

MUNK
SCHOOL
OF
GLOBAL
AFFAIRS



UNIVERSITY OF
TORONTO

Why Are Some Countries Better at Science & Technology Than Others?

All research available at:

<http://www.mzak.net>

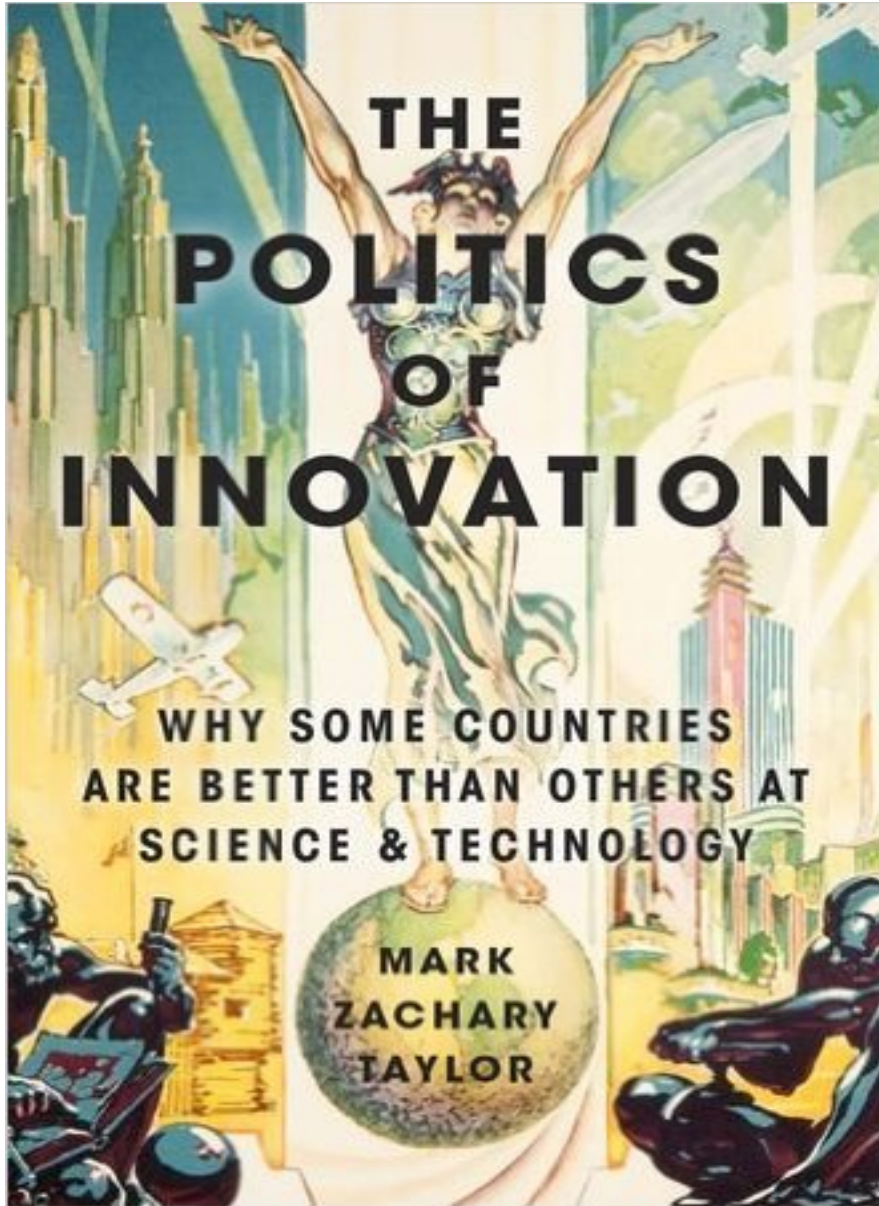
presented by:

Mark Zachary Taylor

Sam Nunn School of International Affairs

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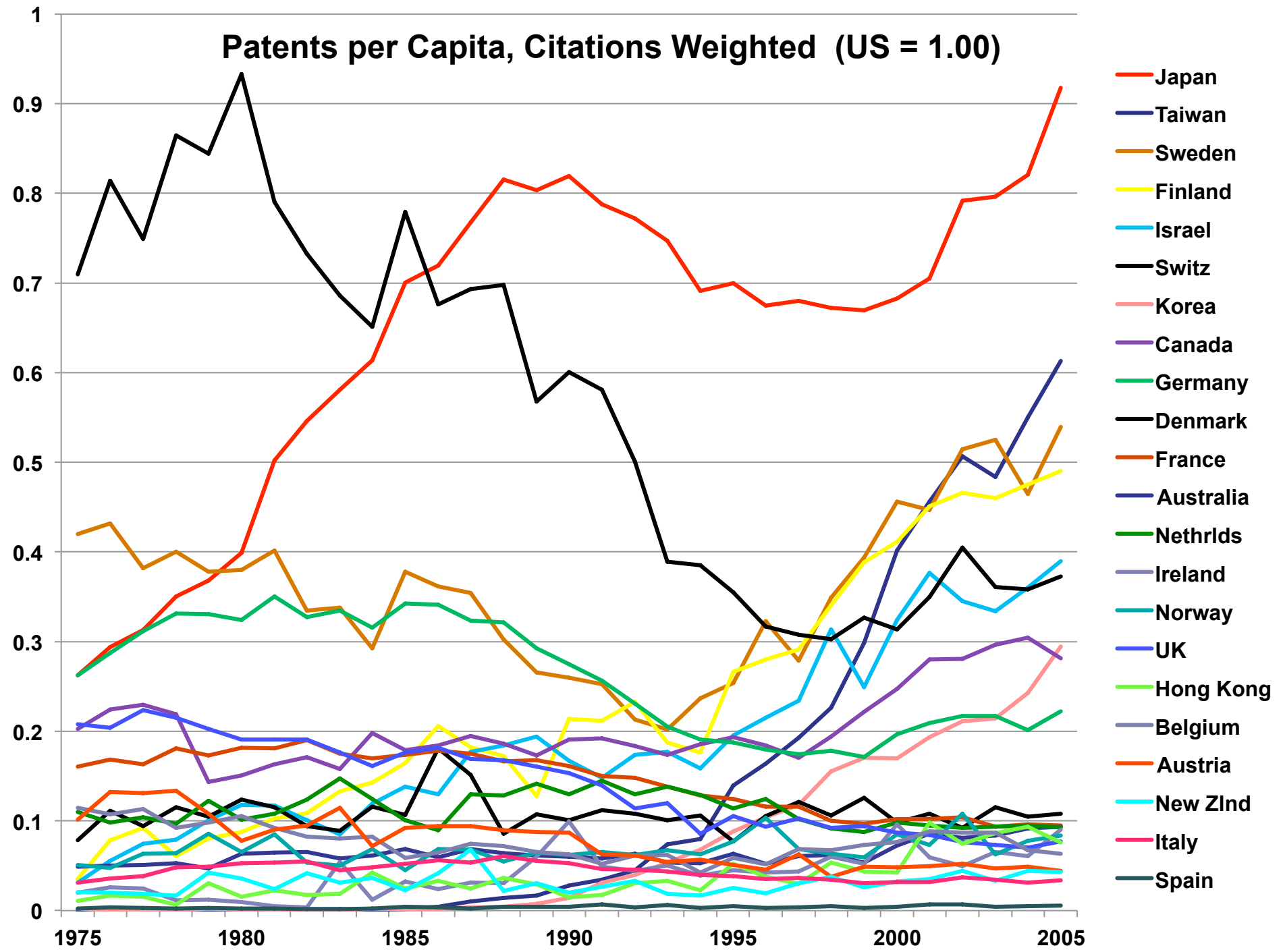
mzak@gatech.edu



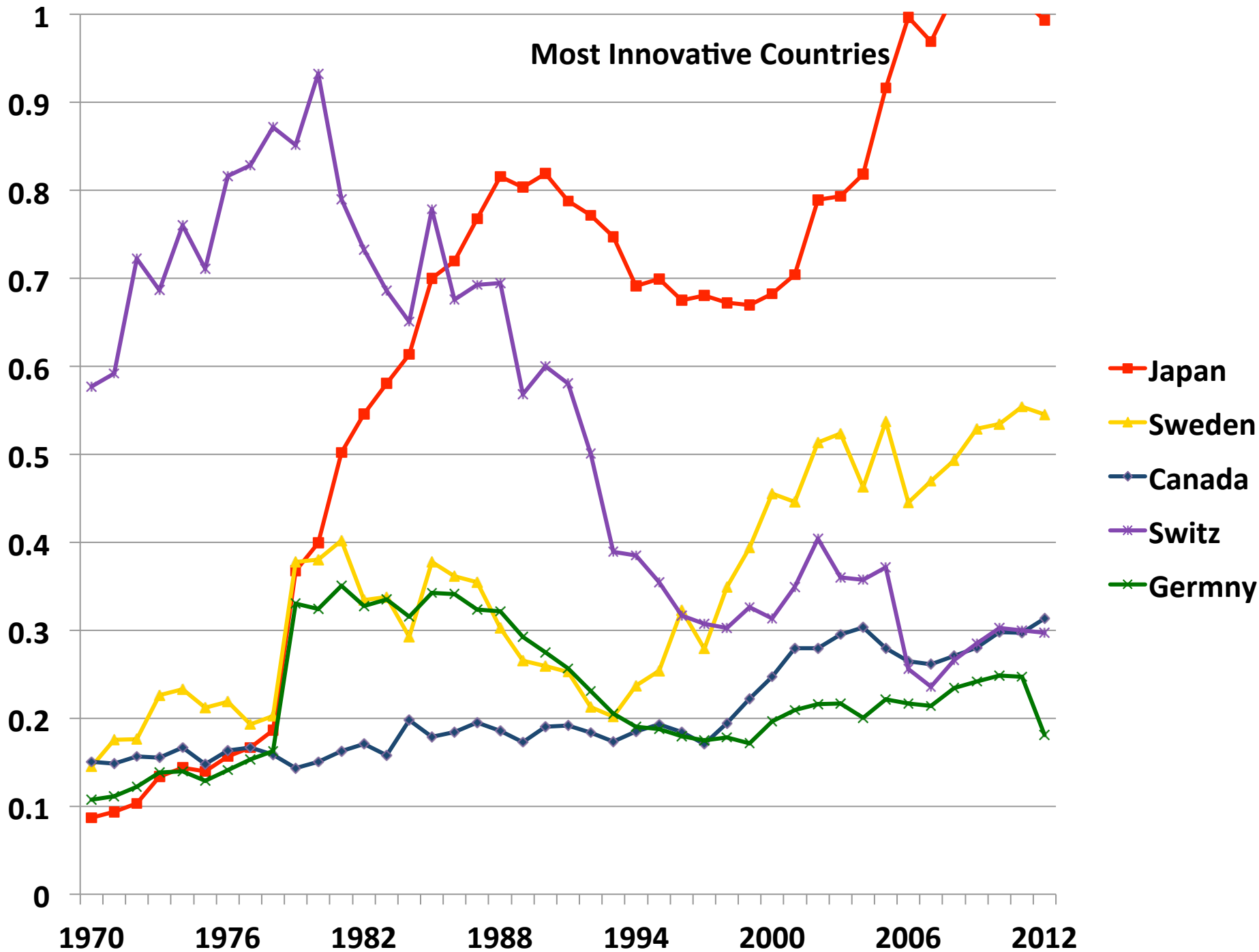
The Politics of Innovation: Why Some Countries Are Better Than Others At Science & Technology
(Oxford University Press, June 2016)

30% DISCOUNT CODE: **ASFLYQ6**
at www.oup.com/academic

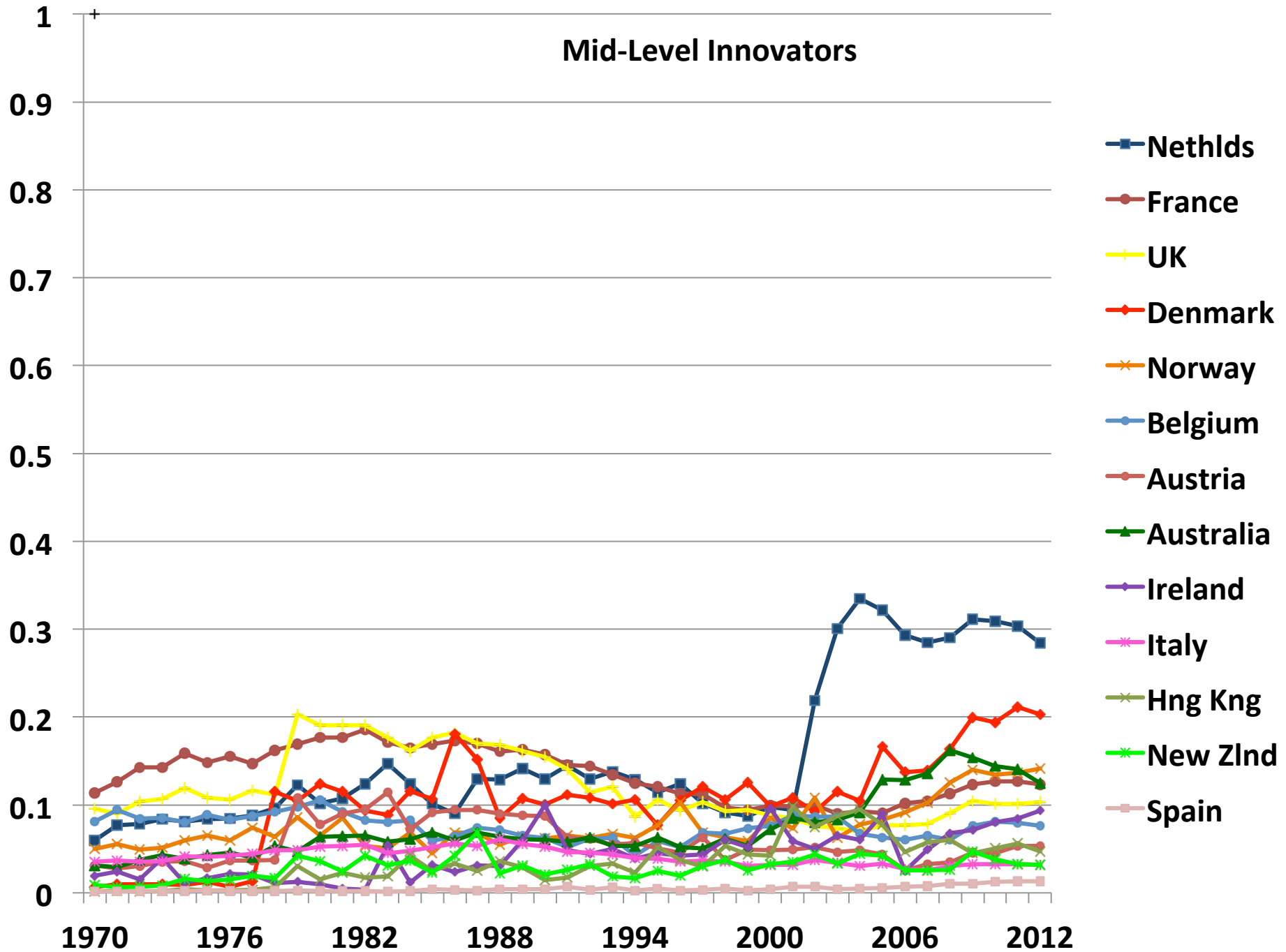
Patents per Capita, Citations Weighted (US = 1.00)



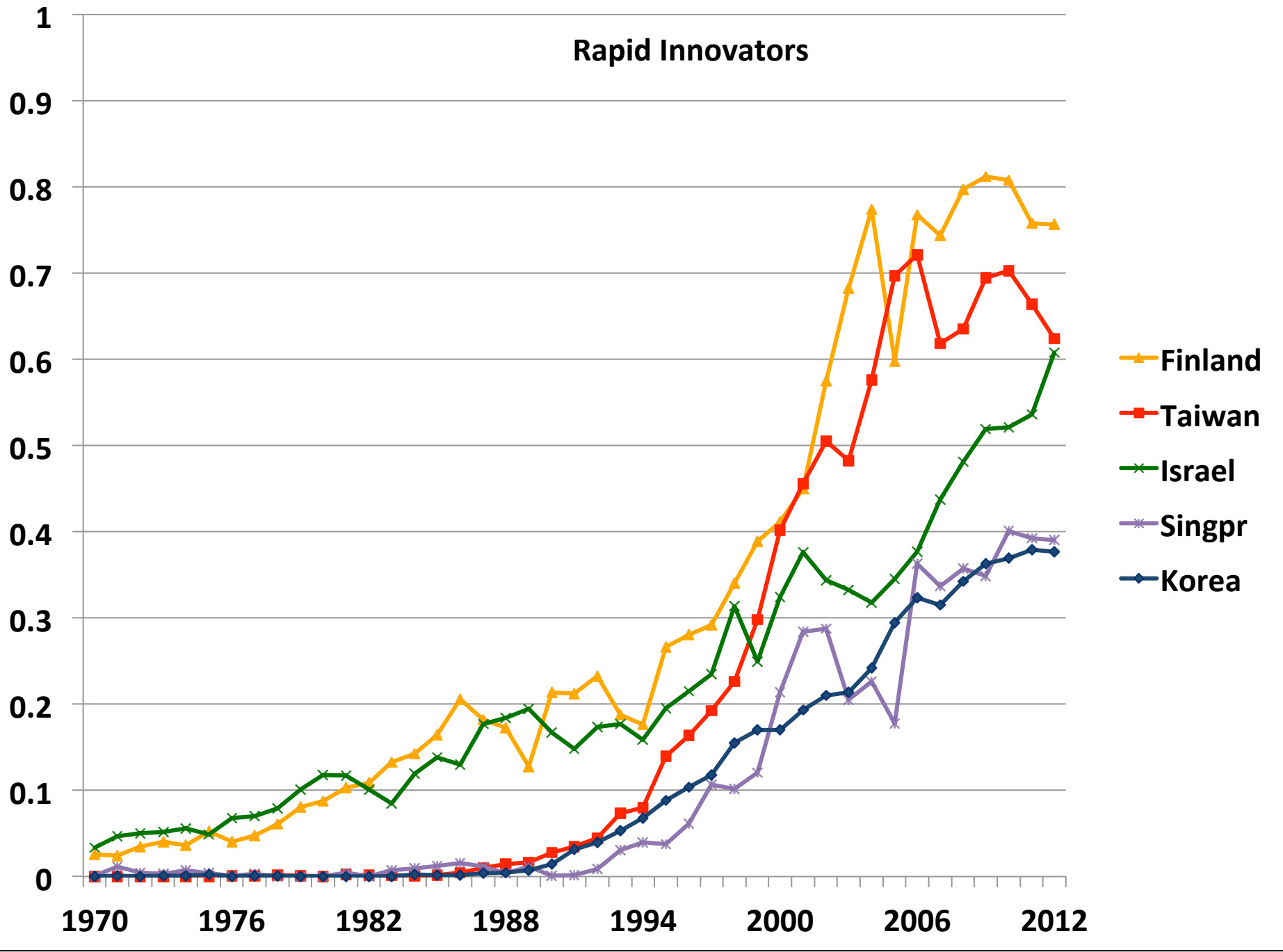
Most Innovative Countries



Mid-Level Innovators



Rapid Innovators



Some of the “Obvious” Explanations:

- Military
- Size
- Scarcity of Labor/Natural Resources
- Barriers to Entry/Increasing Returns
- Free-Riding
- Culture

But do they really explain anything:

- Military
 - USA
- Size
 - Japan
- Scarcity of Labor/Nat. Res.
 - Switzerland
- Barrier to Entry/Incr. Rtrns.
 - Germany
- Free-Riding
 - Canada
- Culture
 - Sweden

Domestic Institutions Theories of Technological Innovation

“National Innovation Systems”

Patent Systems

Financial Insts

Anti-Trust

Govt. Procuremt

Trade Regimes

Science Policy

STEM Education

R&D Subsidies

Labor Unions

Industrial Relations

Envirnmtl Regltns

Defense Policy

Legal Systems

Tax Policy

Budget Constraints



“National Innovation Systems”

United States

- military procurement
- strong anti-trust
- small firms
- universities

Japan

- government control over trade and investment
- cooperative industry-labor relations
- specific corporate management techniques

Varieties of Capitalism Theory

Varieties of Capitalism Theory

Liberal Market Economies

More markets

+More risk

+More profits

= More revolutionary
technological innovation

Coordinated Economies

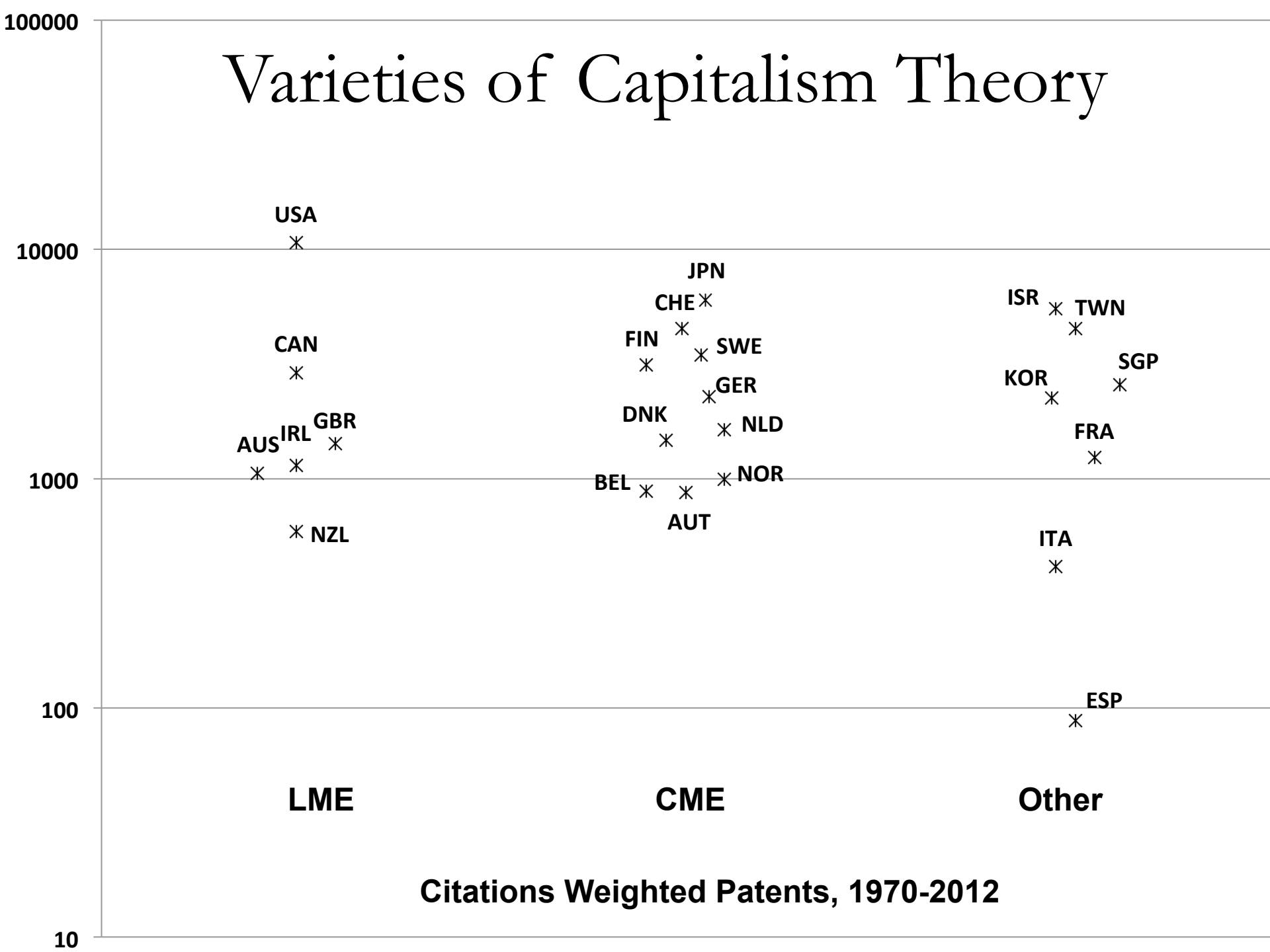
Less markets

+ More consensus

+ Less change

= Slower, more incremental
technological innovation

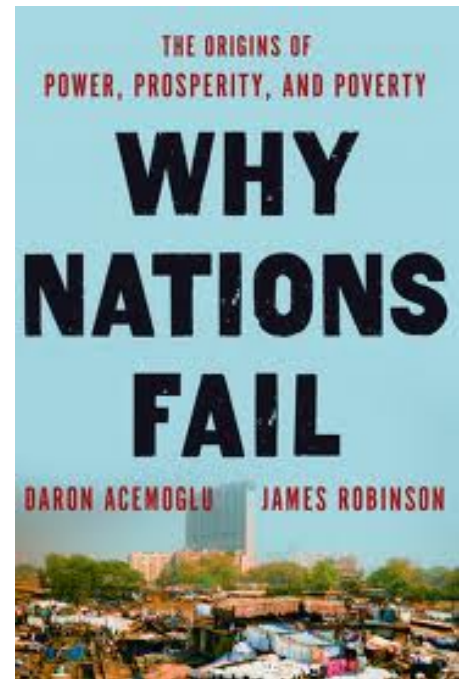
Varieties of Capitalism Theory



Citations Weighted Patents, 1970-2012

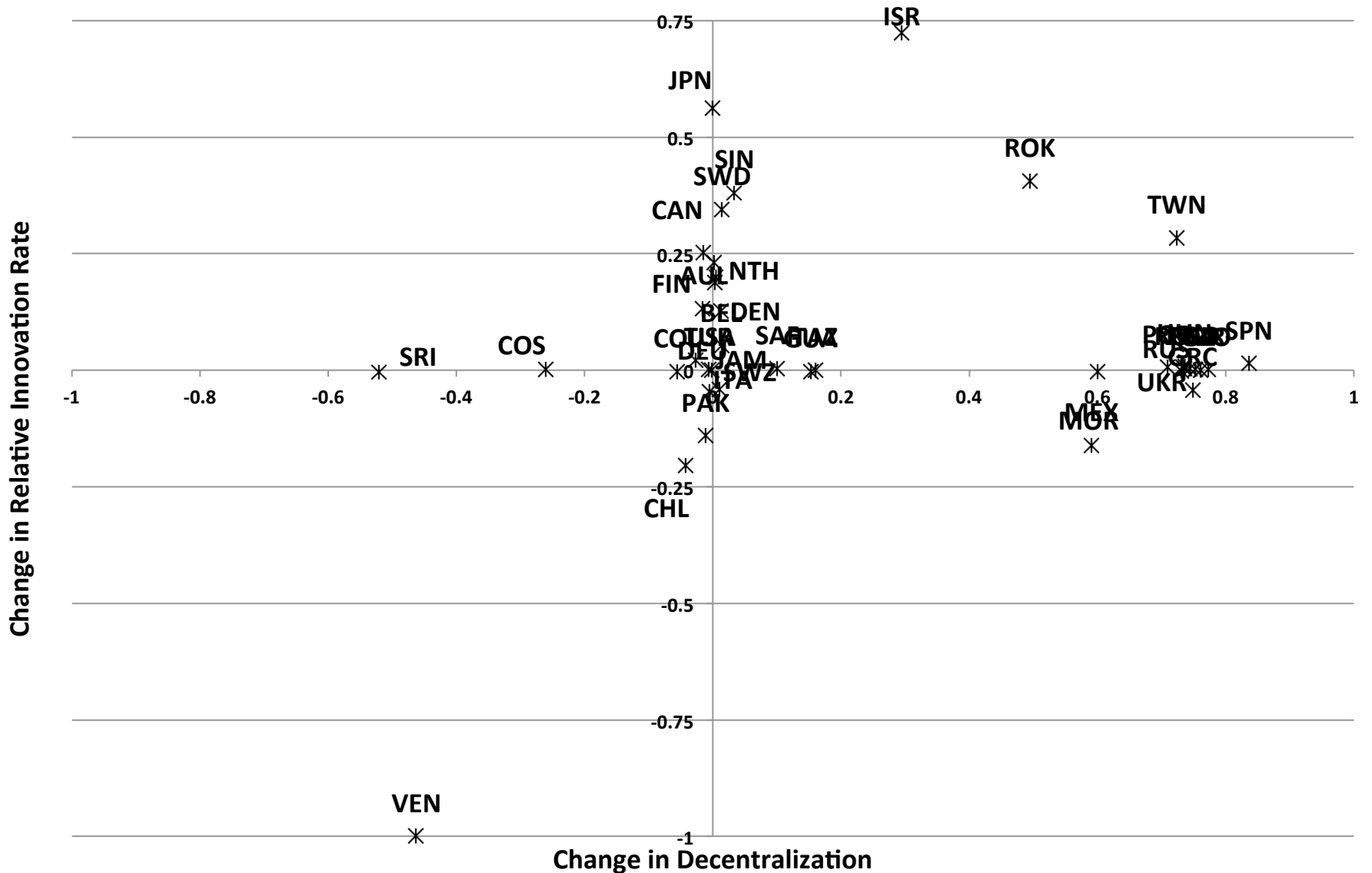
Decentralization Theory

- **Increases Costs of Capture by Status-Quo groups**
- **States act as Experimental Test Beds**
- **Market Preserving Federalism**
- **State-by-State Policy Matching**
- **Locals Have Superior Information**



Decentralization Theory

Innovation vs. Decentralization in 45 Countries (1970-2012)



Strong Durable Democracy?

Insufficient to Turn These 20 Countries into Top S&T Competitors

Strong Durable Democracy Low-Income Economy but POOR INNOVATOR	Strong Durable Democracy Middle-Income Economy but POOR INNOVATOR	Strong Durable Democracy Wealthy Economy but MID-LEVEL INNOVATOR
Botswana (1966)	Argentina (1983)	Australia (1901)
Costa Rica (1919)	Brazil (1985)	Austria (1983)
El Salvador (1984)	Cyprus (1974)	Belgium (1944)
India (1950)	Greece (1975)	Italy (1948)
Mauritius (1968)	Jamaica (1963)	New Zealand (1877)
	Portugal (1976)	Norway (1945)[†]
	Spain (1978)	
	Trinidad (1962)	
	Uruguay (1985)	

(First year of continuous “strong, durable” democratic period).

“Strong” = Polity2 score of 8+; “Durable” = lasting thirty continuous years or more as of 2014.

Why Do Domestic Institutions
Sound so Good in Theory
But
Appear to Fail Empirically?



**DOMESTIC
INSTITUTIONS**

&

POLICIES



**NATIONAL
TECHNOLOGICAL
INNOVATION**

- Market Failures**
- Status Quo Interest Groups**



Democracy

Free Markets

Intellectual Property Regimes

Financial Systems

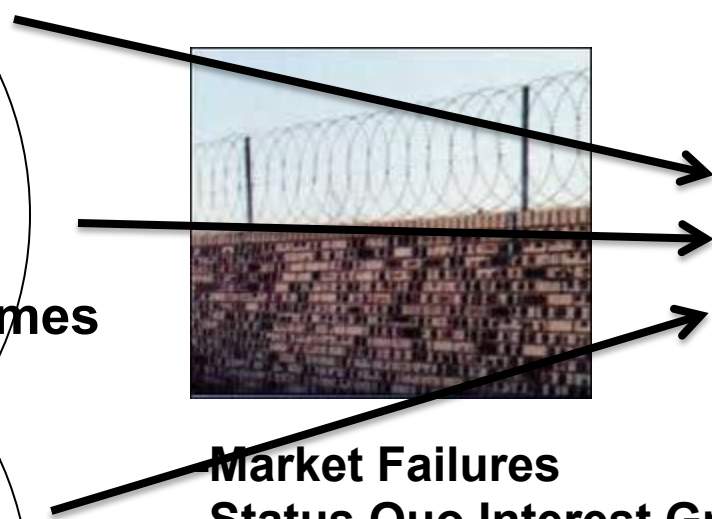
Education policy

R&D subsidies



Market Failures
-Status Quo Interest Groups

**NATIONAL
TECHNOLOGICAL
INNOVATION**



Domestic Institutions Theories' Assumptions

- Innovation = Public Goods Problem (ideas/knowledge)
- High Levels of Risk
- High Levels of Uncertainty
- Imperfect & Costly Information
- High Transaction Costs
- Unstable Property Rights

Solution = INSTITUTIONS!!!

Why Do Domestic Institutions & Policy Theories Fail?



Taiwan*



Israel



Ireland



Mexico

Domestic Institutions Theories' Assumptions

- Innovation = Public Goods Problem (ideas/knowledge)
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- Unstable Property Rights

Solution = INSTITUTIONS + NETWORKS

International Networks Transfer Tacit Knowledge

- Overseas training & education**
- Foreign consultants & technical assistance**
- Attending international expositions, conferences, & lectures**
- Overseas plant visits**
- Consults with foreign capital goods & high technology suppliers/consumers**
- Mergers & acquisitions, joint R&D projects**
- Import-Export Relationships**
- Migration of STEM labor**
- Establishing R&D facilities in high-tech countries**
- Inward FDI in production and R&D facilities from more advanced countries**

**STEM
workers**

Entrepreneurs

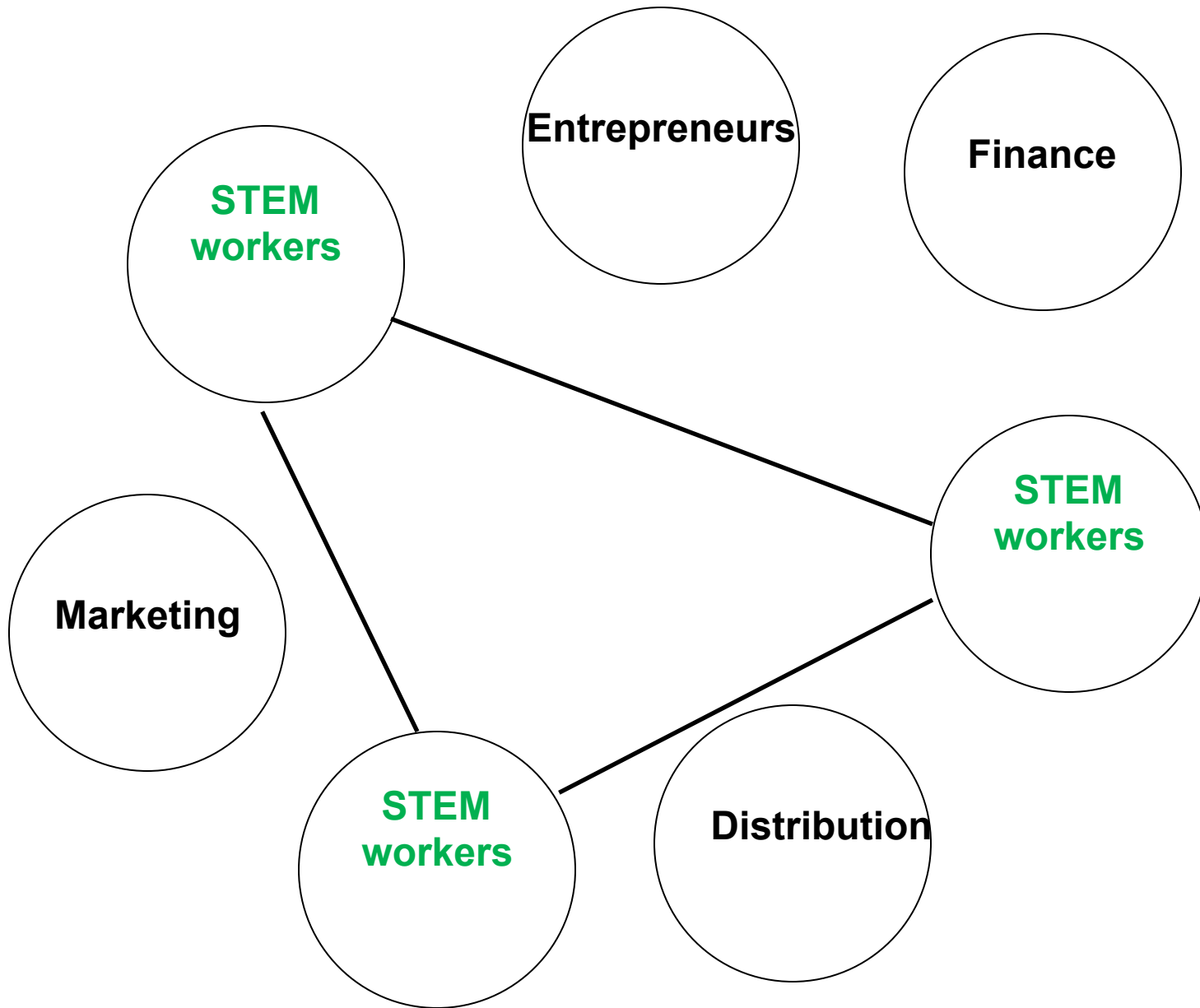
Finance

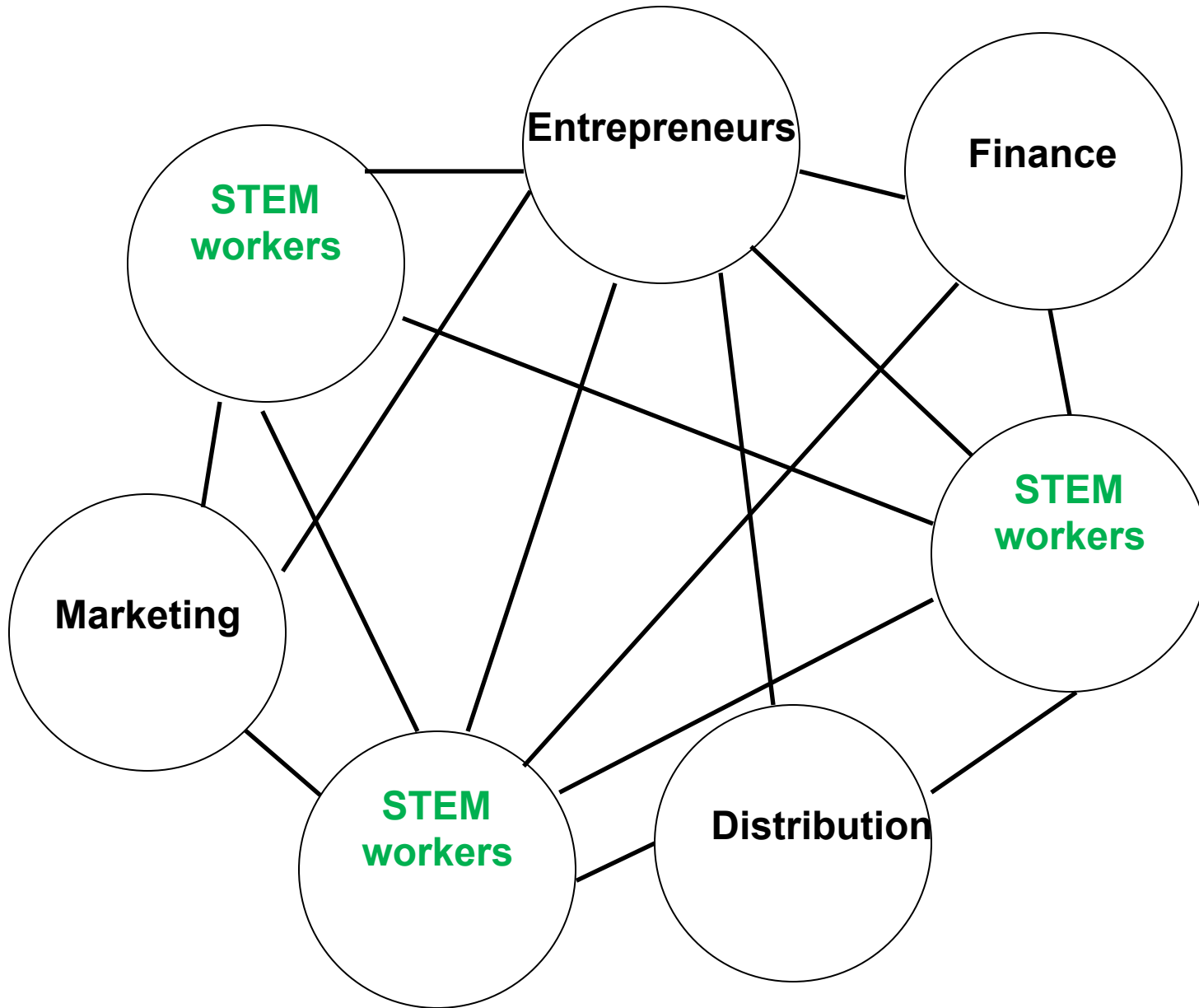
Marketing

**STEM
workers**

**STEM
workers**

Distribution





Successful institutions/policy solve market failures AND promote networks

But then the question becomes....

Why do some countries
set up these institutions and networks
better than others?

External Security

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graph TD; A[External Security] --- B[Military]; A --- C[Economic];
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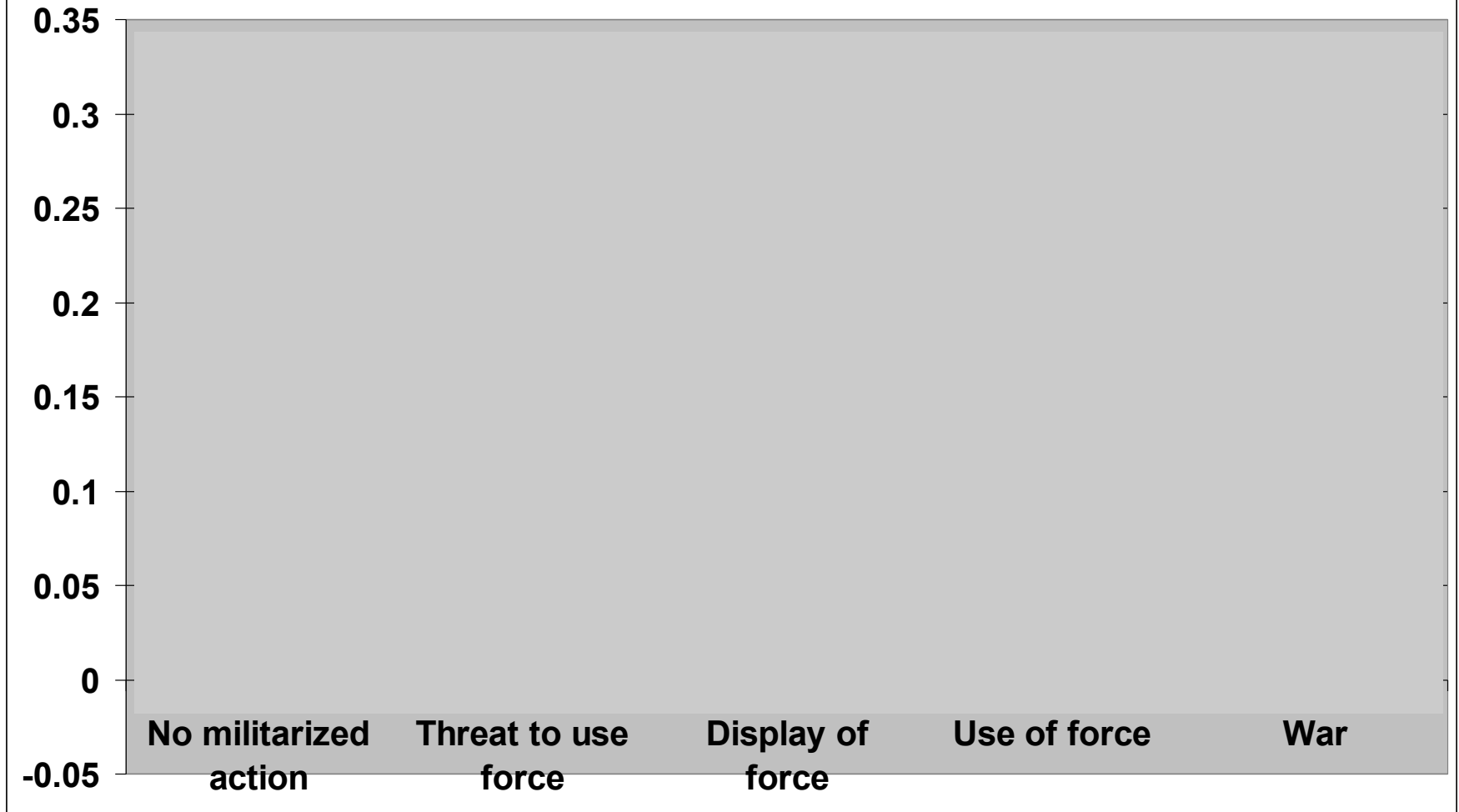
Military

**Innovation builds
indigenous defense capacity**

Economic

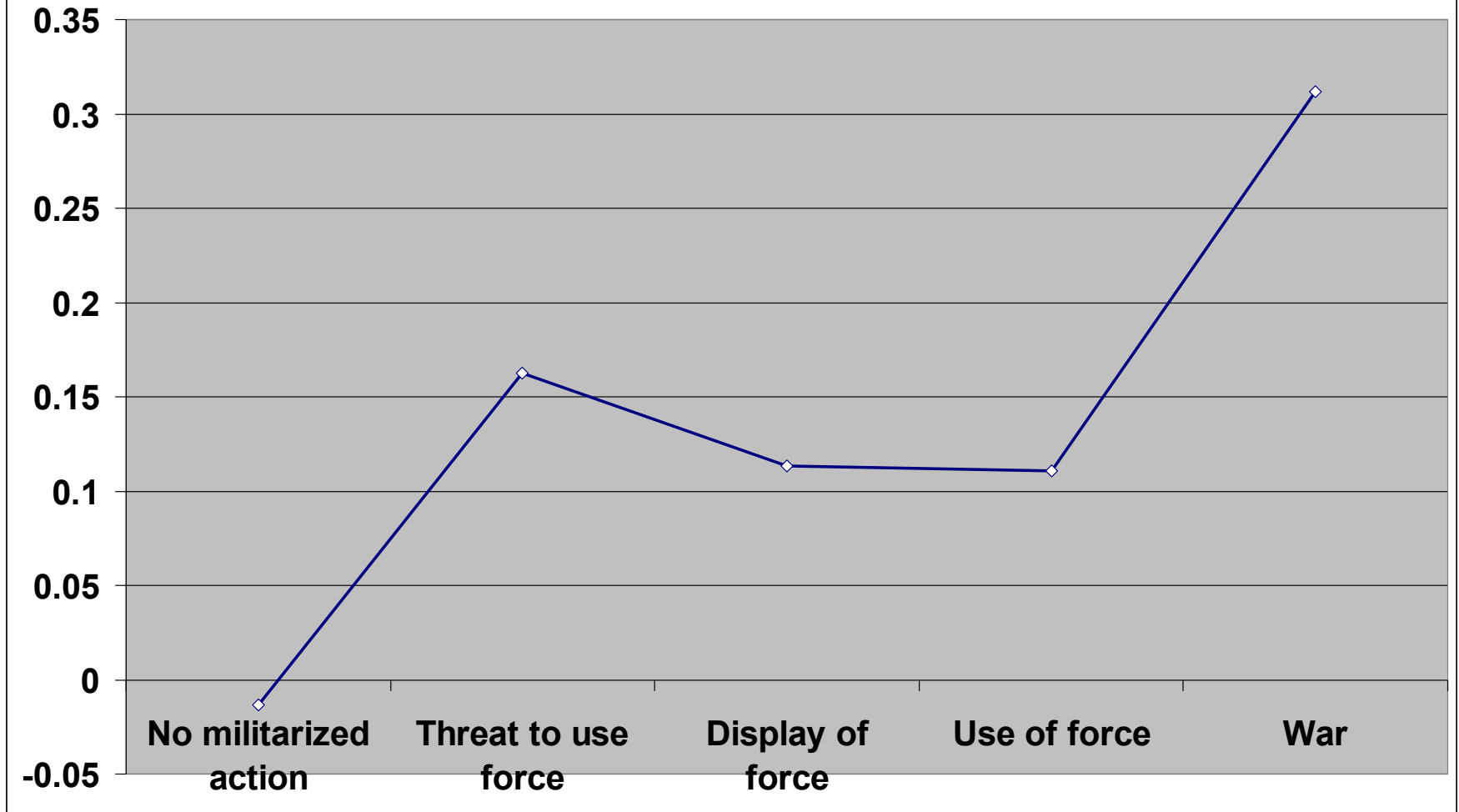
**Innovation earns foreign exchange
for strategic imports
OR
Enable domestic production**

Correlation with Innovation Rate 1975-1995



Higher levels of external threat correlate with higher national innovation rates

Correlation with Innovation Rate 1975-1995



Higher levels of external threat correlate with higher national innovation rates

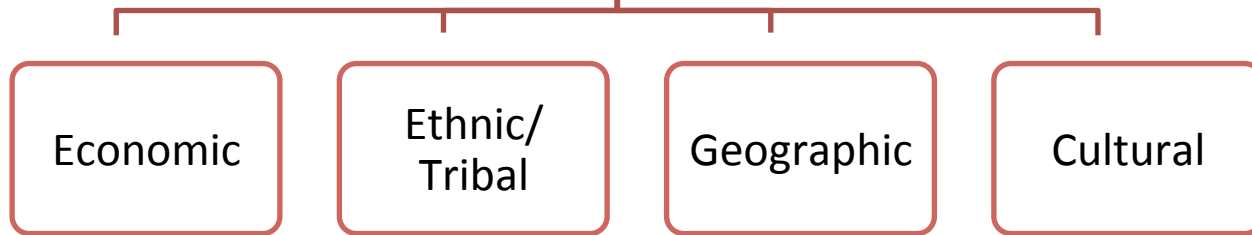
**External
Security
Concerns**

VS.



**Domestic
Tensions**

Domestic Tensions



- Innovation creates winners & losers
- Innovation redistributes wealth & power

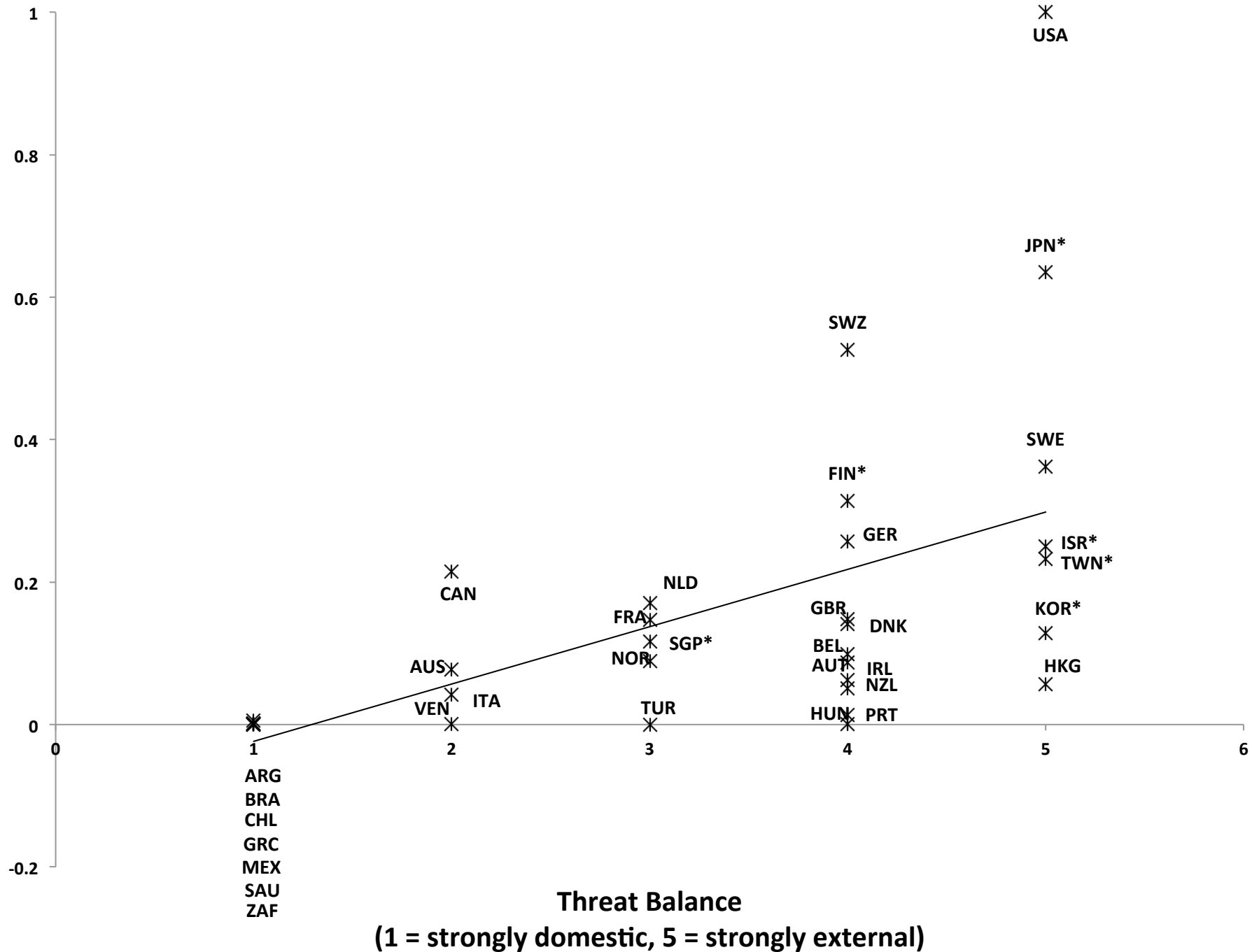
External Threats > Domestic Tensions

- Fewer labor strikes
- Lower economic inequality
- Higher imports of food and energy as % of total consumed
- Longer recent history of external conflicts
- No recent civil war

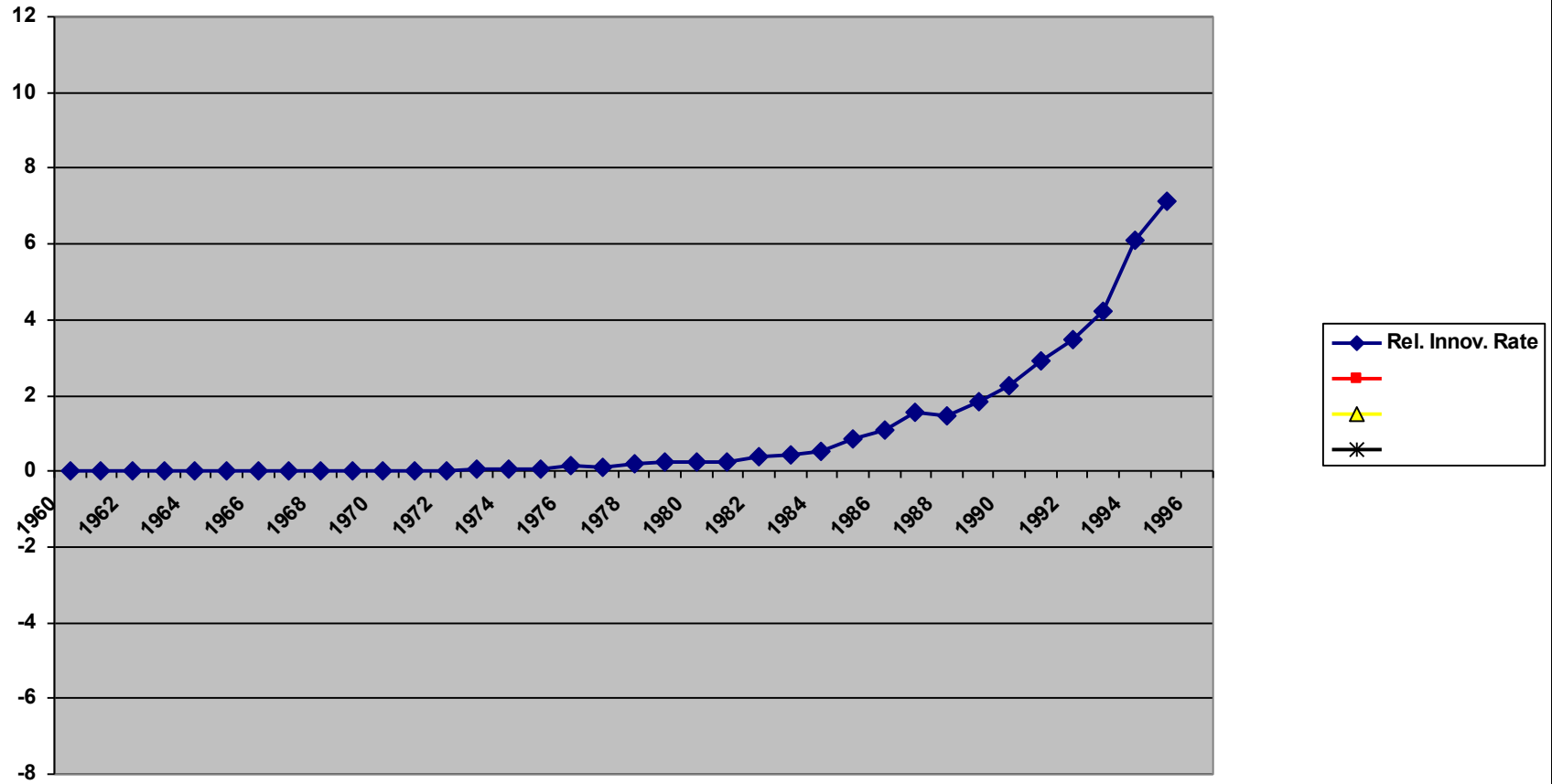
Domestic Tensions > External Threats

- More labor strikes
- Greater economic inequality
- Lower imports of food and energy as % of total consumed
- Shorter recent history of external conflicts
- Recent civil war
- Anti-S&T, pro status-quo military dictatorship

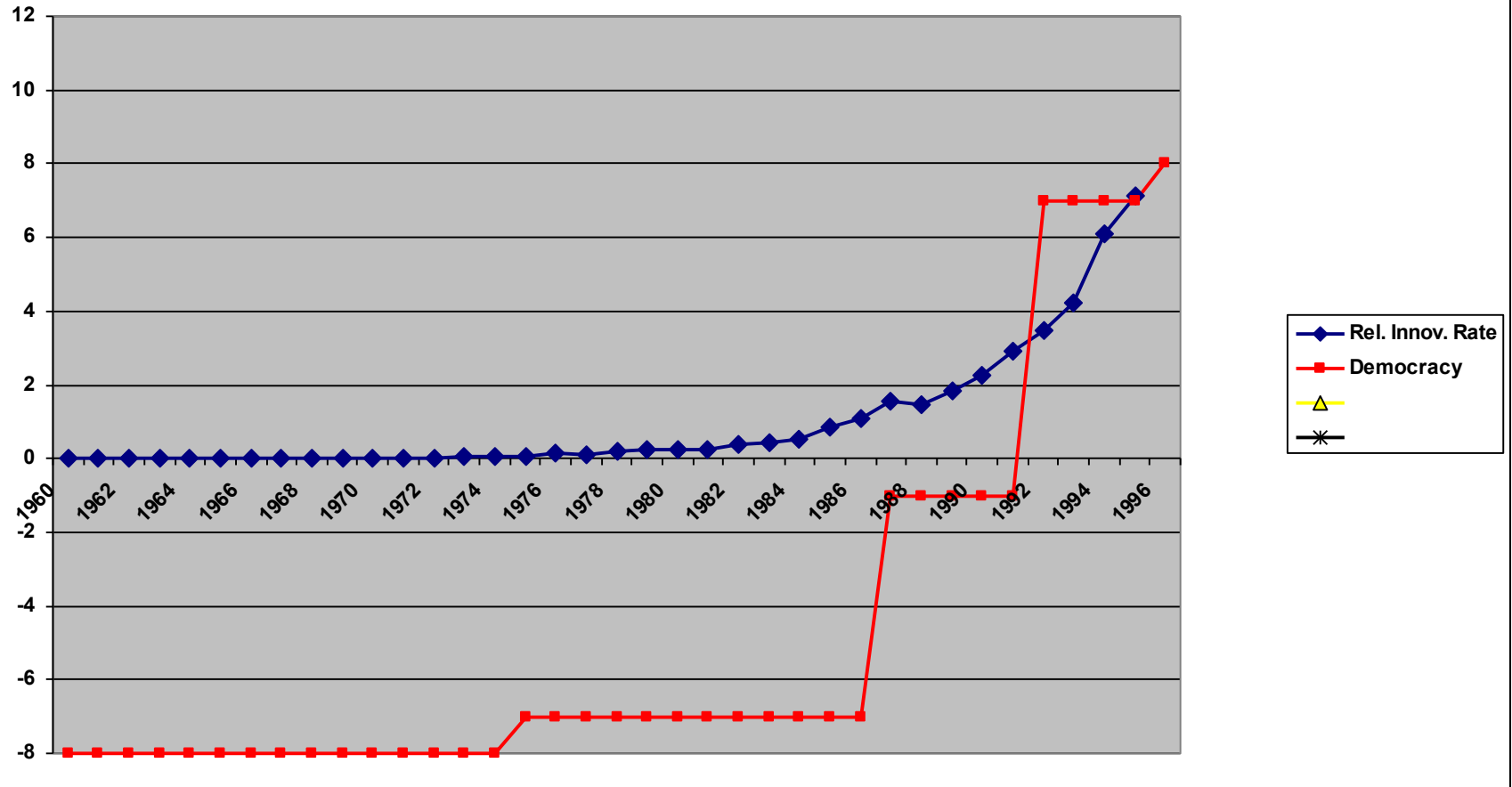
Innovation Rate (1970-2010)



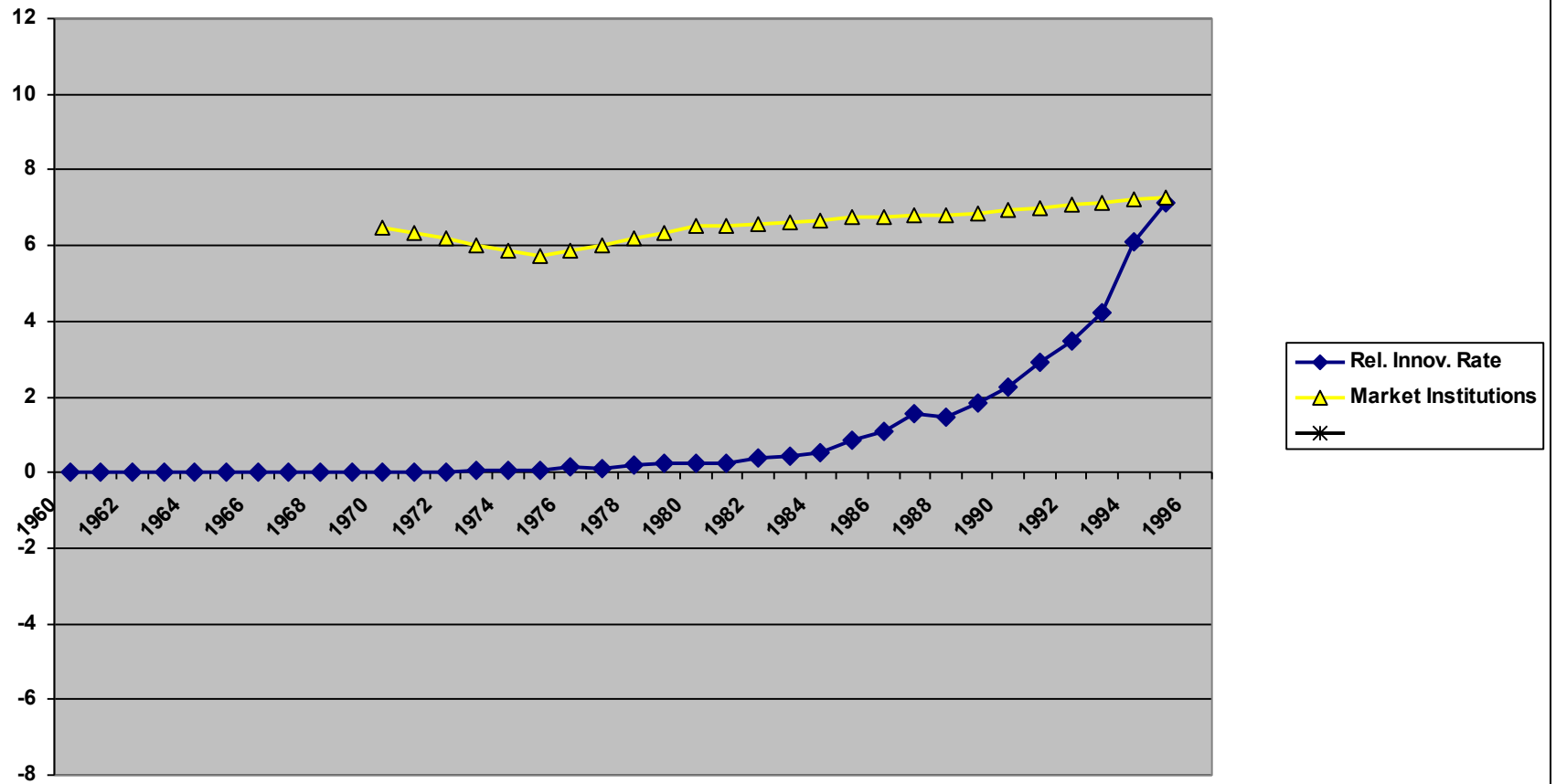
Taiwan



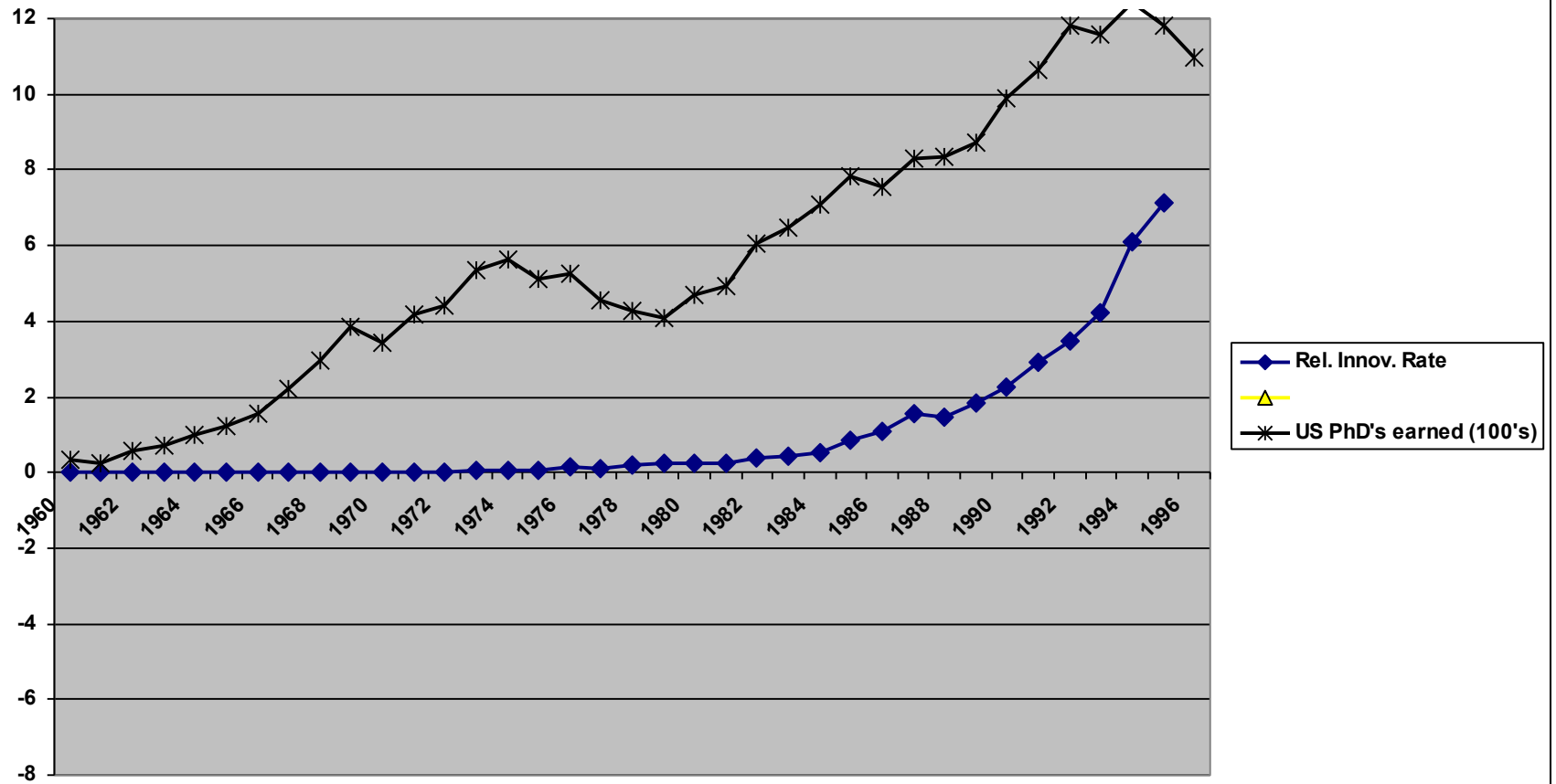
Taiwan



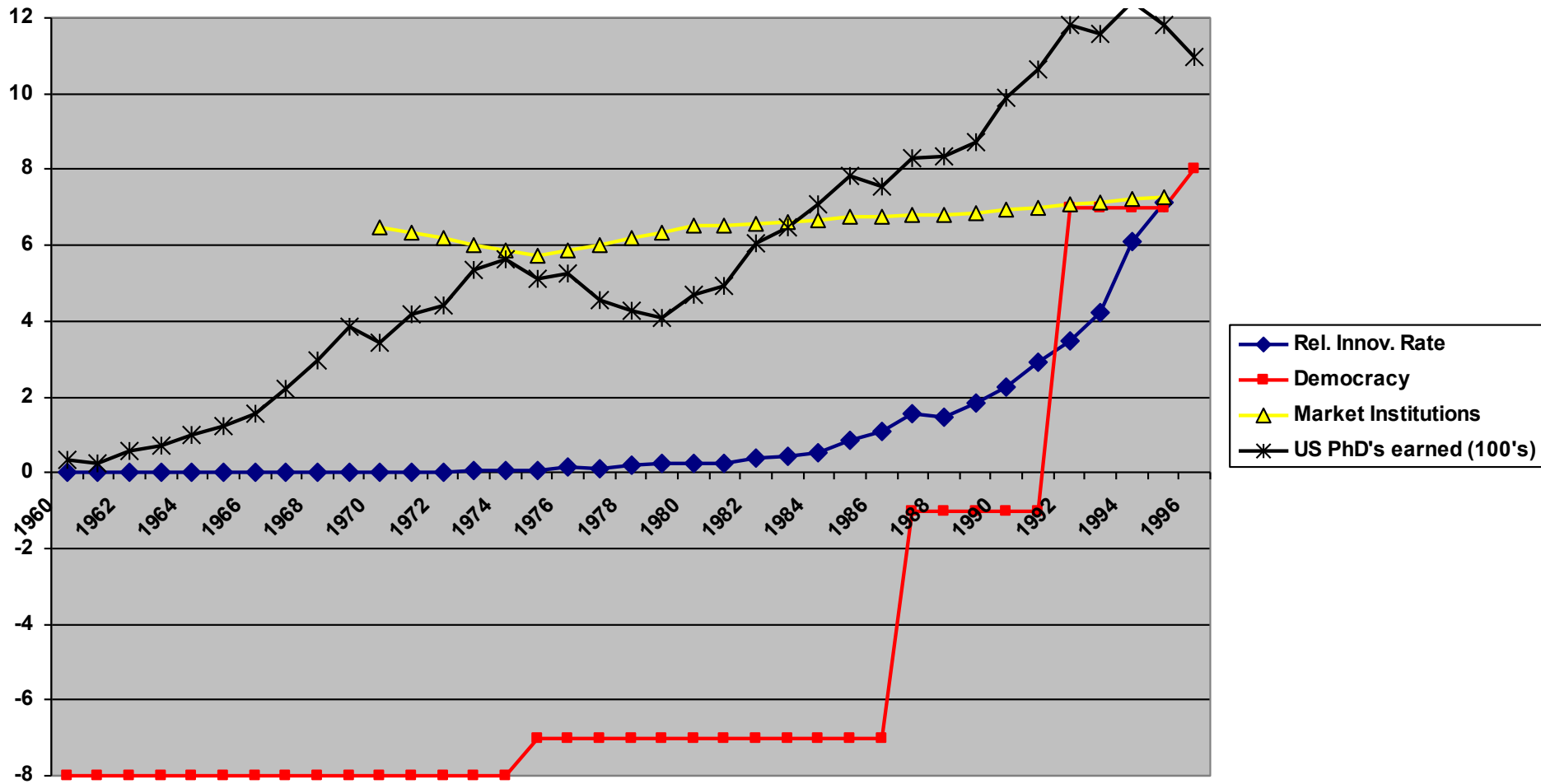
Taiwan



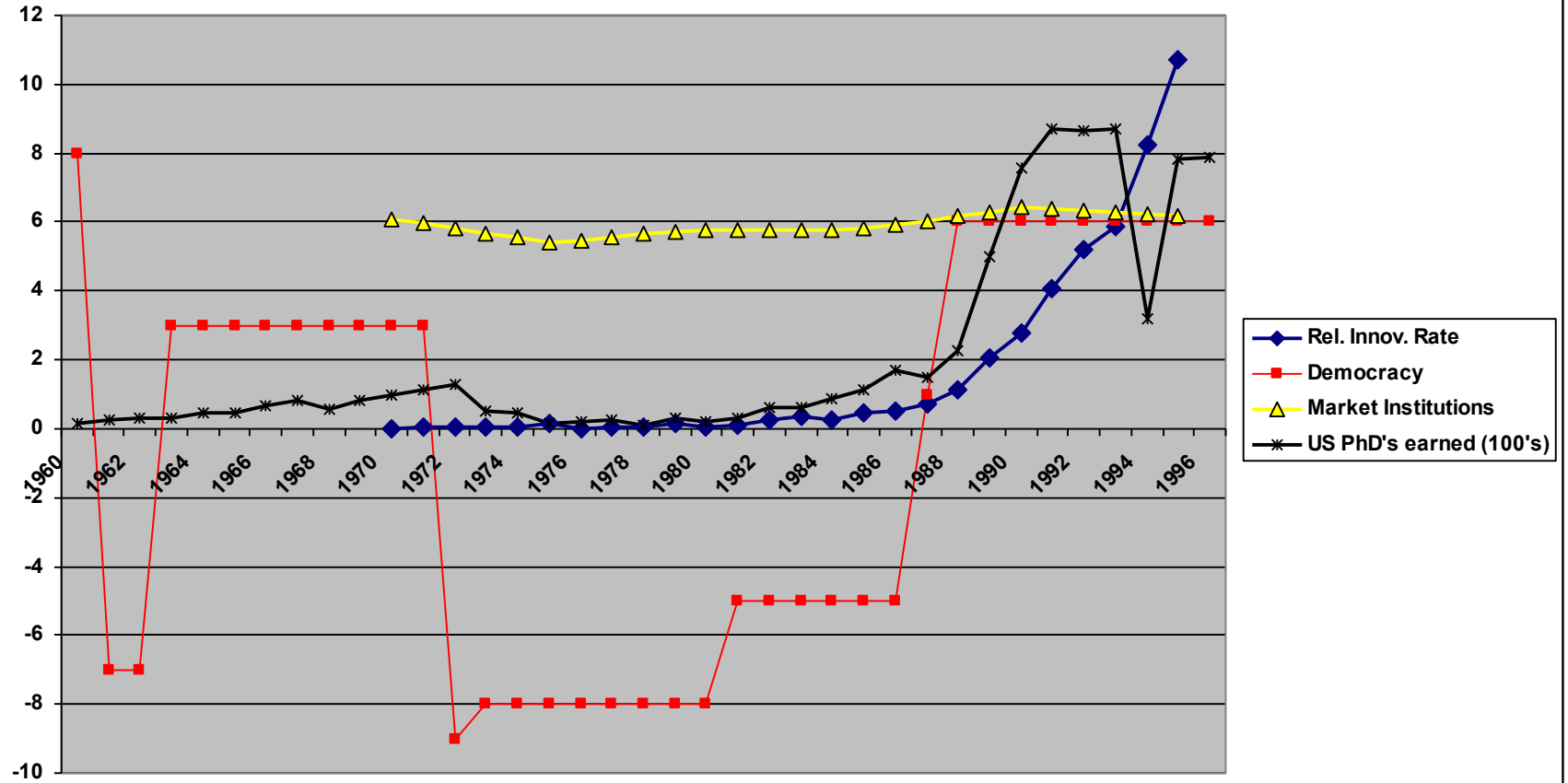
Taiwan



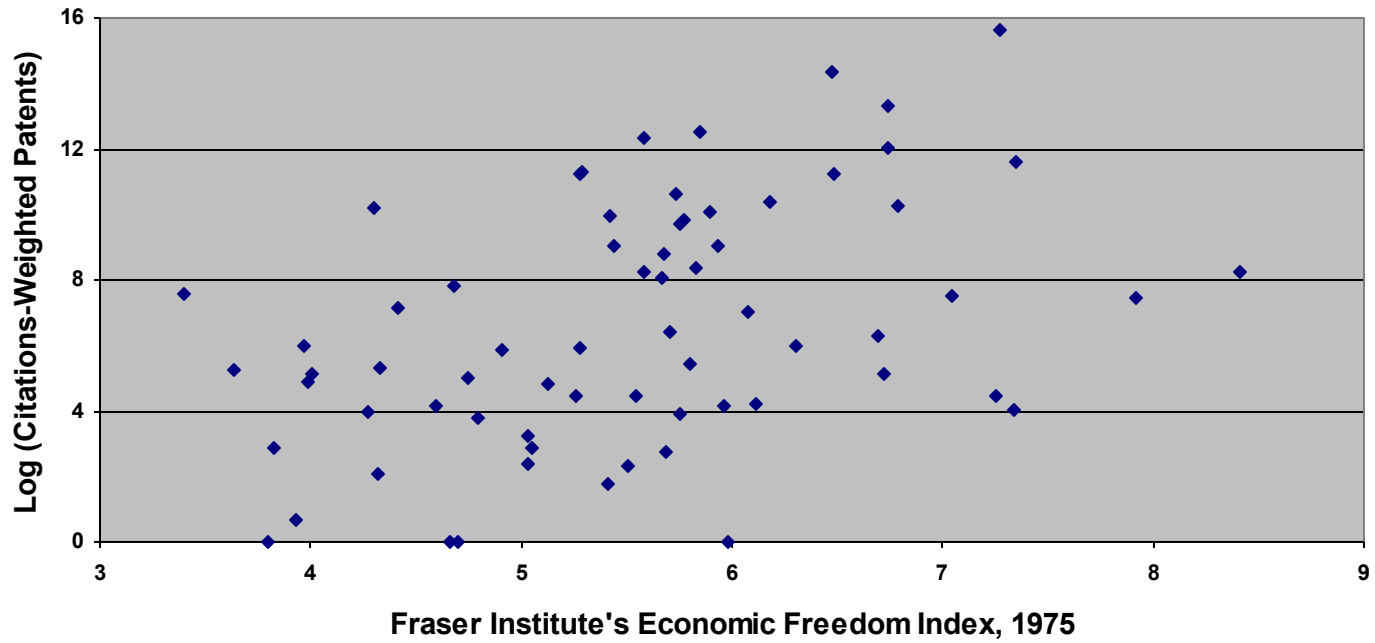
Taiwan



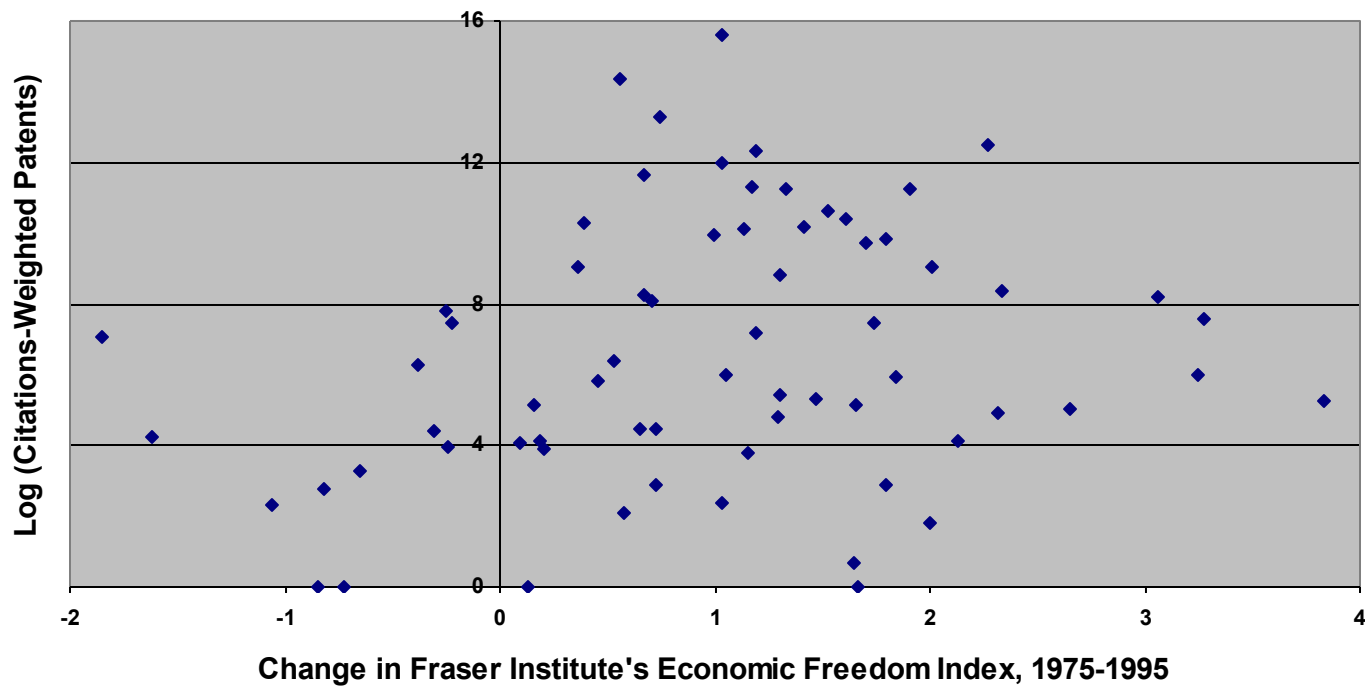
South Korea



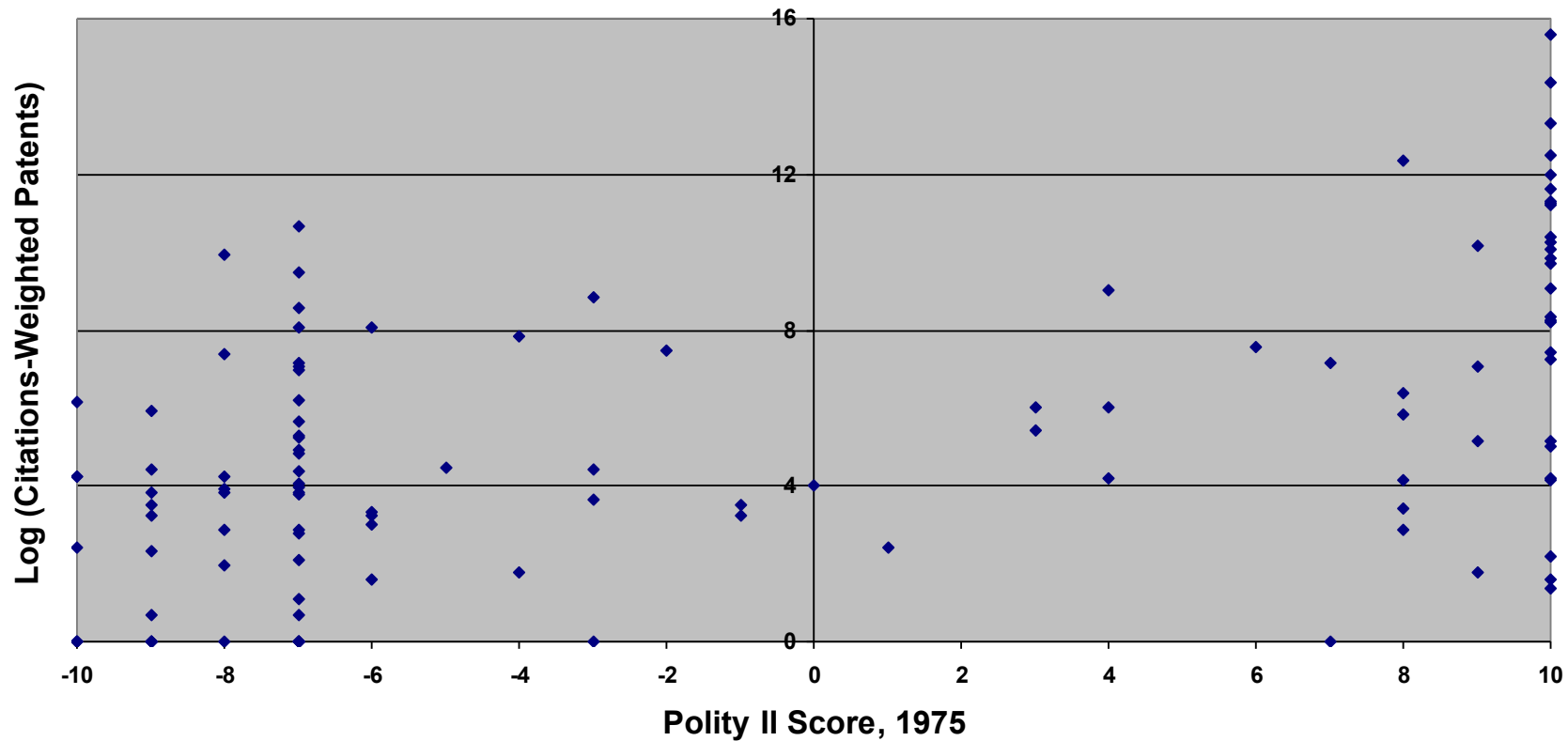
1975 Level of Market Institutions v. 1975-1995 Innovation



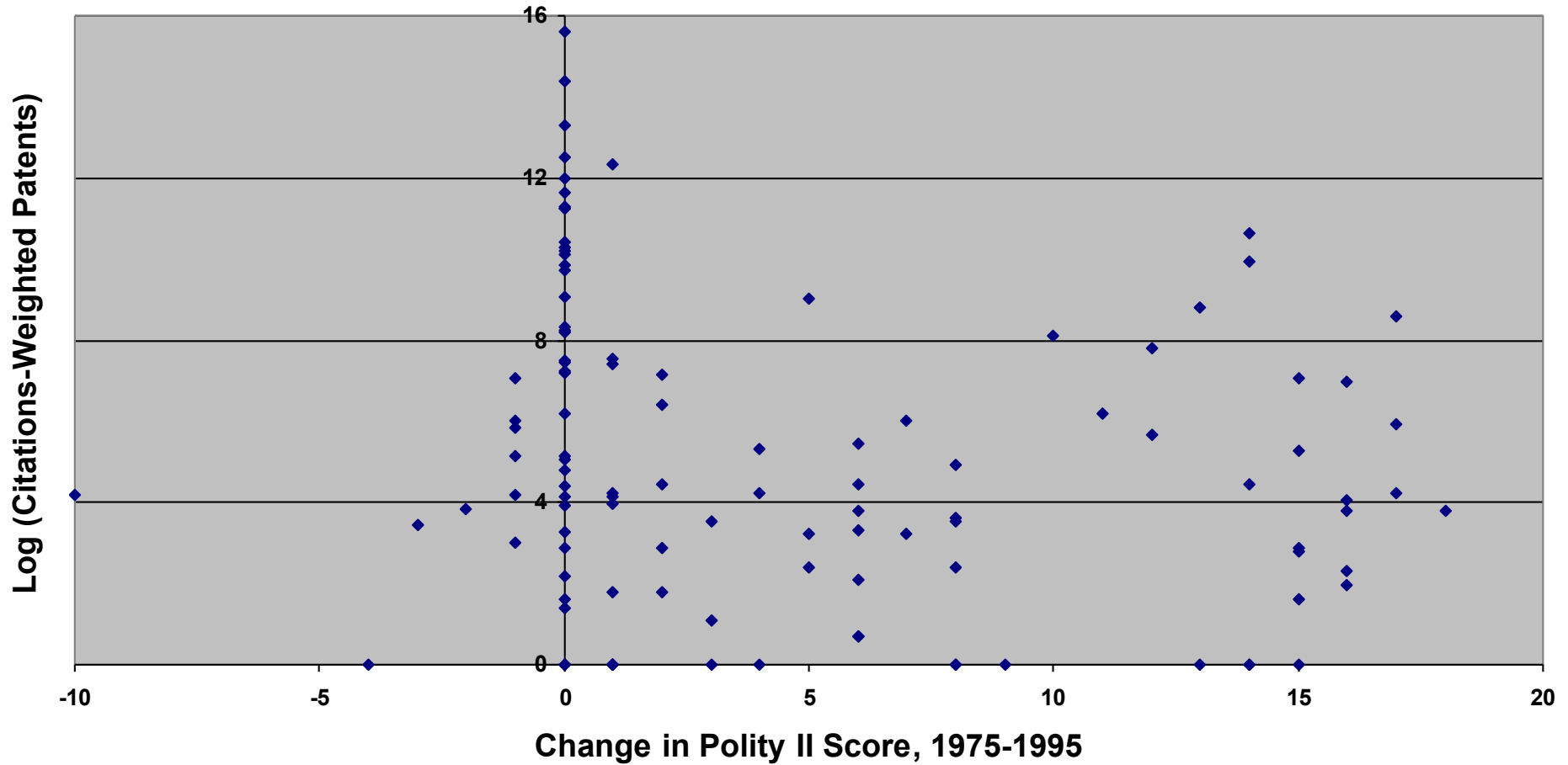
1975-1995: Change in Market Institutions v. Innovation



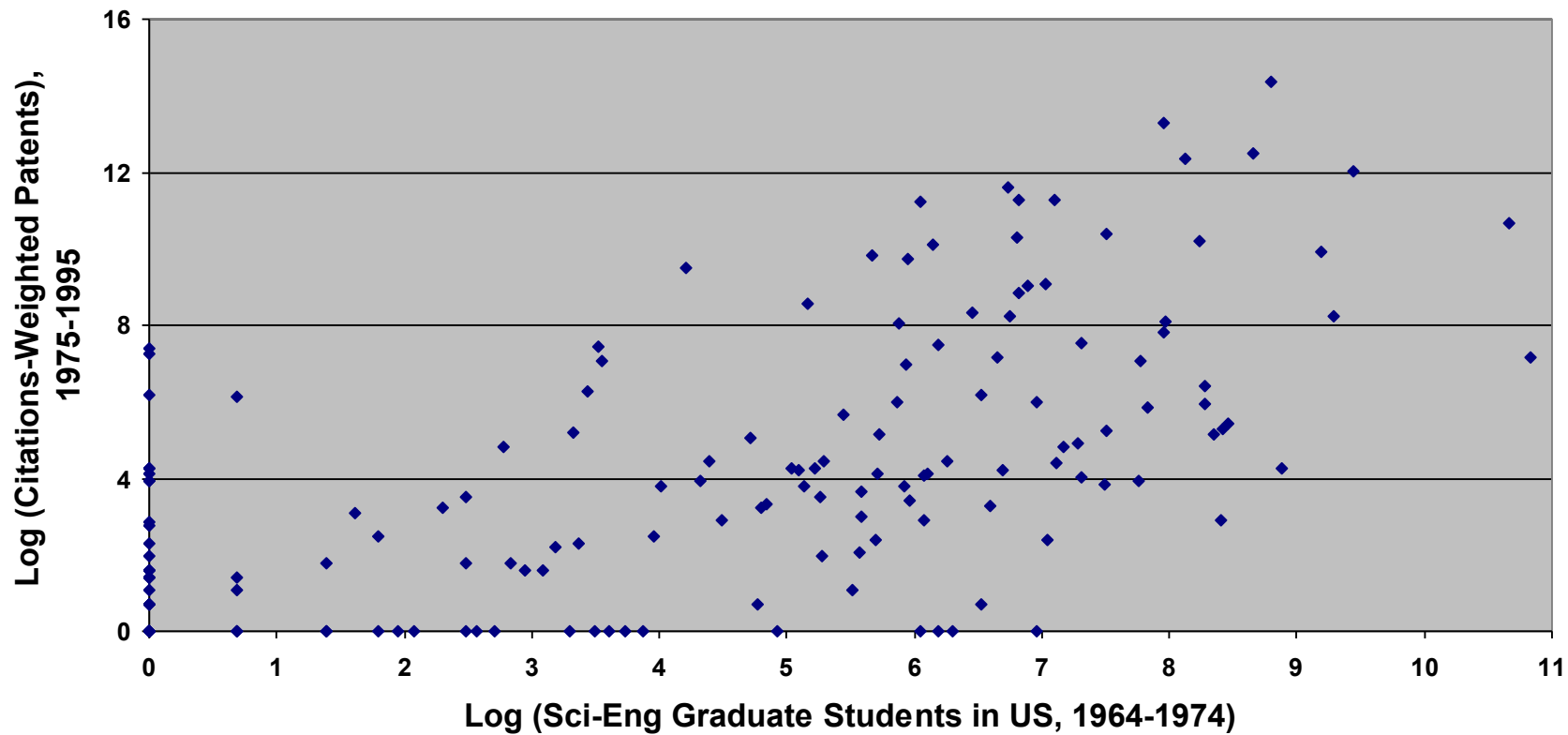
Base Level of Democracy v. Innovation 1975-1995



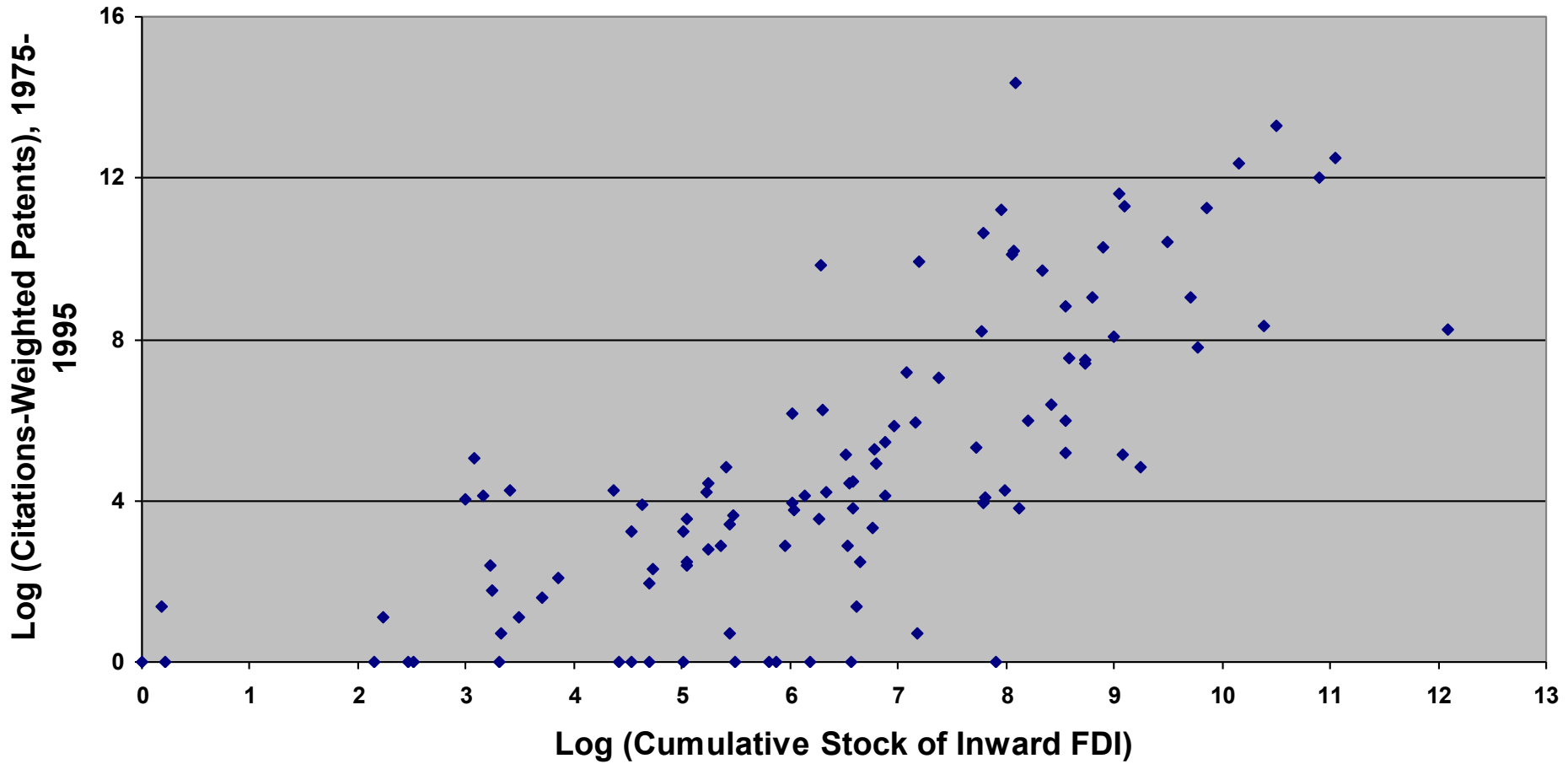
1975-1995: Change in Level of Democracy v. Innovation



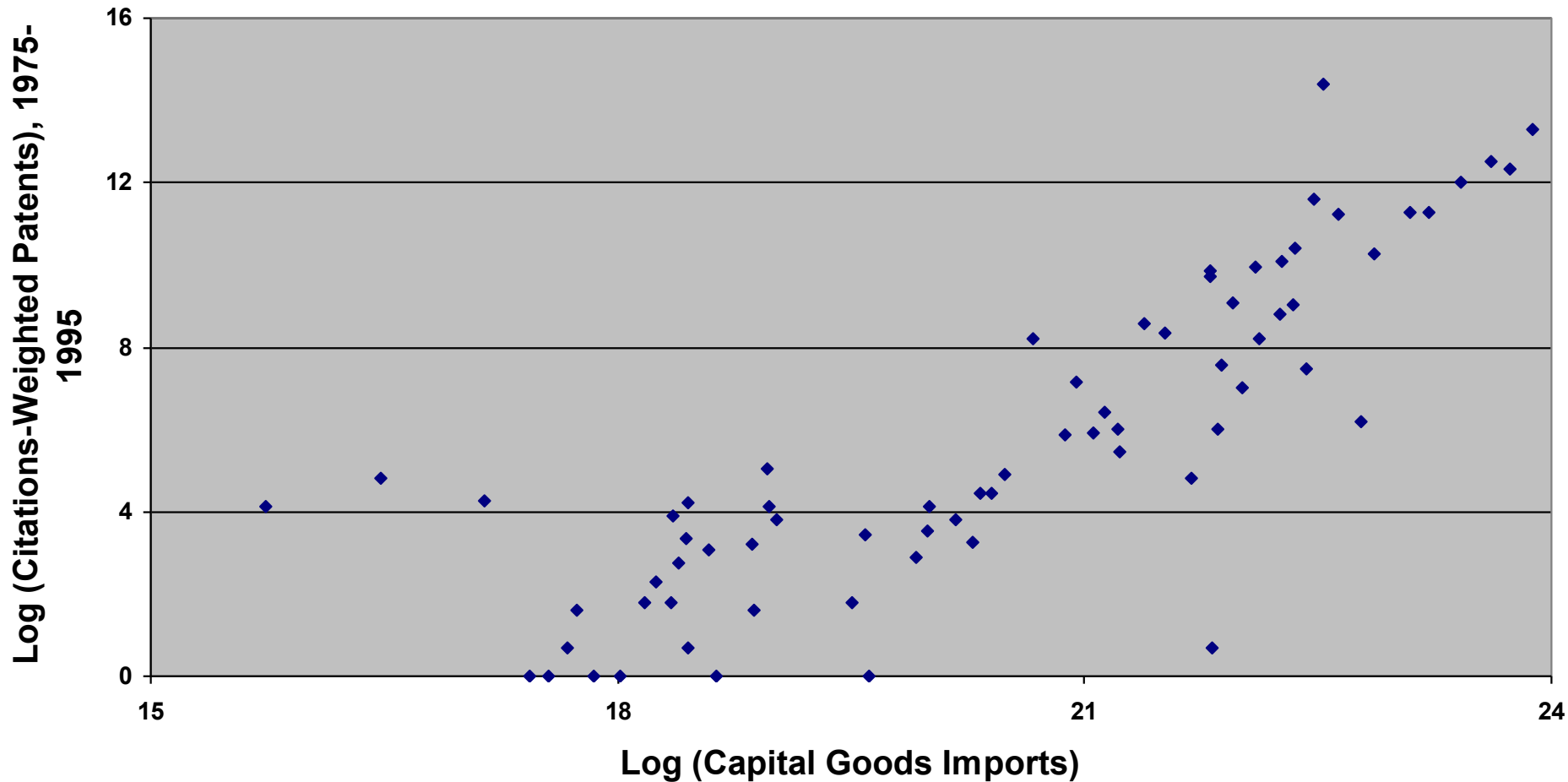
Science-Engineering Grads of US Schools v. Innovation



Inward FDI vs. Innovation



Imports of Capital Goods vs. Innovation



What Does This Evidence Allow us to Say?

1. “Good” domestic institutions are *not* a necessary/sufficient condition for, or producer of, technological performance.
2. International relationships may indeed matter for national innovation rates