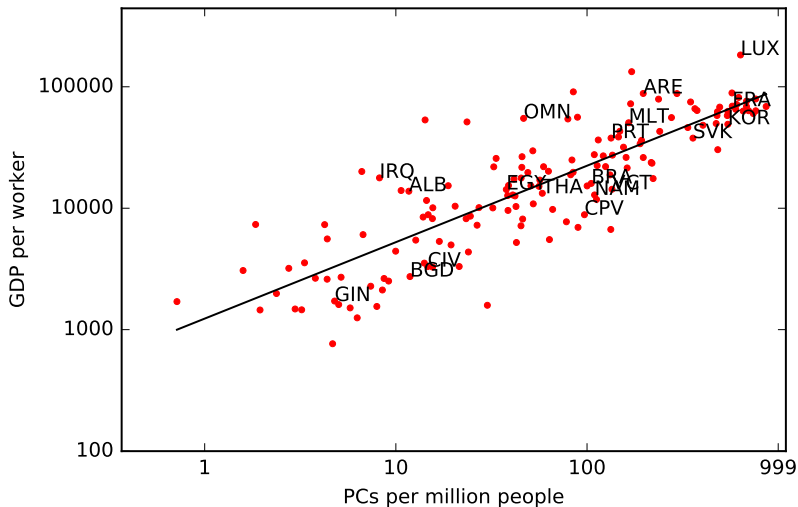# EC569 Economic Growth
Seminar 3

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Question 1

Parente, S. L., & Prescott, E. C. (1994). Barriers to technology adoption and development. Journal of political Economy, 102(2), 298-321.

Motivation

- There is a wide disparity in income across countries
- The standard neoclassical cannot account for it
- Plausible disparity in tax rates on capital income $\Rightarrow$ less income disparity that is found in the data
- It is true even if the reproducible capital share is double by including human capital
- If the share of reproducible capital is near one (α close to 1), disparities in tax rates can generate such disparity in income
- But, then the model predicts slow convergence to steady state, contrary to we observed in countries like Japan

Speed of Convergence to the Steady State

$$\Delta k = \gamma A k^\alpha - \delta k$$

$$\hat{k} = \frac{\Delta k}{k} = \gamma A k^{\alpha-1} - \delta$$

Speed of converge: The fraction of gap to the steady state that is closed.

Growth Rate of Capital per Worker
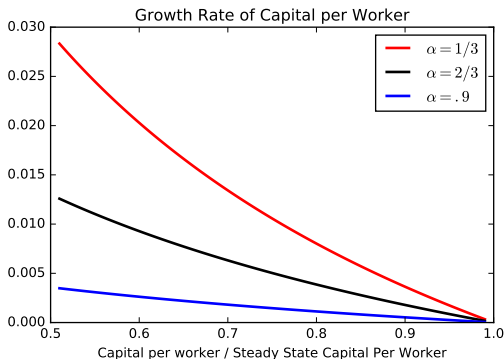
Goal of this Paper

Develop a theory that is quantitatively consistent with

- great disparity of per capita income across countries
- the rapid development of Japan and several other countries during the postwar period

The focus of the theory of this paper:

- technology adoption decision by firms
- barriers to such technology adoption
    - regulatory and legal constraints
    - bribes that must be paid (campaign contributions)
    - violence or threat of violence
    - outright sabotage
    - worker strikes

Theory: Differences in these barriers account for the great disparity in income across countries and that large persistent reductions in these barriers induce development miracles.
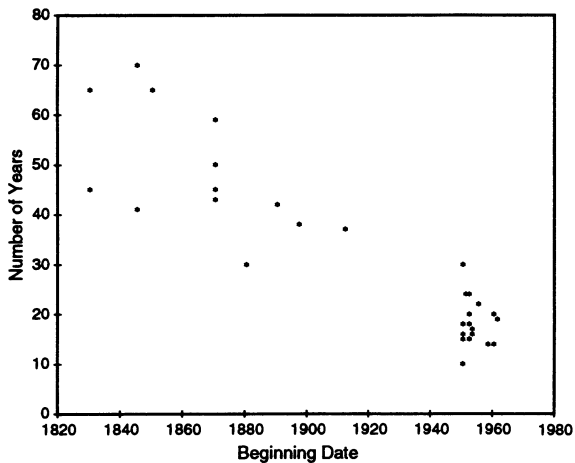
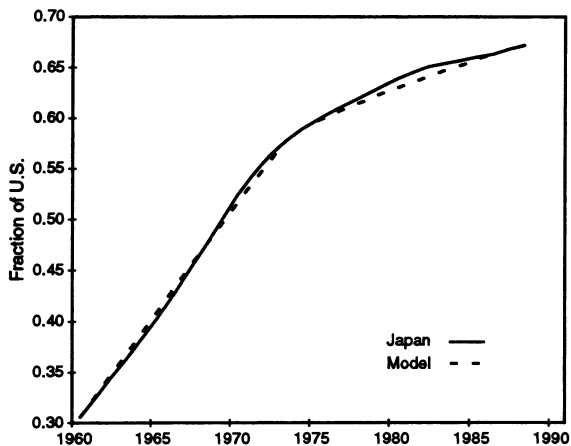Fig. 1.—Rapid growth experiences: number of years to develop from low- to moderate-income economy.

Fig. 2.—Per capita output relative to U.S. level, Japan and model economy for $\theta_z = .55$, 1960–88.

Model Calibration

For a given value of θ_z, pick model parameters such that model moments like $c, x_d, i, ...$ matches with US data of

- non-durable good expenditures plus service expenditures less real estate services
- consumer durable expenditures plus residential structure investment
- average of the historical real return on equity and corporate debt
- ...

For a given value of θ_z, pick μ and beginning of the period capital stock to match

- model's beginning-of-period income match Japanese income relative to the US
- model's end-of-period income match Japanese income relative to the US

TABLE 1

Values of θ_z and π That Match the Japanese
Development Experience and Implied
Relative Income Levels y^{ss}, 1960–88

	1960–73		1975–88	
θ_z	π	y^{ss}	π	y^{ss}
.60	.77	1.82	1.06	.87
.55	.85	1.35	1.10	.82
.50	.93	1.15	1.18	.78
.45	1.05	.95	1.26	.76
.40	1.20	.84	1.39	.74

- $\theta_z > .55$ unreasonable, implausibly large changes in μ
- $\theta_z < .55$ unreasonable, too large decline in annual growth rates

TABLE 2

CONVERGENCE TO BALANCED GROWTH PATH: $\theta_z = .55$

Year	y_m/y_m^{ss}*	x_k/y_m	x_d/y_m	x_z/y_m	k/y_m	d/y_m	z/y_m	h
0	.226	.20	.16	1.01	1.11	.77	8.03	.53
5	.305	.19	.16	.91	1.20	.88	9.02	.51
10	.383	.18	.16	.83	1.27	.98	9.85	.49
15	.457	.18	.16	.76	1.32	1.06	10.55	.48
20	.525	.17	.16	.71	1.36	1.13	11.13	.46
25	.588	.16	.15	.67	1.39	1.19	11.62	.45
30	.644	.16	.15	.61	1.42	1.24	12.03	.43
50	.809	.15	.15	.51	1.47	1.37	13.11	.42
∞	1.00	.14	.15	.41	1.50	1.50	14.19	.40

* y_m/y_m^{ss} denotes year t income as a fraction of the balanced growth level. The subscript m denotes measured output and does not include investment in technology capital.

TABLE 3

EFFECT OF TAX RATES ON RELATIVE INCOMES FOR θ_z'S CONSISTENT WITH JAPANESE DEVELOPMENT

τ	$\theta_z = .50$	$\theta_z = .55$
.00	121.0	124.3
.39	100.0	100.0
.67	76.2	73.5
.90	42.6	38.1

NOTE.—For presentation purposes, we do not list the values of the remaining parameters in either table 3 or table 4. Given a value for θ_z, values for all other parameters are identified by U.S. observations.

- Nearly 100% tax in poor countries and 0% tax in rich ones can explain the income disparity
- Not plausible

TABLE 4

EFFECT OF TECHNOLOGY ADOPTION BARRIERS ON RELATIVE INCOMES FOR θ_z'S CONSISTENT WITH JAPANESE DEVELOPMENT

π	$\theta_z = .50$	$\theta_z = .55$
1.0	100.0	100.0
1.2	76.6	71.5
1.5	55.2	47.5
2.0	36.3	28.0
4.0	13.1	7.8
8.0	4.8	2.2

- Technology barriers twice the size of those in the US lead to a factor of 3 income difference
- Plausible

Country	Income rel. to the US	Tech Barrier rel. to the US
UK	60%	1.3
Columbia	22%	2.3
Paraguay	16%	2.8
Pakistan	10%	3.5
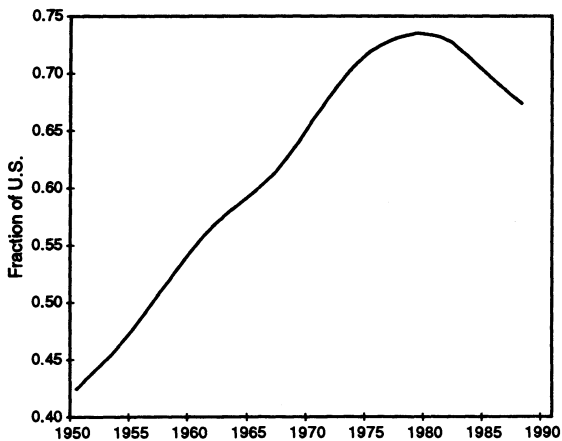
FIG. 3.—France, 1950–88
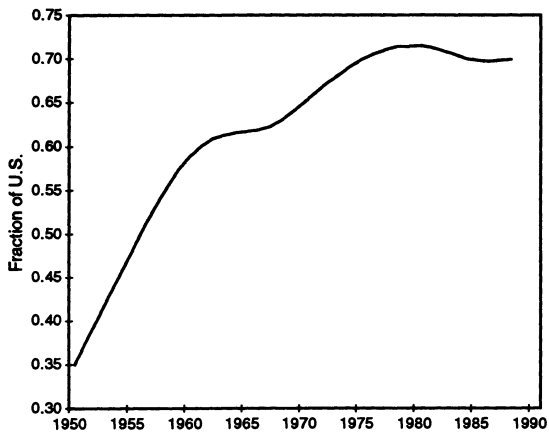
- 1950–1978: $\mu = 1.01$
- 1980–1988: $\mu = 1.25$

Fig. 4.—West Germany, 1950–88

- 1950–1964: $\mu = .88$
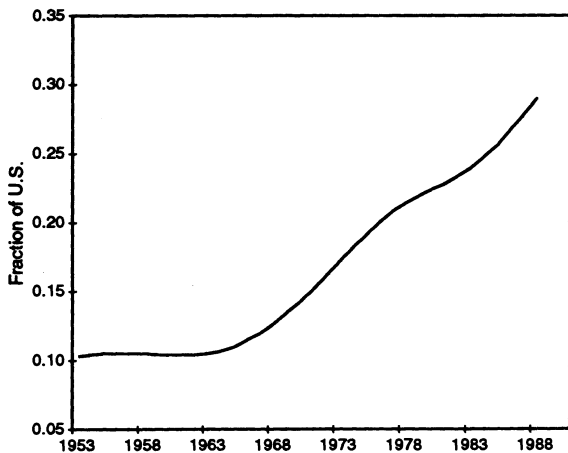- 1966–1988: $\mu = 1.12$

Fig. 5.—South Korea, 1953–88
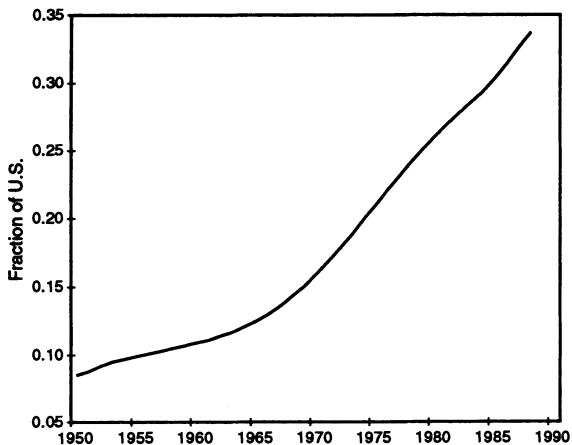
- 1953–1962: $\mu = 3.5$
- 1964–1988: $\mu = 1.44$

Fig. 6.—Taiwan, 1950–88

- 1950–1964: $\mu = 2.42$
- 1966–1988: $\mu = 1.3$

What are the policy implications of Parente and Prescott (1994)

- Reducing barriers
    - government support for technology adoption investment
        - is technology a public 'good'?
- trade openness and world competition
    - weakens resistance to technology blocking