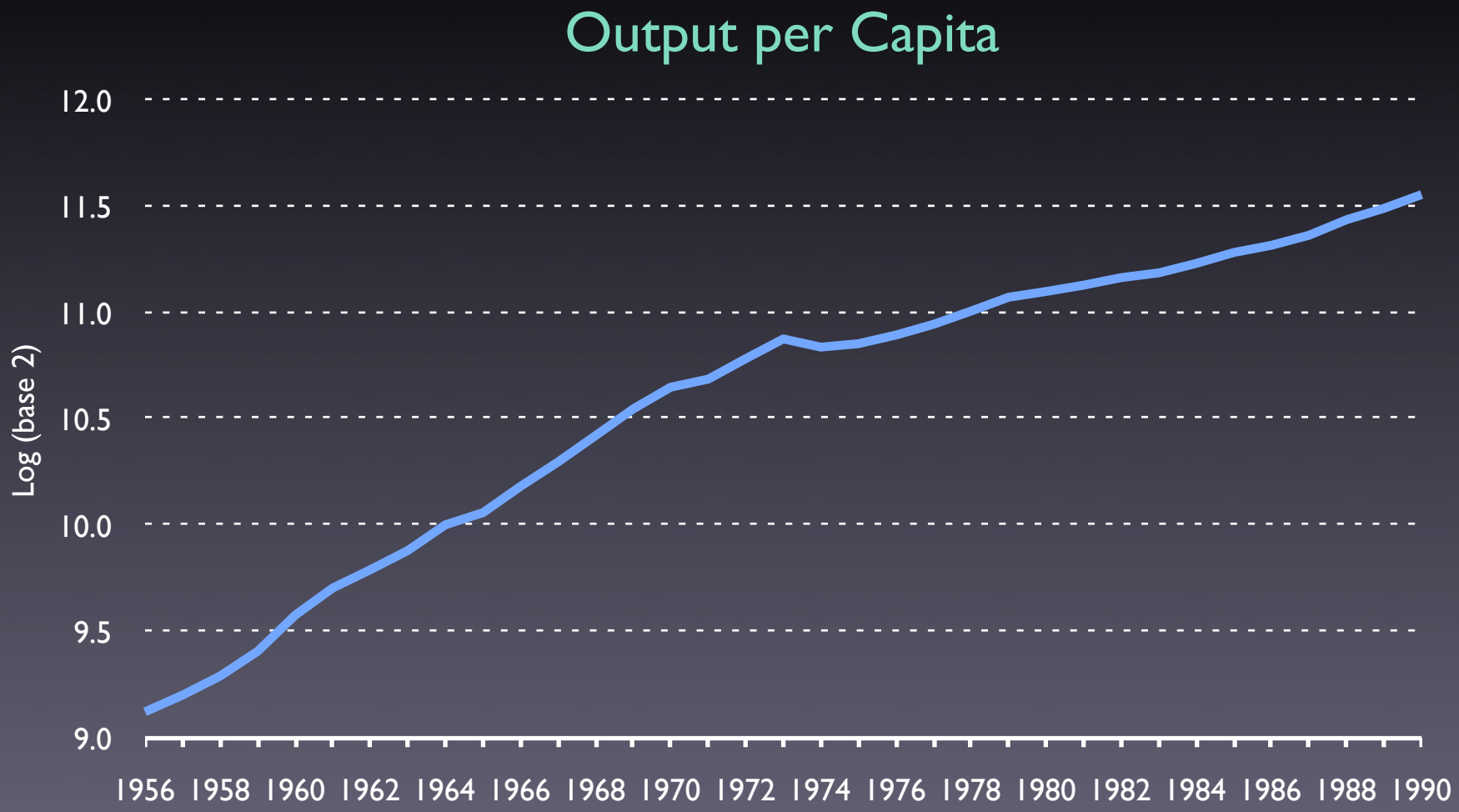
10th Macro Conference

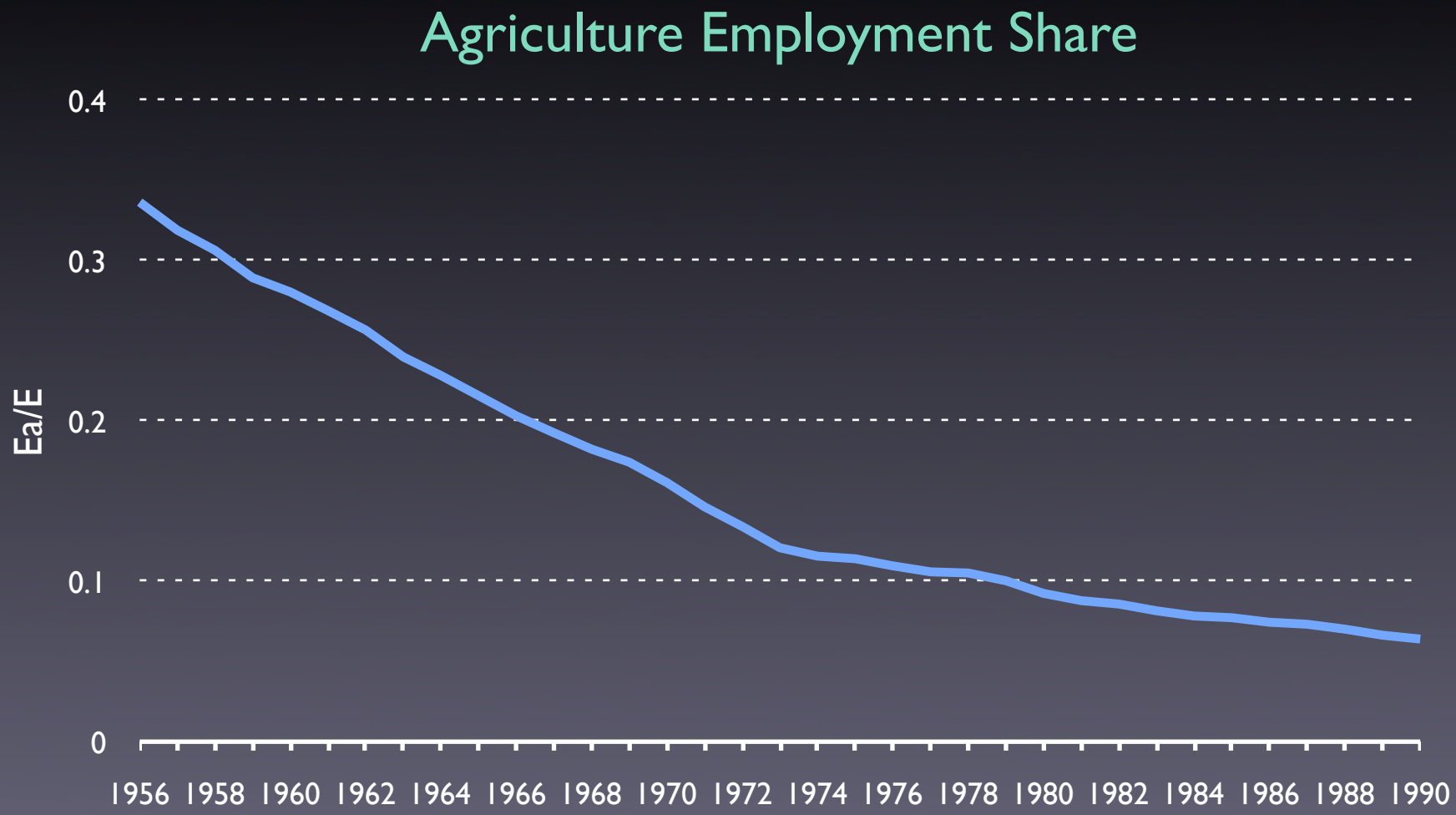
Tokyo, December 6-7, 2008

Output per Capita



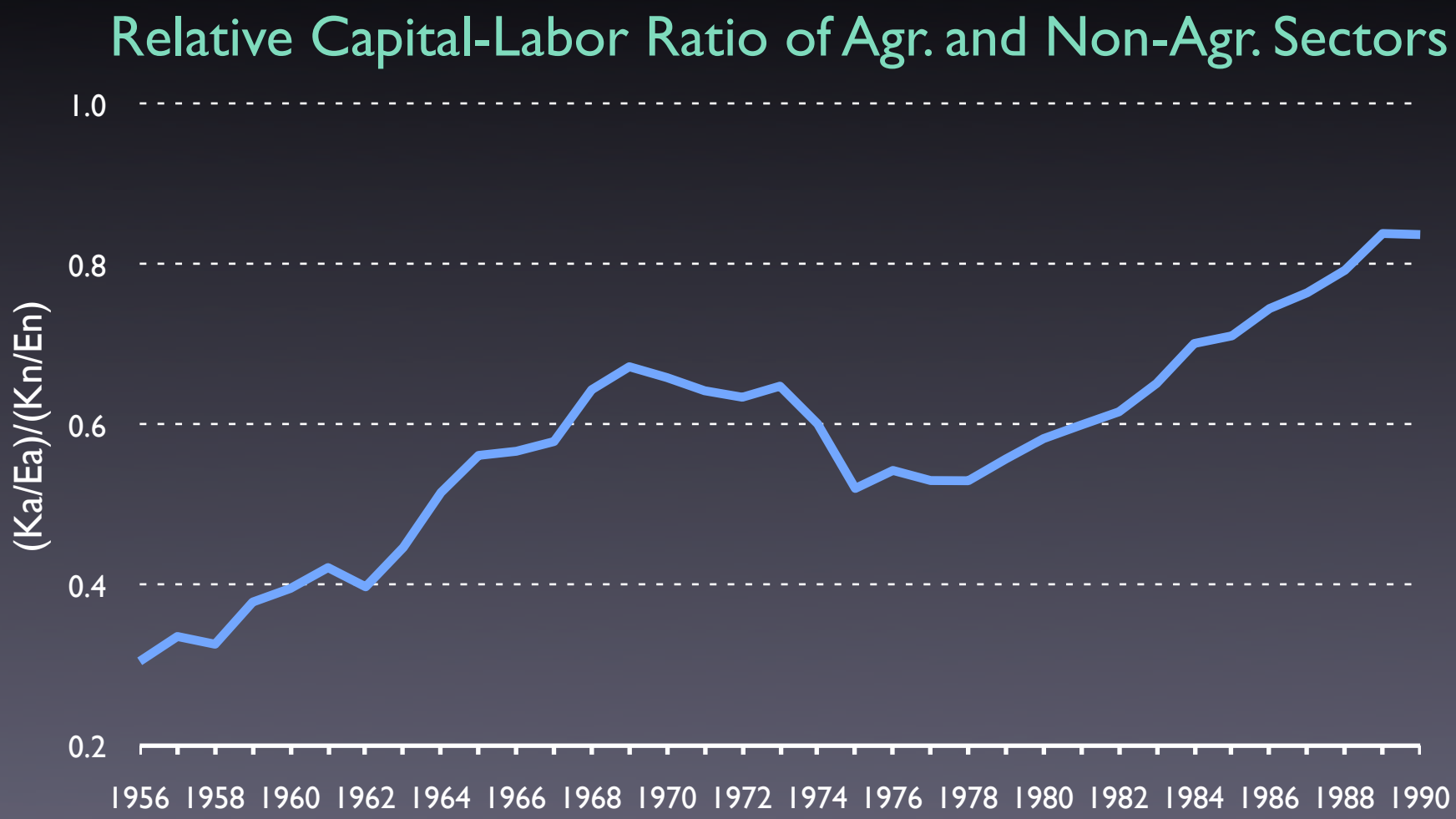
- 1950s-1973: 7.4% growth rate.
- 1974-1990: 2.8% growth rate.

Share of Employment in Agriculture



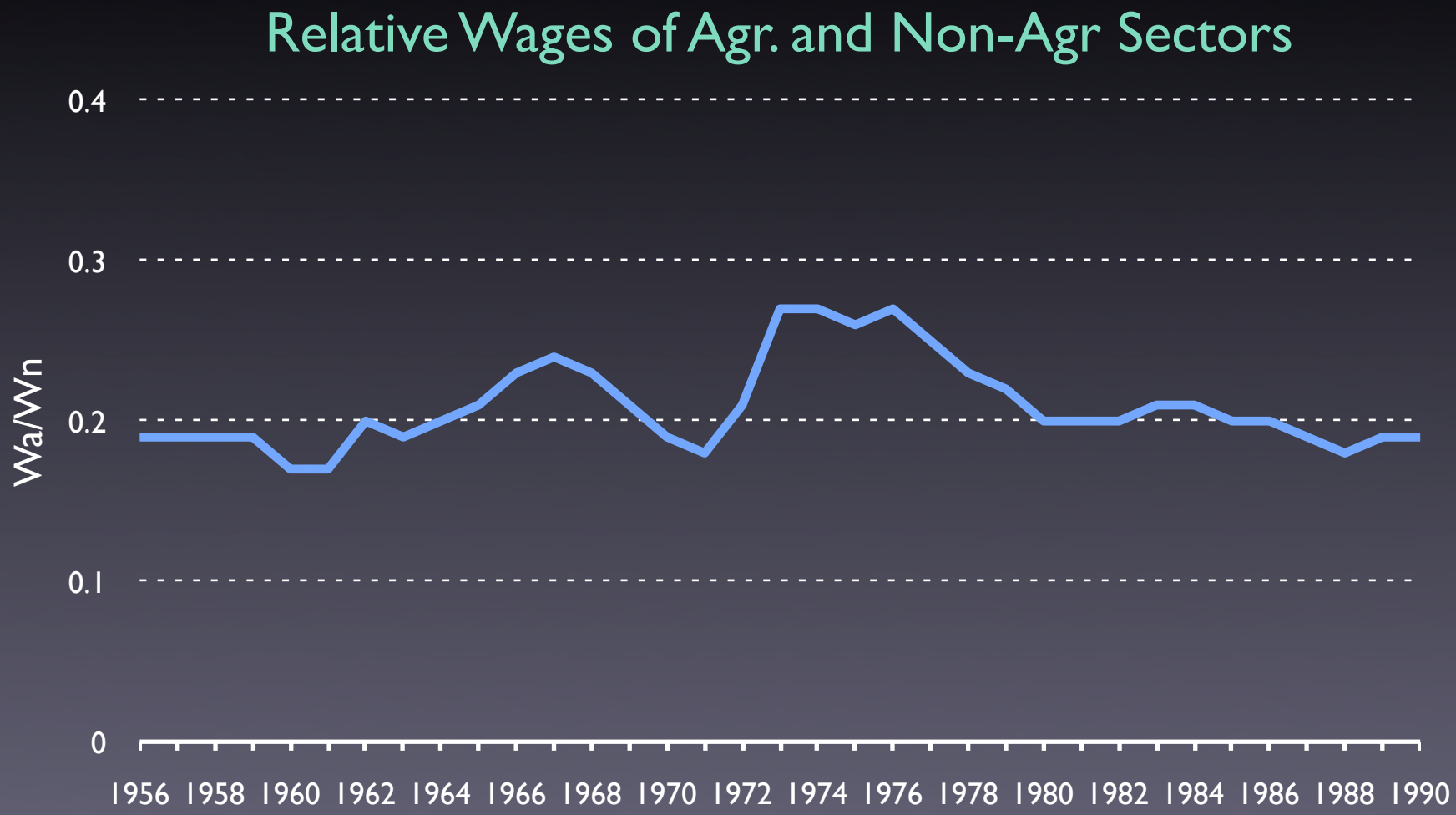
- 1950s-1973: Decreases at high pace from 34% to 12%.
- 1974-1990: Drops at slower speed to 6%.

Relative Capital-Labor Ratio



- Agriculture becomes more capital intensive.

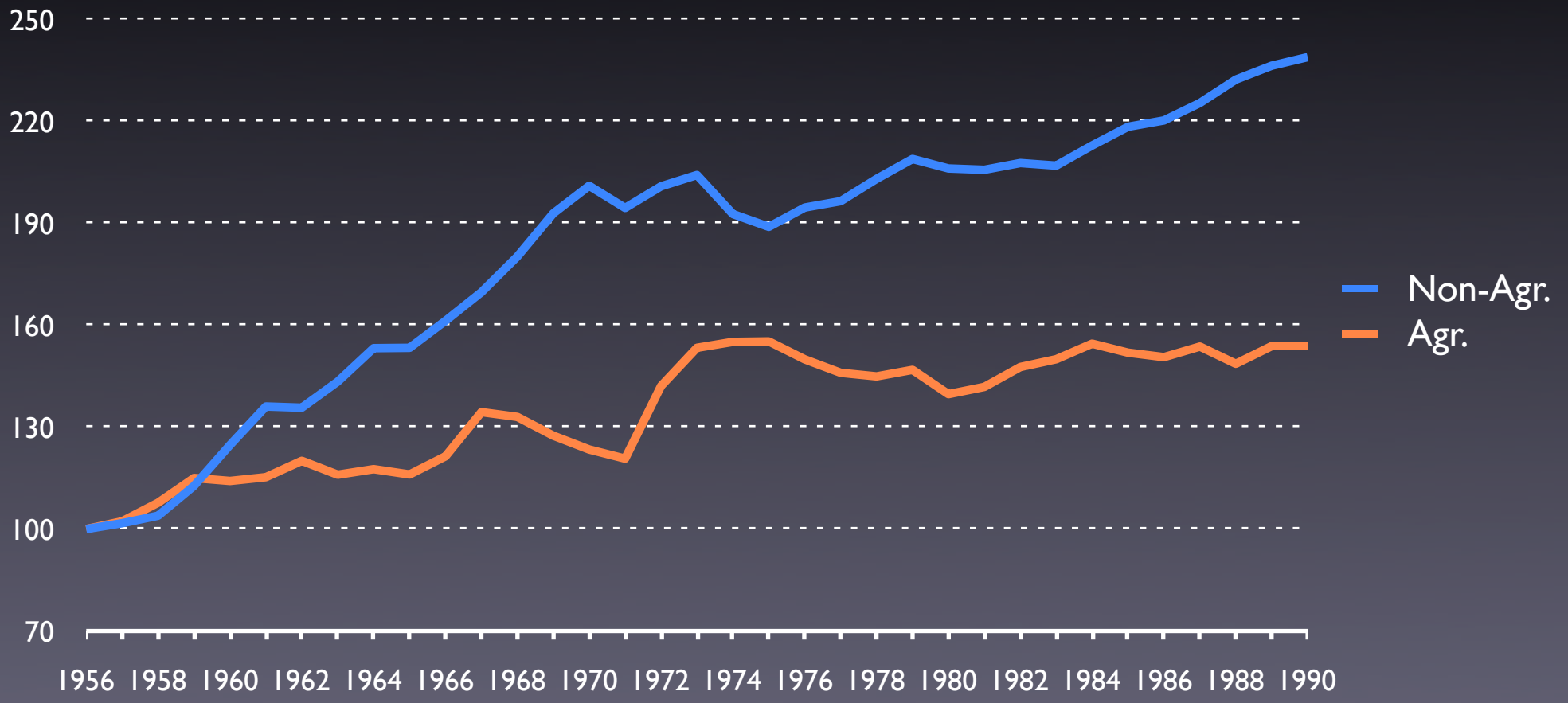
Relative Wages



- Wages in Agr. sector are 20% of those in the non-agr. sector.
- Wage gap is stable throughout postwar period.
- Household's income equalize across sectors (Hayami and Godo, 2002)

Total Factor Productivity

TFP in Agriculture and Non-Agriculture Sectors (1956=100)



- TFP grows in both sectors.
  - TFP growth is higher in Non-Agr sector.
  - Non-Agr. TFP slows down after the 1st oil shock.

Government Policies

- Industrial Policies
  - Intangible policies
    - Sharing of information and administrative guidance.
  - Tangible policies - Investment subsidies:
    - Provision of loans at subsidized rates through FILP.
    - Gov. subsidy is small: 1-3% of total interest payments.
- Agricultural sector protection
  - Investment subsidies:
    - Half of all agr. investment is financed by gov.
  - Price subsidies for agricultural goods
    - For rice, average subsidy rate is 8%, but as high as 20% in 1974.

The Questions of this Paper

(1) How important was TFP in Japan's structural change?

(2) How important were government policies in this change?

What We Do

- We build a 2-sector Neo-classical growth model with gov. policies.
- Calibrate the param. to match Japanese data in postwar period.
- Simulate the economy feeding the path of TFP and other variables.
- Perform counter-factual policy experiments.

Outline

- Model
- Data and Parameterization
- Simulation Results
- Counter-factual Experiments
- Conclusions

The Model

- Neo-Classical growth model, in the style of Cass-Koopmans.
- Two sectors:
  - Agriculture.
  - Non-agriculture.
- Infinitely lived agents:
  - Household.
  - Firms.
  - Government.

Household

- There is a representative household.
- Splits into families:
  - 4 members.
  - Lives in - rural area: 1 agr. worker + 3 non-agr. workers;
    - urban area: 4 non-agr workers.
- Families in urban area pay Φ_t per person (no cost for rural families):
  - Cost proxies for rent, commuting, outside food consumption,...
- Income from agriculture is not taxed (tax evasion).

Household's Problem

- The household chooses $\{c_{at}, c_{nt}, K_{t+1}, s_{et}, s_{kt}\}_{t=0}^{\infty}$ to max

$$\sum_{t=0}^{\infty} \beta^t N_t u\left(c_{at}, c_{nt}\right)$$

$$\begin{aligned}\text{s.t. } q_t C_{at} + C_{nt} + T_t + K_{t+1} =& \Pi_t + w_{at} h_{at} s_{et} E_t + \left(1 - \tau_{lt}\right) w_{nt} h_{nt} \left(1 - s_{et}\right) E_t \\ & - \Phi_t \left(\left(1 - s_{et}\right) E_t - 3 s_{et} E_t\right) + \left(1 - \delta_t\right) K_t + r_{at} s_{kt} K_t \\ & + r_{nt} \left(1 - s_{kt}\right) K_t - \tau_{kt} \left(r_{nt} - \delta_t\right) \left(1 - s_{kt}\right) K_t,\end{aligned}$$

given K_0.

Household's Optimal Conditions

- FOC for c_{at}

$$\frac{\partial u(c_{at}, c_{nt})}{\partial c_{at}} = \frac{q_t}{\lambda_t}$$

- FOC for c_{nt}

$$\frac{\partial u(c_{at}, c_{nt})}{\partial c_{nt}} = \frac{1}{\lambda_t}$$

- FOC for K_{t+1}

$$\lambda_{t+1} = \beta \lambda_t [1 + r_{t+1} - \delta_t]$$

- s_{et} is chosen to satisfy

$$w_{at} h_{at} + 3 (1 - \tau_{lt}) w_{nt} h_{nt} = 4 (1 - \tau_{lt} - \phi_t) w_{nt} h_{nt}$$

- s_{kt} is chosen to satisfy

$$r_{at} = (1 - \tau_{kt}) r_{nt} + \tau_{nt} \delta_t$$

Firm's Problem

- Agricultural sector firms:
  - Production function: $Y_{at} = A_{at} K_{at}^{\alpha_a} L_{at}^{\eta}$, where $\alpha_a + \eta < 1$.
  - Choose $\{K_{at}, L_{at}\}$ to max $(1 + \pi_{qt}) q_t Y_{at} - (1 - \pi_{Kat}) r_{at} K_{at} - w_{at} L_{at}$
  - Optimal conditions:

$$r_{at} = \frac{(1 + \pi_{qt})}{(1 - \pi_{kat})} \frac{\alpha_a q_t A_{at} K_{at}^{\alpha_a - 1} L_{at}^{\eta}}{K_{at}}, \quad w_{at} = \eta \frac{(1 + \pi_{qt}) q_t A_{at} K_{at}^{\alpha_a} L_{at}^{\eta - 1}}{L_{at}}.$$

- Non-agricultural sector firms:
  - Production function: $Y_{nt} = A_{nt} K_{nt}^{\alpha_n} L_{nt}^{1 - \alpha_n}$
  - Choose $\{K_{nt}, L_{nt}\}$ to max $Y_{nt} - (1 - \pi_{knt}) r_{nt} K_{nt} - w_{nt} L_{nt}$
  - Optimal conditions:

$$r_{nt} = \frac{1}{(1 - \pi_{knt})} \frac{\alpha_n A_{nt} K_{nt}^{\alpha_n - 1} L_{nt}^{1 - \alpha_n}}{K_{nt}}, \quad w_{nt} = (1 - \alpha_n) \frac{A_{nt} K_{nt}^{\alpha_n} L_{nt}^{-\alpha_n}}{L_{nt}}.$$

Government

- The gov. taxes the household and subsidizes firms and has gov. expenditures G_t, keeping a balanced budget every period.

$$T_t + \tau_{lt} w_{nt} h_{nt} \left(1 - s_{et}\right) E_t + \tau_{kt} \left(r_{nt} - \delta\right) \left(1 - s_{kt}\right) K_t =$$

$$\pi_{qt} q_t Y_{at} + \pi_{kat} r_{at} K_{at} + \pi_{knt} r_{nt} K_{nt} + G_t.$$

Solution Method and Exogenous Variables

- Perfect foresight forward shooting algorithm, given initial conditions in 1956.
- We feed the model the path of exogenous variables:
  - TFP (Source: Hayashi and Prescott, 2008, and own extension)
    - Agr TFP (A_{at}), Non-Agr TFP (A_{nt})
  - Population (N_t), Employment (E_t), and Hours (h_{at} , h_{at}) (Source: HP, 2008)
  - Capital depreciation (δ_t) (Source: Hayashi and Prescott, 2002)
  - Labor inc. tax (τ_{lt}), Capital inc. tax (τ_{kt}) (Source: Medoza et al. , 1994)
  - Subsisidies
    - Agr price subsidies (π_{qt}) (Source: Food Agency)
    - Agr capital cost subsidy (π_{kat}) (Source: Min. of Agr., Forestry and Fishing)
    - Non-Agr capital cost subsidy (π_{knt}) (Source: Cargill and Yoshino, 2003)
  - Gov. expenditure share of output (ψ_t) (Source: HP, 2008)
  - Cost of living in urban area, (Φ_t) (Calibrated: $\phi_t = \frac{1}{4}\left(1 - \tau_{lt} - \frac{w_{at}h_{at}}{w_{nt}h_{nt}}\right)$

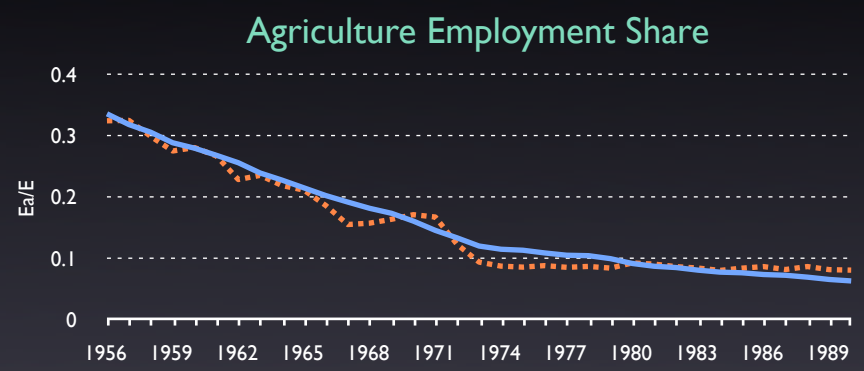
Parameterization

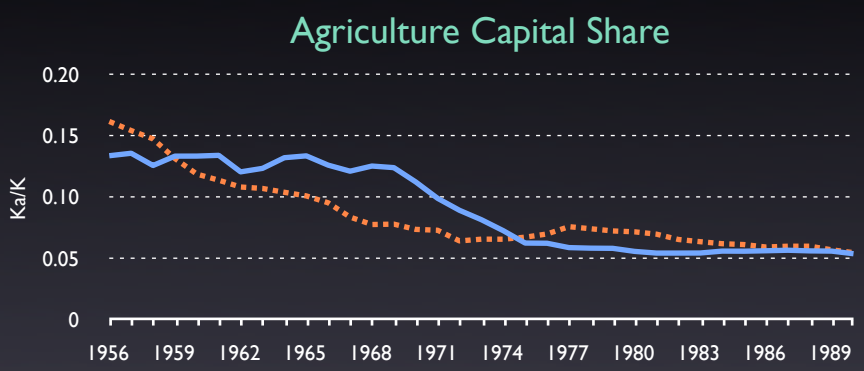
- We assume Engle's Law: $u(c_a, c_n) \equiv \mu_a \log(c_a - \bar{a}) + \mu_n \log c_n$

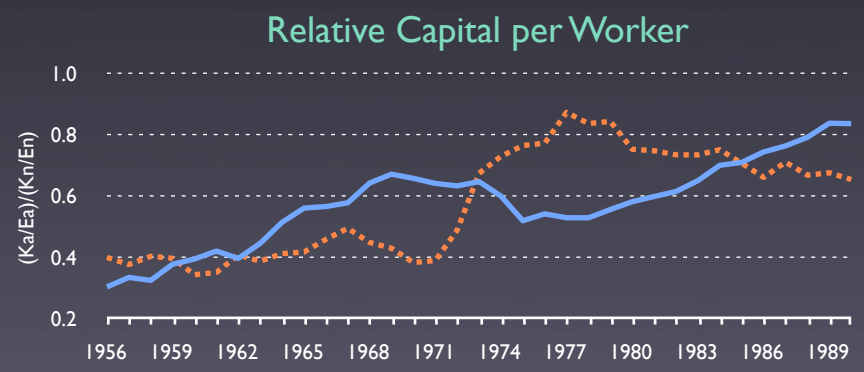
Calibrated parameters

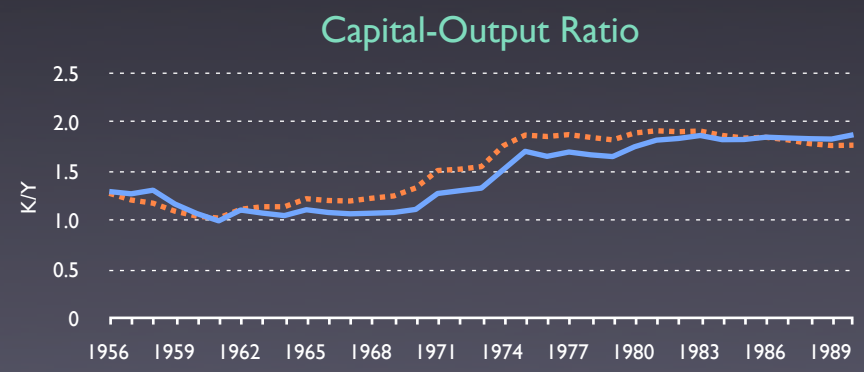
Parameters (6)	*Moment/Condition Matched (6)*	*Source*
β : Discount Factor 0.963	Capital-Output ratio (1990) 1.87	SNA Data
$\bar{a}$: Agr. good subsistence level 63.2	Agr. ouput share in 1956	SNA Data
μ_a : Weight of food cons. in util. 0.0025	μ_n = 1 - μ_a and from 1956-1990. $\frac{\mu_a}{\mu_n} = \frac{(c_{at} - \bar{a})q_t}{c_{nt}}$	SNA Data
α_n : K share in non-agr output 0.33		Hayashi and Prescott (2008)
α_a : K share in agr output 0.36	$r_{at} = (1 - \tau_{kt})r_{nt} + \tau_{nt}\delta_t$ and MP cond.	SNA Data
η : Labor share in agr output 0.45	$\eta = (1 - \alpha_a)\frac{\text{labor share}}{\text{labor share+land share}}$	Hayami et al. (1975)

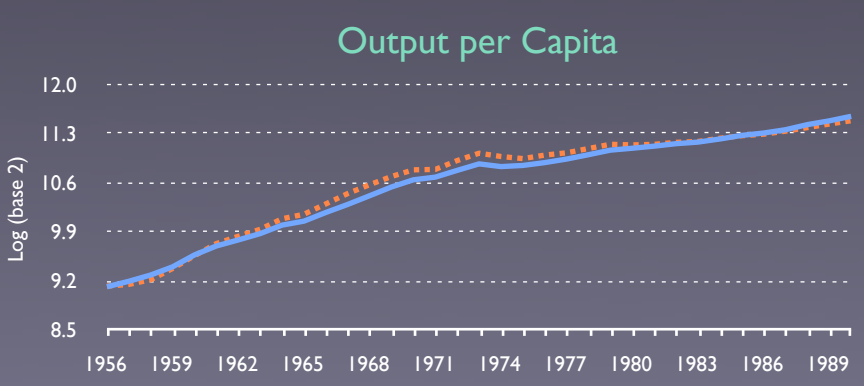
Simulations Results

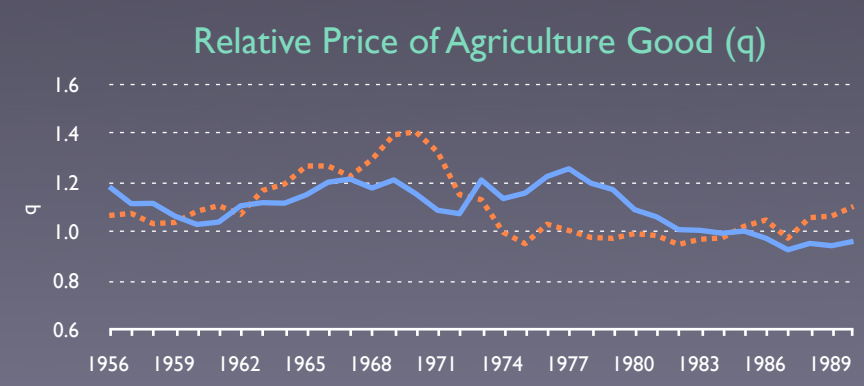








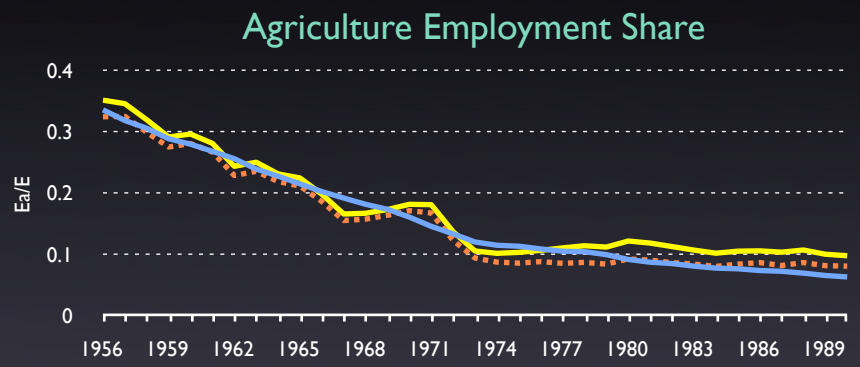


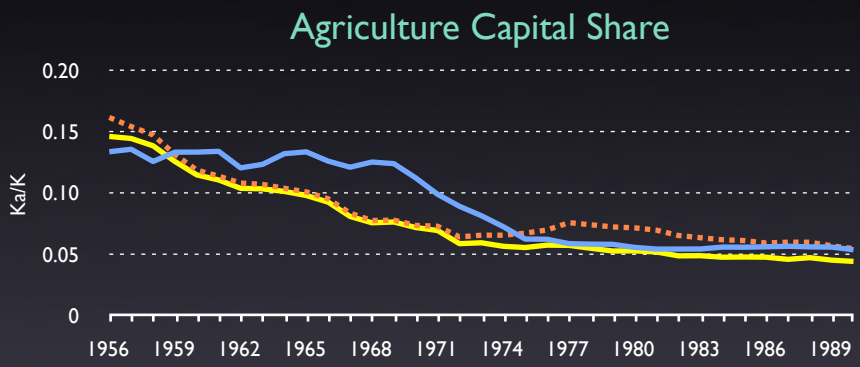


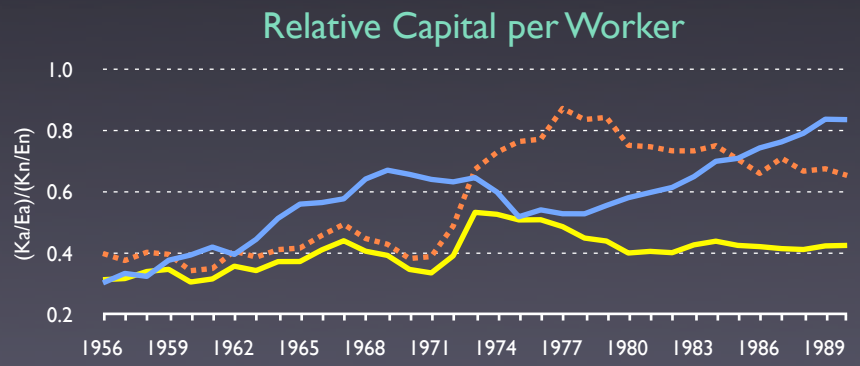
Data

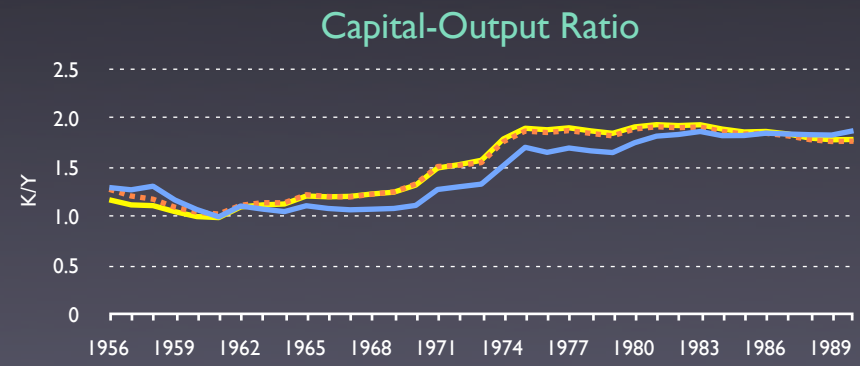
Model

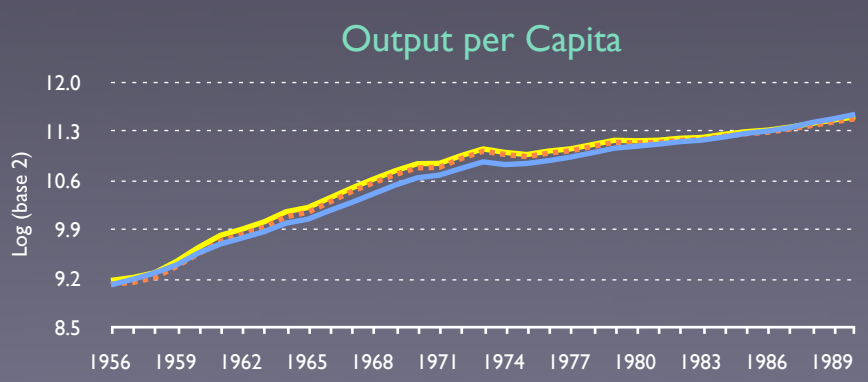
Remove Gov. Subsidies ($\pi_{qt} = \pi_{kat} = \pi_{knt} = 0$)

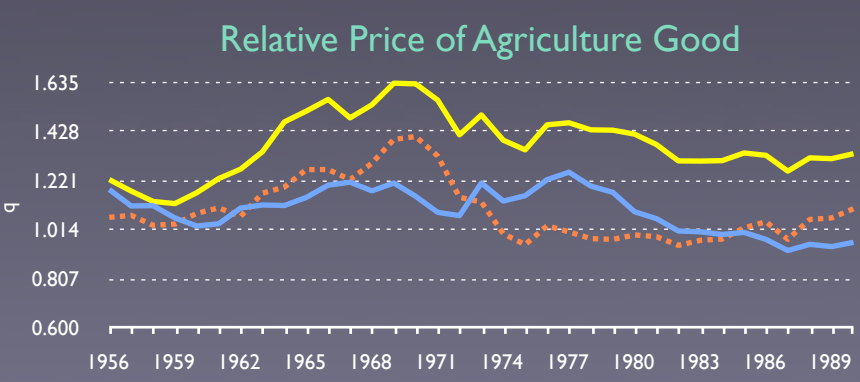






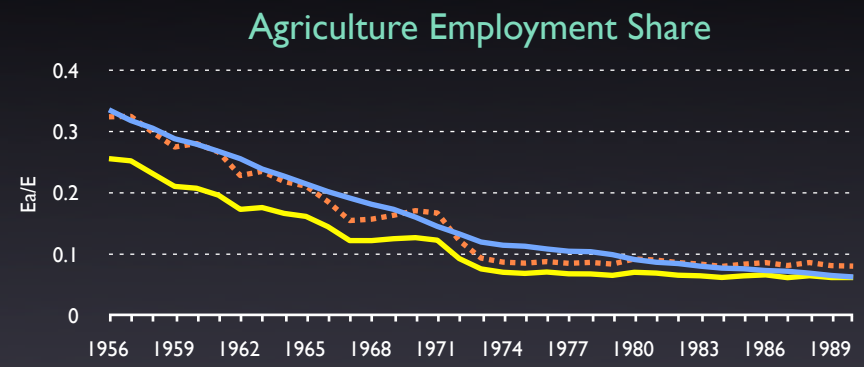


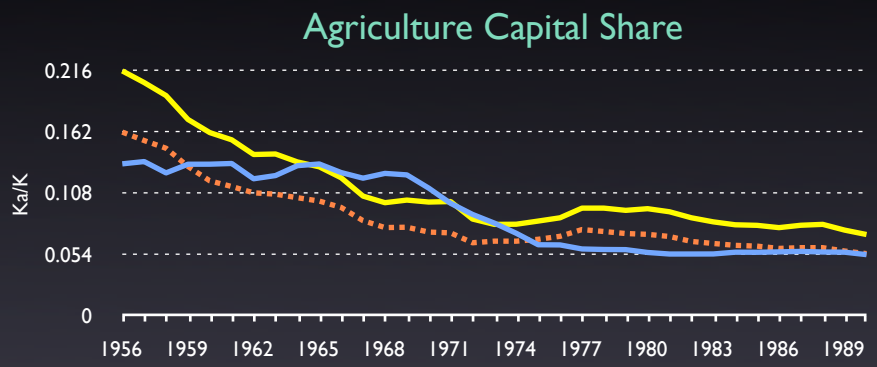


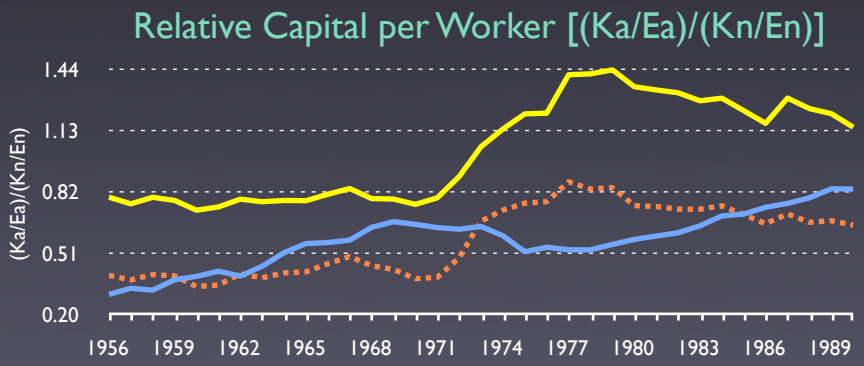


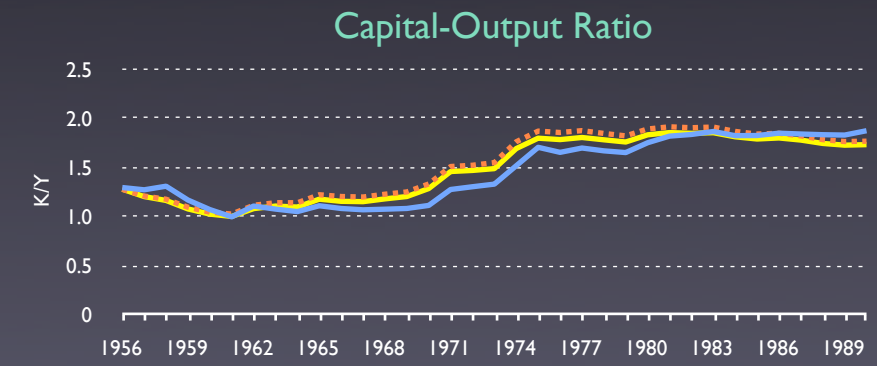
Data Model No Subsidies

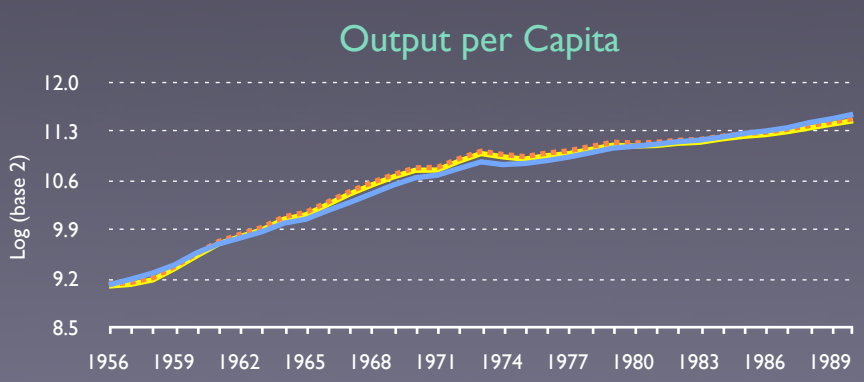
Subsidy to Cost of Living in the City (30%)

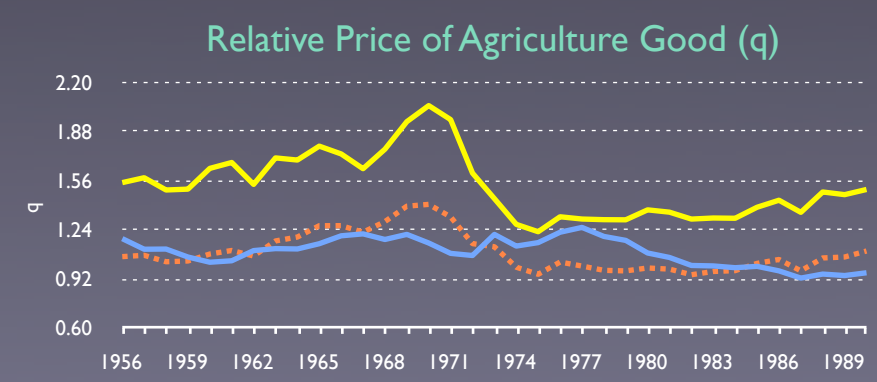






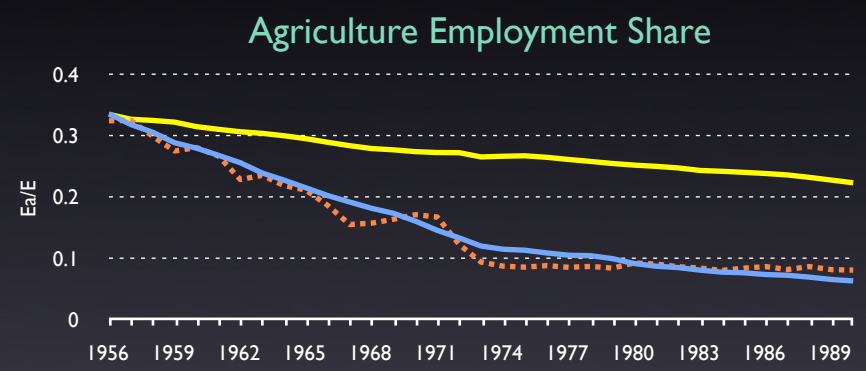


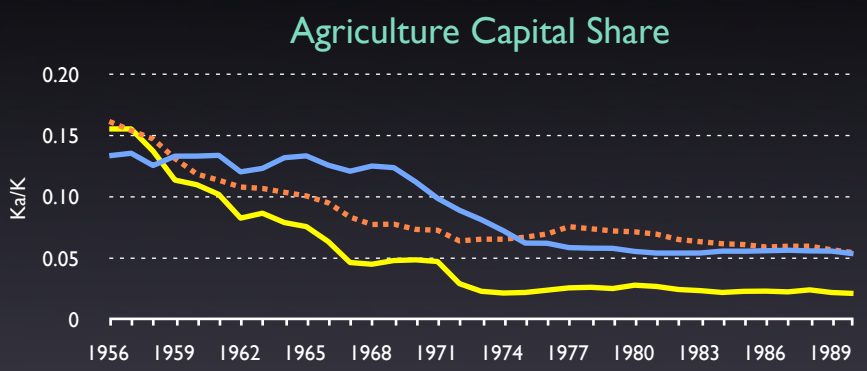


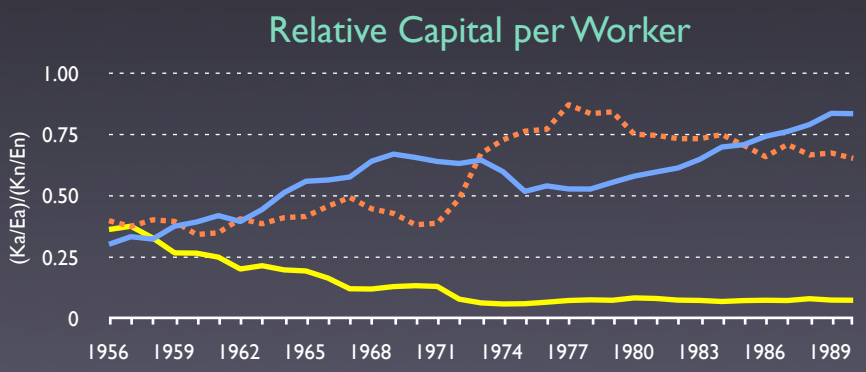


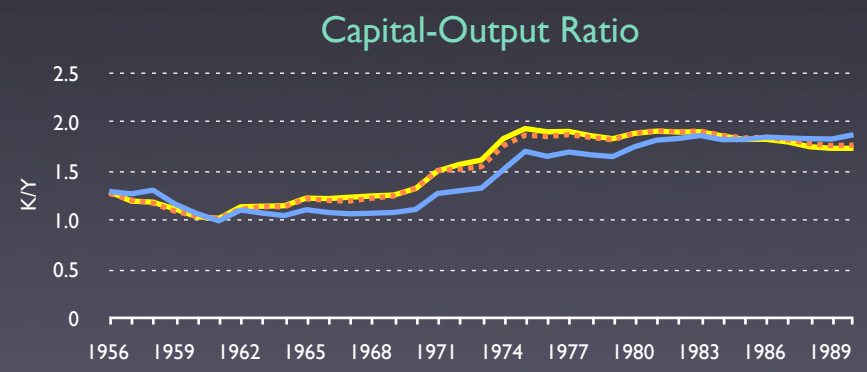
Data Model Subsidy to Φt

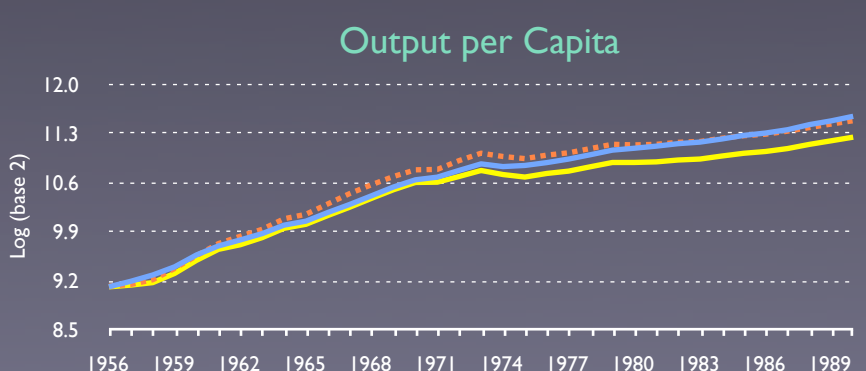
Labor Mobility Barrier (E_a = 14 Million)

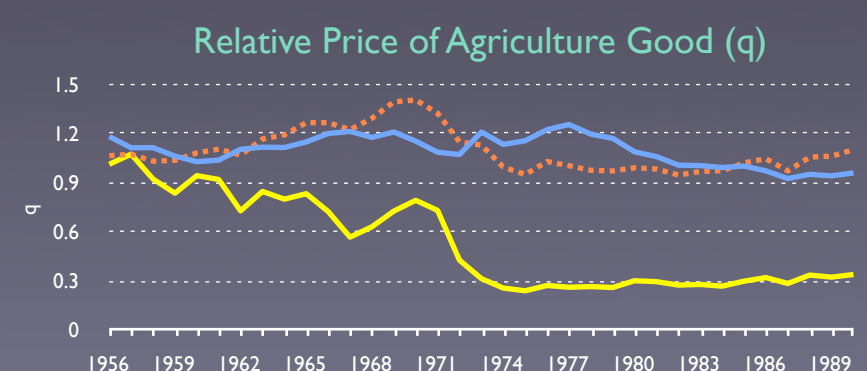












Data Model Labor Mobility Barrier

Conclusions

- Japan had great output growth in post-war period, accompanied by a shift in labor from agr to non-agr activities.
- We build a two-sector neo-classical growth model with gov policies to explain the struc. change and study policy effects.
- The model matches the data fairly well.
- Counterfactual policies show that:
  - Subsidies are not all that important.
  - Cost of moving to the city is important, but not on the performance of output.
  - Barrier is important, and had it not disappeared, output per capita in the long-run would have been lower.

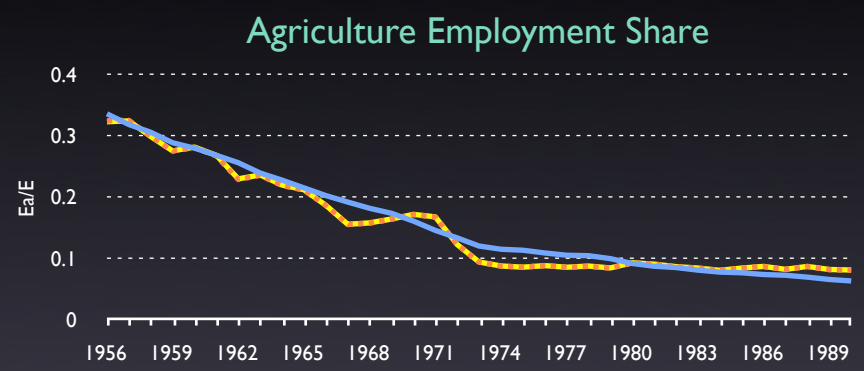
Income Equilization

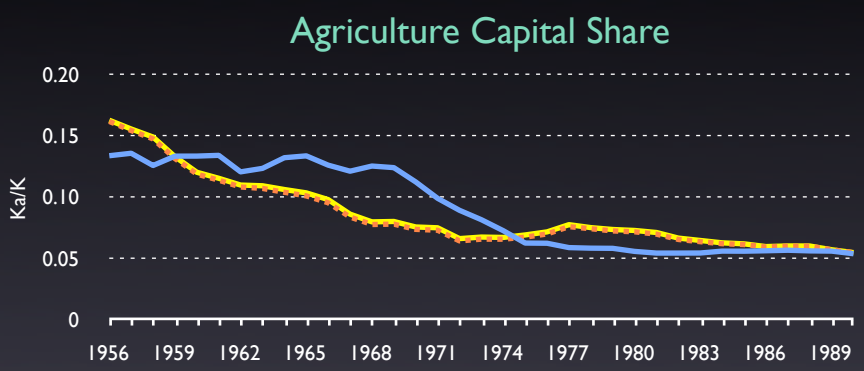
- Hayami and Godo (2002) and Hayami (1986) report data on income for farming and non-farming households.

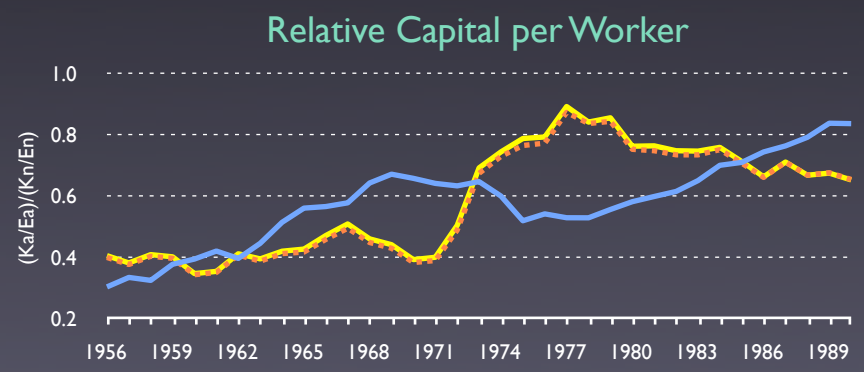
Year	Farm HH Inc. / Worker HH Inc.
1955	1.02
1960	0.91
1965	1.05
1970	1.17
1975	1.37
1980	1.34
1983	1.32
1990	1.40
1998	1.23

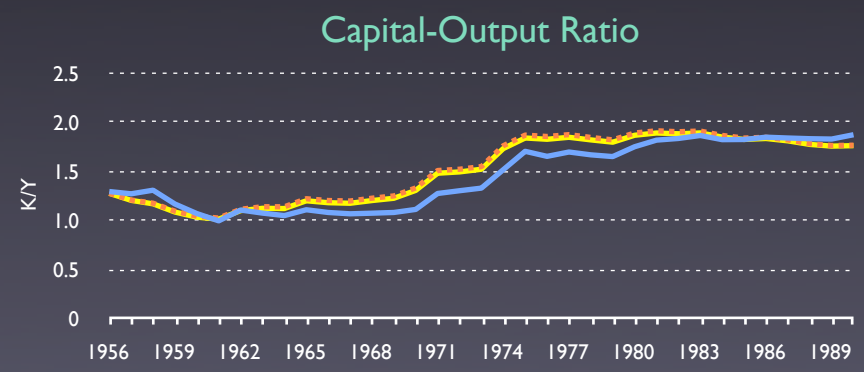
Back

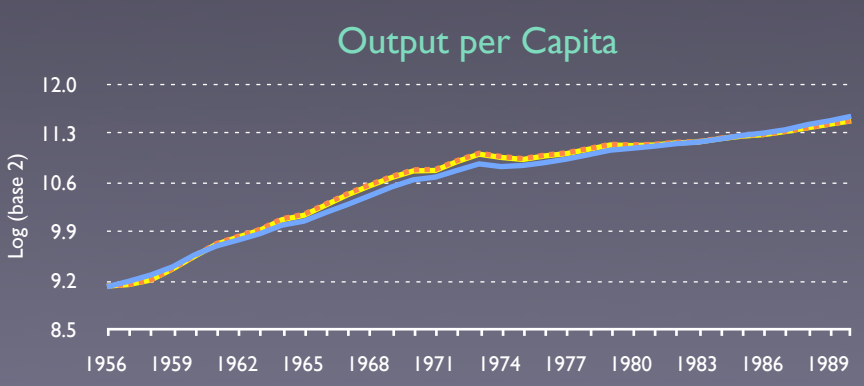
No Inv. Subsidies for Non-Agr. ($\pi_{knt} = 0$)

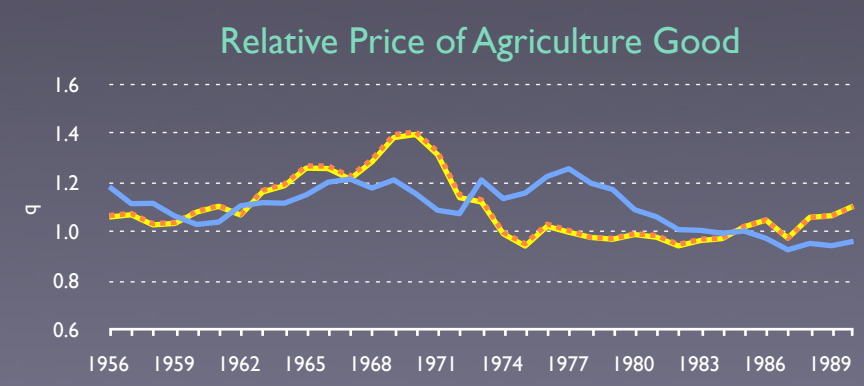






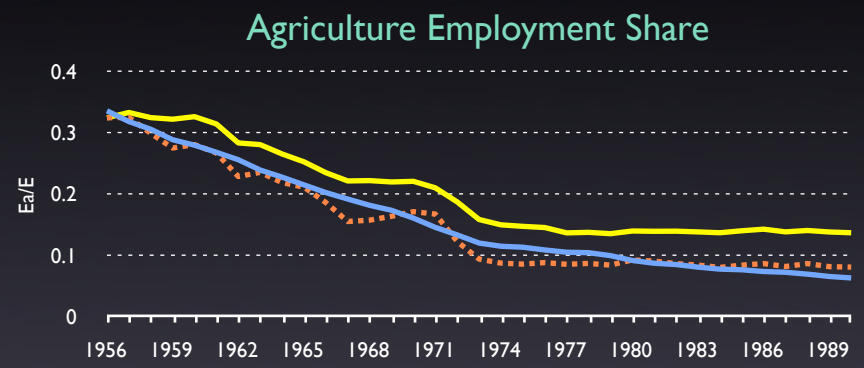


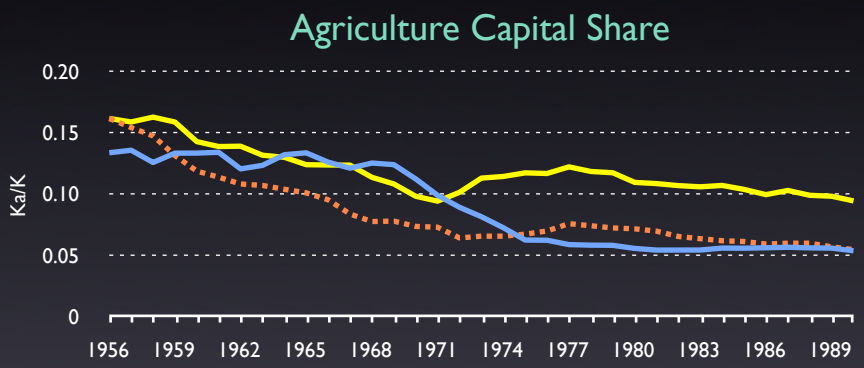


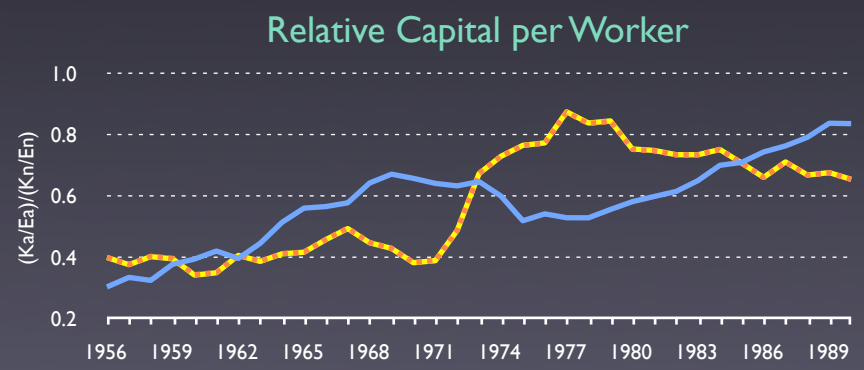


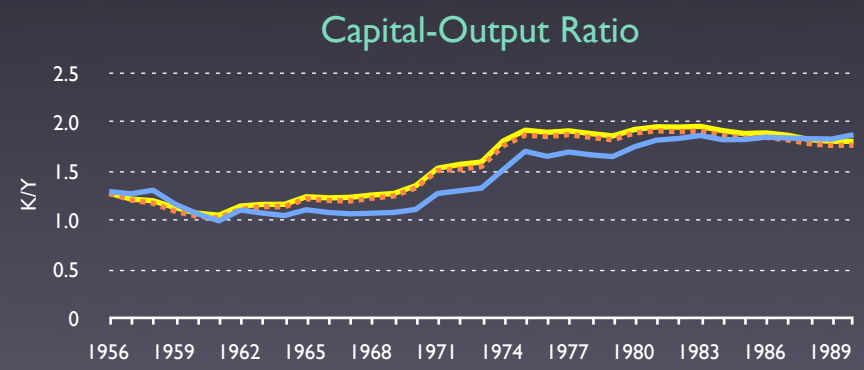
Data Model No Subsidies

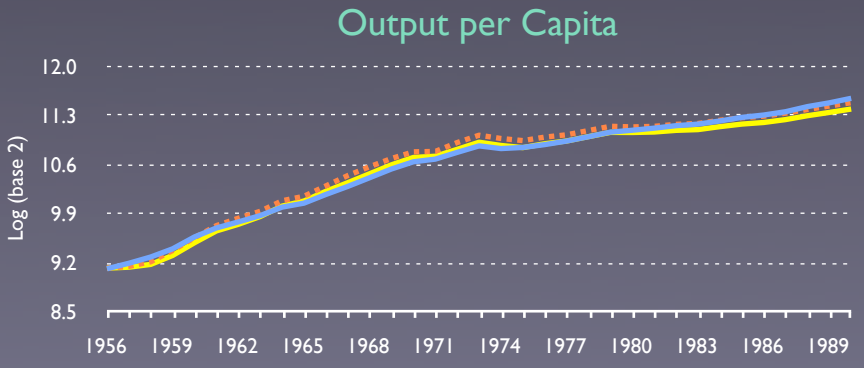
Constant TFPa

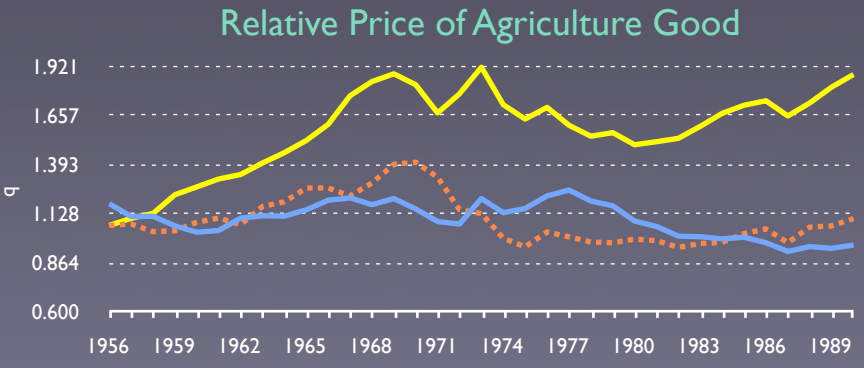






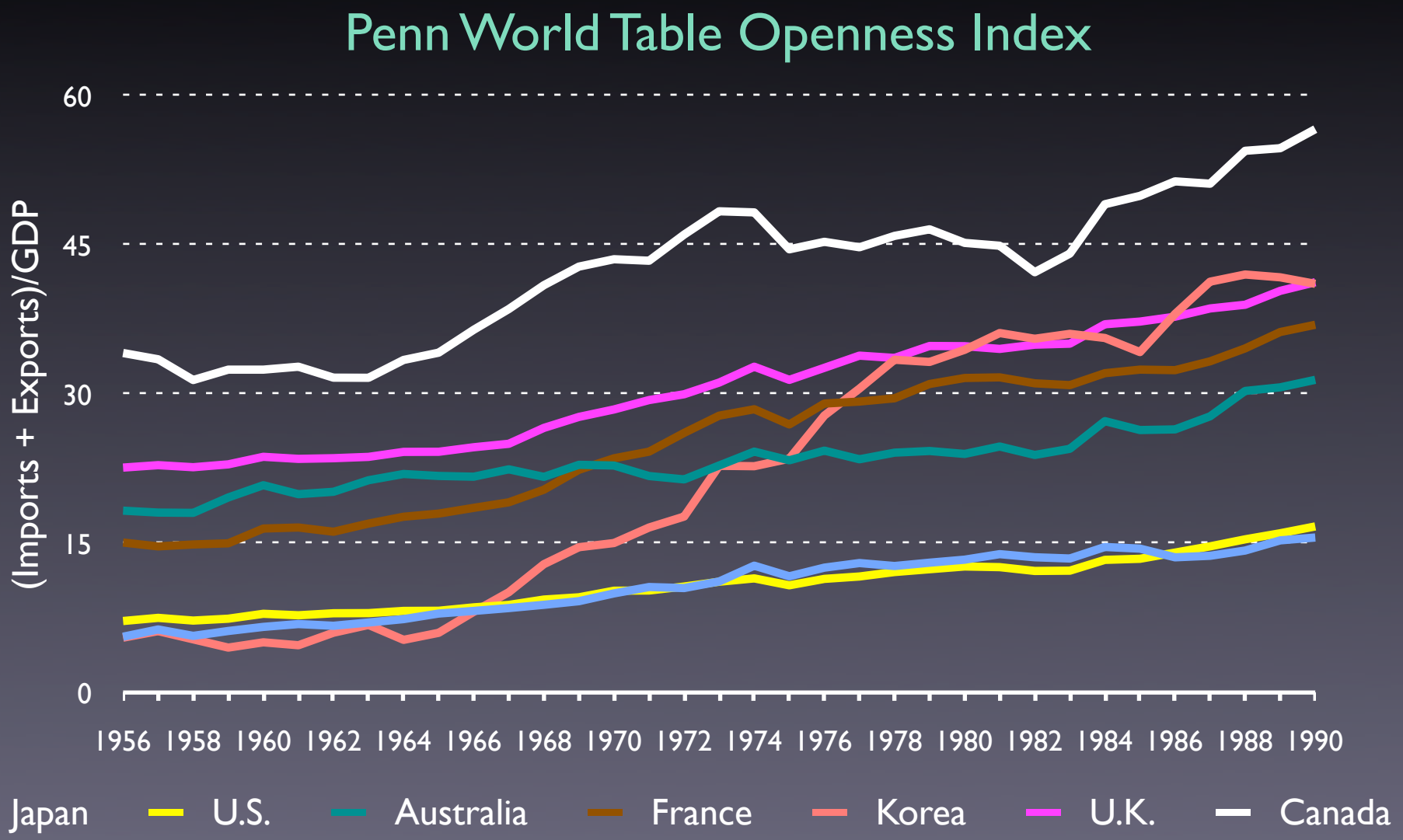






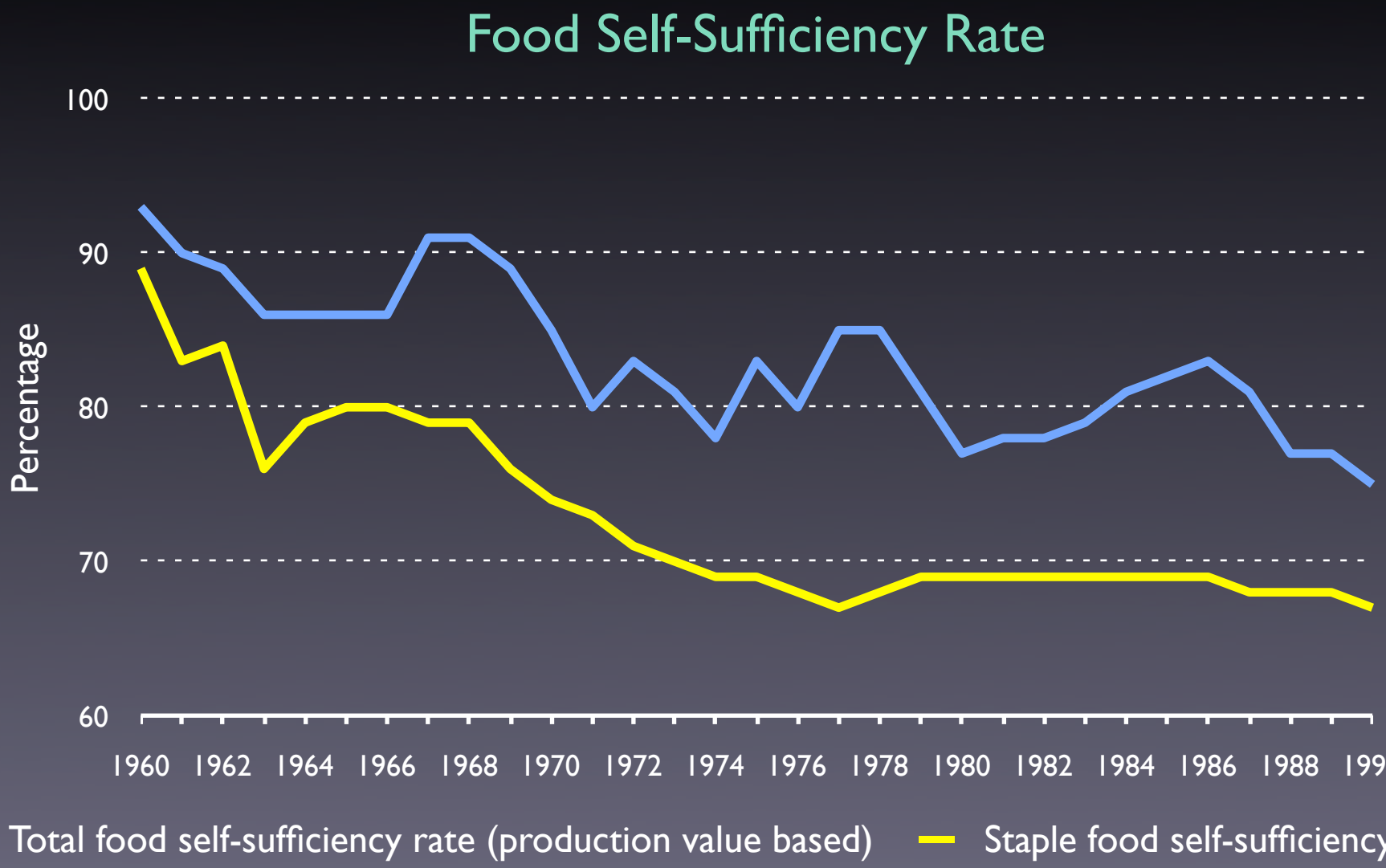
Data Model Constant TFPa

Degree of Openness



- Japan's degree of openness is similar to the U.S.

Food Self-Sufficiency Rates



- A high fraction of Japanese food was domestically produced.