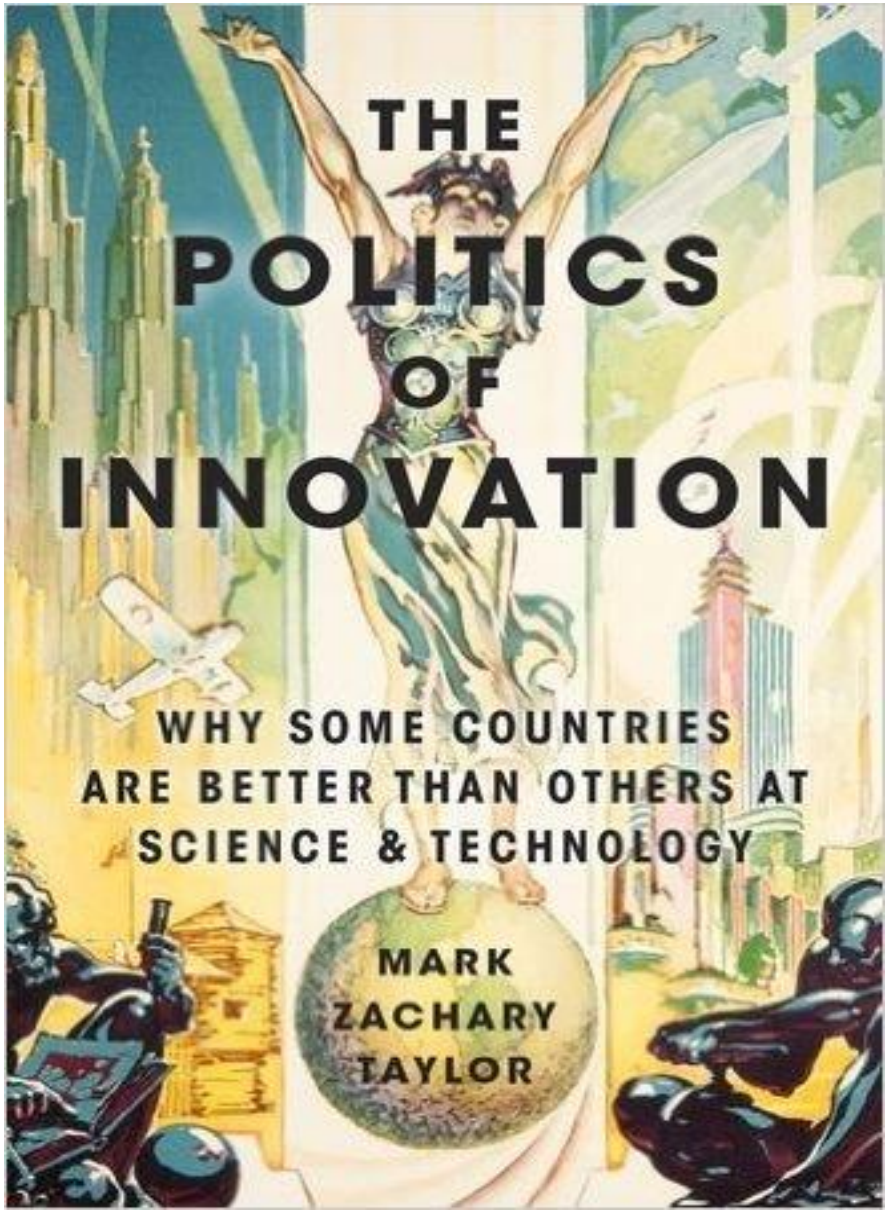
Why Are Some Countries Better at Science & Technology Than Others?

All research available at:
http://www.mzak.net

presented by:
Mark Zachary Taylor
School of Public Policy
Georgia Institute of Technology
mzak@gatech.edu



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

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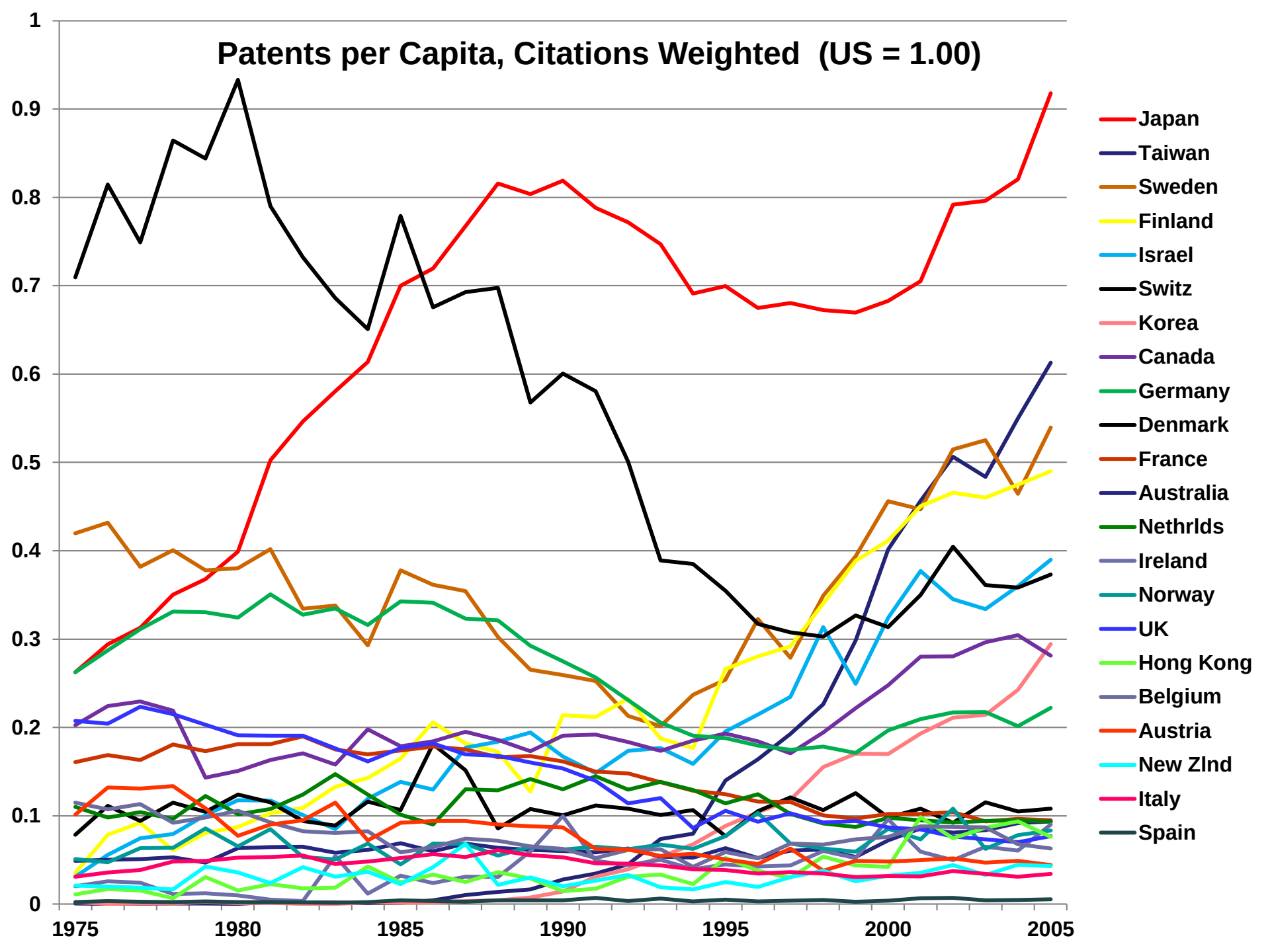
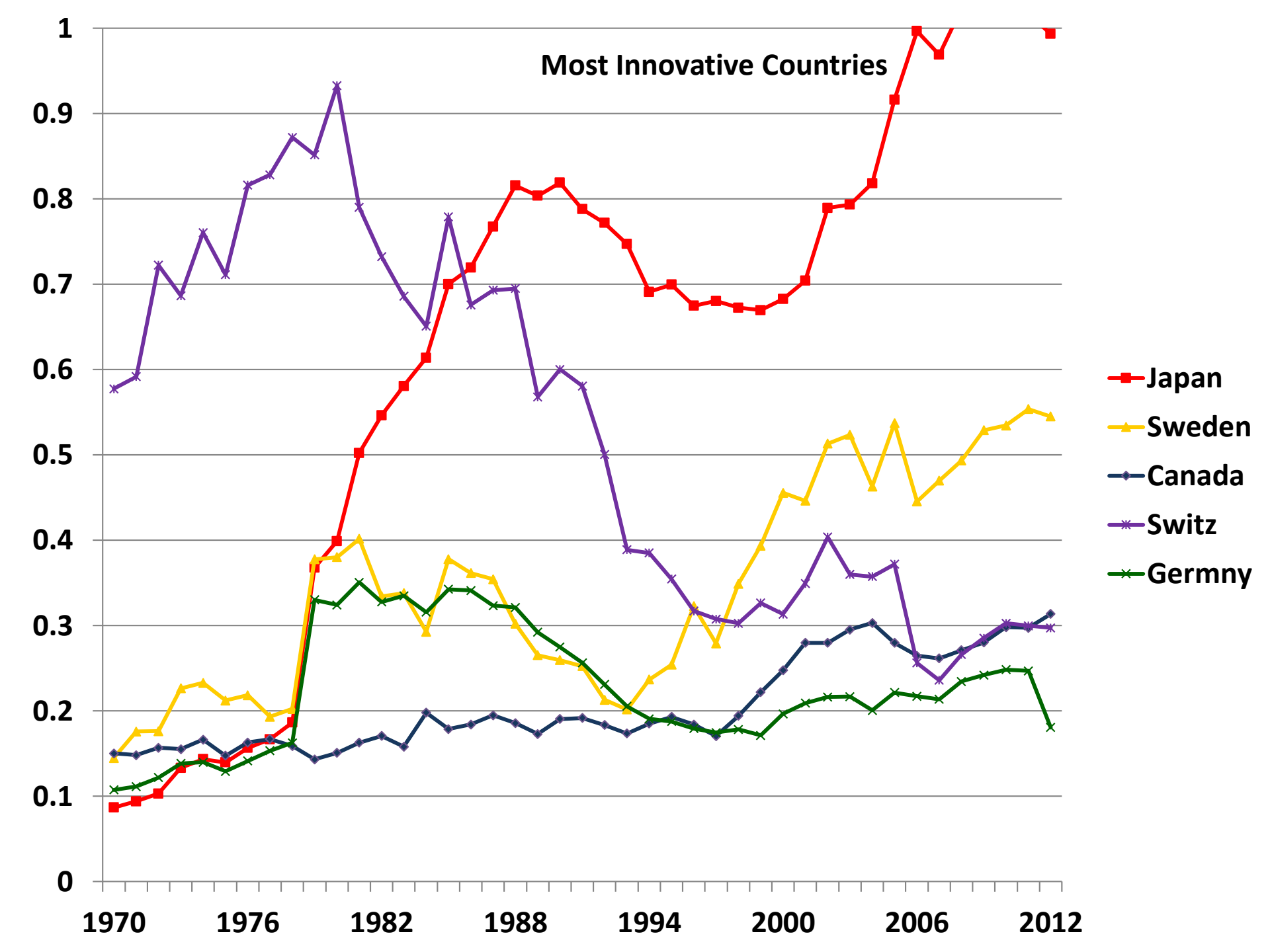
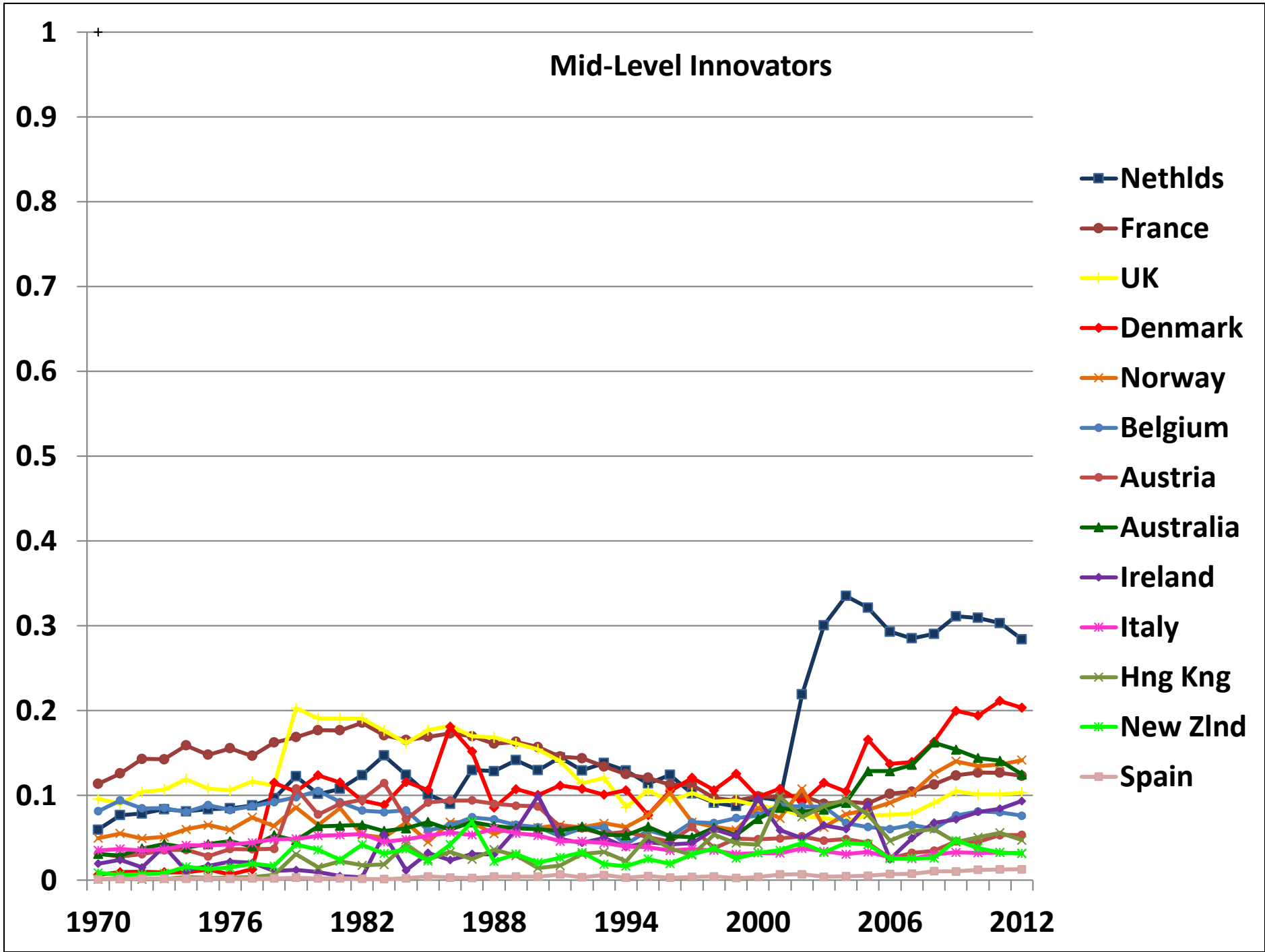
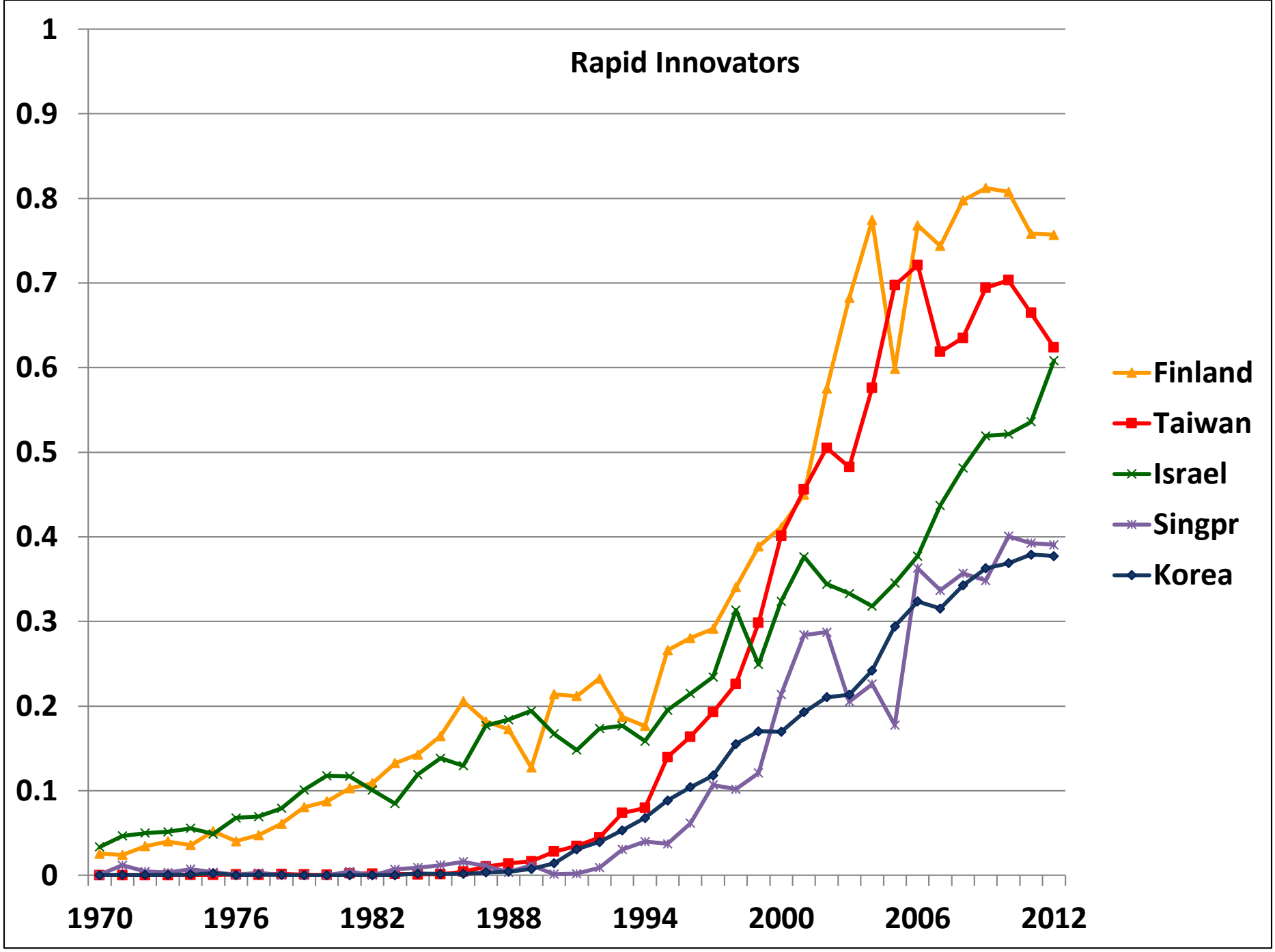

Patents per Capita, Citations Weighted (US = 1.00)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1975
1980
1985
1990
1995
2000
2005
Japan
Taiwan
Sweden
Finland
Israel
Switz
Korea
Canada
Germany
Denmark
France
Australia
Nethrlds
Ireland
Norway
UK
Hong Kong
Belgium
Austria
New Zlnd
Italy
Spain


Most Innovative Countries
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1970
1976
1982
1988
1994
2000
2006
2012
Japan
Sweden
Canada
Switz
Germny


Mid-Level Innovators
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1970
1976
1982
1988
1994
2000
2006
2012
Nethlds
France
UK
Denmark
Norway
Belgium
Austria
Australia
Ireland
Italy
Hng Kng
New Zlnd
Spain


Rapid Innovators
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1970
1976
1982
1988
1994
2000
2006
2012
Finland
Taiwan
Israel
Singpr
Korea

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
- Size
- Scarcity of Labor/Nat. Res.
- Barrier to Entry/Incr. Rtrns.
- Free-Riding
- Culture

- USA
- Japan
- Switzerland
- Germany
- Canada
- 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
Indstrial 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

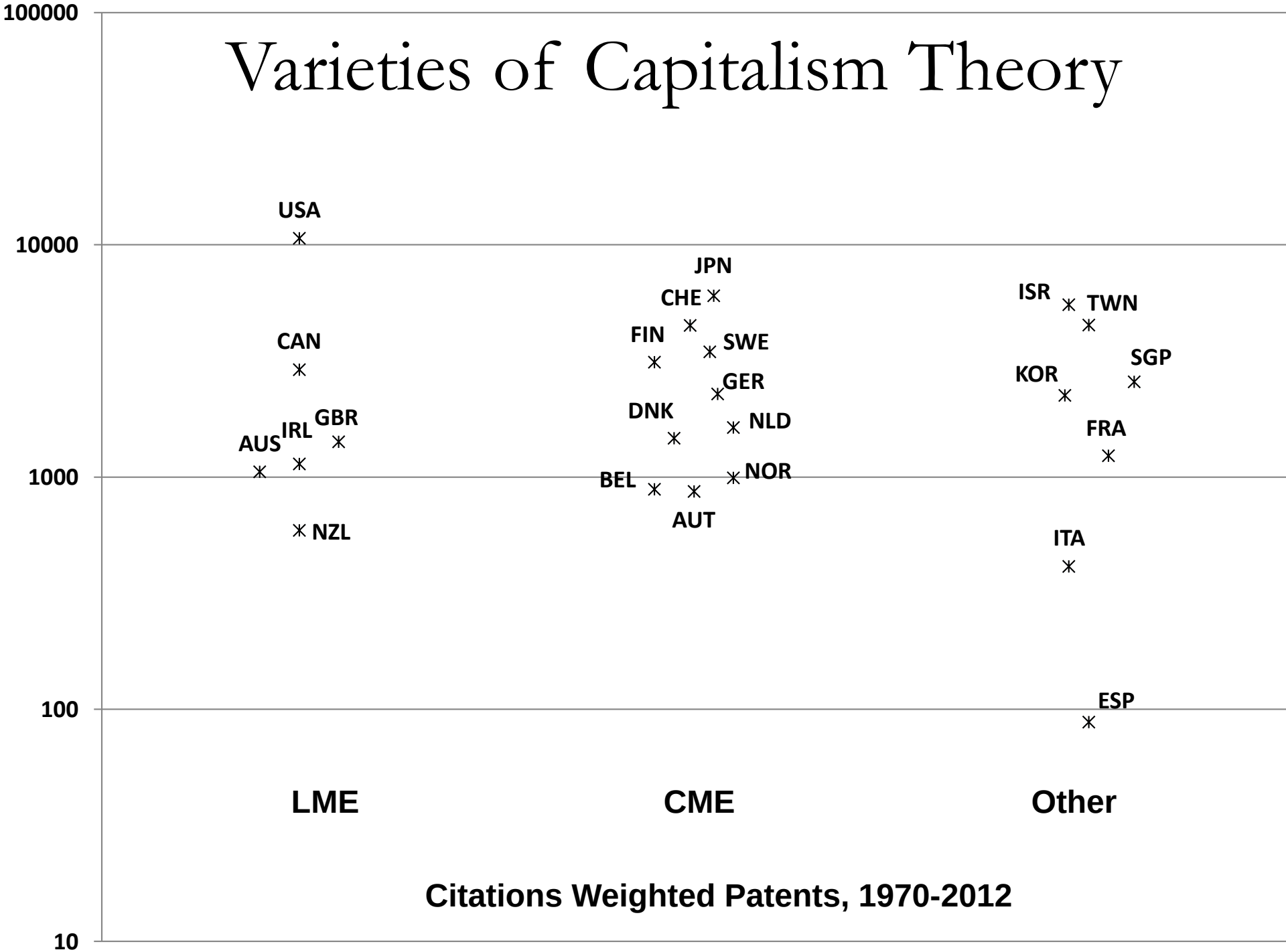
Less markets

+ More consensus

+ Less change

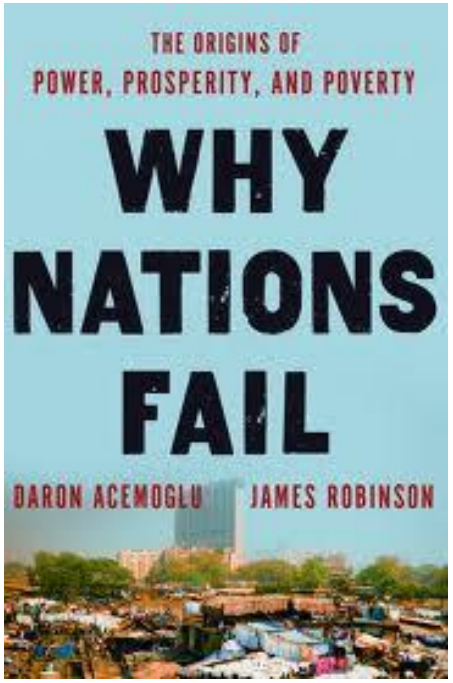
= Slower, more incremental technological innovation

Varieties of Capitalism Theory

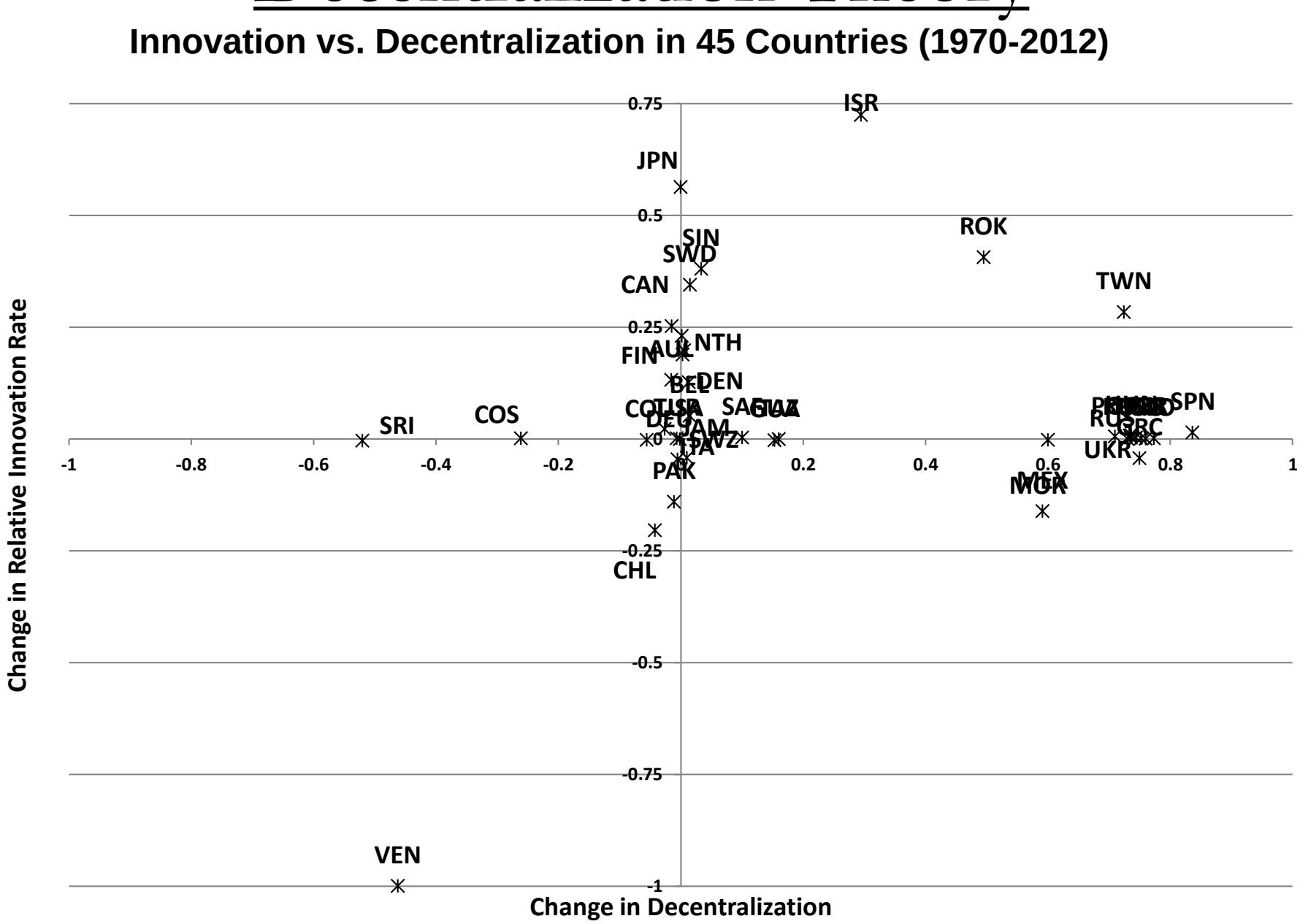


Decentralization Theory

- **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



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

-Market Failures
-Status Quo Interest Groups

→ **NATIONAL TECHNOLOGICAL INNOVATION** **X**

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)
- High Levels of Risk
- High Levels of Uncertainty
- Imperfect & Costly Information
- High Transaction Costs
- 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

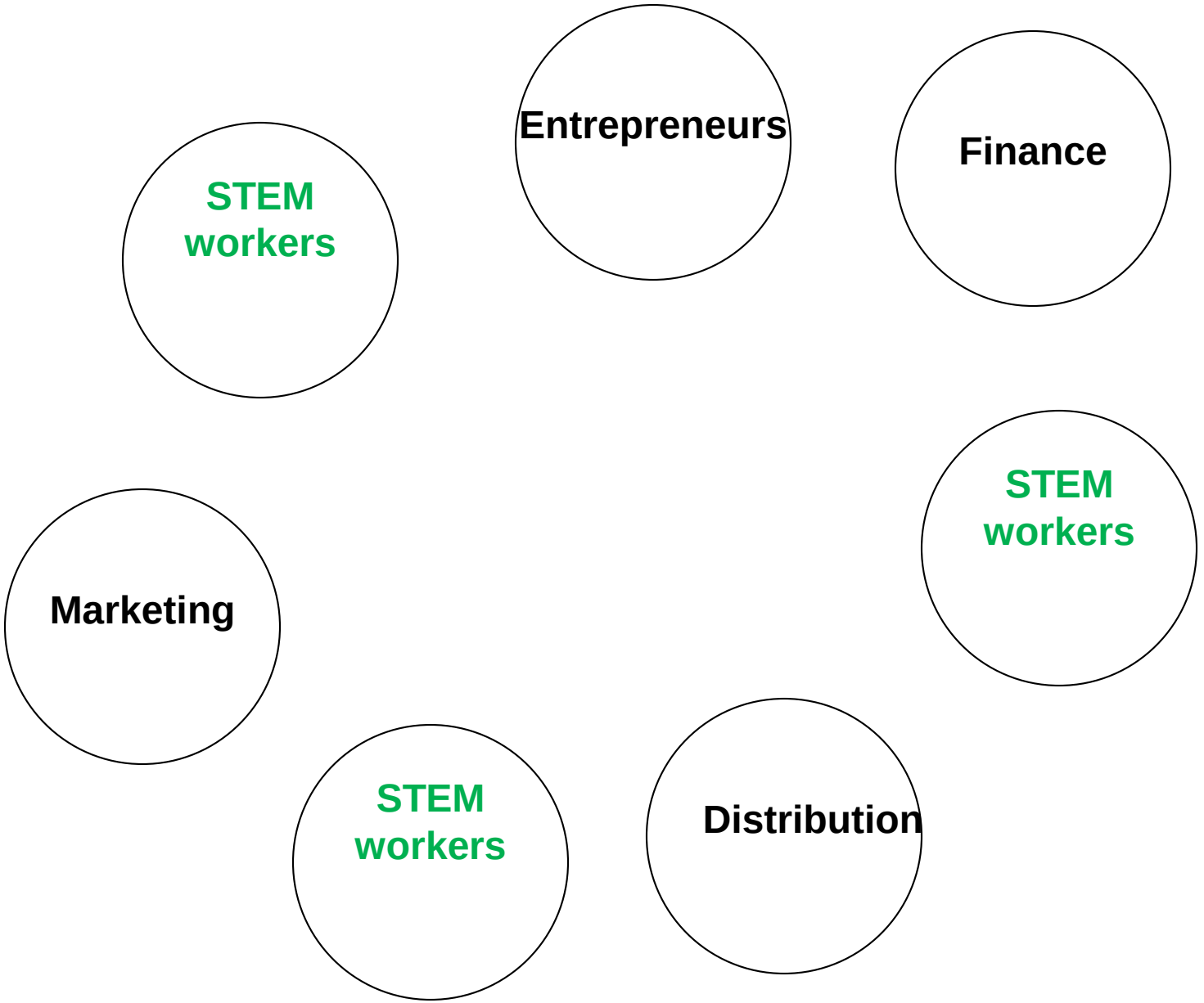
-Mergers & acquisitions, joint R&D projects

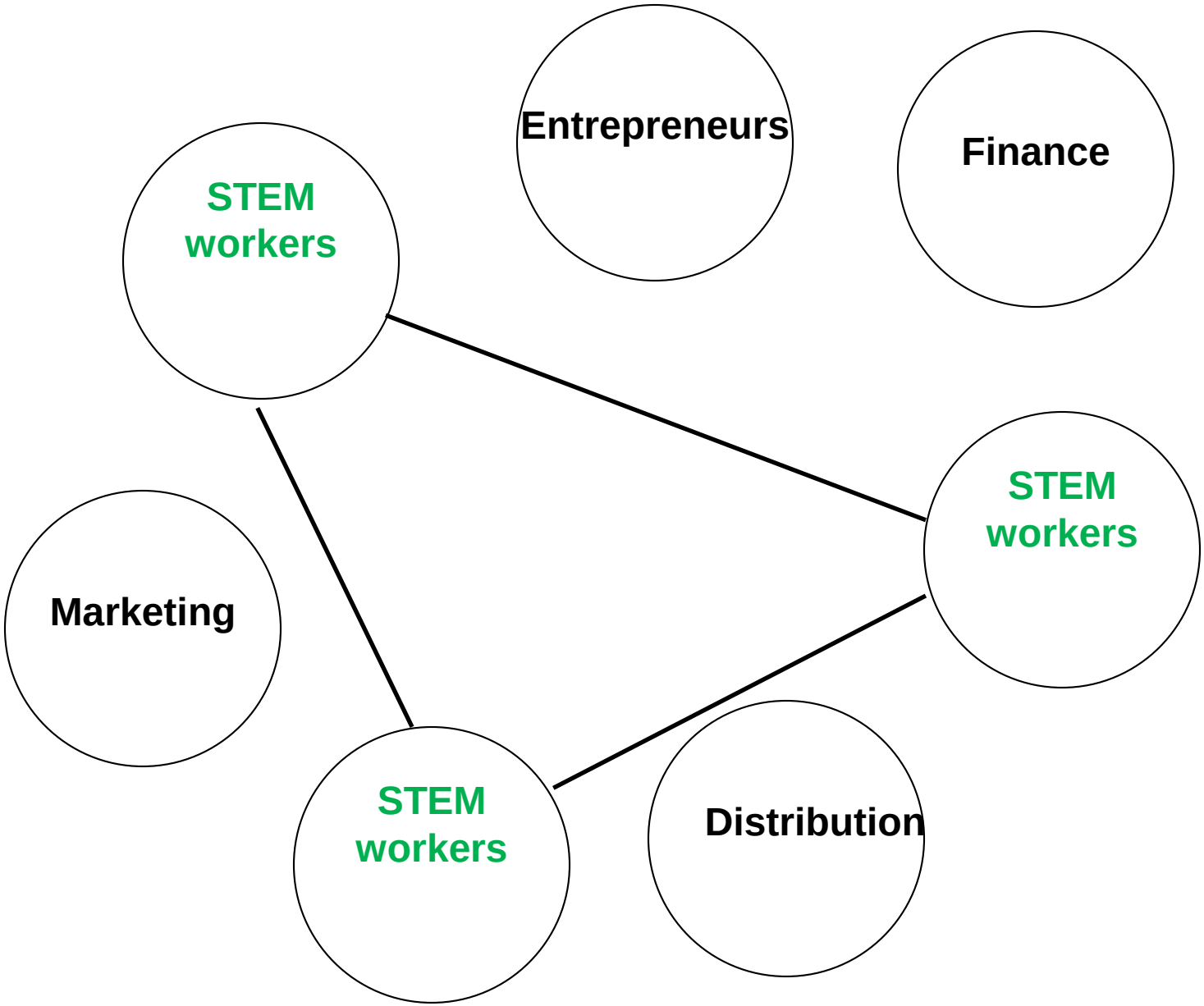
-Import-Export Relationships

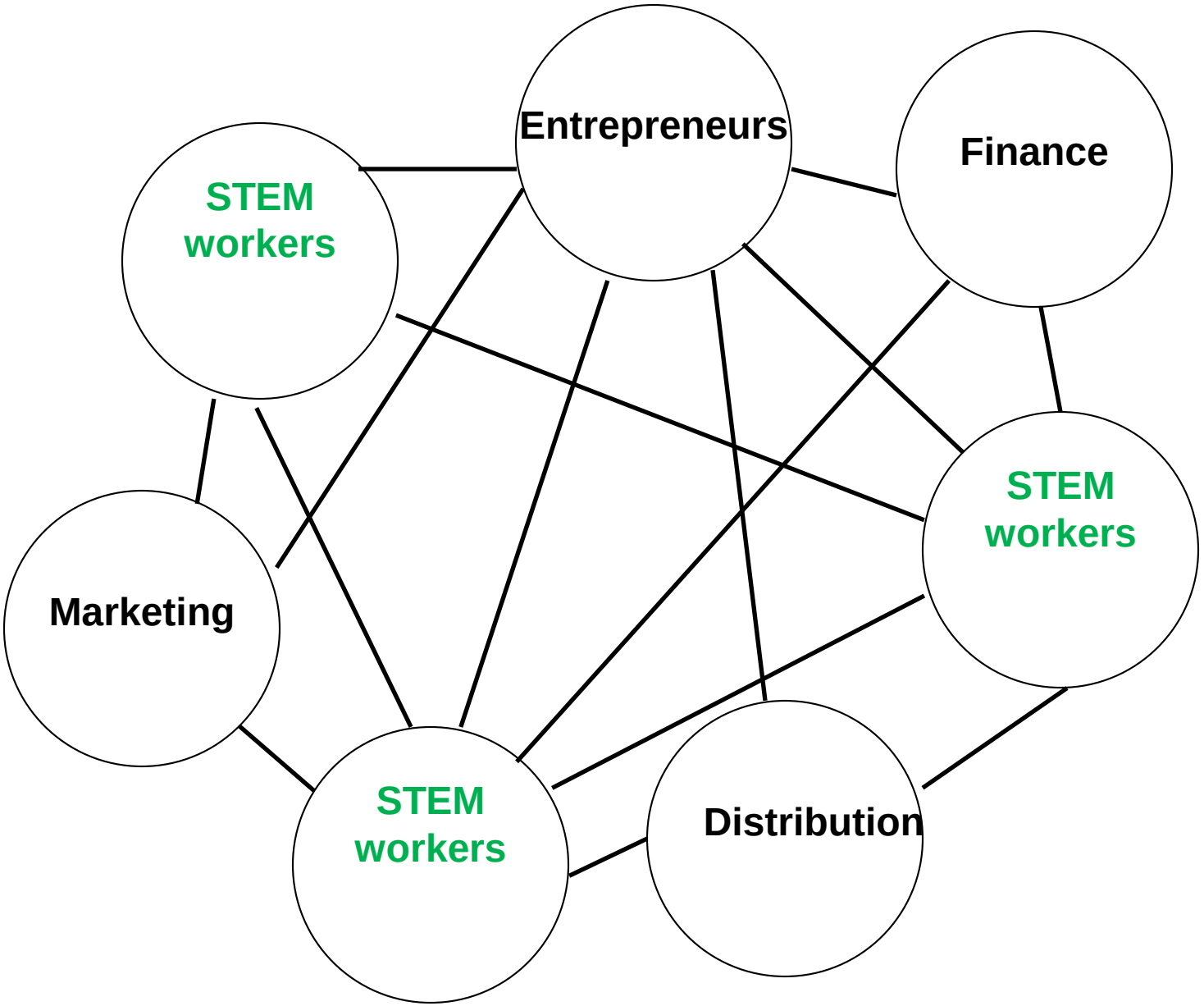
-Migration of STEM labor

-Establishing R&D facilities in high-tech countries

-Inward FDI in production and R&D facilities from more advanced countries


Entrepreneurs
Finance
STEM workers
STEM workers
Marketing
STEM workers
Distribution

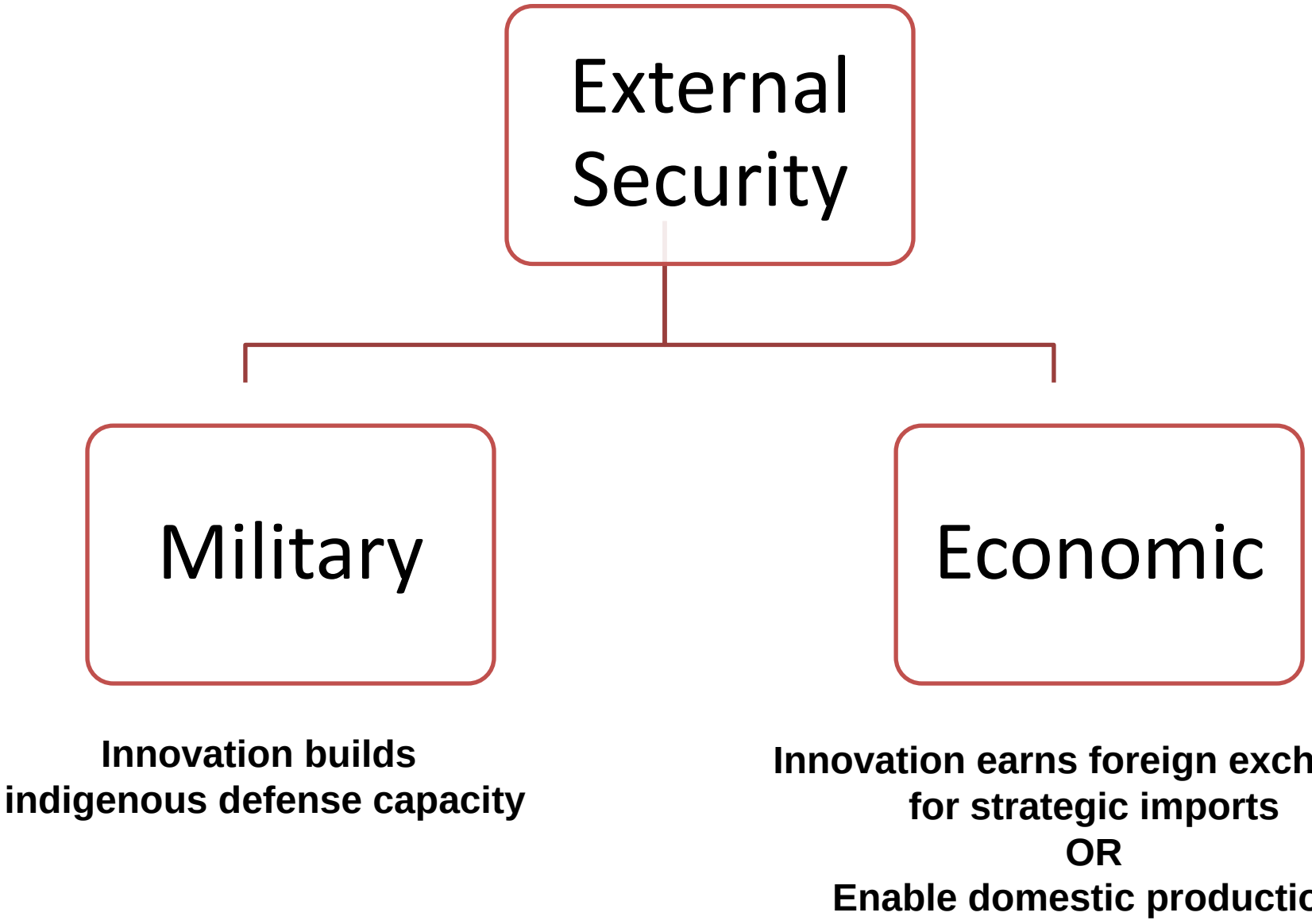

Entrepreneurs
Finance
STEM workers
STEM workers
Marketing
STEM workers
Distribution

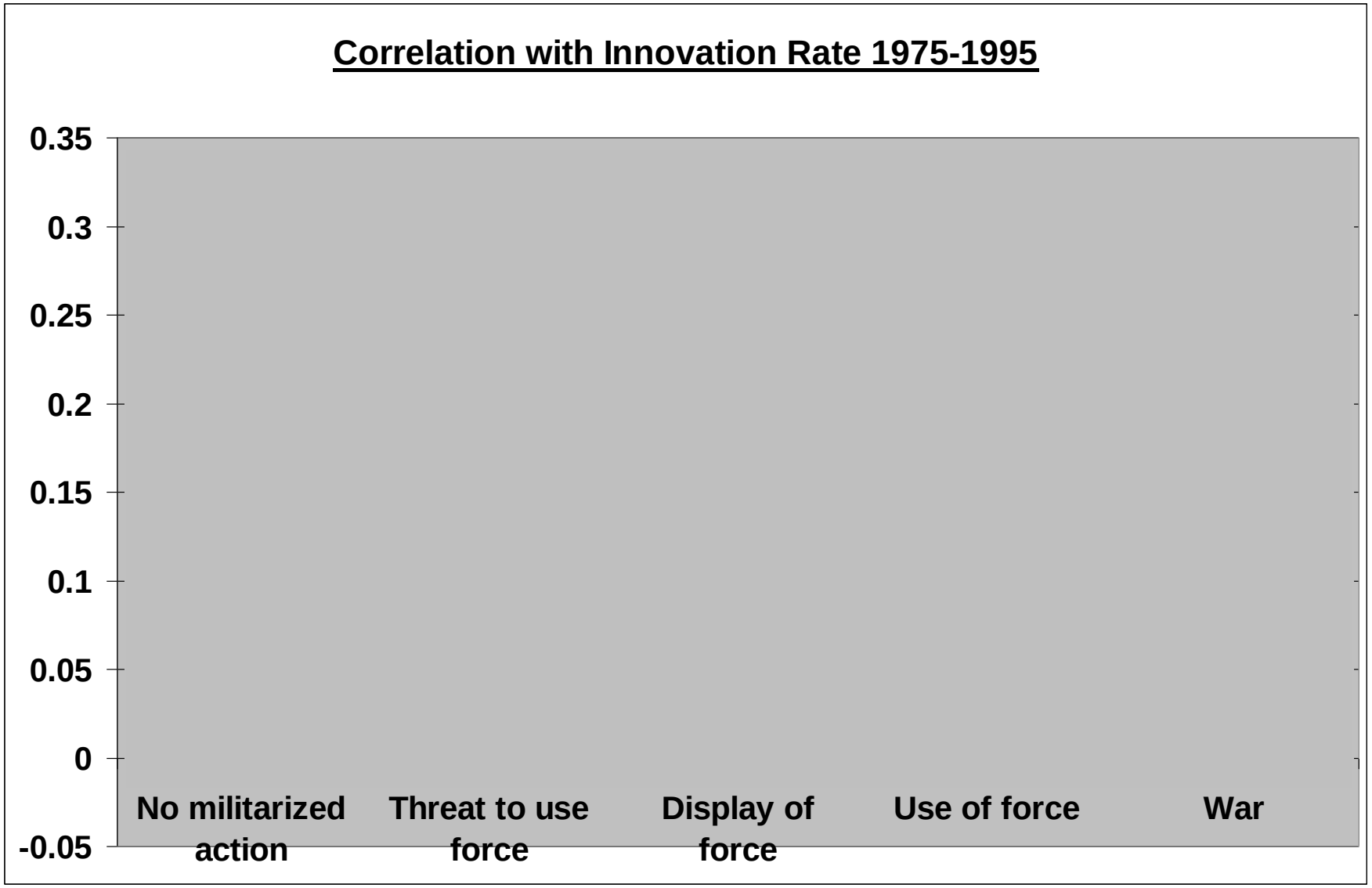


Successful institutions/policy solve market failures AND promote networks

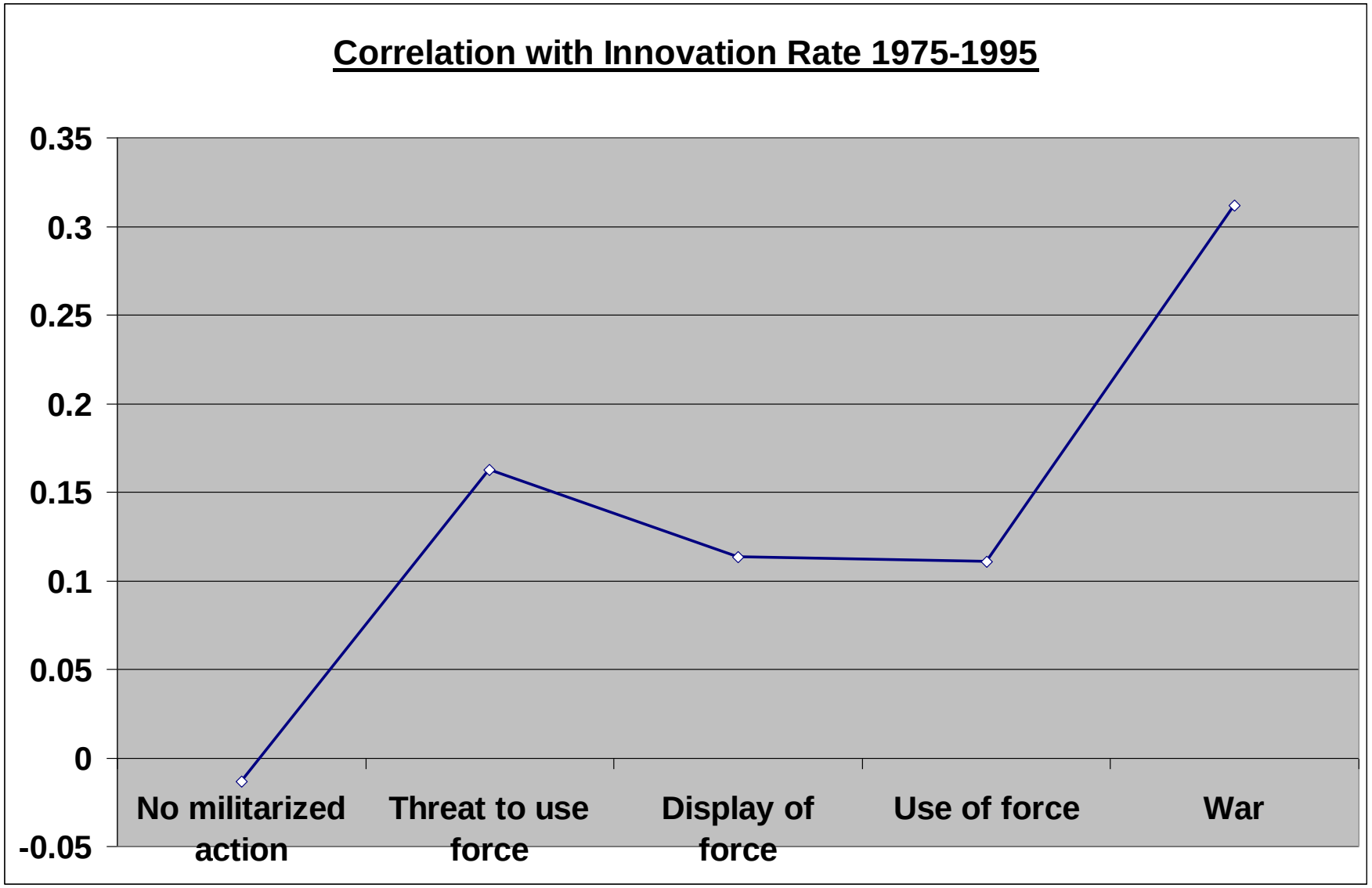
But then the question becomes….

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

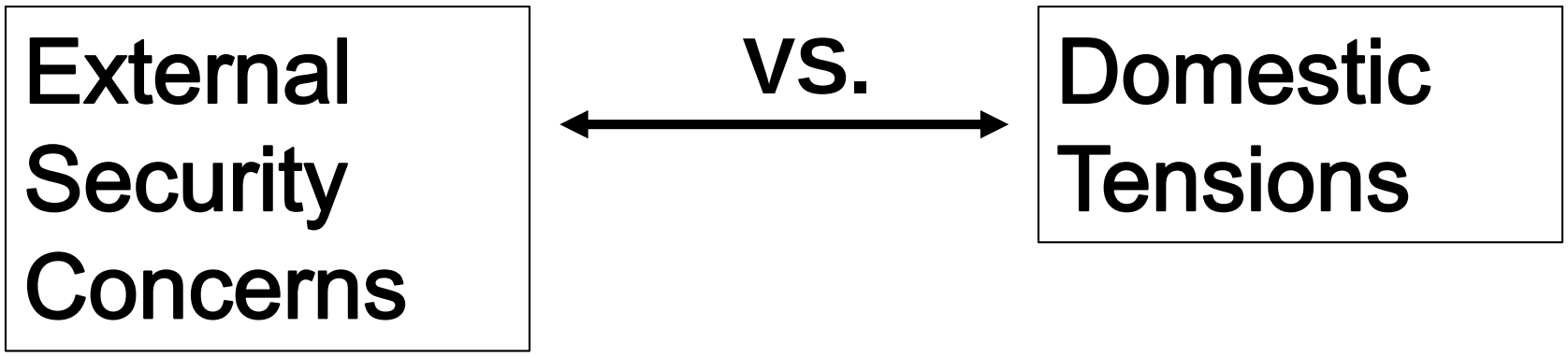

External Security
Military
Economic
Innovation builds indigenous defense capacity
Innovation earns foreign exchange for strategic imports
OR
Enable domestic production



Higher levels of external threat correlate with higher national innovation rates



Higher levels of external threat correlate with higher national innovation rates


External Security Concerns
vs.
Domestic Tensions

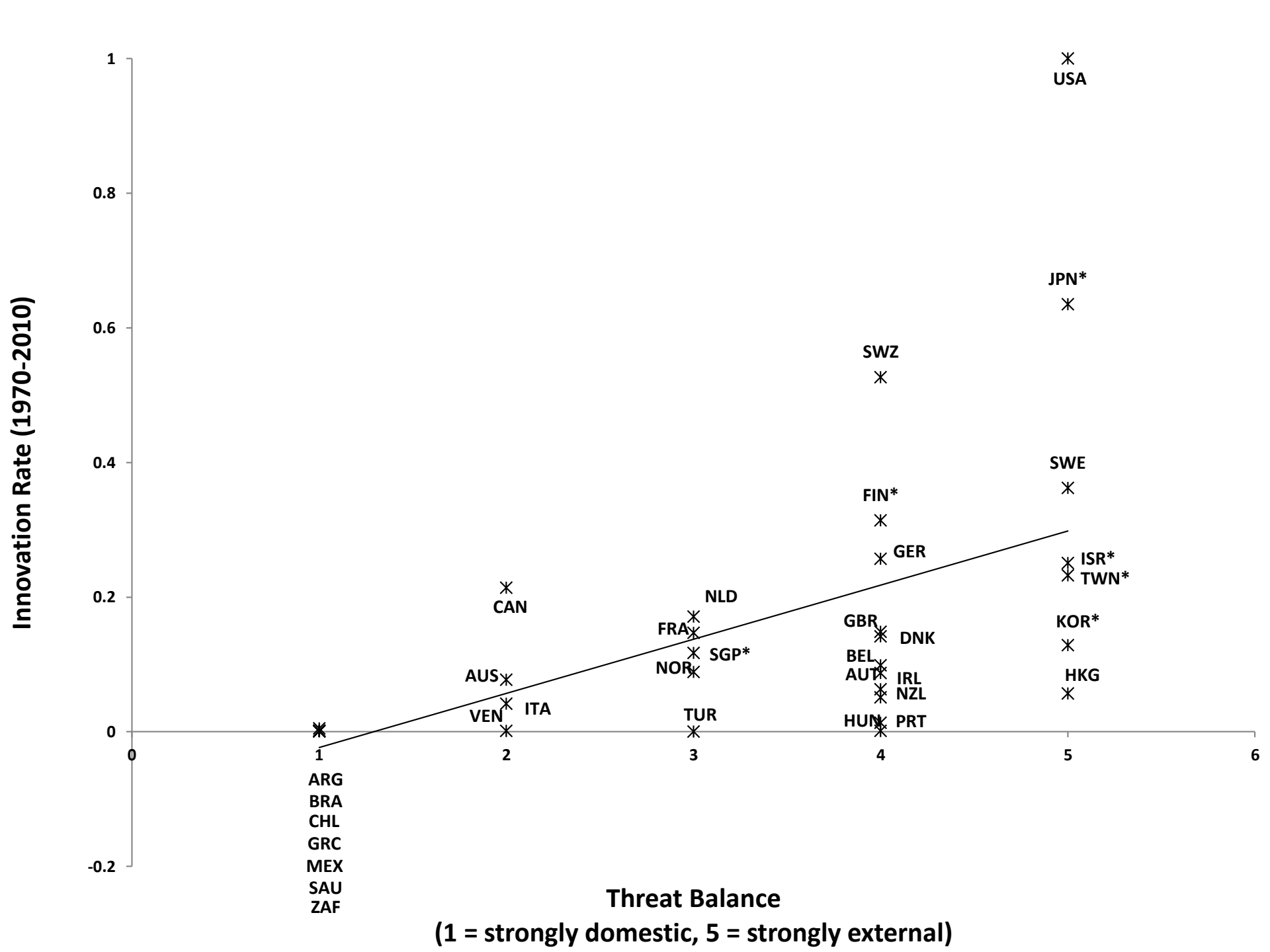
Domestic Tensions

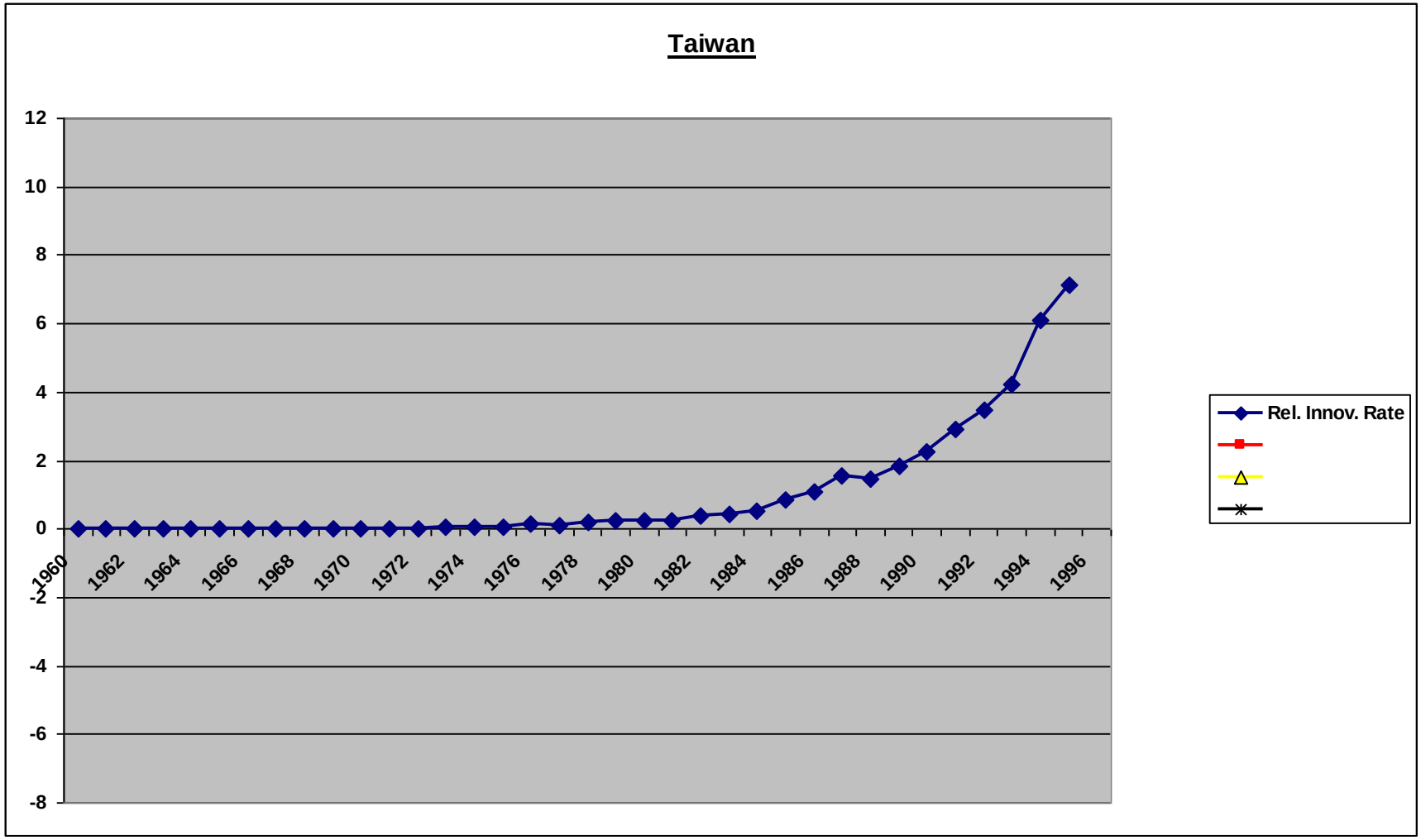
- Economic
- Ethnic/Tribal
- Geographic
- Cultural

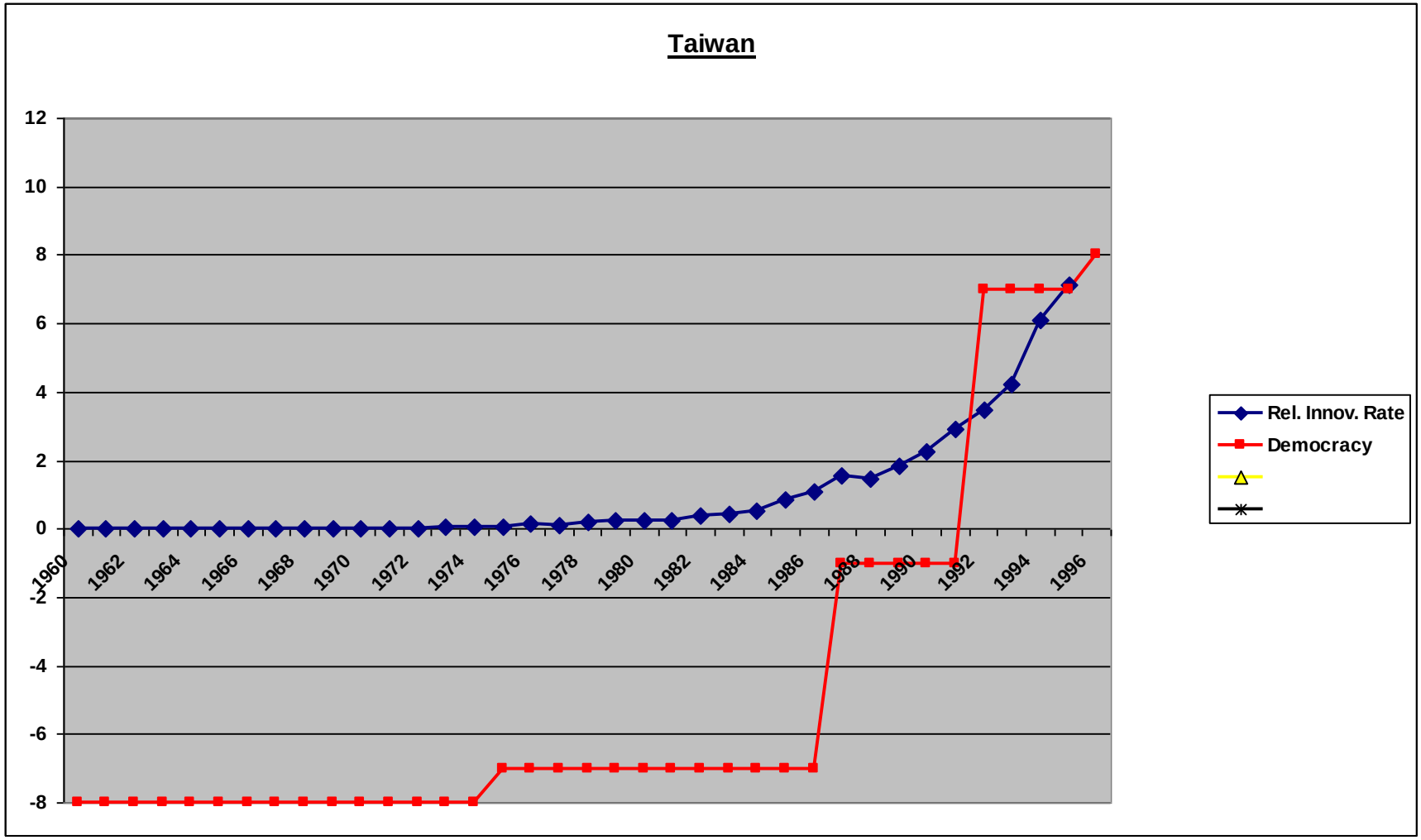


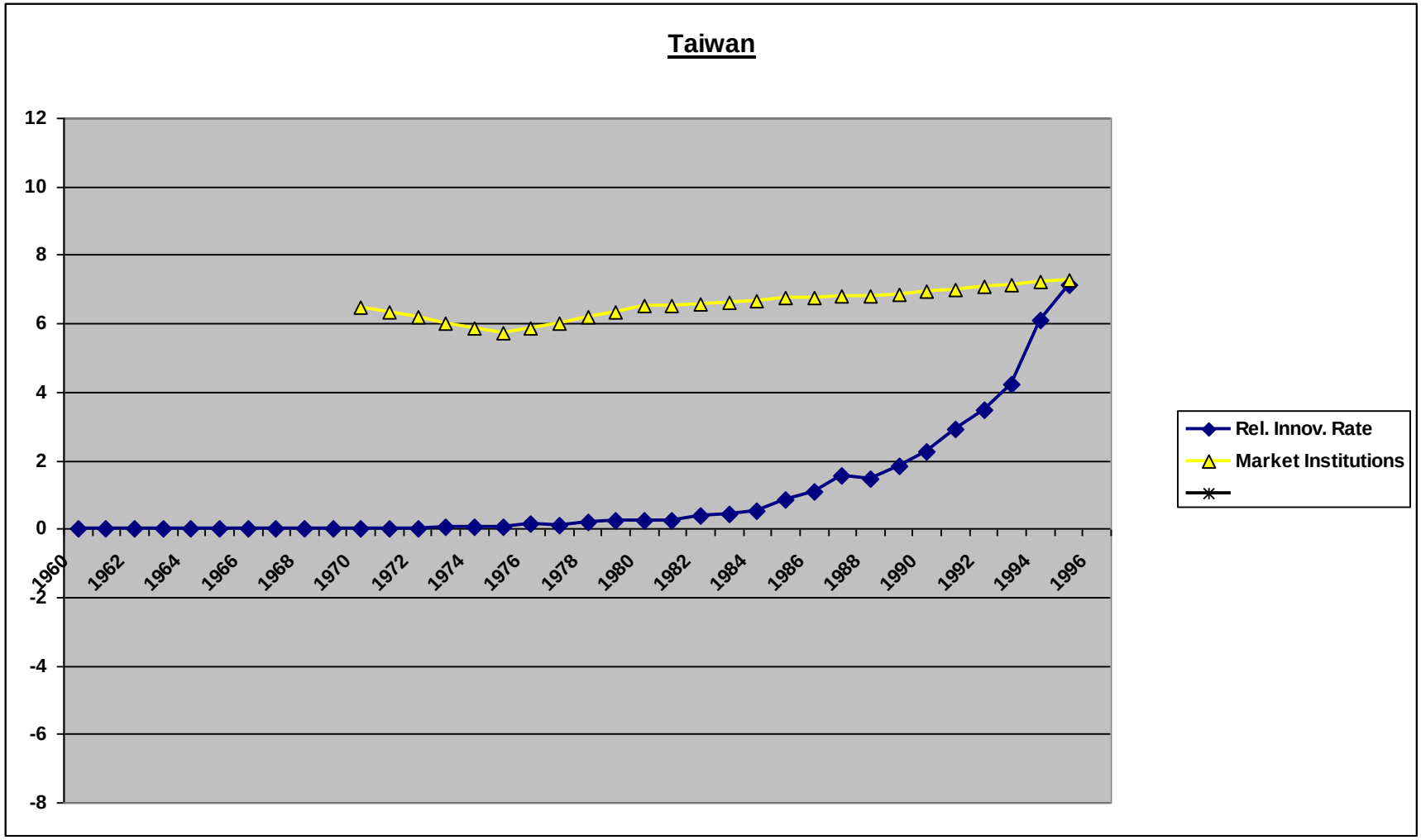

-Innovation creates winners & losers
-Innovation redistributes wealth & power

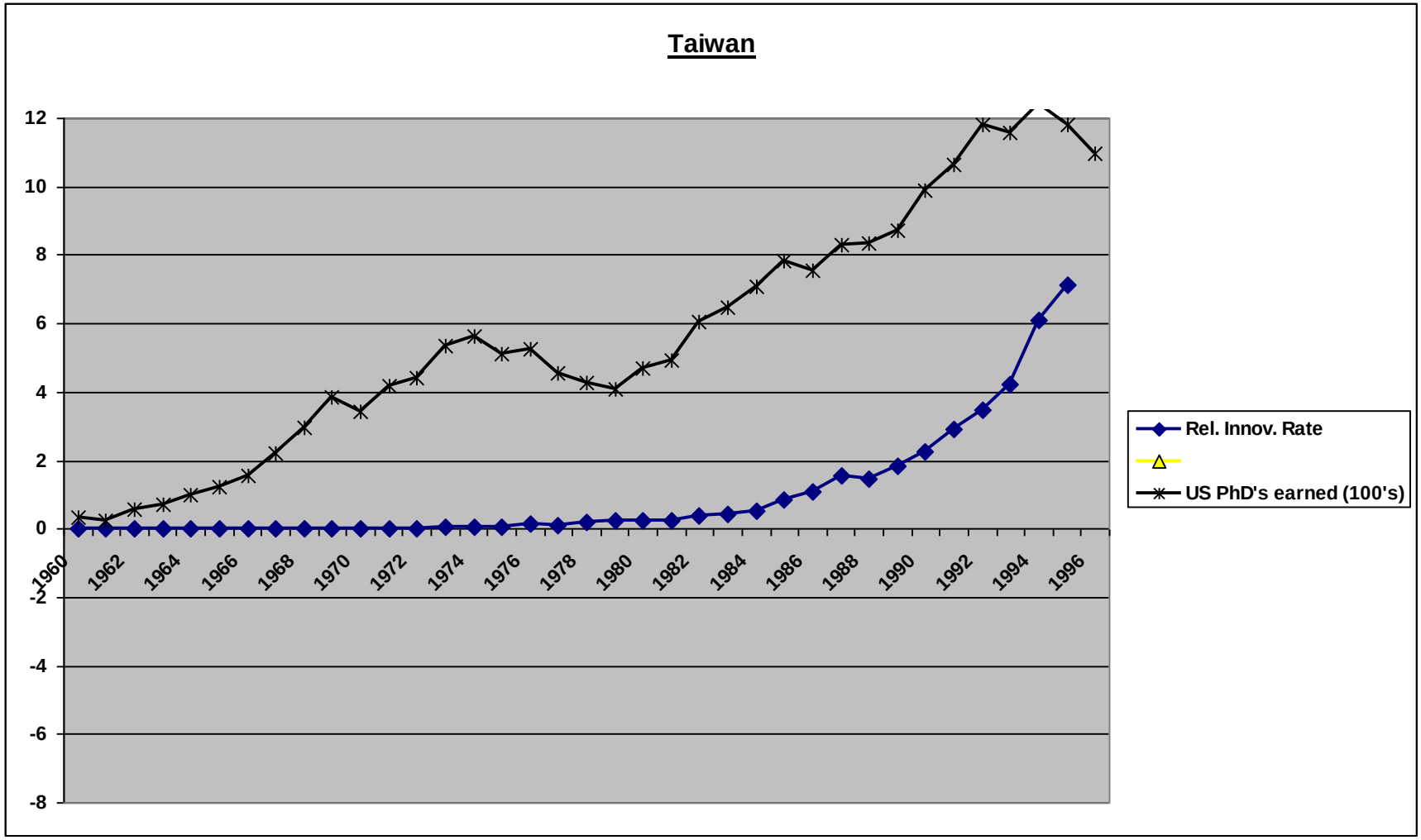
External Threats > Domestic Tensions	Domestic Tensions > External Threats
● Fewer labor strikes	● More labor strikes
● Lower economic inequality	● Greater economic inequality
● Higher imports of food and energy as % of total consumed	● Lower imports of food and energy as % of total consumed
● Longer recent history of external conflicts	● Shorter recent history of external conflicts
● No recent civil war	● Recent civil war
	● Anti-S&T, pro status-quo military dictatorship

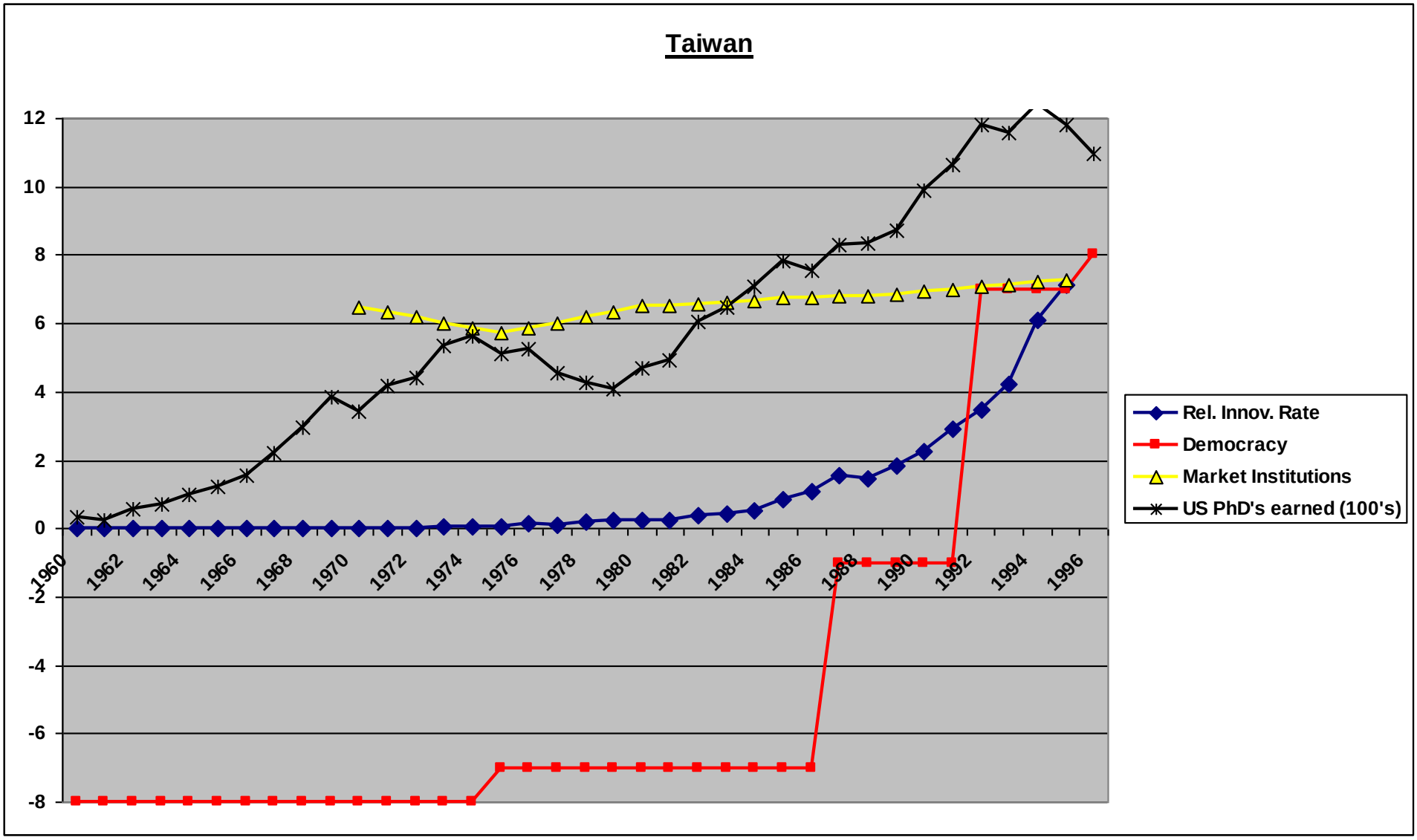

Innovation Rate (1970-2010)
1
0.8
0.6
0.4
0.2
0
-0.2
0
1
2
3
4
5
6
USA
JPN*
SWZ
SWE
FIN*
GER
ISR*
TWN*
CAN
NLD
FRA
GBR
DNK
KOR*
SGP*
BEL
AUS
NOR
AUT
IRL
HKG
NZL
ITA
VEN
TUR
HUN
PRT
ARG
BRA
CHL
GRC
MEX
SAU
ZAF
Threat Balance
(1 = strongly domestic, 5 = strongly external)

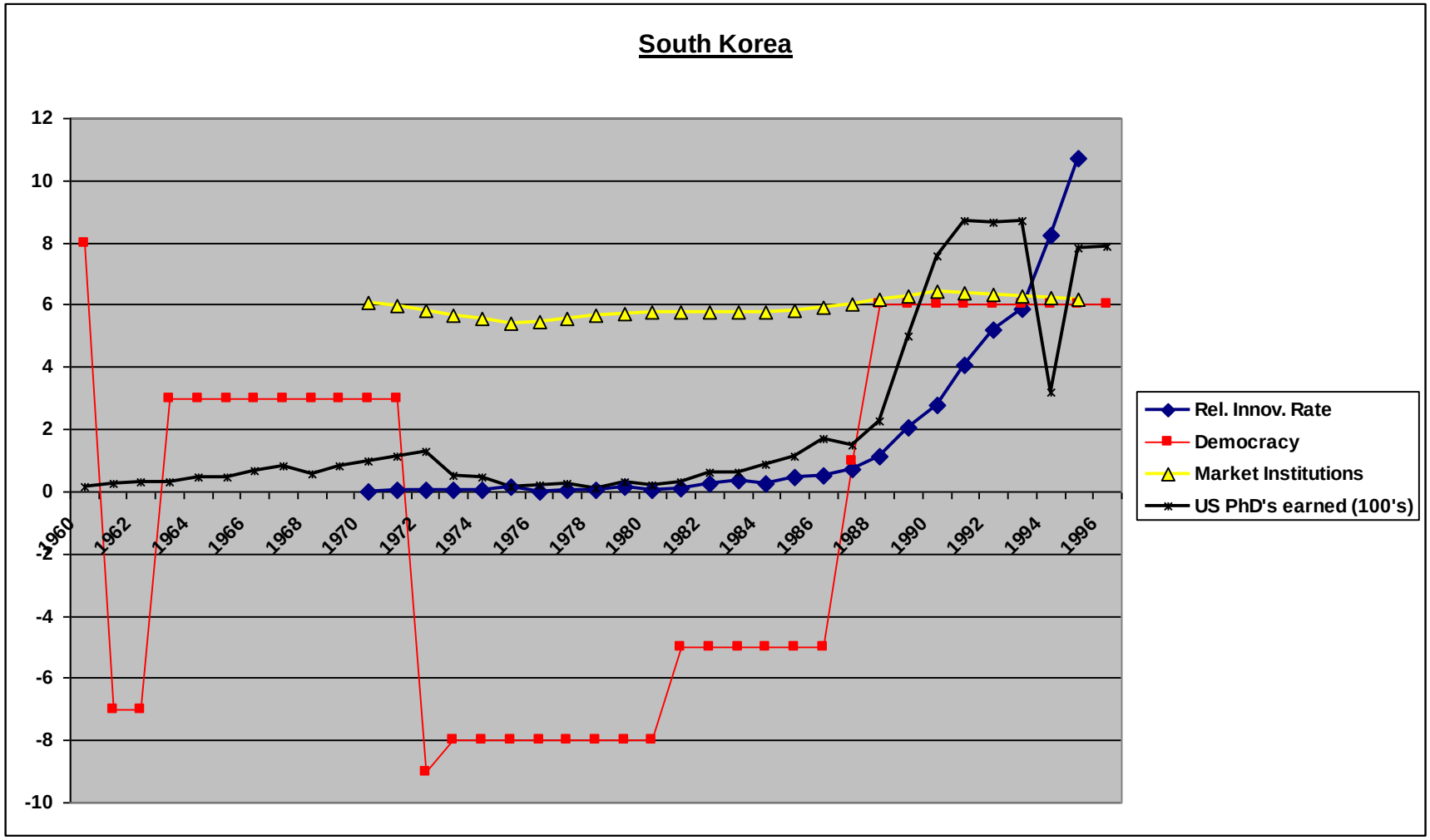

Taiwan
12
10
8
6
4
2
0
-2
-4
-6
-8
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
Rel. Innov. Rate

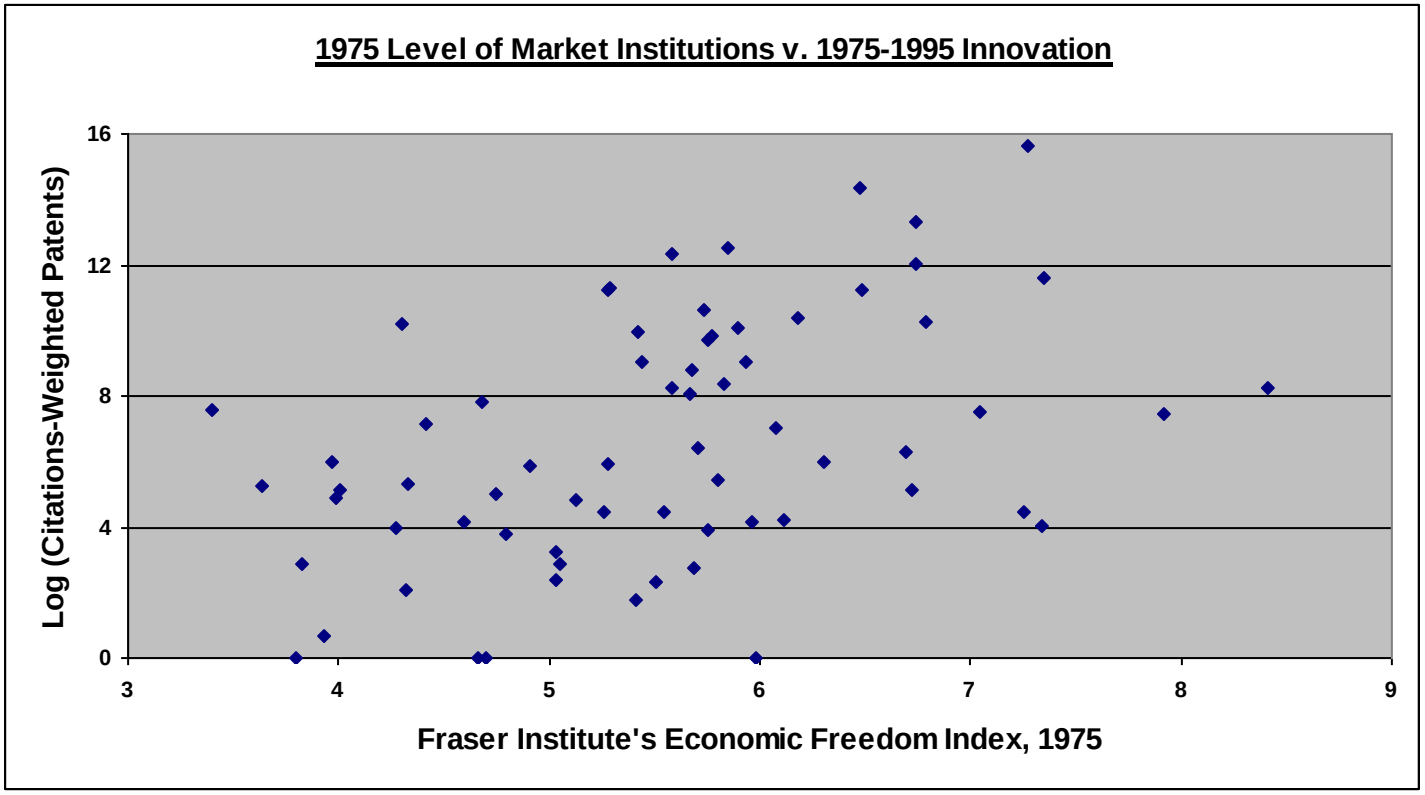

Taiwan
12
10
8
6
4
2
0
-2
-4
-6
-8
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
Rel. Innov. Rate
Democracy

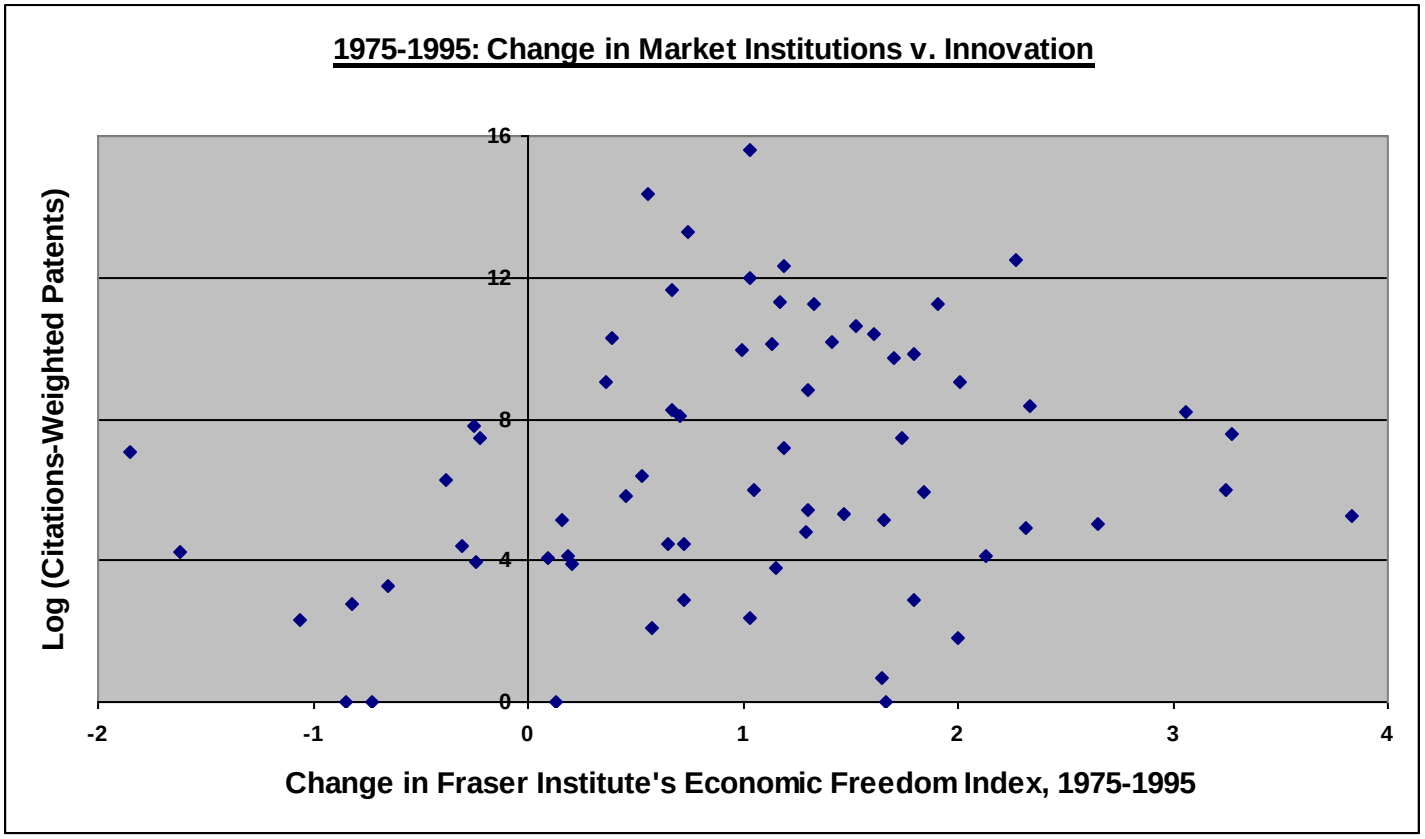

Taiwan
12
10
8
6
4
2
0
-2
-4
-6
-8
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
Rel. Innov. Rate
Market Institutions

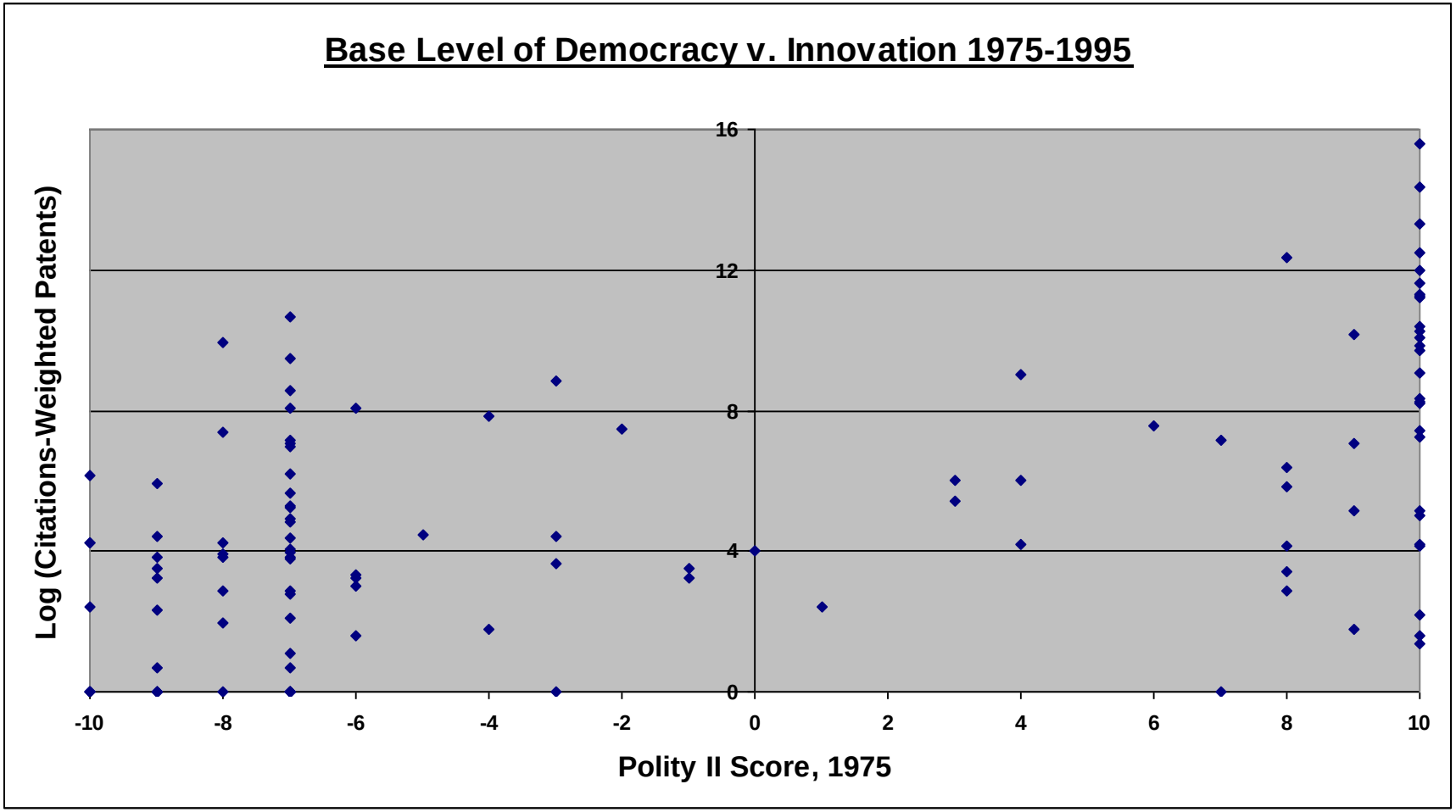

Taiwan
12
10
8
6
4
2
0
-2
-4
-6
-8
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
Rel. Innov. Rate
US PhD's earned (100's)


Taiwan
12
10
8
6
4
2
0
-2
-4
-6
-8
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
Rel. Innov. Rate
Democracy
Market Institutions
US PhD's earned (100's)

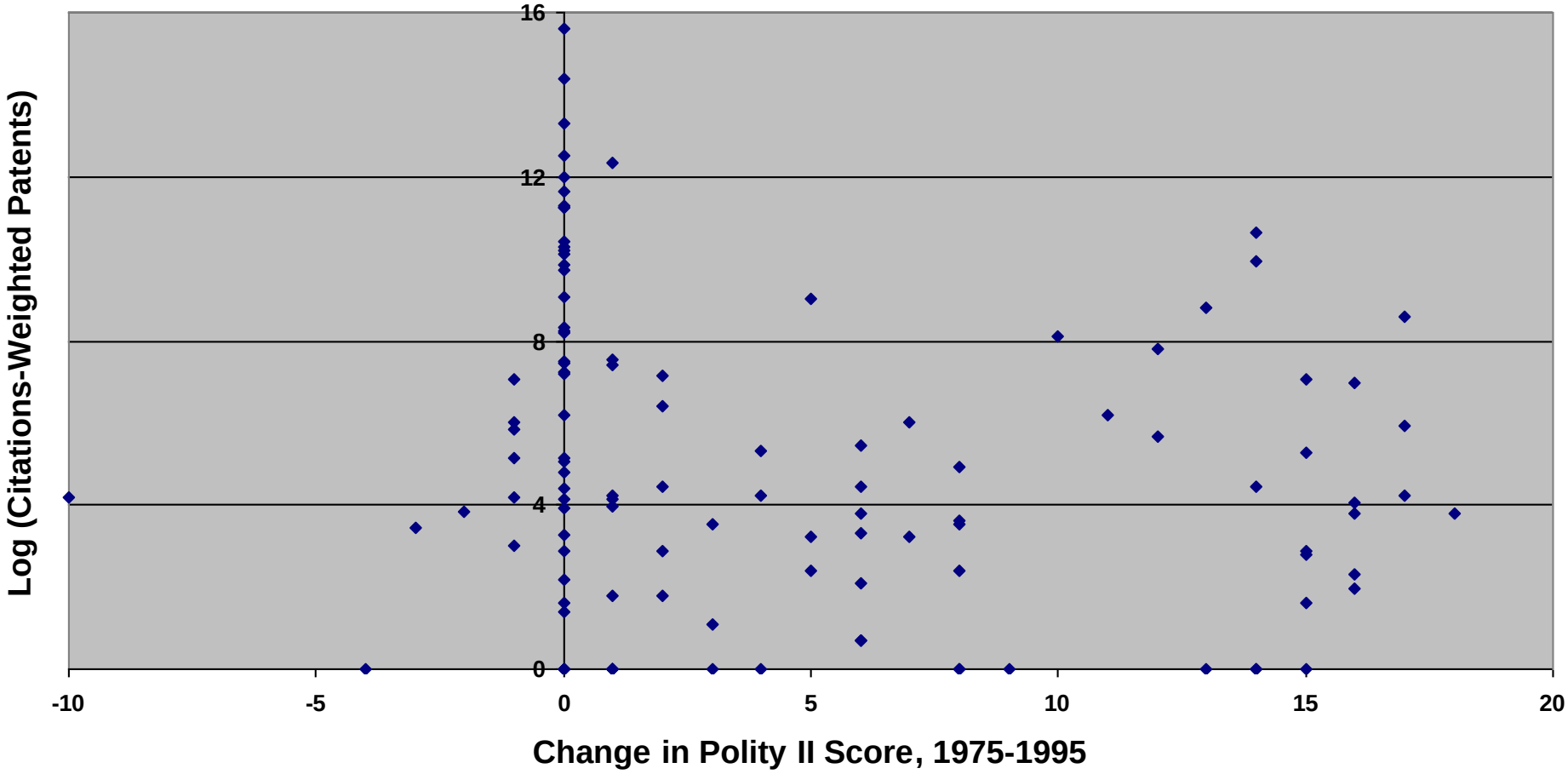

South Korea
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
Rel. Innov. Rate
Democracy
Market Institutions
US PhD's earned (100's)

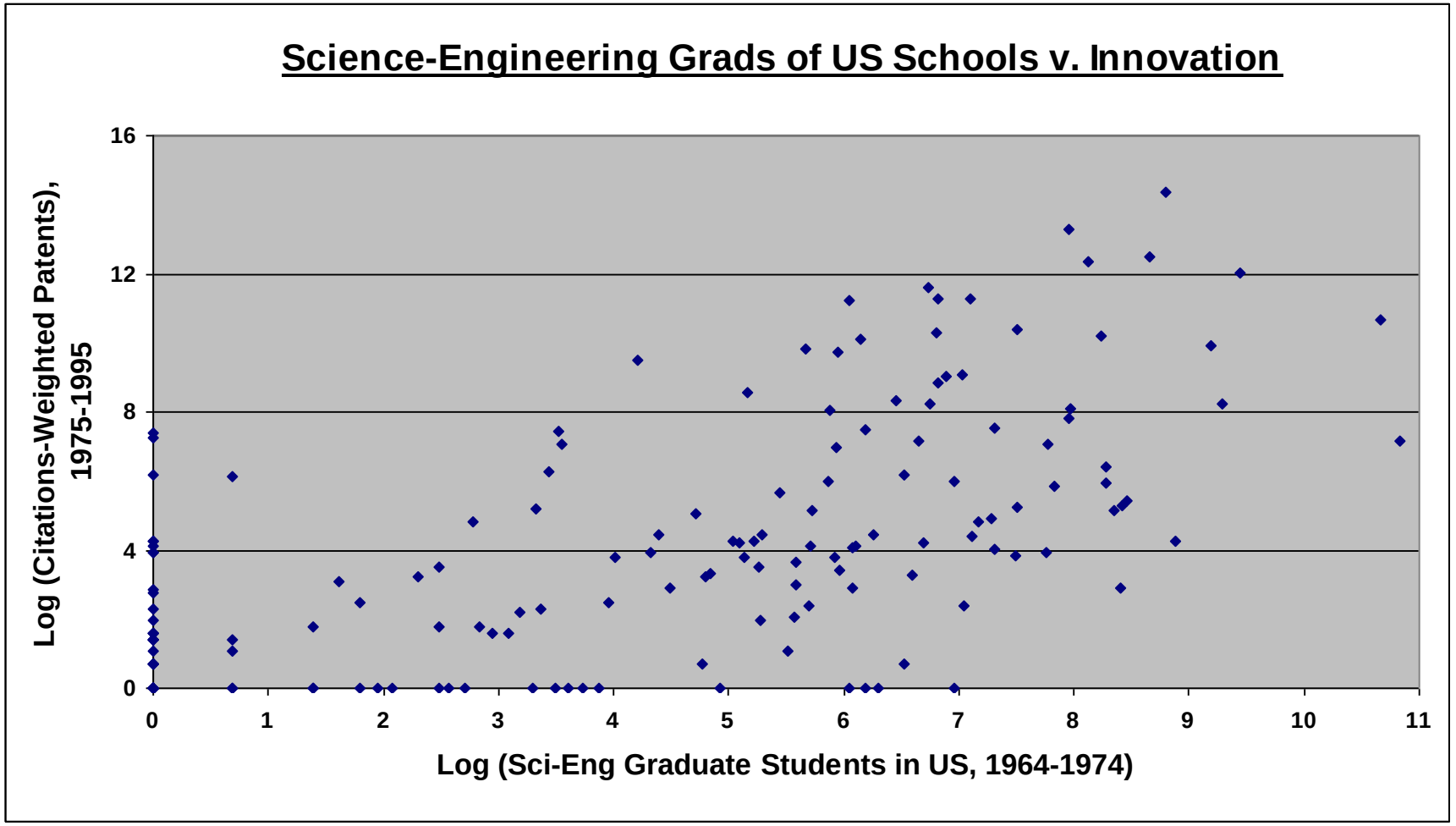

1975 Level of Market Institutions v. 1975-1995 Innovation
Log (Citations-Weighted Patents)
16
12
8
4
0
3
4
5
6
7
8
9
Fraser Institute's Economic Freedom Index, 1975


1975-1995: Change in Market Institutions v. Innovation
Log (Citations-Weighted Patents)
16
12
8
4
0
-2
-1
0
1
2
3
4
Change in Fraser Institute's Economic Freedom Index, 1975-1995

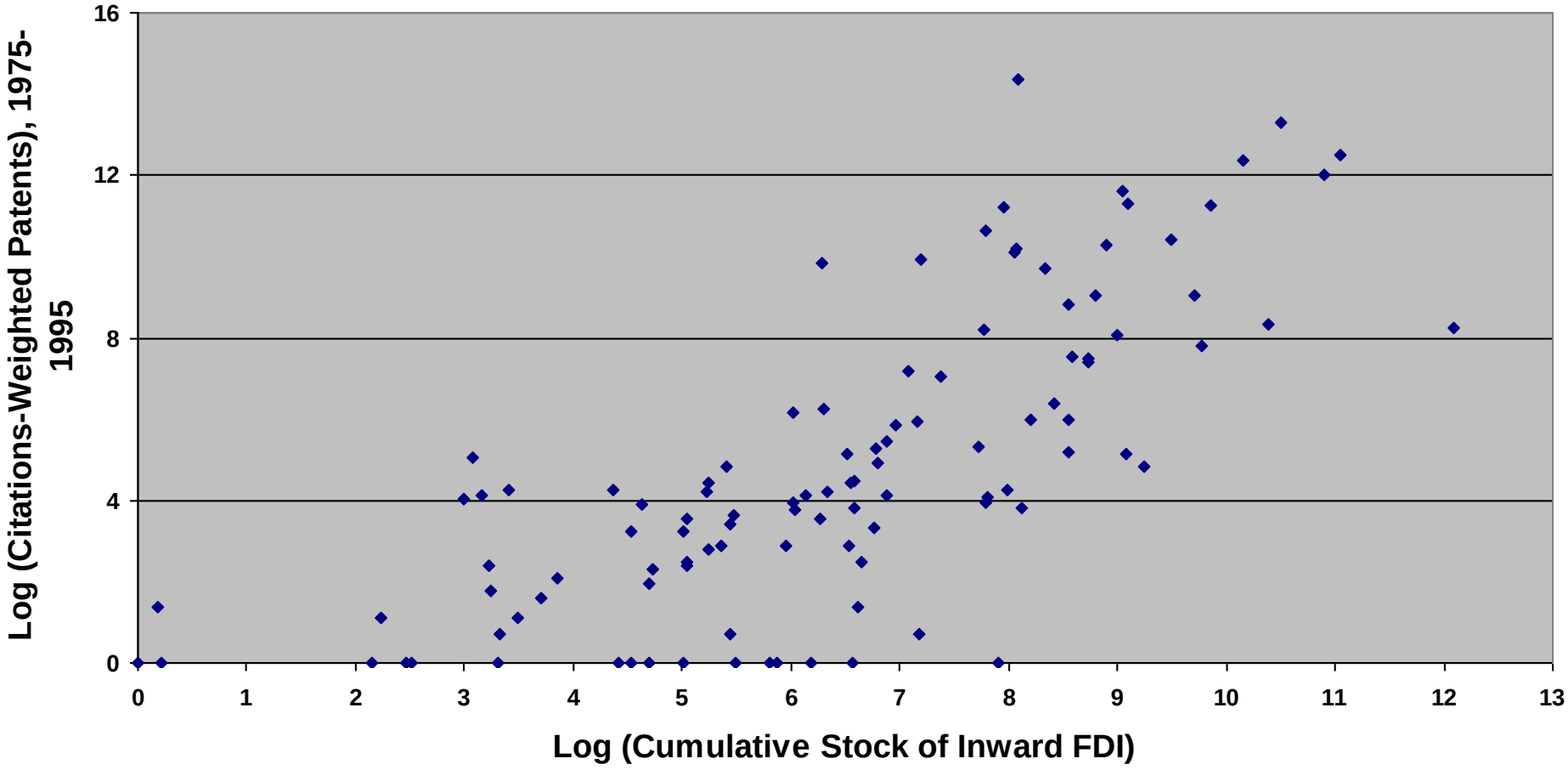

Base Level of Democracy v. Innovation 1975-1995
Log (Citations-Weighted Patents)
16
12
8
4
0
-10
-8
-6
-4
-2
0
2
4
6
8
10
Polity II Score, 1975

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

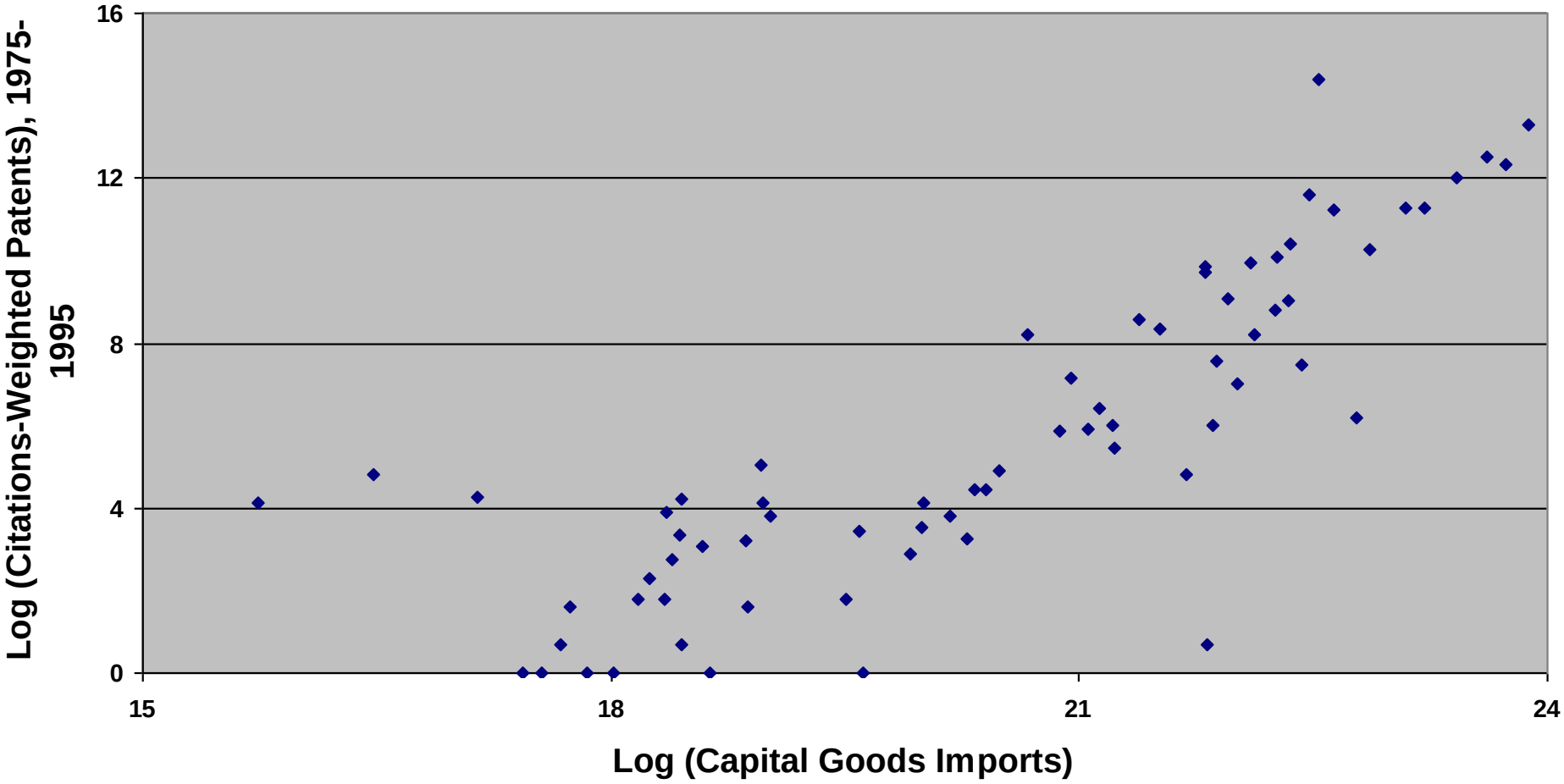



Science-Engineering Grads of US Schools v. Innovation
Log (Citations-Weighted Patents), 1975-1995
16
12
8
4
0
0
1
2
3
4
5
6
7
8
9
10
11
Log (Sci-Eng Graduate Students in US, 1964-1974)

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