Fourth Summer School in Trade, Industrialisation, and Development 2005

Gargnano, Italy

Trade, Innovation, and Technology Diffusion: Implications for Developing Countries

Lecture 1: Basic Measures of Innovation, Diffusion, and Trade

September 2005

How should we proceed?

A desire is that theory and measurement progress in concert

Two failures:

1. Keynesian macroeconomic forecasting models: data without theory.

2. Factor Endowments: Elegant theory that sits awkwardly with the facts

More successful:

Growth economics.

I. The International Trade of Countries: The Gravity Equation

$$X_{ni} = \kappa \frac{X_n Y_i}{\tau_{ni}}$$

Notation

X_{ni}	purchases by n from i
X_n	total purchases by n
Y_i	total production by i
τ_{ni}	distance measure
κ	constant (unit dependent)

Evidence

1. Total Imports and Market Size: 1970-1972 vs. 1995-1997

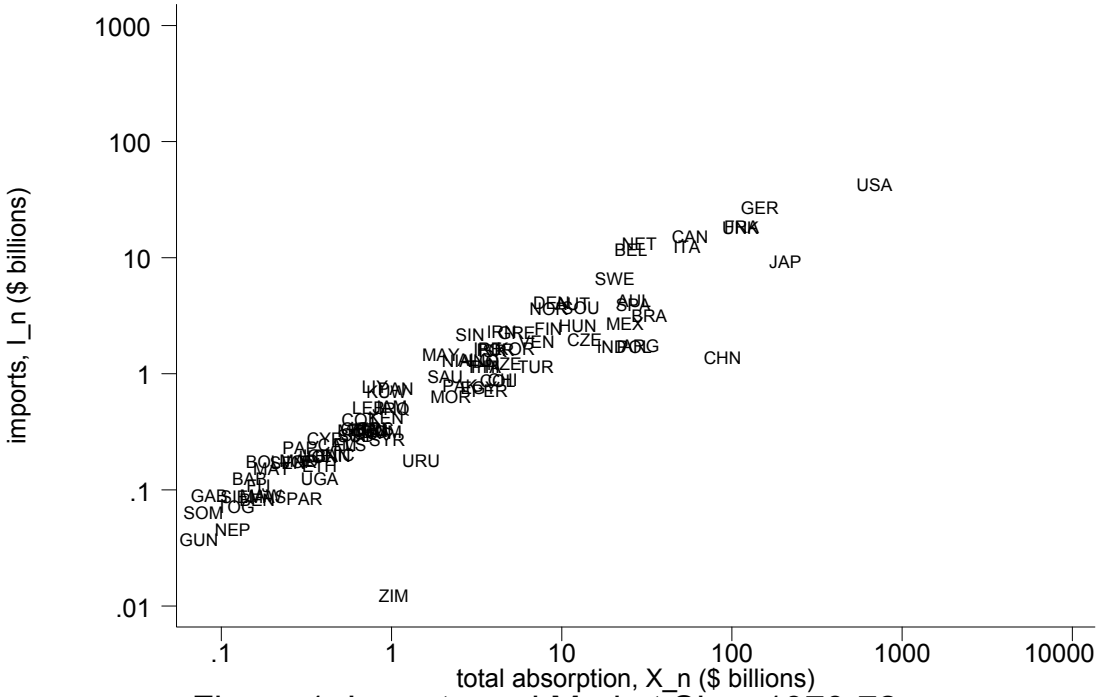


Figure 1: Imports and Market Size, 1970-72

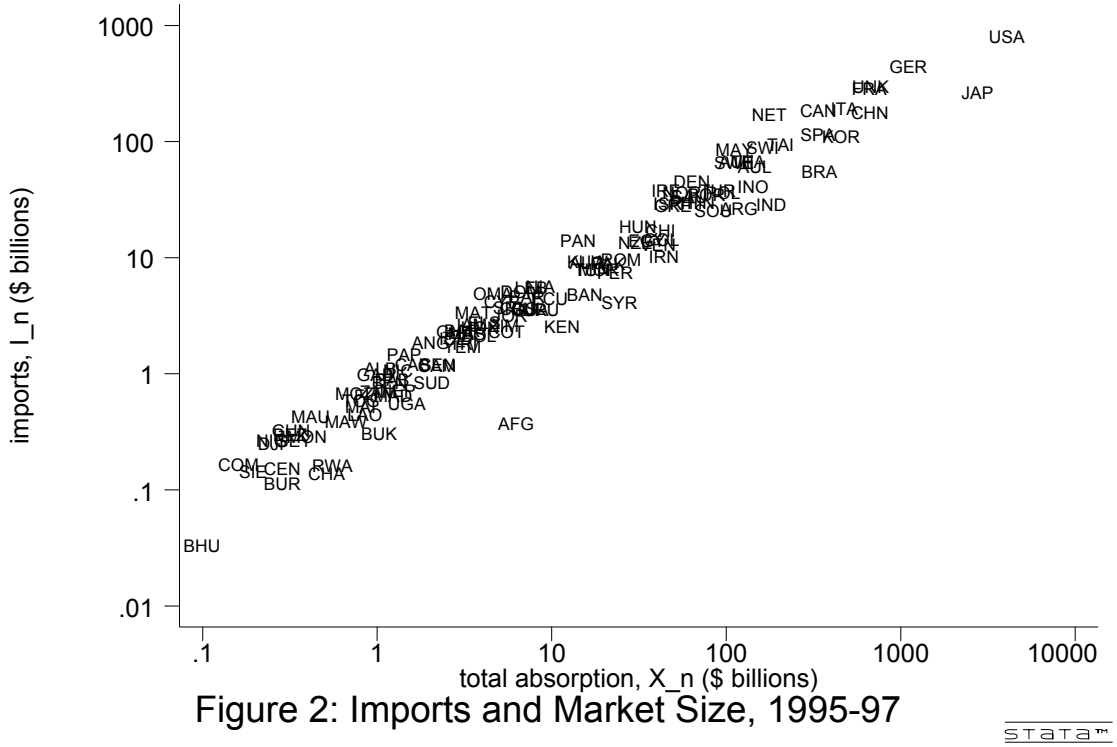


Figure 2: Imports and Market Size, 1995-97

2. Bilateral Exports and Production

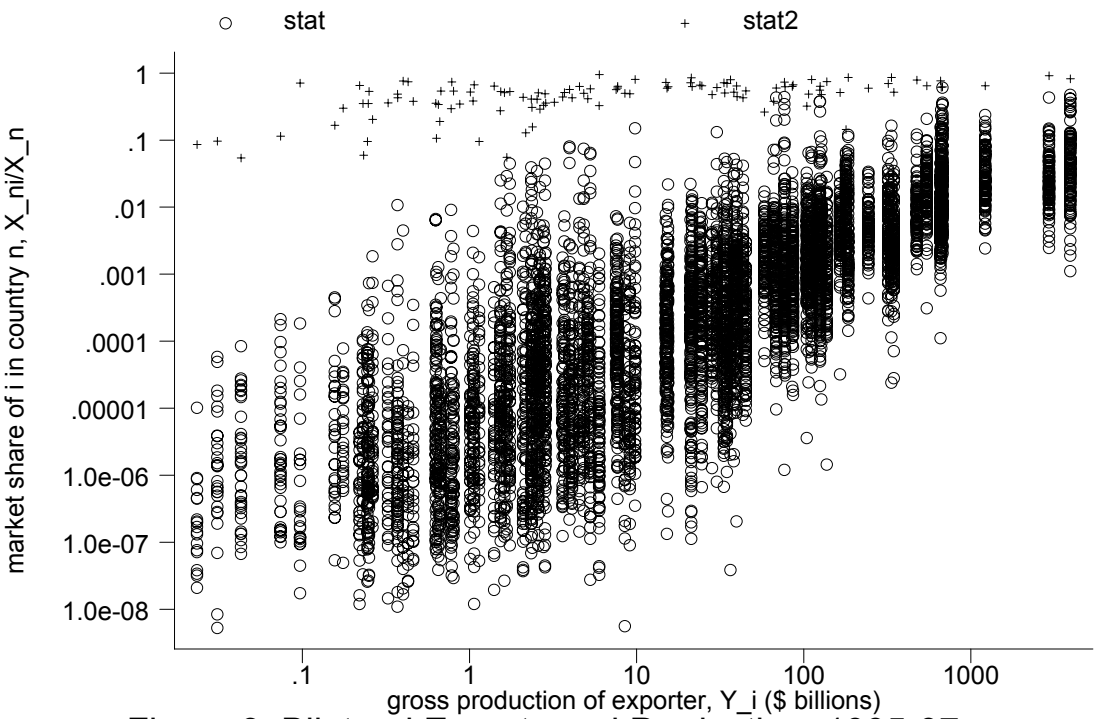


Figure 3: Bilateral Exports and Production, 1995-97

3. Bilateral Trade and Distance:1970-1972 vs. 1995-1997

$$\frac{X_{ni}X_{in}}{X_{nn}X_{ii}} \text{ vs. distance}$$

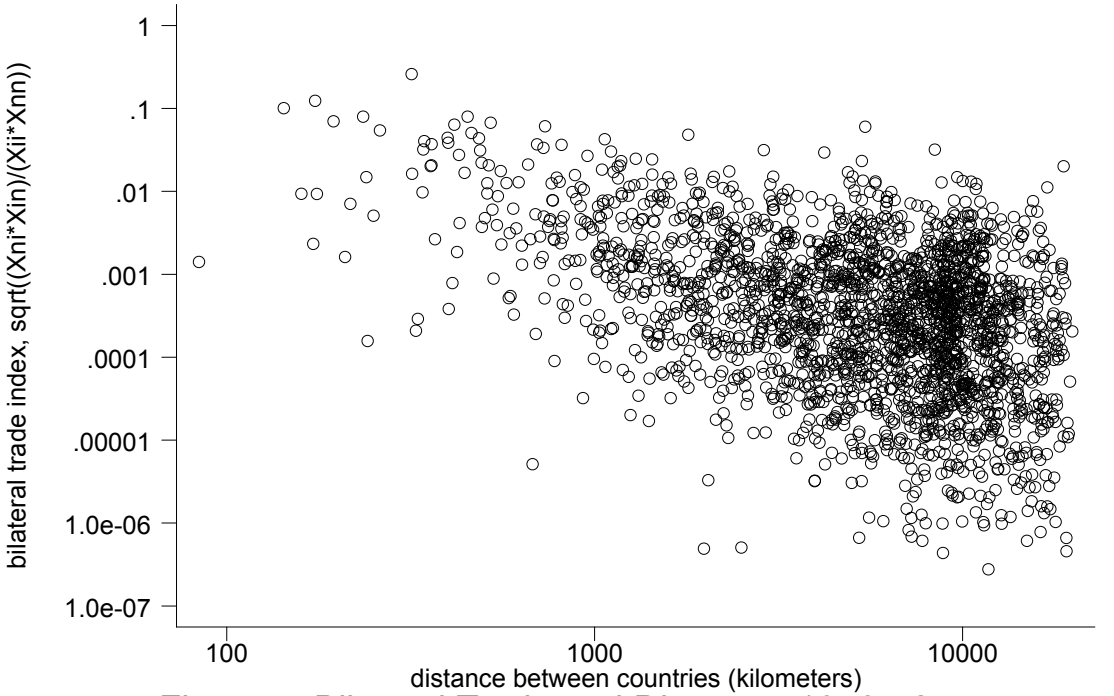


Figure 4: Bilateral Trade and Distance, 1970-72

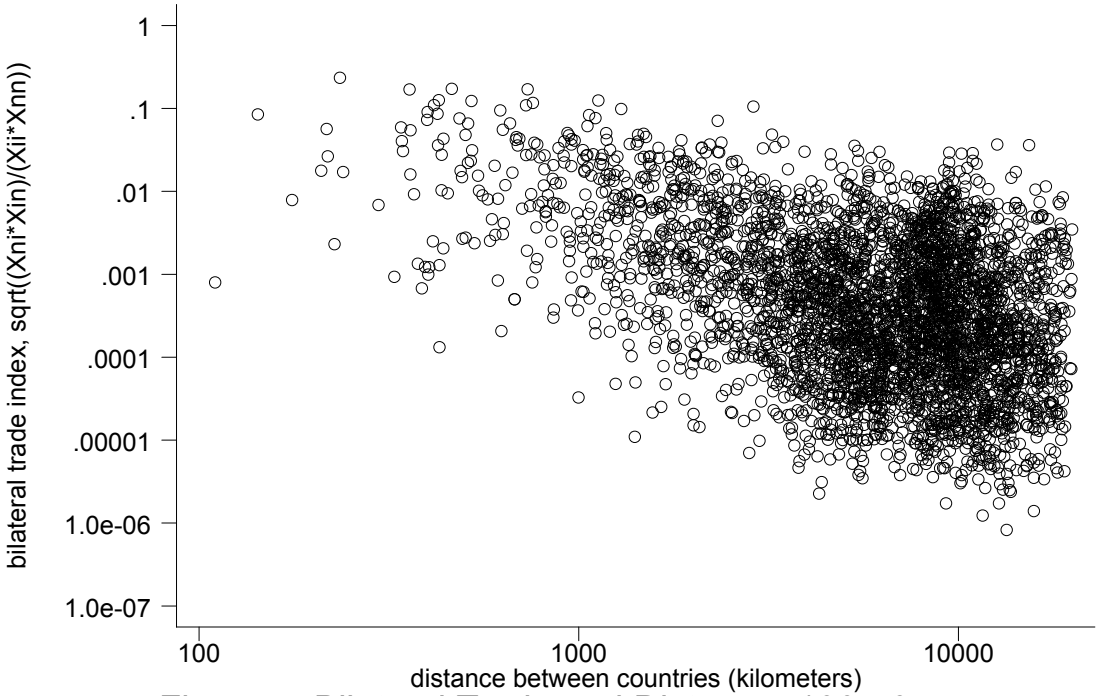


Figure 5: Bilateral Trade and Distance, 1995-97

II. The International Trade of Firms

1. Markets and French Firm Penetration

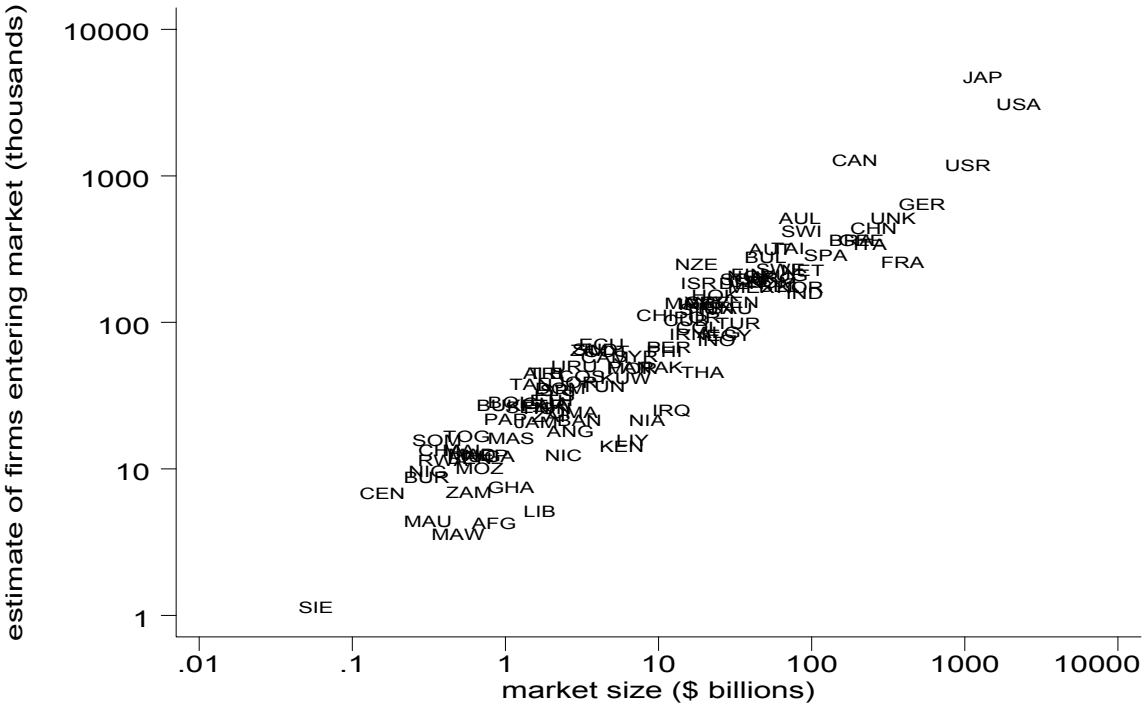


Figure 7: Entry and Market Size

2. French Firms and Market Penetration

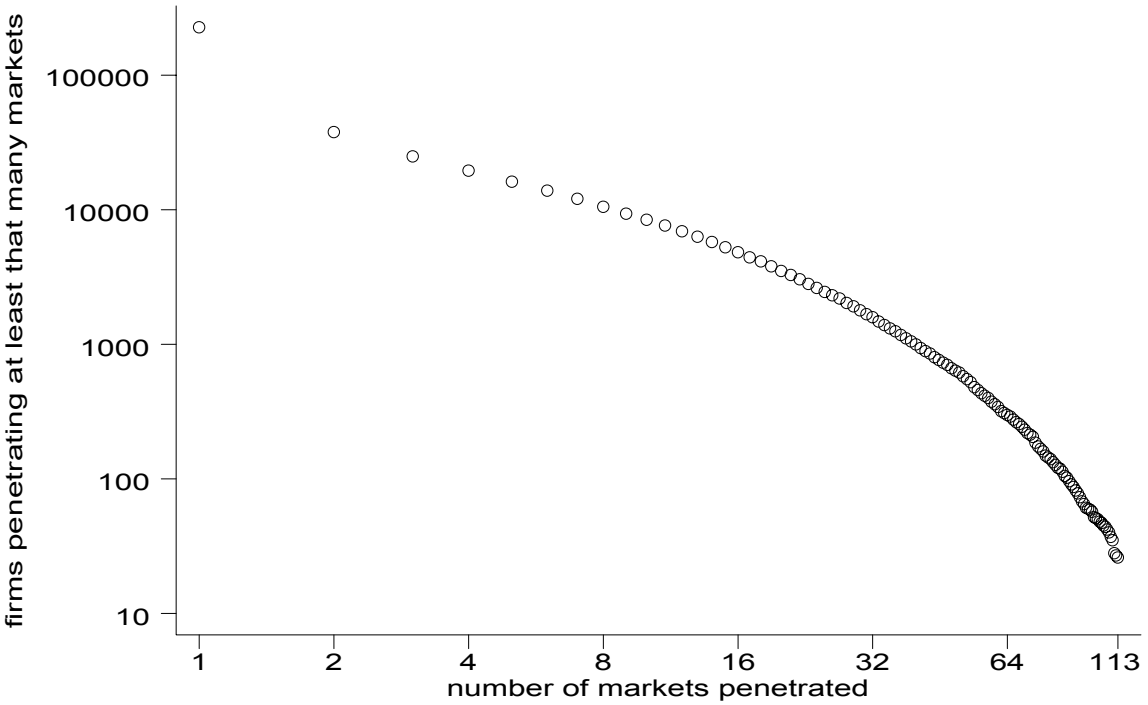


Figure 6: Frequency of Selling in Multiple Markets

3. Market Penetration and Size in France

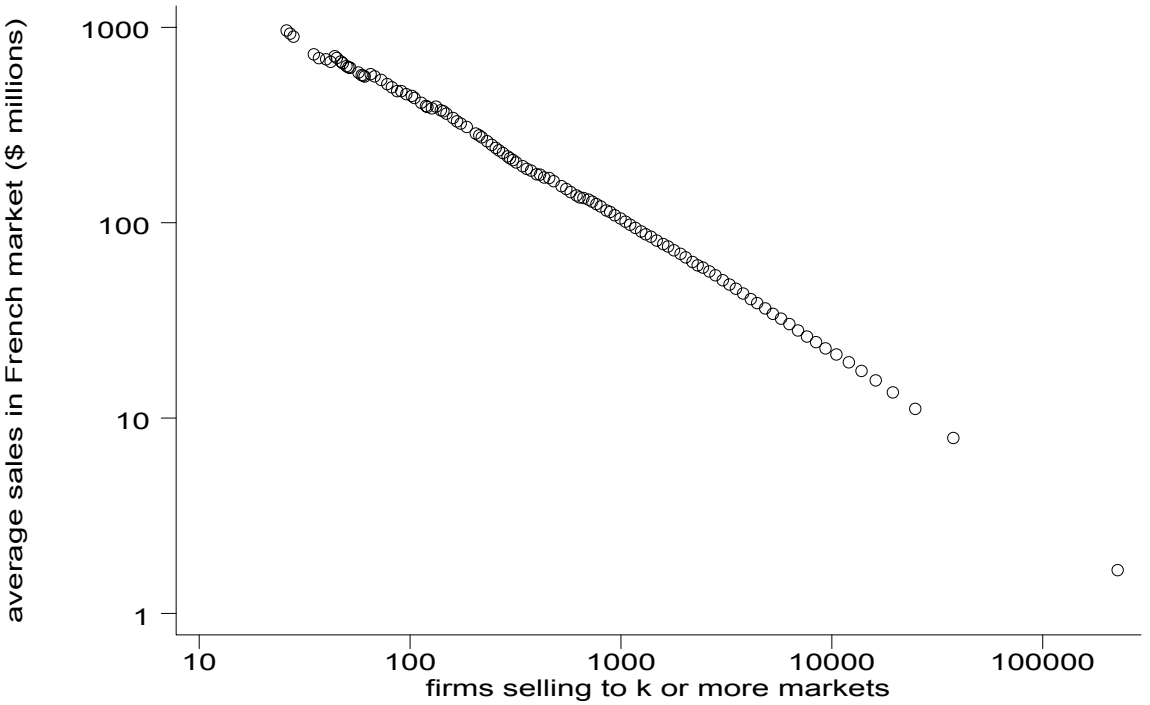


Figure 8: Firm Size and Frequency of Multiple Markets

III. Innovation Around the World

1. Innovation Measures

Figure 8: Industry Financed Business Enterprise R&D

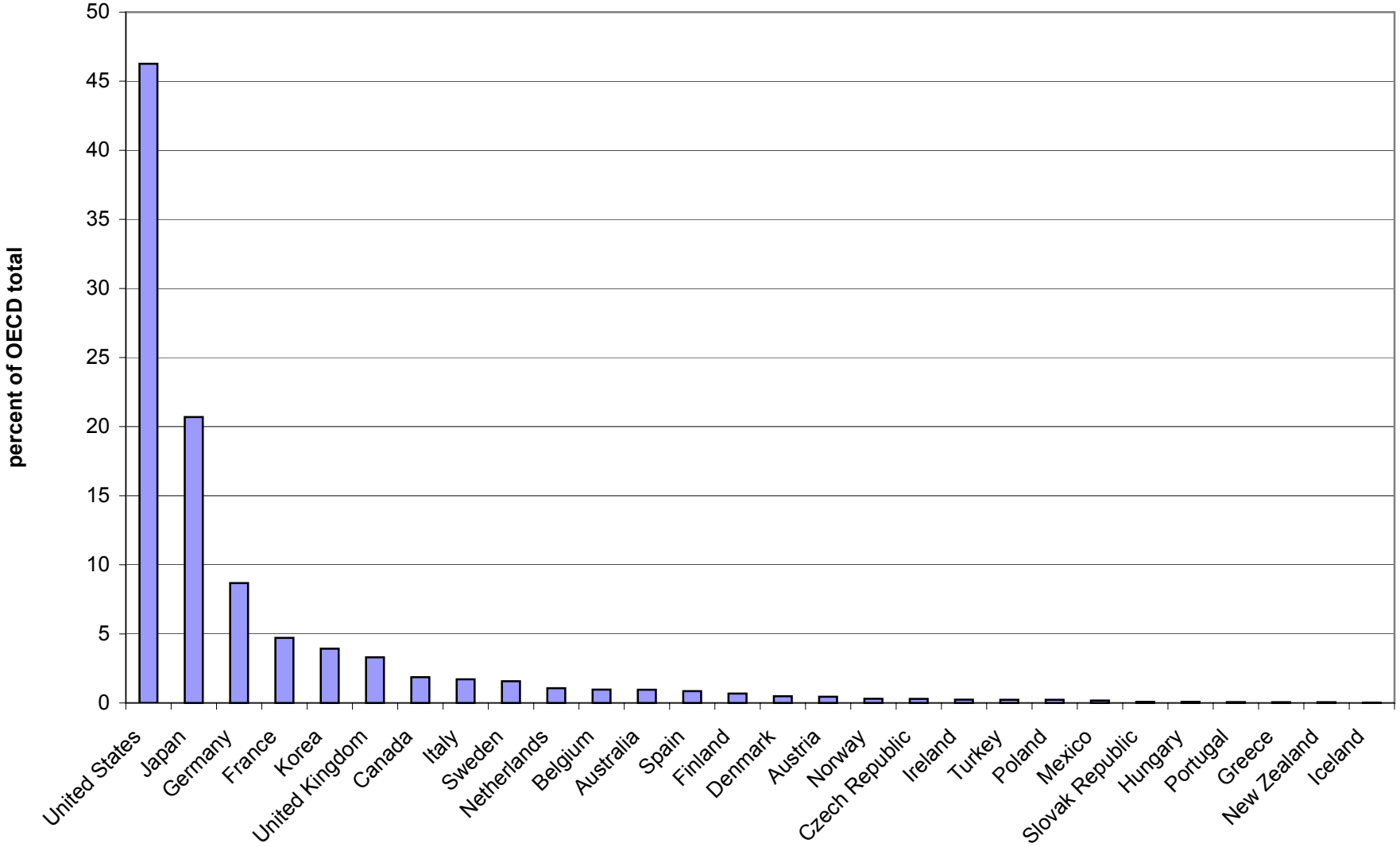


TABLE 2

Business Sector Research Scientists
(per 1000 Industrial Workers)

COUNTRY	Scientists	Income	Population
Finland	12.2	69	5176
United States	10.2	100	275423
Japan	9.8	73	126919
Sweden	7.7	69	8871
Luxembourg	6.8	138	441
Russia	6.6	28	145555
Belgium	6.2	70	10254
Norway	6.0	90	4491
Canada	5.9	81	30750
Germany	5.5	67	82168
Singapore	5.3	80	4018
France	5.1	66	60431
Denmark	4.5	80	5338
Ireland	4.4	76	3787
Korea	4.2	42	47275
United Kingdom	4.2	68	59756
Taiwan	4.2	55	21777
Austria	3.9	70	8110
Netherlands	3.6	72	15920
Australia	2.4	76	19157
Slovenia	2.0	48	1988
Spain	1.8	53	39927
New Zealand	1.7	56	3831
Italy	1.6	64	57728
Slovak Republic	1.6	35	5401
Czech Republic	1.4	42	10272
Hungary	1.4	31	10024
Romania	1.4	14	22435
Poland	0.8	27	38646
Portugal	0.7	48	10005
China	0.7	11	1258821
Greece	0.5	44	10558
Turkey	0.2	21	66835
Mexico	0.1	27	97221

Data are for 2000 or the previous available year
Income is relative to the United States (100)
Population is in 1000's
Sources: OECD (2004) and Heston, Summers, and Aten (2002).

2. Patenting Measures

Figure 9: R&D and Patents

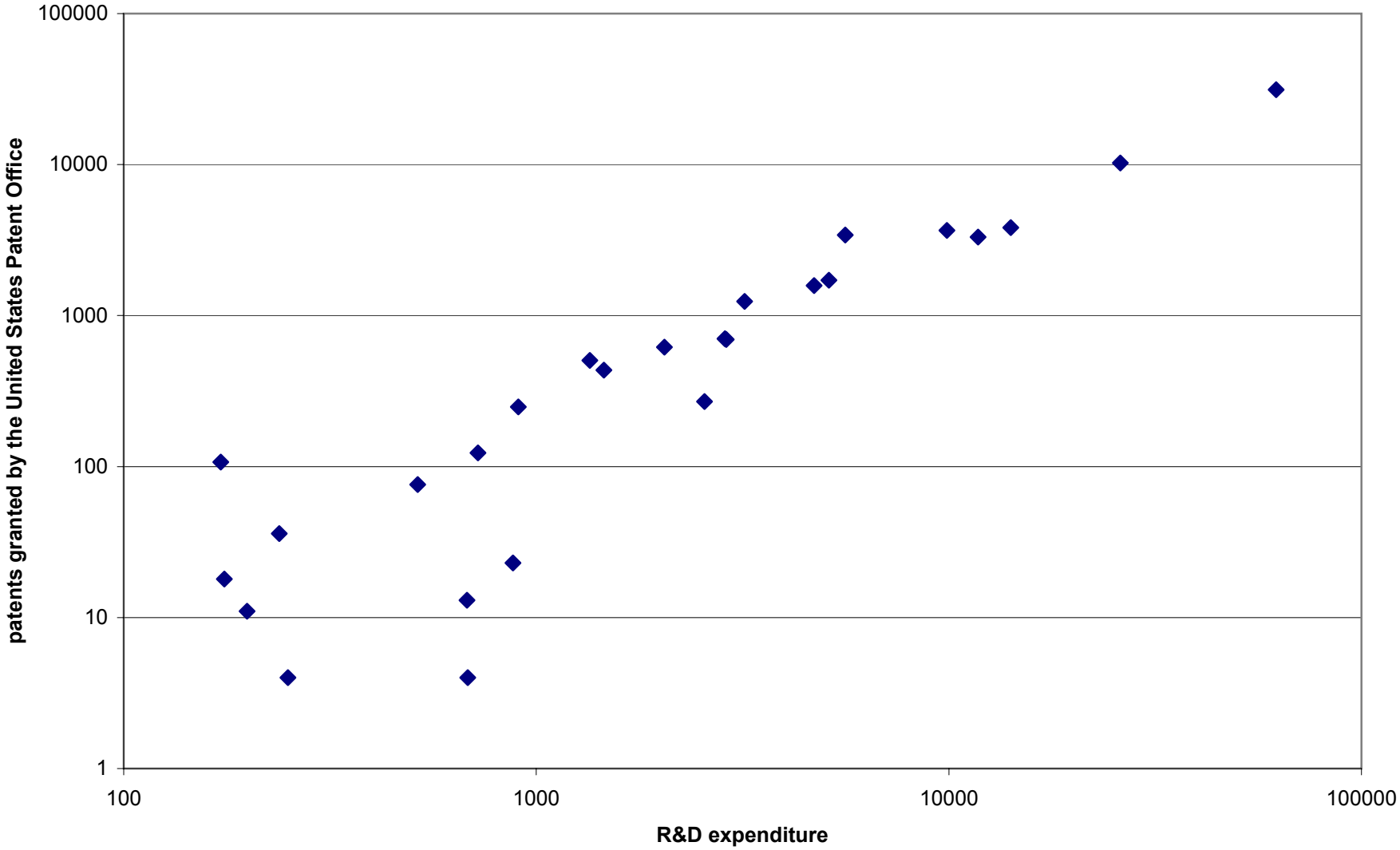
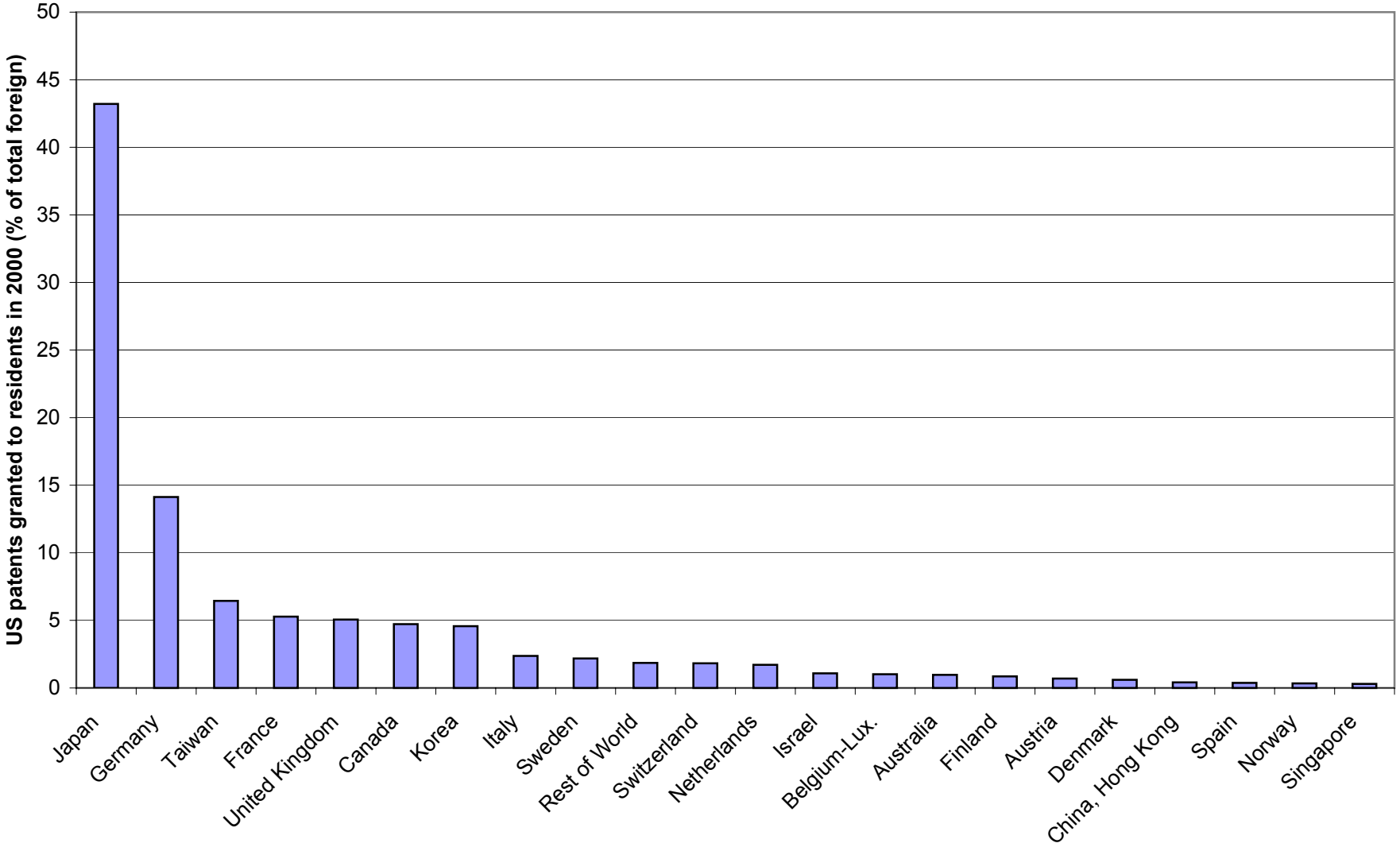


Figure 10: Foreign Patenting in the United States



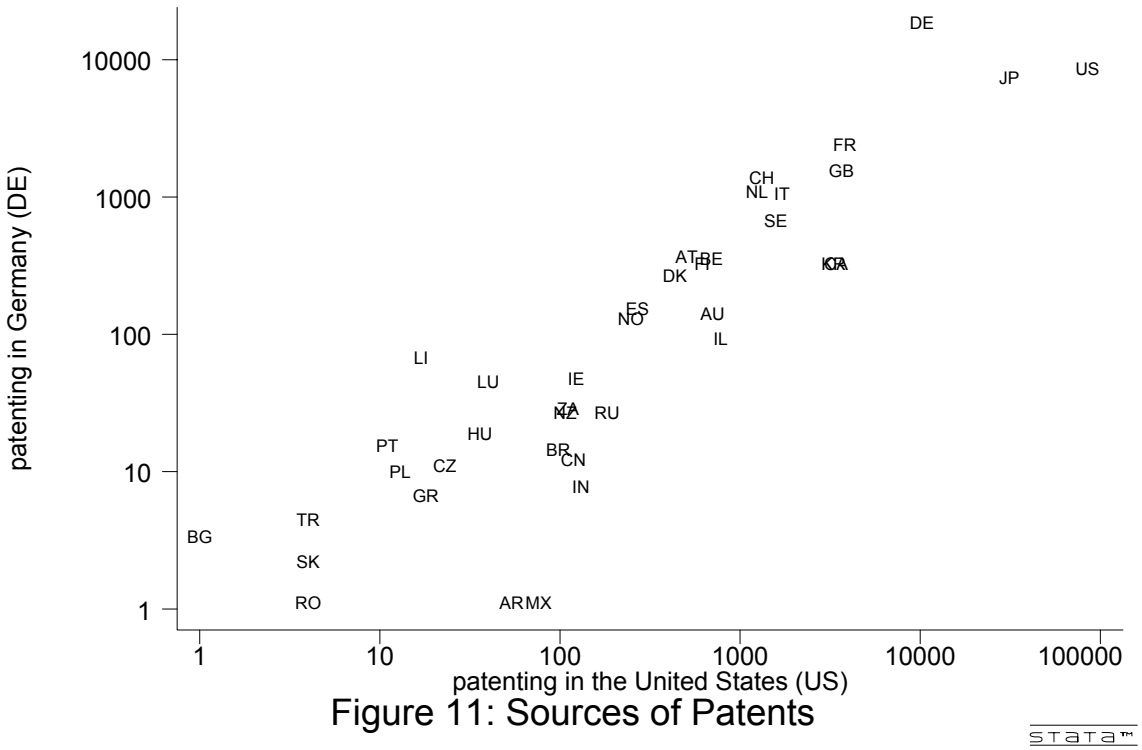


Figure 11: Sources of Patents

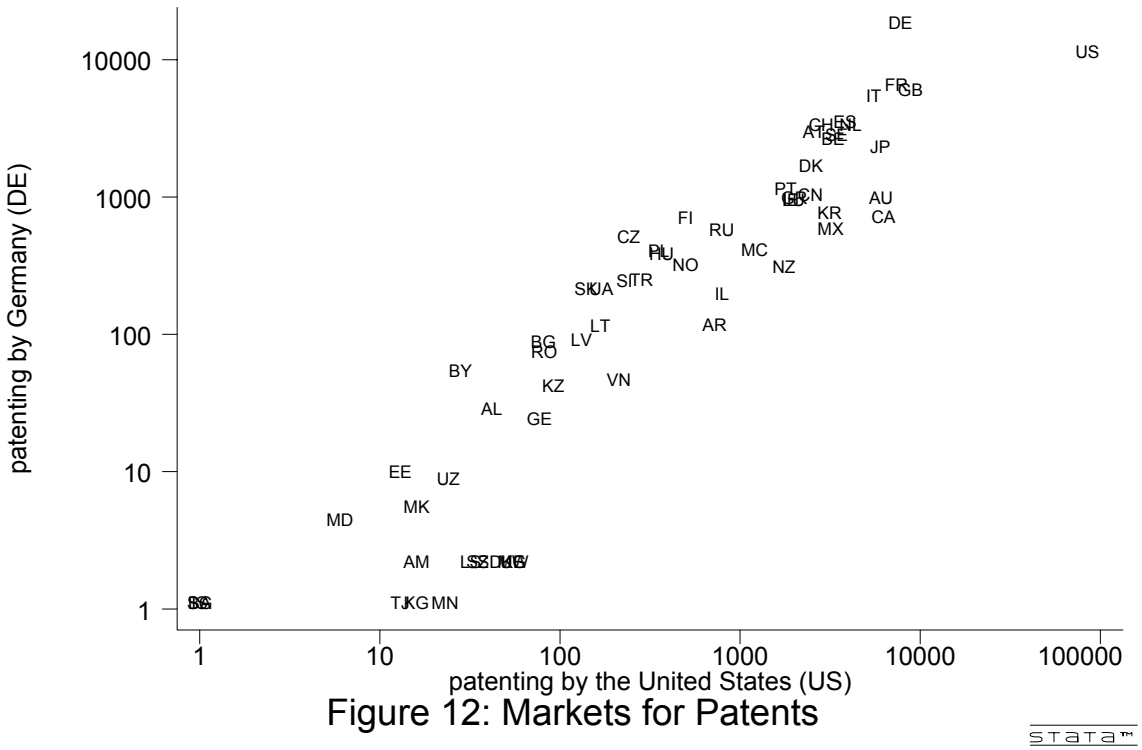


Figure 12: Markets for Patents

3. Bilateral Patenting and Distance:

$$\frac{P_{ni}P_{in}}{P_{nn}P_{ii}} \text{ vs. distance}$$

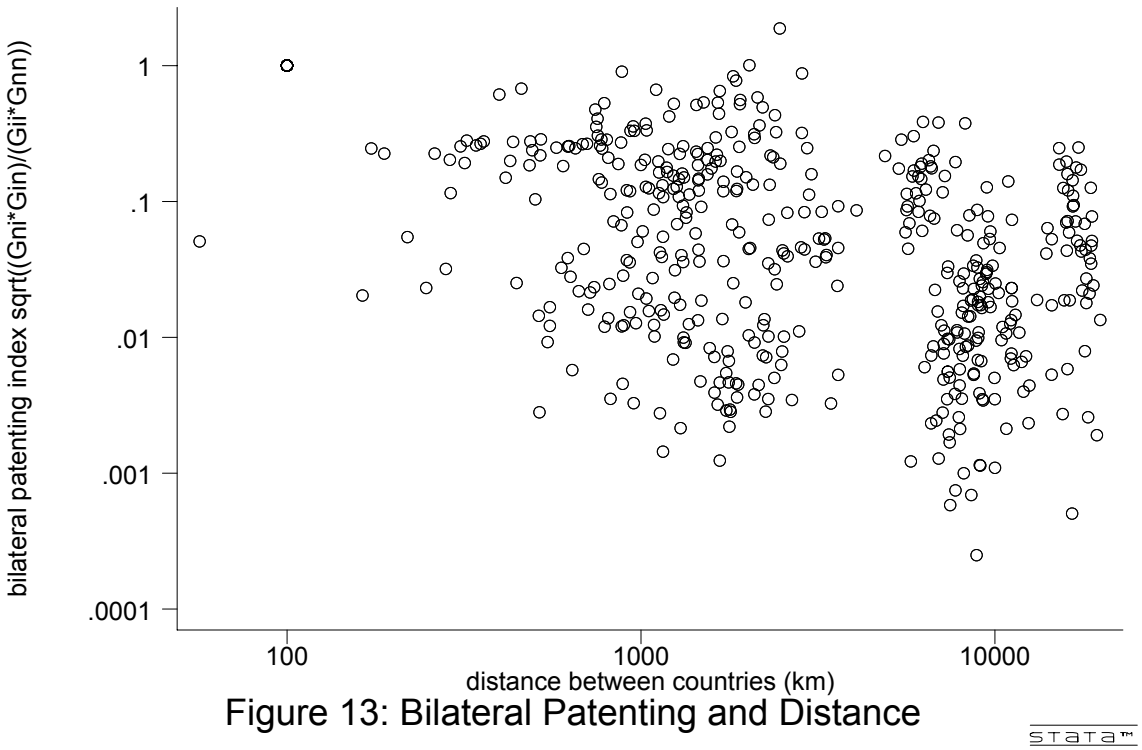


Figure 13: Bilateral Patenting and Distance

IV. The Evolution of Productivity: Growth as a Global Phenomenon

Figure 14: Evolution of Productivity in High Productivity Countries

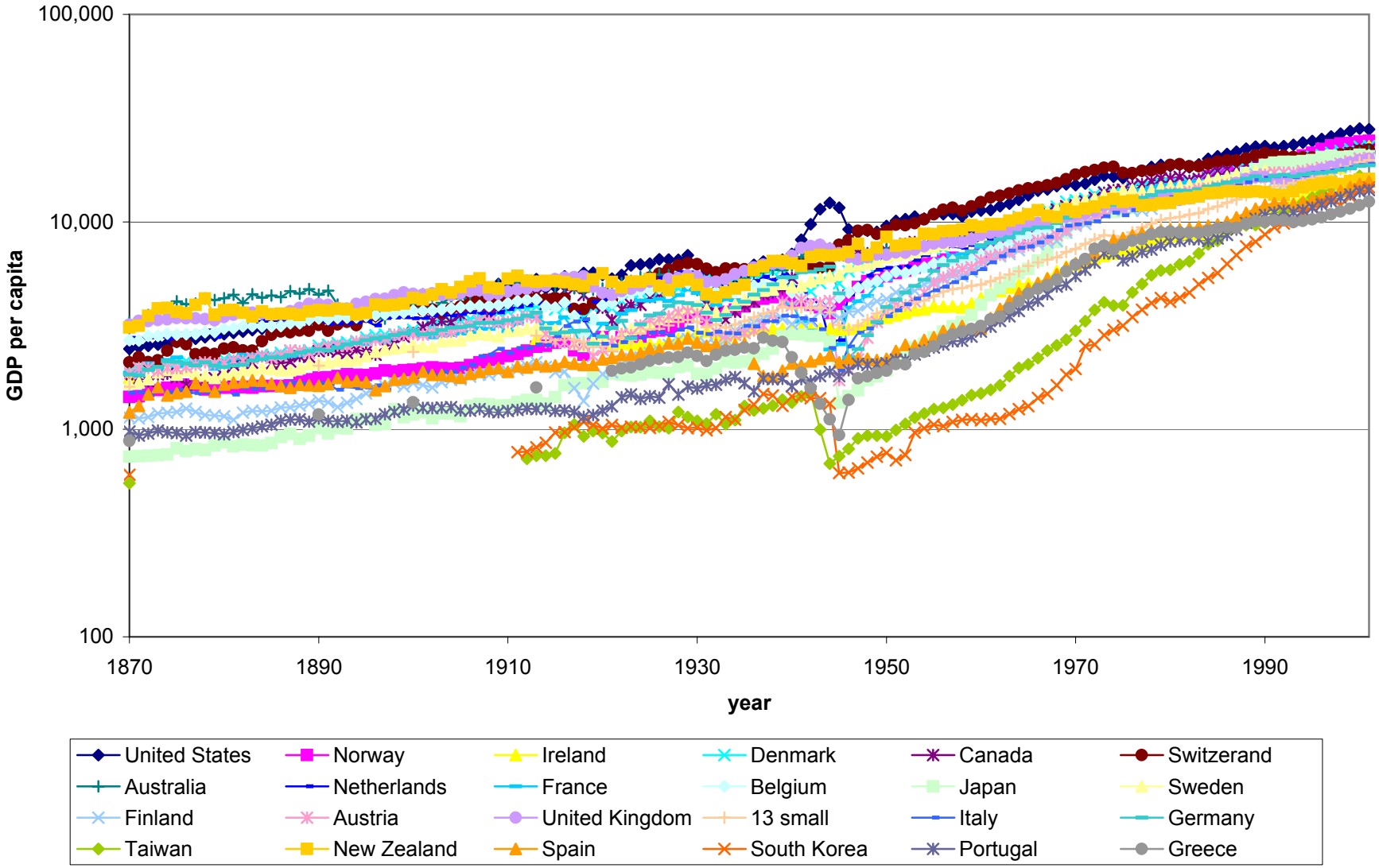
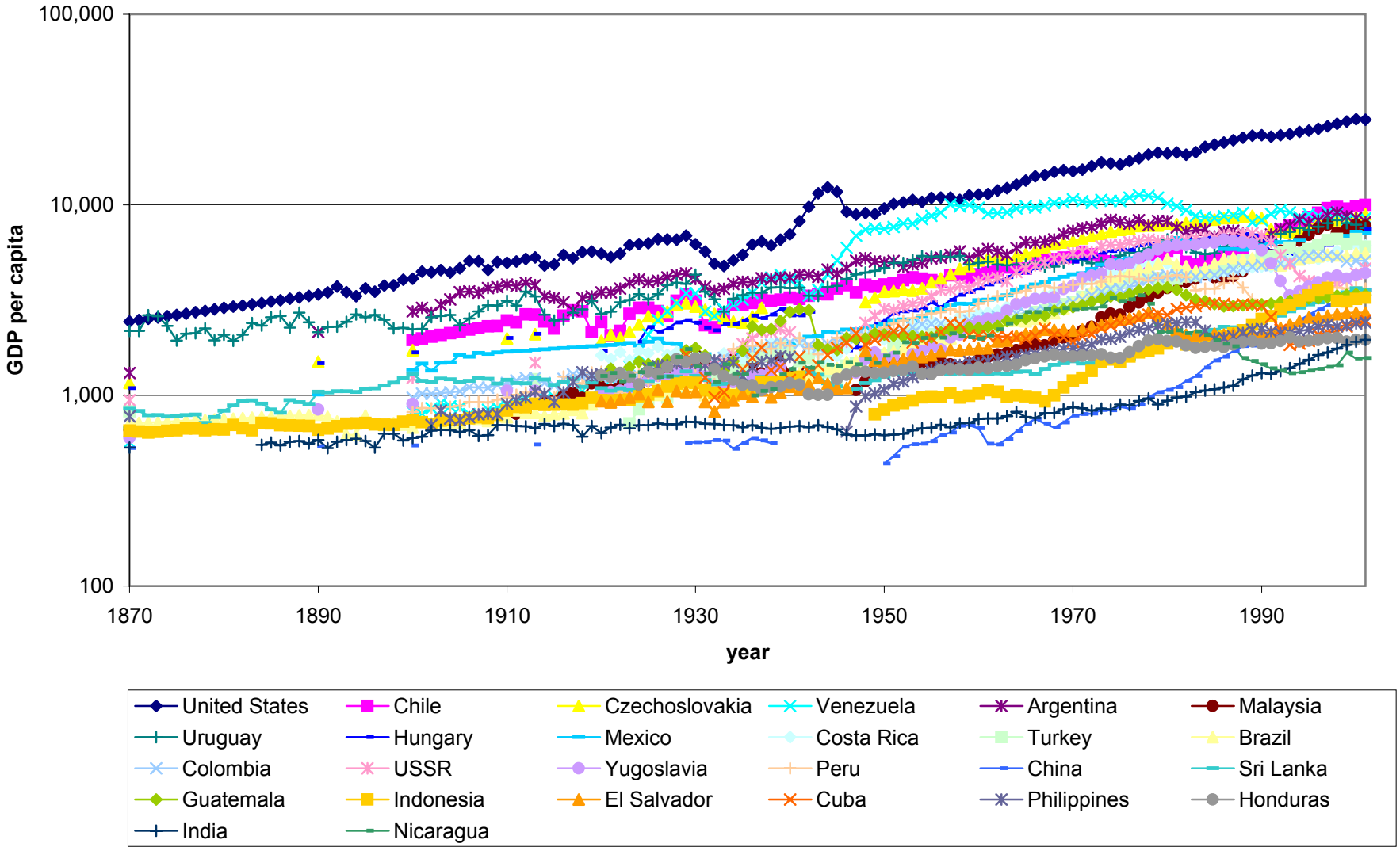


Figure 15: Evolution of Productivity in Low Productivity Countries



Challenges for Theory

1. Accommodating Market Segmentation and Geography

2. Reconciling Aggregate and Producer-Level Data

3. Modeling Specialization in Innovation and Technology Diffusion

4. Explaining the Geography of Economic Growth